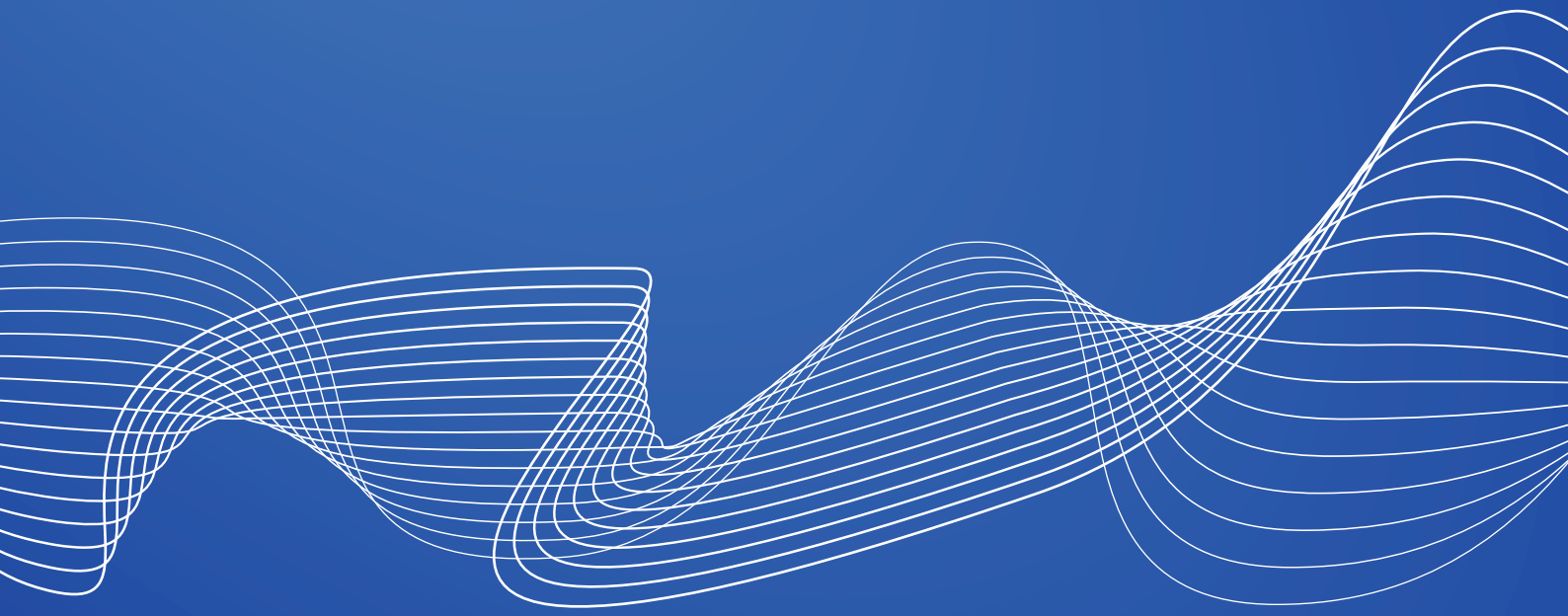
ESRB report on the regulatory treatment of sovereign exposures

March 2015



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Foreword

This report has been produced by the European Systemic Risk Board (ESRB) through a special expert group composed of members of its advisory committees (the Advisory Technical Committee and the Advisory Scientific Committee). The exposures that banks and insurance corporations have held vis-à-vis sovereigns have been seen by many as a source of fragility in the recent and prolonged episodes of financial stress, while others have seen them as a factor of crisis mitigation. The current regulatory framework of sovereign exposures held by financial institutions needs to be re-examined at a global level. The report describes the regulatory treatment of sovereign exposures in the European Union, analyses the incentives that it may create, provides data measuring those exposures and offers analytical explanations of recent developments.

The report argues that, from a macro-prudential point of view, the current regulatory framework may have led to excessive investment by financial institutions in government debt. The report recognises the difficulty in reforming the existing framework without generating potential instability in sovereign debt markets, as well as the intrinsic difficulty of redesigning regulations so as to produce the right incentives for financial institutions. It examines a set of possible options which may be considered either on their own merits or in combination with each other, both in banking and insurance, offering a detailed discussion of the pros and cons.

The ESRB is hereby providing the broader public in Europe and authorities across the world with a systematic analysis of macro-prudential vulnerabilities related to the sovereign exposures of banks and insurance companies, as well as illustrating how to pre-empt or mitigate them. I trust that the report will help to foster a discussion which, in my view, is long overdue.

Mario Draghi
ESRB Chair

Executive summary

The expert group on the regulatory treatment of sovereign exposures[1] was set up jointly by the Advisory Technical Committee and the Advisory Scientific Committee of the ESRB to analyse and report back on potential systemic risks or concerns related to the treatment of sovereign and government-related exposures under existing and upcoming financial regulation in the EU and, where necessary, to identify options for macro-prudential policy to mitigate them. The expert group was asked to investigate the following issues:

- The treatment of sovereign and government-related exposures under the capital and liquidity requirements of banks (the Basel III agreement and CRR/CRD IV), including the large exposures regime.

- The treatment of sovereign and government-related exposures under the solvency rules of insurance undertakings (Solvency II).

- Whether the approaches identified lead to any potential systemic risks.

- Potential policy options to address the systemic risks identified or concerns related to such treatment, including implementation issues associated with the proposed options and a cost-benefit analysis of the options. If considered appropriate, the expert group should also formulate proposals on how to change the relevant EU regulations to mitigate the systemic risks identified, staying in conformity with global rules and taking into account how the proposed changes would fit into the overall EU legislative framework.

The review of the current global and EU regulatory frameworks for banks and insurance undertakings indicated preferential treatment for sovereign exposures compared with other counterparties. The most prominent features of the favourable treatment of sovereign exposures in the current prudential regulations relate to the following aspects (**Chapter 1**):

- low or zero capital requirements on certain sovereign exposures;

- low capital requirements for government bond-collateralised exposures due to lower haircuts for high-rated sovereigns;

- the exclusion of zero-risk-weighted sovereigns from existing limits within the large exposures regime;

- the categorisation of high-quality government bonds as highly liquid assets within the liquidity regulations;

- a 0% risk factor in the standard formula on certain government exposures within the Solvency II insurance regulation.

1 A list of the members of the expert group is provided in Annex 12.

For decades, the regulatory treatment of sovereign debt has significantly discounted and, in many cases, ignored the possibility of default on exposures that are denominated and funded in the country's own currency. The evidence presented in the report illustrates, however, that sovereign risk is not a novel concept. Sovereign defaults, though not as frequent as those in the private sector, have occurred regularly throughout history, including for sovereign debt denominated and funded in domestic currency. The recent financial crisis and subsequent distress suffered by a number of sovereigns, including some EU Member States, has further highlighted these risks. Elevated levels of sovereign debt imply that such debt can no longer be regarded as having zero credit risk and may also not be liquid. Indeed, the bond spreads and credit default swap premia observed for a number of sovereigns suggest that the possibility of default is clearly non-negligible.

A rise in sovereign risk may affect the banking and the insurance sector and have systemic implications. The systemic risk arises from concerns about the underlying solvency of the sovereign, including credit and market (devaluation) risk, as well as from intrinsic linkages between banks and sovereigns, which causes the weakness of one to spread to another. The report (**Chapter 2**) identifies and discusses several channels and the potential spillover effects to the real economy stemming from sovereign risk.

Chapter 3 presents the stylised facts regarding the sovereign debt held by banks and insurance companies and the results of an empirical analysis aimed at understanding the determinants of sovereign exposures. Owing to the available data coverage, the empirical analysis conducted by the expert group focuses mainly on the euro area countries and is more comprehensive for banks than for insurance companies.

The main conclusions from the analysis conducted are as follows:

- In most euro area countries, euro area sovereign debt exposures of banks (as a proportion of total assets) were considerably larger at the inception of the Economic and Monetary Union than they are now. After a reduction in the first half of the 2000s, banks in stressed euro area countries have gradually increased their euro area sovereign debt holdings again (as a proportion of total assets) in the last six years. In contrast, banks from other euro area countries either continued to reduce or stabilised their euro area sovereign debt exposures.

- In almost all euro area countries, banks' exposures to their domestic sovereign (in relation to total assets) followed a declining trend between the end of the 1990s and September 2008, when the Lehman default occurred. This date coincides with a reversal of this trend: the home country bias increased until it stabilised in 2014. For banks in non-stressed countries, the increase was less marked.

- In almost all euro area countries, the euro area sovereign debt exposure of banks is overwhelmingly towards their domestic issuer, and this home bias is particularly strong in the countries where banks' total euro area sovereign exposure is largest (as a proportion of total assets).

- In the insurance sector, the data indicates a high concentration of domestic sovereign securities in the portfolios, albeit with significant cross-country differences, a trend which has continued to increase in recent years.

- There is no significant difference between sovereign exposures held by systemically important financial institutions (SIFI) and non-SIFI.

- In general, banks in stressed euro area countries increased their exposure to domestic sovereign debt in response to increases in its yield. This response may have been motivated by different factors, including banks' search for yield by engaging in carry trades that take into account redenomination risk, the desire to increase holdings of liquid assets, moral suasion exerted by sovereigns, or banks' attempts to preserve the stability of their respective countries. For a more limited range of countries, there is also some evidence that banks in stressed countries increased their sovereign exposures in response to worsening domestic macroeconomic conditions.

- Whatever the motive, the exposure of banks in stressed euro area countries to domestic sovereign debt has increased concurrently with an increase in the risk of such debt, therefore increasing risk in these banks' balance sheets and reinforcing the banks-sovereign link, which is itself a source of systemic risk.

The policy implications of these considerations are examined in **Chapter 4**. Based on the results of the analytical work, the expert group addressed a broad range of potential policy options for banking and insurance sector regulations to address the systemic risks identified. It should be recognised that the policy options outlined in the report constitute just an initial contribution and should be interpreted as a starting point for the policy discussion.

It should be stressed that, according to the expert group's mandate, any discussion about the appropriate legislation must be concerned with laying the foundations for financial stability in the future when the crisis has been resolved. Against this background, the analysis in this field is aimed at developing proposals for the steady-state regulatory framework rather than dealing with the euro area debt crisis. This means that the policy options assessed by the expert group are not envisaged as policies to be applied or announced in the current situation. At the same time, the policy recommendations have to consider the potential impact of any new rules as well as the transition to a new regime.

The expert group members agreed that the policies should:

- increase the resilience of the financial sector to sovereign risk over the economic cycle;

- limit systemic risks at the EU-wide level;

- ensure appropriate and stable availability and pricing of funding for the economy as a whole;

- be consistent with other prudential regulation;

- not hinder or interfere with fiscal, monetary and financial integration policy in the EU;

- not hinder or interfere with free movement of capital in the EU, ensuring a level playing field.

The expert group also noted that the banking union might potentially contribute to severing the links between sovereigns and banks, as contagion from banks to sovereigns could be reduced through more effective supervision. Furthermore, recovery and resolution procedures involving bail-ins of non-exempt creditors and resolution funds at the Member State and EU levels might also reduce contagion between sovereigns and banks.

While agreeing that it is important to address the problem of sovereign risk at its roots, particularly through sound fiscal policies, this report recognises that there is a danger that financial institutions could still be exposed to significant amounts of risks stemming from their holdings of sovereign exposures. To forestall this danger, prudential regulation should take account of the risks that are effectively there. If the policies that are being put in place by the EU and its Member States to address the problem at its roots reduce the credit risk associated with sovereign exposures, the regulation should have enough flexibility to acknowledge this.

Furthermore, any new regulation would need to guard against the risk of exacerbating the financial cycle. In particular, effective prudential regulation of sovereign exposures needs to prevent the build-up of excessive risks in the initial phase of the cycle, provide sufficient loss absorbency if risks materialise and disincentivise outsized investments in sovereign risk. It should not exacerbate the downturn of the financial cycle or prevent effective countercyclical fiscal policy.

The potential policy options and areas for reform identified and analysed by the expert group include the following.

Banking sector regulations

1. Stricter Pillar 1 capital requirements for sovereign exposures:

   (a) removing the domestic carve-out in the standardised approach;

   (b) introducing a non-zero risk-weight floor for sovereign exposures in the standardised approach;

   (c) reducing mechanistic reliance on external credit ratings in the standardised approach;

   (d) setting a minimum (regulatory) floor in the internal ratings-based (IRB) approach.

2. Diversification requirements (fully or partially removing the exemption of sovereign exposures from the large exposures regime and introducing a capital requirement for concentration risk).

3. Coverage of sovereign exposures in macro-prudential regulation (i.e. a flexible tool that would allow policy-makers to change the capital requirement on sovereign debt to vary over the cycle).

4. Enhanced Pillar 2 requirements (through recommendations for stress tests and/or qualitative guidance on diversification).

5. Enhanced Pillar 3 disclosure requirements on banks' sovereign exposures (e.g. by implementing mandatory templates for disclosure).

6. Regulation of liquidity risk, including alternative approaches to treating central government debt in liquidity regulation.

Insurance sector regulations

1. Maintaining the Solvency II approach.

2. The inclusion of sovereign exposures in the concentration and spread risk modules of the solvency capital requirement standard formula.

3. Enhanced Pillar 2 requirements.

4. Enhanced Pillar 3 disclosure requirements on insurers' sovereign exposures.

For a rigorous assessment of the above-mentioned policy proposals, a set of clear policy objectives and constraints was defined, against which policy options have been assessed by the expert group in a structured and transparent way (qualitative impact assessment). Furthermore, for a number of policy options, the report presents the results of a quantitative impact assessment in terms of extra capital requirements or portfolio adjustments that are needed. Finally, the transitional arrangements for policy options are discussed.

The report does not give a ranking for the policy options, nor does it provide any discussion of possible combinations of measures. For some options, the report indicates that implementation problems may be too difficult, but beyond that does not give preference to one option or combination of options over another. Such an expression of preference would require a more detailed impact assessment, with more data than the expert group had at its disposal. There is a consensus in the expert group that responsible bodies considering legislative reform for the regulatory treatment of sovereign exposures should engage in a more detailed impact assessment.

The calibration of the policy options has been considered to be outside the expert group's mandate, while calibration obviously has a very significant impact on the assessment of the costs and benefits of policies. Moreover, while giving due consideration to differences between regulated sectors, coherent treatment of like exposures across financial sectors should be ensured in order to avoid any potential regulatory arbitrage between the banking and the insurance regulations.

Given its forward-looking nature and the lack of a ranking of proposals, this report does not provide the basis for a recommendation, let alone a warning from the ESRB.

Finally, the ESRB is aware that the issues raised in this report also have an international dimension and that they may be discussed in global regulatory fora like the Basel Committee on Banking Supervision. This publication also intends to contribute to these considerations.

Introduction

For decades, the regulatory treatment of sovereign debt has significantly discounted and, in many cases, ignored the possibility of default on exposures that are denominated and funded in the country's own currency. Sovereign risk, however, is not a novel concept. Sovereign defaults, though not as frequent as those in the private sector, have occurred regularly throughout history. The recent financial crisis and subsequent distress suffered by a number of sovereigns, including some EU Member States, has further highlighted these risks. Indeed, the bond spreads and credit default swap (CDS) premia observed for a number of sovereigns suggest that the possibility of default is clearly non-negligible.[1] The crisis has also highlighted a close two-way link between banking and sovereign distress, with problems in the banking sector having a negative effect on the sovereign, and sovereign stress exacerbating the disruption in the banking system. The ESRB's Advisory Scientific Committee (ASC) has stressed the need for comprehensive reform, for instance of the risk weight of sovereign debt in prudential regulation.[2]

In light of these events, it is crucial to critically assess and reform, where necessary, the treatment of sovereign risk in regulation. This report aims to make some progress in this respect.

The first chapter of the report describes the existing regulatory treatment of sovereign exposures, both in the global Basel context and in the EU legislative framework. In particular, it highlights the following features of the current regulation: (i) low or zero capital requirements on certain sovereign exposures, (ii) low capital requirements for government bond-collateralised exposures due to lower haircuts for high-rated sovereigns, (iii) the exclusion of zero-risk-weighted sovereigns from existing limits within the large exposures regime, (iv) the categorisation of high-quality government bonds as highly liquid assets within the liquidity regulations, and (v) a 0% risk factor on certain government exposures within the Solvency II insurance regulation.

The second chapter of the report describes the risks associated with sovereign exposures and their systemic implications. The risks arise from concerns about the underlying solvency of the sovereign and include credit and market (devaluation) risk. These are analysed along several dimensions, including currency denomination and central bank independence. Systemic risks arise from intrinsic linkages between bank weakness – which impacts sovereign creditworthiness via its effect on the real economy (e.g. via deleveraging) and bank bailouts – and sovereign weakness – which affects the banks both via direct write-downs on sovereign exposures and higher bank funding costs. Chapter 2 discusses the main channels through which sovereign risk may affect the banking and the insurance sector and have potential spillover effects to the real economy.

1 For example, the market-implied probabilities of default for a number of EU sovereigns are well in excess of zero: see Chart 1.1 in Bank of England (2011).

2 Advisory Scientific Committee of the ESRB (2011).

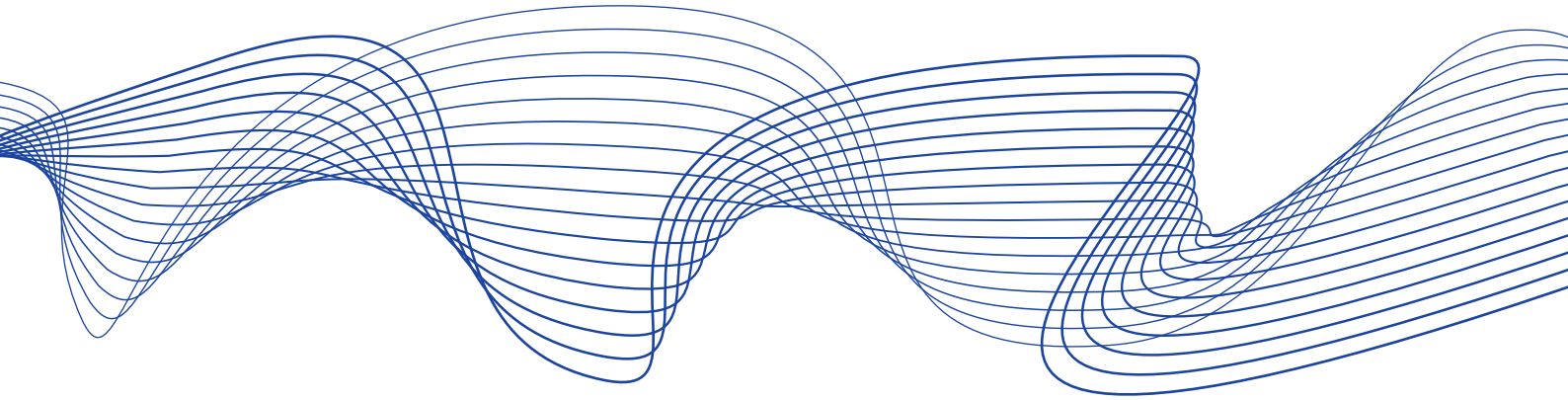
The third chapter presents the evidence based on data regarding sovereign debt holdings drawn from the following three sources: (i) aggregated data from the European Central Bank's (ECB) "MFI balance sheet items" statistics; (ii) bank-level data drawn from the stress test conducted by the European Banking Authority (EBA), covering the years 2009, 2010, 2011 and 2014; and (iii) the ECB's "Insurance corporations and pension fund" statistics. The chapter presents evidence on the following five issues: (1) how much sovereign debt is held by banks, insurance companies and other financial institutions, and how much of it is domestic debt; (2) how bank sovereign exposures have evolved over time, especially recently, and whether their time pattern differs for domestic and non-domestic sovereign debt; (3) whether sovereign exposures are concentrated in specific financial institutions, especially systemically important financial institutions; (4) whether sovereign exposures of banks respond to sovereign yields, after controlling for country-level macroeconomic determinants and for common euro area shocks; and (5) whether sovereign exposures have affected the risk of financial institutions and, if so, of which ones.

In parallel to the analytical work, the expert group discussed the policy implications for the regulatory treatment of sovereign exposures presented in Chapter 4. Based on the results of the analysis presented in the first three chapters, the expert group identified a broad range of potential policy options for banking and insurance sector regulations to address the systemic risks recognised. For a rigorous assessment of the set of possible policy measures, a set of clear policy objectives and constraints was defined, against which policy options have been assessed by the expert group in a structured and transparent way (qualitative impact assessment). Furthermore, for a number of policy options, the report presents the results of the quantitative impact assessment in terms of the extra capital requirements or portfolio adjustments needed. Finally, the transitional arrangements for policy options are discussed.

It should be stressed that, according to the expert group's mandate, any discussion about the appropriate legislation must be concerned with laying the foundations for financial stability in the future when the crisis has been resolved. Against this background, the analysis in this field is aimed at making a proposal for the steady-state regulatory framework rather than dealing with the euro area debt crisis. This means that the policy options assessed by the expert group are not envisaged as policies to be applied or announced in the current situation. At the same time, the policy recommendations have to consider the potential impact of any new rules as well as the transition to a new regime.

Section 1

Regulatory treatment of sovereign exposures



Regulatory treatment of sovereign exposures

This chapter highlights the main features of the regulatory treatment of sovereign exposures for financial institutions. The focus of the report here is on prudential regulations for banks and insurance companies.[1] As Chapter 2 points out in more detail, sovereign exposures create two main types of risk: credit risk of outright default or debt restructuring, and devaluation risk of inflation and higher nominal interest rates associated with the money creation used to finance the debt. The focus here lies on the treatment of credit risk in the banking book. In this area of banking regulation, the treatment of sovereigns is especially preferential compared with other issuers and may have repercussions for the banking industry. This is complemented by some remarks on the treatment of interest rate risk, the liquidity regulation, the forthcoming leverage ratio regulation, and the large exposures regime.

1.1 International convergence of capital measurement and capital standards (Basel II framework)[2]

The recommendations of the Basel Committee on Banking Supervision (BCBS) are to be respected directly only by large internationally active groups. The Basel Accord is of general character and its actual implementation takes place at jurisdictional level. Although the recommendations of the BCBS – and thus the Basel framework for the capital requirements for credit institutions – are not legally binding per se, they formed the starting point for the relevant EU directives, which, in contrast to the Basel frameworks, apply to every credit institution within the European Union.[3]

1.1.1 Risk weights for sovereign exposures

According to the Basel II framework, the procedure of determining the risk weight (and thereby the minimum capital requirement) of an exposure depends on the usage of one of two approaches to quantify credit risk. Banks can either utilise the standardised approach and determine risk weights in a standardised manner supported by external ratings, or apply the internal ratings-based (IRB) approach and make use of their own rating systems and more advanced calculation models.

In the standardised approach, the Basel II rules imply a risk weight of 100% by default for sovereign exposures. However, where an assessment from a rating agency is available, this is taken into account, leading to a weighting ranging from 0% to 150%.

1 There are no explicit or direct rules for sovereign exposures at the supplementary level for financial conglomerates under the financial conglomerates directive (FICOD) or its amending directive (FICOD I). The only provisions in FICOD that indirectly refer to sovereign exposures are the requirements for financial conglomerates to report to the coordinating supervisor any significant risk concentration (Article 7 of the FICOD). According to Article 2, paragraph 19, of FICOD, "risk concentration" means all risk exposures with a loss potential which is large enough to threaten the solvency or the financial position in general of the regulated entities in a financial conglomerate.

2 Basel Committee on Banking Supervision (2006), *International convergence of capital measurement and capital standards. A revised framework – Comprehensive version*, June.

3 The treatment of sovereigns in the EU regulations is covered in Section 1.3.

Table 1

Risk weights for sovereigns and central bank exposures in the standardised approach, as stated in paragraph 53 of the Basel II Accord

(percentages)

Credit Assessment	AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to B-	Below B-	Unrated
Risk Weight	0	20	50	100	150	100

Source: BCBS.

In the IRB approach – which should be used by large and sophisticated banks – the risk weight of assets is calculated according to the bank's internal rating system, which must take a number of risk parameters into account (e.g. probability of default – PD, loss given default – LGD, exposure at default, and maturity of exposure). The IRB approach thereby allows banks to assess the credit risk of borrowers using a granular rating scale and to account for a number of specific asset characteristics. Paragraph 389 of the Basel II framework requires that there be a "meaningful differentiation" of risk.

Zero risk weights for sovereign exposures have been a feature of capital regulation ever since the first Basel Accord,[4] where exposures resulting from the holding of government bonds issued by sovereigns who are members of the Organisation for Economic Co-operation and Development (OECD) were exempted from the requirement to be backed by own funds. However, later frameworks do not include a similar provision wherefore automatic zero risk weights are not actually mandated by the Basel Accord.

They can merely result from high external ratings or from a few exceptions regarding the application of the approaches used to quantify credit risk if respective paragraphs in the Basel II regime are analogously adopted in national regulatory frameworks.

Usually, sovereign exposures in the standardised approach are risk weighted according to their external rating as stipulated in paragraph 53 of the Basel II Accord (see Table 1 above). However, paragraph 54 states that: "At national discretion, a lower risk weight may be applied to banks' exposures to their sovereign (or central bank) of incorporation denominated in domestic currency and funded in that currency." This opens up the possibility to deviate from the original risk weighting method and can imply a zero risk weight for sovereign exposures if national regulation is formulated accordingly.

The Basel II IRB approach for calculating credit risk capital does not automatically imply a zero risk weight for highly rated sovereigns. It calls instead for a granular approach, allowing for a meaningful differentiation of sovereign risk. Banks opting for the IRB approach are allowed to use their own internal measures for key drivers of credit risk and, in this context, have the obligation to determine their own estimates of sovereigns' PDs (banks using the advanced IRB approach can also rely on their own estimates of the LGD for each sovereign). Besides the fact that the Basel II framework exempts sovereign exposures from the 3-basis point PD floor prescribed for corporate and bank exposures, it must be noted that these estimated figures mostly result from the historical data of default for these counterparts (which most of the time show low – if not no – default). Therefore, the risk parameters on sovereign debt are often very low and the risk weight of sovereign assets which is based on these parameters is usually also at a low level (see Table 2 below).

4 Basel Committee on Banking Supervision (1988), *International convergence of capital measurement and capital standards*, July.

Table 2

Basel II: Illustrative IRB risk weights and capital charges for sovereigns (example with moderate LGD and maturity)

(in percentage)

Asset class LGD: 45% Maturity: 2.5 years Probability of default	Sovereign exposure	
	Risk weight	Capital charge
0.00	0.00	0.00
0.01	7.53	0.60
0.02	11.32	0.91
0.03	14.44	1.16
0.05	19.65	1.57
0.10	29.65	2.37
0.25	49.47	3.96
0.40	62.72	5.02
0.50	69.61	5.57
0.75	82.78	6.62
1.00	92.32	7.39
1.30	100.95	8.08
1.50	105.59	8.45
2.00	114.86	9.19
2.50	122.16	9.77
3.00	128.44	10.28
4.00	139.58	11.17
5.00	149.86	11.99
6.00	159.61	12.77
10.00	193.09	15.45
15.00	221.54	17.72
20.00	238.23	19.06

Source: BCBS.

Also, banks using the IRB approach for other classes of exposure (e.g. corporates and mortgages) are mandated to do so for sovereigns. However, paragraph 260 of the Basel II framework permits IRB banks to use the standardised approach for certain exposures, as long as they are "immaterial in terms of size and perceived risk profile". This permission is subject to supervisory approval. Depending on how the standardised approach is designed in the respective national regulation, this rule allows for a zero risk weighting of some sovereign exposures at IRB banks (so called "permanent partial use").

1.1.2 Haircuts for sovereign debt in the context of credit risk mitigation and repo transactions

According to the Basel II framework, banks are allowed to use a number of approaches to mitigate the credit risks to which they are exposed. Thus, if financial institutions are capable of adequately

pursuing the respective techniques, they can lower the amount of equity required to back their transactions. The collateralisation of credit risk is a common means to achieve this objective. It enables banks to reduce their exposure through the acceptance of an asset provided by the counterparty as security. Current regulation classifies a number of financial instruments, such as government or corporate bonds, as eligible collateral that may be used in the context of credit risk mitigation. However, to account for potential fluctuations in prices, the value of any counterparty-provided security must be adjusted before being acceptable as collateral for risk hedging purposes. This is usually done through the use of standardised haircuts that differ according to the asset class a security belongs to. Under the Basel II framework, government bonds with a rating of AA- or higher are subject to haircuts of 0.5% (residual term < 1 year), 2% (residual term 1-5 years) and 4% (residual term > 5 years), while haircuts of 1%, 4% and 8% respectively are applicable for private debt.[5] The lower haircuts for sovereign debt – which are also granted for repo transactions that are not primarily aimed at the mitigation of credit risk – result in high-rated government bonds representing more valuable collateral than other assets because the respective securities allow for a larger amount of exposure reduction. Accordingly, the Basel II rules incentivise banks to preferably acquire sovereign debt rather than private debt due to the cost-saving potential in the context of risk mitigation and/or repo transactions.

1.1.3 Treatment of other risks under Pillar 2

Pillar 1 of the Basel II framework contains the minimum capital requirements for credit risk, market risk and operational risk. There are, however, a number of other material risks that a bank may face, which is why Pillar 2 – the supervisory review process (SRP) – has been incorporated into the Basel II framework. It adds a qualitative element to the quantitative minimum capital requirements of Pillar 1 and mainly aims at identifying the overall risk of an institution and the main influential factors on its risk situation as well as at evaluating them from a supervisory perspective. Among these other risks, concentration risk and interest rate risk in the banking book are of particular importance.

In this regard, it should be noted that sovereign exposures do not benefit from any specific preferential treatment, as all banking book exposures are treated in the same manner regarding these two risk categories under the Basel II framework. However, given the observed bulkiness of the sovereign exposures banks may hold, concentration risk does matter for these balance sheet items. In addition, since a sovereign can de facto default on its debt by monetising it instead, or reneging on its obligations to repay the creditors, sovereign risk can transcend into interest rate risk from higher inflation and nominal interest rates. Moreover, the bulkiness of exposures will also lead to a large impact on bank balance sheets if interest rate risk materialises. Nevertheless, interest rate risk will affect the whole balance sheet of the bank and not just its sovereign debt holdings.

Given this relevance of concentration risk and interest rate risk for sovereign exposures, their current treatment is presented here in more detail.

Concentration risk

The Basel II framework addresses concentration risk in general through Pillar 2 provisions. Although the BCBS has recently adopted rules for one particular aspect of concentration risk via

5 Paragraph 151 of the Basel II framework.

the large exposure regime (see Section 1.2.5), sovereign exposures are exempted from these rules. Since there are no other rules in place to deal with the concentration risk arising from sovereign exposures, sovereign risk is not addressed appropriately in the setting of minimum Pillar 1 capital requirements.

Interest rate risk

Sovereign risk events can translate into interest rate risk if the perception that the central bank may not be able or willing to maintain a stable currency in view of the situation of the sovereign leads to a rise in inflation expectations and inflation risk premia (see Section 2.2.1). It should be noted, however, that this is not the case in the euro area, where the ECB is responsible for the conduct of monetary policy, not the individual Member States. Moreover, it is also not relevant for non-euro area Member States, as the Treaty on the Functioning of the European Union (TFEU) stipulates that all EU central banks are to be independent.

The prohibition of monetary financing (Article 123 TFEU), which holds for all EU central banks, prohibits the central bank from providing credit to the sovereign,[6] which should ensure that a situation where the sovereign "monetises debt" cannot arise. In this situation, sovereign risk should translate into credit risk (which would lead to higher credit risk premia) and not a rise in inflation expectations and inflation risk premia.

If sovereign risk were to lead to a rise in inflation expectations and inflation risk premia (which can be seen as theoretical for the EU, given the treaty requirements), a strong increase in the nominal interest rate would result, which would pose a risk to the bank and reduce the value of fair-valued securities,[7] including sovereign debt – even if the sovereign did not default on its obligations. Such risk should be adequately capitalised. It should be noted that the materialisation of interest rate risk described is not specific to sovereign exposures, but would apply to a much wider class of assets in the economy concerned.

The treatment of interest rate risk will depend on whether the debt is held in the trading or banking book. In the trading book, interest rate risk is covered under Pillar 1 (both in Basel and EU regulations) under the market risk capital charge. There are two possible methodologies for calculating this capital charge: a model-based approach and a standardised approach. Broadly speaking, both seek to capture the risk of mark-to-market losses from volatility in market interest rates. The trading book capital requirements are currently under revision by the BCBS,[8] where the increased criticism of value-at-risk (VAR) models has led the BCBS to consider moving from VAR to expected shortfall, a risk measure that better captures "tail risk", and establishing the more standard approaches as a floor. For interest rate risk associated with a rise in inflation expectations and inflation risk premia triggered by the situation of the sovereign, it would

6 Article 123(1) TFEU reads: "Overdraft facilities or any other type of credit facility with the ECB or with the central banks of the Member States … in favour of Community institutions or bodies, central governments, regional, local or other public authorities, other bodies governed by public law, or public undertakings of Member States shall be prohibited, as shall the purchase directly from them by the ECB or national central banks of debt instruments".

7 Despite the potential fair value losses, economically, the risk is purely in terms of interest rate mismatch, if assets and liabilities have the same currency denomination.

8 Basel Committee on Banking Supervision (2012), *Fundamental review of the trading book – Consultative document,* 3 May; Basel Committee on Banking Supervision (2013), *Fundamental review of the trading book – Second consultative document,* 31 October; Basel Committee on Banking Supervision (2014), *Fundamental review of the trading book: outstanding issues – Consultative document,* 19 December.

be important to take account of the fact that such occurrences may be rare events and the associated processes highly non-stationary, which raises serious issues for the reliability of statistical inference from the available data.

For the banking book, however, interest rate risk is not captured under Pillar 1. Instead, a tailored approach is defined as part of Pillar 2. Hence, there are no (regulatory) capital requirements for the measurement of interest rate risk in the banking book, but rather a reliance on (internal) economic capital assumptions which differ between banks and which may also differ over time.[9]

The lack of Pillar 1 capital requirements in the banking book leaves banks vulnerable to interest rate risk of the type described above. In addition, regulatory arbitrage opportunities arise when the same risks attract no Pillar 1 capital requirements if held in the banking book, but carry a capital charge if held in the trading book.

Therefore, the treatment of interest rate risk in the banking book needs to be considered at a global level, on an asset-liability basis, and not restricted to sovereign exposures. Such an approach would contribute to increasing the bank's resilience to interest rate risk and to sovereign risk (to the extent that it would translate into interest rate risk), while simultaneously ensuring consistency within the prudential regulation framework.

The issue of whether interest rate risk in the banking book should be a part of Pillar 1 or maintained in Pillar 2 is a matter that has been considered by regulators and supervisors. The BCBS has responded by conducting a consultation on the fundamental review of the trading book.[10]

It is the opinion of the expert group members that the current treatment of interest rate risk is unsatisfactory. The expert group recommends explicit treatment of interest rate risk in the banking book. The ESRB should support and actively engage in the review of interest rate risk to ensure that this outcome is achieved.

1.2 Newer Basel frameworks

1.2.1. Risk weights for sovereign exposures

The Basel III framework[11] does not change the rules described above in regard to the determination of risk weights in the banking book; the standardised approach and the IRB approach as formulated in Basel II remain applicable.

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9 Nevertheless, both the Basel and EU regulations do require (as a minimum) that supervisory authorities take measures in the case of institutions whose economic value declines by more than 20% of their own funds as a result of a supervisory standard shock, i.e. a sudden and unexpected change in interest rates of +/- 200 basis points for major currencies or the equivalent to the first and 99th percentile of interest rate changes observed (five years of one-day movements observed scaled up to a 240-day year). In addition, banking book positions should also be subject to interest rate stress tests.

10 See consultative documents cited above.

11 Basel Committee on Banking Supervision (2011), *Basel III: A global regulatory framework for more resilient banks and banking systems,* December 2010 (revised, June 2011).

However, the BCBS' revisions to the Basel II market risk framework (Basel II.5)[12] completed the introduction of an incremental risk charge on the trading book in 2009 that had been initiated earlier. The amendments to Basel II imply risk differentiation (not zero risk weight) through the capture of default risk (including sovereigns) in the trading book and also capture other risks like interest rate risk under the trading book rules.

The effectiveness of minimum requirements depends on whether they constitute a constraint for the bank, either because they operate close to the regulatory minimum or because they try not to breach a certain target capital ratio. In the future, an additional factor might be that either the capital requirement or a leverage ratio (see the discussion below) is the binding constraint for the bank.

1.2.2 Liquidity

Taking into account the lessons learnt during the financial crisis, the Basel III framework stipulates via the liquidity coverage ratio (LCR) framework[13] and the net stable funding ratio (NSFR) framework[14] that banks have to secure the sufficient provision of liquidity and an adequate financing structure at all times.

The LCR shall increase the short-term resilience of a bank's liquidity profile by ensuring that the financial institution has sufficient unencumbered high-quality liquid assets to withstand a 30-day stress scenario in the form of a severe net cash outflow. The ratio is defined as:

$$LCR = \frac{Stock\ of\ high\text{-}quality\ liquid\ assets}{Total\ net\ cash\ outflows\ in\ 30\text{-}day\ stress\ scenario} \geq 100\%$$

Assets must meet certain criteria to be deemed highly liquid within the LCR framework and are categorised according to their quality into Level 1 liquid assets, which qualify in their entirety, and Level 2 liquid assets, which – after applying a haircut – can be taken into account for up to 40% of total assets within the LCR. Level 2 assets consist of higher-liquidity Level 2A assets, which are highly rated corporate and covered bonds (subject to a 15% haircut) and lower-liquidity Level 2B assets, which can be included at supervisors' discretion and consist of lower-rated corporate bonds, high-rated residential mortgage-backed securities and certain equities (subject to haircuts of 20%-50%). Level 2B assets may not account for more than 15% of a bank's total stock of high-quality liquid assets (HQLAs). Furthermore, the stock of HQLAs should be well diversified within the asset classes themselves, with the exception of the sovereign debt of the bank's home jurisdiction or from the jurisdiction in which the bank operates, central bank reserves, central bank debt securities and cash.

The objective of the NSFR is to promote resilience over a longer-term horizon by requiring banks to provide a sustainable maturity structure of assets and liabilities. Banks are to permanently re-finance activities through stable instead of short-term funding sources. The ratio is defined as:

$$NSFR = \frac{Available\ Stable\ Funding}{Required\ Stable\ Funding} \geq 100\%$$

12 Basel Committee on Banking Supervision (2009), *Revisions to the Basel II market risk framework,* July.

13 For the detailed rules on the LCR, see Basel Committee on Banking Supervision (2013), *Basel III: The liquidity coverage ratio and liquidity risk monitoring tools,* January.

14 For the detailed rules on the NSFR, see Basel Committee on Banking Supervision (2014), *Basel III: the net stable funding ratio,* October.

Available stable funding (ASF) corresponds to the sum of a bank's liabilities, weighted according to their expected availability within a one-year stress scenario via the ASF factor; required stable funding (RSF) corresponds to the sum of a bank's assets and off-balance sheet exposures, weighted according to their assumed liquidity via the RSF factor.

Under the terms of Basel III, sovereign bonds with a standardised risk weight of 0% under Basel II, paragraph 53, i.e. those rated AAA to AA-, are eligible to classify as Level 1 liquid assets within the LCR framework. The same treatment also applies to domestic currency-denominated debt of sovereigns in the bank's home country, or operating in the country in which liquidity risk is being taken (up to the limit of stressed outflows in that country). Sovereign bonds with a 0% Basel II standardised risk weight will also be assigned a low RSF factor of 5% within the NSFR framework, making them an attractive asset in terms of required stable funding. High-quality covered bonds and corporate bonds will be categorised as Level 2A assets within the LCR framework (and thereby be subject to the above-mentioned haircuts and qualification limits, whereas Level 1 assets are not subject to haircuts or quantification limits) and will be weighted with an RSF factor of at least 20% (thereby requiring substantially higher amounts of stable funding) within the NSFR framework. Such treatment of sovereigns is generally consistent with the fact that sovereign debt tends to be the most liquid asset in a given country.

The LCR standard entered into force on 1 January 2015, but the minimum requirement began at 60%, rising in equal annual steps of 10 percentage points to reach 100% on 1 January 2019. The NSFR will become a minimum standard on 1 January 2018 and the BCBS has recently launched a consultation on specific liquidity disclosure standards.[15]

1.2.3 Leverage ratio

The introduction of a leverage ratio in Basel III shall backstop the risk-based system of capital requirements and reduce the costs of any model risk in the system of risk-weighted assets (RWAs). Sovereign exposures are fully included in the denominator of the leverage ratio, so the leverage ratio ensures that even those banks investing heavily in sovereign debt hold equity equal to at least 3% of their non-risk-weighted assets. Notably, there is only a preliminary calibration at this point in time,[16] with a view to migrating the leverage ratio to a binding minimum requirement in 2018, following review and re-calibration.

The effectiveness of the leverage ratio eventually depends on whether the risk-based requirements or the leverage ratio are binding for the bank. Either the leverage ratio or the capital ratio, or both, can operate as constraints for the bank if the bank operates close to the regulatory minimum or close to a target for either of the two ratios that it has set internally. For example, if a bank invests most of its funds in high-risk assets, such as equities, and a small proportion of its funds in sovereign debt, it is likely to be bound by the risk-based requirement rather than the leverage ratio.[17] So, at the margin, in this case, acquiring extra sovereign

15 Basel Committee on Banking Supervision (2014), *Net stable funding ratio disclosure standards - Consultative document*, 9 December.

16 Basel Comittee on Banking Supervision (2014), *Basel III leverage ratio framework and disclosure requirements,* January.

17 For example, if such a bank requires 100 units of capital to meet the 6% RWA minimum, and 80 units of capital to meet the 3% leverage ratio (i.e. the average risk weight across the balance sheet is still high despite some holdings of sovereign debt), the risk-based requirement of 100 units of capital would be binding.

exposures will still require zero capital. The other way around, a bank that specialises in public finance or low-risk-weighted real estate financing is more likely to be effectively constrained by the leverage ratio than by a risk-weighted capital requirement that encompasses, for instance, a low risk weight for public sector exposures.[18] So, at the margin, in this case, acquiring extra sovereign exposures will require extra capital, whereas a low positive risk weight for public sector exposures will not.

Overall, a leverage ratio of 3% would require banks to have additional capital if the average risk weight on the balance sheet is around 35% or lower. For the effectiveness of the leverage ratio, it is key that central government exposures are measured for leverage purposes in a comprehensive manner.[19]

1.2.4 The treatment of unrealised gains and losses on available-for-sale securities

According to Basel III, Common Equity Tier 1 (CET1, the most loss-absorbing form of bank capital) consists of the (algebraic) sum of various elements, among them "accumulated other comprehensive income". In a company's statement of comprehensive income ("income statement"), "other comprehensive income" is the difference between "net income" and "comprehensive income", and represents certain gains and losses not recognised in profit or loss. Among these gains and losses not recognised in profit or loss are unrealised gains and losses on available-for-sale securities (i.e. securities classified in the "available for sale" portfolio for accounting purposes). "Accumulated other comprehensive income" is a subsection in equity where "other comprehensive income" is accumulated (summed or "aggregated").

Under Basel II, it was possible to remove from banks' regulatory capital unrealised gains or losses recognised on the balance sheet as other comprehensive income (through the application of a so-called "prudential filter"). The main objective behind this option was to avoid (or reduce) the excessive volatility of regulatory capital related to changes in the fair value of banks' securities portfolio.

Under Basel III, this option is no longer available. All unrealised gains and losses recognised on the balance sheet as other comprehensive income (among them those on available-for-sale securities), with the exception of "cash flow hedges", fully increase (gains) or decrease (losses) regulatory capital (in particular CET1). In other words, in Basel III, there are hardly any adjustments left to remove unrealised gains or losses recognised on the balance sheet from CET1.

For sovereign exposures (government securities) classified in the available-for sale portfolio, this prudential treatment of unrealised gains and losses in Basel III is, de facto, equivalent (from an economic point of view) to a capital charge.[20]

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18 For example, if such a bank requires 100 units of capital to meet the 3% leverage ratio, and 80 units of capital to meet the 6% RWA minimum (i.e. the average risk weight across the balance sheet is low), the leverage ratio requirement of 100 units of capital would be binding.

19 The expert group has not had a detailed discussion of the leverage ratio's preliminary calibration, but notes that there is an open question about assets acquired or used as collateral in securities financing transactions, including repo and repo-style transactions. A large proportion of such assets is accounted for by central government bonds. In particular, it appears that leverage resulting from exposures to such debt instruments would not be measured in a comprehensive way if the party exposed to the default risk of the asset was able to offset the asset in the leverage ratio with monies payable or treat the asset as sold when they are economically still exposed to it.

20 However, this does not apply to securities classified in the held-to-maturity portfolio that will continue to be registered at amortised cost. Therefore, this may give some leeway to regulatory arbitrage.

1.2.5 Large exposures regime

The large exposures regime applies a limit to exposures that exceed a certain size, more precisely 25% of an institution's eligible capital.[21] This is a Pillar 1 requirement. Notably, however, exposures to sovereigns are exempt from large exposure requirements. Similar rules had already been implemented in the EU before the standard for large exposures was set by the BCBS in 2014 (the EU rules are described in more detail in Section 1.3.3).

1.3 Banking regulation within the European Union

Although Basel III provides a general framework for global regulation, the framework has been implemented in the EU/EEA via the Capital Requirements Directive (CRD IV)[22] and the Capital Requirements Regulation (CRR).[23] It is these rules that apply to every EU credit institution and provide a working framework for EU supervisors. This section also discusses institutions' options for using certain provisions.

1.3.1 Risk weights for sovereign assets

Following the structure of the Basel framework, the CRR, too, contains two approaches to be chosen by credit institutions to cover the credit risk of sovereign exposures: the standardised and IRB approaches. The procedure of determining the risk weight of exposures is generally based on the Basel II methods outlined above (the incremental risk charge on the trading book mentioned under 1.2.1 has been integrated into the EU regulatory framework in the course of the CRD III[24] adoption). In the standardised approach, external ratings are taken into account when calculating how much equity is required to back transactions, while in the IRB approach, banks use more sophisticated models adhering to the requirements stated in the second Basel Accord.

The CRR does not grant a general zero risk weight for sovereign debt. However, owing to the analogous adoption of exemptions stated within the Basel II framework, EU regulation de facto grants zero risk weights for the majority of debt issued by EU sovereigns.

According to Article 114(4) of the CRR, "exposures to Member States' central governments and central banks denominated and funded in the domestic currency of that central government and central bank shall be assigned a risk weight of 0%" in the standardised approach. Because of the currency union, the exemption is automatically applicable to all banks within the euro area that finance euro-denominated government debt, leading to preferential treatment of the respective bonds in spite of actual differences in credit risk.

21 Basel Committee on Banking Supervision (2014), *Supervisory framework for measuring and controlling large exposures,* April.

22 Directive 2013/36/EU of the European Parliament and of the Council on access to the activity of credit institutions and the prudential supervision of credit institutions and investment firms, OJ L 176, 27.6.2013, p. 338.

23 Regulation (EU) No 575/2013 of the European Parliament and of the Council on prudential requirements for credit institutions and investment firms, OJ L 176, 27.6.2013, p. 1.

24 Directive 2010/76/EU of the European Parliament and of the Council amending Directives 2006/48/EC and 2006/49/EC as regards capital requirements for the trading book and for re-securitisations, and the supervisory review of remuneration policies, OJ L 329, 14.12.2010, p. 3.

In addition, for the standardised approach, Article 114(5) of the CRR provides for a transitional period[25] for a risk weighting of 0% to be applied to all exposures to an EU Member State central government in the domestic currency of any other EU Member State, provided it is funded in that same currency.

Also, diverging from Basel II, the CRR permits credit institutions using the IRB approach to apply the standardised approach to any domestic sovereign exposures, irrespective of their size, as long as these exposures are assigned a 0% standardised risk weight (Article 150 – "permanent partial use"). This exemption is much broader than that in Basel, and effectively allows EU IRB banks to apply a one-size-fits-all zero risk weight to the euro-denominated debt of EU sovereigns (if permitted by the competent authorities).

A report[26] submitted by the BCBS in October 2012 also highlights, inter alia, the different regulatory treatment of sovereign exposures using the IRB approach between the CRD and Basel:

"Basel allows a bank using the IRB approach to permanently apply the standardised approach for exposures in insignificant business units or asset classes only if they are immaterial in terms of size and perceived risk profile, and subject to supervisory approval. The CRR, however, includes specific provisions that permit a bank using the IRB approach to permanently apply, subject to supervisory approval, the standardised approach to sovereigns, public sector bodies and certain other exposures, without the condition in Basel that this may be applied only if they are immaterial in terms of size and perceived risk profile."

Therefore, the BCBS report confirms the assessment made above that the exemption is much broader under the CRR than that in Basel and classifies that divergence as a "material non-compliance" of the CRR compared with the Basel framework. It should be noted, however, that the data analysis confirms a restrictive application of the exemption in some national jurisdictions. Nevertheless, the report assigns that level of materiality because the exemption under the CRR is seen as material in terms of exposure size.[27]

It should be noted, however, that the assessment of the EU regulations in this field made by the BCBS has been contested by the European Commission (EC).[28] In the EC's view, the BCBS's findings do not appear to be supported by rigorous evidence and a well-defined methodology. The EC stressed that the average size of the exposures treated under the standardised approach instead of the IRB approach is only 5.49% and no estimate of the impact on capital requirements is provided in order to confirm the materiality of the finding.

25 The transitional period ends on 31 December 2017, with a phasing-out period until 2020.

26 Basel Committee on Banking Supervision (2012).

27 "The data analysis indicates that the finding is material. Based on data from 16 banks, the notional amount of exposures to sovereigns exempted under Article 145(1)(d) typically averages at 5.49% of total exposures of the bank, with the most affected bank reporting permanent partial use under this Article at around 20%. This is material in terms of exposure size" – Basel Committee on Banking Supervision (2012). Please note that Article 145 mentioned in the report corresponds to Article 150 in the final version of the CRR.

28 See European Commission (2012).

In turn, the 2011 EBA stress test reports that only 36 out of the 90 participating EU banks applied their own internal model to sovereign risk, a lower fraction than for the corporate, mortgage or retail asset classes (see Table 3 below).[29]

According to the EBA, only 20% of the sovereign portfolio of the 90 EU banks which were part of the stress test exercise in 2011 is covered by an IRB model (and is therefore supposedly not to be 0% risk-weighted on euro sovereign exposures). Knowing that for some of this 20%, banks have used mostly historical data on sovereign default, the final risk weights on these exposures, even though not zero, are pretty low most of the time.

This chapter has highlighted, in particular, the treatment of sovereign exposures under Pillar 1. However, in the context of the adoption of the CRR and the CRD IV, the legislators decided to clarify that the Pillar 2 obligations for banks and investment firms to address and control concentration risk also extend to public sector exposures. They also noted that controlling concentration risk is more effective than risk weighting these exposures, given the size of these exposures and the difficulties in calibrating capital requirements.

Table 3
Use of the IRB approach by banks involved in the EBA's 2011 stress test

Portfolio	**Number of banks participating: 90** **of which number of banks with IRB models: 59**
Sovereign	36
Institutions	44
Corporate	58
Retail residential mortgage	53
Retail revolving	31
Retail SME	44
Total retail	53
Commercial real estate	54
Total	**59**

Source: EBA stress test 2011.

29 See also Hannoun (2011).

Table 4

Ways of obtaining a 0% risk weight for central governments under the standardised approach for credit risk according to EU banking regulation

	0% risk weight for exposures to	
	Central governments of EU Member States	**Central governments of third countries**
Article 114(2) of the CRR	Central government has a credit assessment of "1" (obligor dimension)	Central government has a credit assessment of "1" (obligor dimension)
Article 114(4) of the CRR	Exposure is denominated and funded in domestic currency of the Member State (exposure dimension)	
Article 114(5) of the CRR	Until 31 December 2017: Exposure is denominated and funded in the domestic currency of any Member State (exposure dimension)	

1.3.2 Haircuts for sovereign debt in the context of credit risk mitigation and repo transactions

The Basel III-based CRR allows banks the use of a number of approaches to mitigate credit risks to which they are exposed. The values of counterparty-provided securities are adjusted according to the original Basel II rules as laid out above; the same applies for repo transactions.

1.3.3 Large exposures regime

The large exposures regime requires banks and investment firms to monitor and control their large exposures in a way that ensures diversification of a bank's holdings and avoids systemic risk associated with significant reliance by any one financial institution on any given counterparty. The rules require that exposures be measured not simply on an entity-to-entity basis, but also across groups or similarly interrelated counterparties, because solely assessing exposures on an individual basis may not give an accurate reflection of the risk to which a bank is subject (multiple entities may form the same risk because they are members of the same group or cross-guaranteed). To avoid risk concentration, current regulation therefore imposes limits on large exposures in the trading and the banking book: the amount of exposure to any single counterparty, group of connected clients or connected counterparties must not exceed 25% of own funds. However, Article 400 of the CRR exempts all sovereign exposures that would be assigned a risk weight of 0% under the standardised approach for credit risk from the limit to large exposures. Since most sovereign exposures would be assigned a risk weight of 0% according to these rules (see 1.3.1 above), this leads to a preferential treatment of sovereign exposures which can in turn be accumulated regardless of any potential concentration risk.

1.3.4 Liquidity

The CRR introduced a framework for liquidity risk management, standards and measurement which draws on the Basel III rules outlined above. The LCR was introduced in 2015,[30] and the application of a net stable funding requirement will start in 2018. In line with Basel III rules, the CRR recognises that domestic sovereigns are eligible for use in the HQLA buffers of domestic banks. In addition, also in line with Basel III, domestic sovereigns can be included in the stock of HQLAs without limits for domestic banks – and for foreign banks taking liquidity risk in that country/currency.

1.3.5 Leverage ratio

The disclosure of the leverage ratio started on 1 January 2015, but there is currently no binding requirement. The CRR requires the EC to submit a report by the end of 2016, as well as, where appropriate, a legislative proposal to introduce the leverage ratio as a binding requirement from 2018 onwards. The definition of the leverage ratio generally follows that of the Basel III framework.

1.3.6 Options for institutions in EU Member States

Although the CRR establishes, in general, uniform rules to set capital requirements across EU countries, there are areas where it allows some heterogeneity by granting options to institutions in Member States.

Three such options are significant in the context of the regulatory treatment of sovereign exposures. They refer to the following aspects:

- recognition of a third country's treatment of central government and central bank exposures (standardised approach), according to Article 114(7) of the CRR;
- recognition of a third country's treatment of regional government and local authority exposures (standardised approach), according to Article 115(4) of the CRR;
- treatment of sovereign guarantees denominated in the domestic currency of the borrower if the exposure is funded in that currency (credit risk mitigation), according to Article 235(3) of the CRR.

This in fact means that these provisions enable institutions to assign a lower risk weight (i.e. basically 0%) to exposures to the central government (or central bank) of a country treating sovereign exposures preferentially (under the standardised approach and regarding exposures denominated and funded in the domestic currency only). This results in an even more preferential treatment of sovereign exposures under the CRR.

30 The LCR was introduced on 1 January 2015, but the minimum requirement will begin at 60%, rising in equal annual steps of 10 percentage points to reach 100% on 1 January 2019.

1.3.7 Treatment of sovereign exposures by the European Banking Authority

The aim of this subsection is to present the EBA's approach to sovereign exposures, as adopted in the methodology for the EU-wide stress test exercises conducted in 2011 and 2014, and also in a recommendation issued in December 2011.

The EBA's 2011 EU-wide stress test

The methodology adopted for the EU banking stress test in 2011[31] recognised sovereign risk by applying haircuts to sovereign exposures in the trading book and by prescribing the method for the calculation of provisions for sovereign exposures in the banking book (both the standardised approach and the IRB portfolio). For the latter, the EBA developed an approach based on the PDs attributed by credit rating agencies (CRAs) and on assumptions of certain downgrades that depend on the credit quality of the specific exposures. The first step was to identify the degree of the downgrade (number of notches), which was linked to the initial rating. For sovereign exposures with an AAA rating, no downgrade was needed. For AA sovereign exposures, a two-notch downgrade needed to be applied. Finally, for sovereign exposures with a BBB+ rating, a four-notch downgrade was requested (floor at CCC). After the application of the downgrade

Table 5
(percentages)

Fitch rating	Fitch Global Corporate Finance 2 years average (cumulative) default rates – 1995-2009*	Moody's rating	Moody's Corporate 2 years average (cumulative) default rates – 1998-2010**	Standard and Poor's rating	S&P's Global Corporate 2 years average (cumulative) default rates 1981-2010***	Average Implied PD****
AAA-AA	0	Aaa-Aa2	0.02	AAA-AA	0.04	0.03
AA-	0.07	Aa3	0.13	AA-	0.11	0.10
A+	0.12	A1	0.30	A+	0.12	0.18
A	0.30	A2	0.28	A	0.21	0.26
A-	0.37	A3	0.27	A-	0.23	0.29
BBB+	0.35	Baa1	0.45	BBB+	0.45	0.42
BBB	0.80	Baa2	0.55	BBB	0.57	0.64
BBB-	1.36	Baa3	0.98	BBB-	1.17	1.17
BB+	3.34	Ba1	1.69	BB+	1.48	2.17
BB	3.73	Ba2	1.82	BB	2.47	2.67
BB-	3.13	Ba3	3.64	BB-	3.92	3.56
B+	4.55	B1	5.78	B+	7.00	5.78
B	7.38	B2	9.13	B-	12.62	9.71
B-	5.19	B3	14.28	B-	17.19	12.22
CCC-C	32.55	Caa1-C	39.12	CCC-C	36.79	36.15

Source: EBA 2011 stress test.
** Global Corporate Finance*
*** Corporate Default and Recovery Rates, 1920-2010*
**** 2010 Annual Global Corporate Default Study and Rating Transitions*
***** EBA calculations*

31 See European Banking Authority (2011a).

to the initial rating, this post-stress rating needed to be mapped to a PD. For simplicity and consistency purposes, the EBA used the average of the PDs used by the three well-known CRAs Fitch, Moody's and Standard and Poor's (see Table 5 above). The LGD to be used for the calculation of the impairments was set at 40% by the EBA. The increased amount of provisions is equal to the multiplication of the PD after the downgrade and the LGD of 40%.

The new PDs determined after incorporating both the downgrade and the LGD of 40% were used only for the calculation of the increased amount of provisions. For the calculation of the RWAs, banks used their own stressed input parameters.

The EBA's sovereign buffer in the Recommendation of December 2011

On 8 December 2011, the EBA issued a Recommendation on the creation of a temporary capital buffer to restore market confidence.[32] This measure was part of a broader package agreed by the European Council to address the situation in the EU in order to restore stability and confidence in the markets.

The formal Recommendation adopted by the EBA's Board of Supervisors stated that national supervisory authorities (NSAs) should require the banks included in the sample (the largest EU banks) to strengthen their capital positions by building up an exceptional and temporary capital buffer against sovereign debt exposures through:

- the removal of any prudential filter applied by the bank on the assets held in the available-for-sale portfolio in order to align the accounting and the prudential value of the assets and reflect the mark-to-market value of the assets in the capital position of the banks;

- the computation in the capital position of the banks of the latent losses on the sovereign exposures in the held-to-maturity portfolio, as well as in the loans-and-receivables portfolio (resulting from the application of the mark-to-market value).

The amount of the sovereign capital buffer was set to reflect market prices as at the end of September and was fixed (i.e. not subject to any revision). In addition, banks were required to have a CET1 capital ratio of 9% by the end of June 2012.

The buffers were designed to provide reassurance to markets about the banks' ability to withstand a range of shocks and still maintain adequate capital levels. However, this recapitalisation exercise was explicitly designed as a "one-off" event (to be a temporary capital buffer, that was to be released when market conditions improve) to enhance confidence in the financial markets, hence setting no precedent for the "normal" treatment of sovereign debt exposures in the future.

32 EBA/REC/2011/1, available at http://www.eba.europa.eu/documents/10180/16460/EBA+BS+2011+173+Recommendation+FINAL.pdf/b533b82c-2621-42ff-b90e-96c081e1b598

It should be noted that while the computation of the potential losses and the removal of the prudential filters on the assets held in the available-for-sale portfolio is in line with the full implementation of the Basel III framework, a full marking-to-market requirement for all sovereign debt exposures, including the held-to-maturity portfolio and the loans-and-advances portfolio, is inconsistent with accounting and prudential treatment. More precisely, the accounting requirements in the EU provide for the measurement of certain categories of financial assets at amortised cost, provided that these financial instruments meet specific criteria (e.g. in IAS 39, the intention and ability to hold the particular asset until maturity, and in the new IFRS 9, both the "cash flow characteristics" and the "business model" tests).

The EBA's 2014 EU-wide stress test

In the 2014 stress test, the methodology for recognising sovereign risk differed depending on whether the exposures were held (i) in the regulatory banking book, (ii) as available for sale and designated at fair value in the profit and loss statement, or (iii) in the held-for-trading portfolio.[33]

For sovereign positions in the regulatory banking book, banks were requested to estimate impairments/losses excluding fair value positions subject to the market-risk approach in line with sovereign credit risk shocks provided by the ESRB/ECB. The other two categories were subject to the market risk parameters and haircuts provided for by the ESRB/ECB. Haircuts were applied to direct exposures, while other exposures were to be stressed with market risk parameters. Banks were also asked to compute stressed RWAs according to the applicable prudential framework and the corresponding credit risk or market risk approach.

Another important feature of the sovereign methodology was the common application of prudential filters for sovereign available-for-sale assets in line with minimum CRR requirements, e.g. including 20% of unrealised losses in 2014, 40% in 2015 and 60% in 2016.

1.4 Insurance regulation

The currently applicable insurance regulation, Solvency I, refers to a range of EU directives regulating the insurance sector. The provisions spelled out in the directives are not fully harmonised across EU Member States, and a rather heterogeneous set of rules therefore still prevails. Indeed, some Member States have concluded that the current EU minimum requirements are not sufficient and have implemented their own reforms, thus leading to a situation where there is a patchwork of regulatory requirements across the EU.

Under Solvency I, there is no explicit capital requirement related to market risk. This means that insurers do not have to keep capital against the risk of holding financial assets, unless national law has introduced a more risk-sensitive framework. Under basic Solvency I rules, capital requirements would therefore generally depend on the volume of premiums, technical provisions or claims incurred, unrelated to the government bond exposure and any other investment exposure.

33 European Banking Authority (2014a).

The management of investment risk is also dealt with in a relatively simplistic and non-risk-sensitive way by splitting investments into two categories depending on the purpose of their holdings. First, "assets covering technical provisions" are assets which back obligations relating to policyholders. These are subject to a number of quantitative restrictions (e.g. asset eligibility criteria and quantitative limits, including diversification requirements), but no capital requirements. The second category of assets is termed "free assets" and includes any other assets which are not subject to quantitative restrictions.

In general, government bond holdings would go into the first category. The quantitative limits are spelled out in the directive itself, but many of the limits may be increased by Member States. Importantly, however, the diversification requirement makes an exemption for loans granted to a State, regional or local authority or to an international organisation of which one or more Member States are members. Although all assets must be valued on a prudent basis, indicating that consideration has to be taken of whether it is likely that valuations could be realised in the market, it is not clear how that should be carried out in practice.

In light of the shortcomings of Solvency I, the Solvency II framework[34] aims to implement solvency requirements that better reflect the risks that companies face, especially on the asset side, and deliver a supervisory system that is consistent across all Member States. Solvency II will introduce consistent economic risk-based solvency requirements across all EU Member States for the first time. These new regulatory requirements will be more risk-sensitive and thus more complex than in the past, aiming to enable better coverage of the real risks run by any particular insurer. For the purpose of this report, the discussion of insurance regulation relates to the new regulation, Solvency II, which will enter into force on 1 January 2016.[35]

Solvency II requirements will be more comprehensive than in the past. Thus far, the EU solvency requirements have concentrated mainly on the liabilities side, and have been volume-based instead of risk-based. Solvency II takes into account both asset-side and liability-side risks. The new regime will be a "total balance sheet"-type regime where all the risks and their interactions shall be considered and mitigation techniques (such as reinsurance and hedging) will be taken into account.

Furthermore, the basic principle underpinning Solvency II is a market-consistent balance sheet (i.e. both assets and liabilities are valued at market value) where the required capital should match the amount of risk taken on by the insurance company. Solvency II establishes two levels of capital requirements: (i) a lower-level minimum capital requirement (MCR), which is the threshold below which the authorisation of the (re)insurance undertaking may be withdrawn if the undertaking is unable to ensure compliance with the MCR within three months through a short-term realistic finance scheme; and (ii) an upper level, i.e. the solvency capital requirement (SCR) which is the level below which an insurer shall re-establish its level of own funds covering the SCR within six months.

34 Directive 2009/138/EC of the European Parliament and of the Council on the taking-up and pursuit of the business of Insurance and Reinsurance, OJ L 335, 17.12.2009, p. 1.

35 See Directive 2013/58/EU of the European Parliament and of the Council of 11 December 2013 amending Directive 2009/138/EC (Solvency II) as regards the date for its transposition and the date of its application, and the date of repeal of certain Directives (Solvency I), OJ L 341, 18.12.2013, p. 1.

The SCR is based on a VAR measure calibrated to a 99.5% confidence level over a one-year horizon. The basic idea is to require insurers to keep capital so that they remain solvent with high probability within this time horizon. The SCR is calculated either using a standard formula or by means of an internal model (partial or full) that needs to be approved by the NSAs. Several risk categories need to be taken into account for the SCR calculation, including market risk, underwriting risks, operational risk and credit risk. The MCR is derived as a formula-based calculation with limits calculated as a percentage of the SCR, technical provisions, premiums and capital at risk. Furthermore, in the event of a breach of capital requirements, and where the solvency position of the undertaking continues to deteriorate, the supervisory authorities may take all measures necessary to safeguard the interest of policyholders.

Moreover, Solvency II also aims to enhance the risk management of insurance companies. In addition to capital requirements, Solvency II includes comprehensive requirements on governance and risk management, including an own risk and solvency assessment (ORSA). The ORSA will be carried out independently from the SCR standard formula and will be an essential element of the undertaking's risk management. In the ORSA, the undertaking must take into consideration all the risks they face, regardless of whether these risks are in the standard formula. Therefore, risks related to sovereign holdings are likely to be assessed in the ORSA and should be managed either by quantitative or qualitative measures. In addition, standard formula users will have to explain their (large) investments as part of the supervisory review process.

In relation to investment management, insurers will no longer have to comply with quantitative limits, but will instead have to comply with the "prudent person principle", which requires them to ensure the security, quality, liquidity and profitability of the investment portfolio. In the investment risk management policy, undertakings must state the company's own assessment of the credit risk of counterparties, including instances where the counterparties are central governments.

The next section reviews the SCR standard formula and how government bonds are treated within the market risk module, as well as discussing their treatment in the internal models.

1.4.1 Government bond treatment

Standard formula

The SCR standard formula is divided into modules, one of them being the market risk module. Market risk and its various components are of particular relevance when it comes to examining the implications of Solvency II for sovereign exposures. Market risk SCR is calculated as the result of several sub-modules applying to specific asset classes and concentration risk. The sub-modules are as follows:

- *interest rates* – applies to all assets and liabilities for which the net asset value is sensitive to changes in the term structure or in the volatility of interest rates;

- *equities* – refers to all assets and liabilities whose value is sensitive to changes in the level or in the volatility of equity prices;

- *property* – refers to all assets and liabilities whose value is sensitive to changes in the level or in the volatility of market prices of property;

- *spread* – applies to all assets and liabilities and is designed to capture risk arising from changes in the level or in the volatility of credit spreads over the risk-free interest rate term structure;

- *currency* – refers to all assets and liabilities whose value is sensitive to changes in the level or in the volatility of currency exchange rates;

- *concentration* – additional risk stemming either from a lack of diversification in the asset portfolio or from a large exposure to default risk by a single issuer.

According to the Delegated Regulation,[36] exposures to government bonds issued or guaranteed by EEA countries, and issued in their own currency, are exempt from capital requirements in the spread and concentration risk module. Non-EEA sovereign bonds (or bonds issued by an EEA sovereign in a currency other than their own) will be subject to capital requirements for these modules according to their ratings (although with a lower risk weight than corporates). Moreover, all government bonds will be subject to interest rate risk, and insurers would be required to hold capital for them in the interest rate risk module (like any other asset sensitive to interest rate fluctuations). Also, investments which are denominated in a currency that is different from that of a firm's liabilities will incur a risk charge.

If a supervisory authority concludes that the risk profile of the insurance or reinsurance undertaking deviates significantly from the assumptions underlying the SCR calculated using the standard formula, the authority may require the undertaking to use an internal model to calculate the SCR, or the relevant risk modules in the SCR. Furthermore, where the requirement to use an internal model is inappropriate or has been ineffective and while an internal model is developed, the supervisory authorities may set capital add-ons.

Internal model

Solvency II also allows companies to use their own internal models – as an alternative to the standard model, or any of its modules or sub-modules – to determine their capital requirements. Both partial and full internal models will be reviewed and only allowed subject to approval by the relevant NSA. An internal model should aid a company, regulators and CRAs by providing a reliable representation of the company's current and future financial position. Companies often have complex structures, consisting of many business units with various insurance, reinsurance, loan and service agreements. A good internal model will allow for the interactions between these various elements as well as interactions with the business, economic and demographic environment.

A large number of insurers – especially large groups – are already using their own model assumptions, and further companies are currently developing their own models that could meet the requirements of Solvency II. The design of these internal models may be similar to that of

36 Commission Delegated Regulation (EU) 2015/35 supplementing Directive 2009/138/EC of the European Parliament and of the Council on the taking up and pursuit of the business of Insurance and Reinsurance (Solvency II), OJ L 12, 17.1.2015, p. 1.

the standard SCR formula specified by the Directive. However, the internal models are aimed at enabling insurers to gauge their individual risk situation more accurately. Subject to regulatory approval, internal models can be used to determine companies' regulatory capital.

Moving towards Solvency II, the pre-application process indicates that a large number of insurance groups in various Member States will apply for a (partial) group internal model approval covering at least the market and credit risk modules. Consequently, treatment of sovereign debt instruments for capital requirements in insurance internal models may be company-specific. The methodology and calibration of market or credit risk may be somewhat different among large EU insurance groups, reflecting differentials in risk profiles and the principle-based approach of Solvency II. However, given that the SCR should be calibrated to a 99.5% VAR over one year, there might not be too much room for differences in the potential calculation of sovereign exposures, and internal models should cover all risks faced by the particular insurer, including sovereign exposures. However, it is still an open issue whether, in the validation process of internal models, insurers will have to demonstrate to NSAs that the precedent provided by the standard formula enables them to have similar treatment in their internal models for sovereign debt issued by EEA countries. Should that be the case, insurers will have to demonstrate, in accordance with the statistical quality standards for internal models, that their sovereign exposures do not give rise to risks that are captured by the 99.5% VAR.

1.4.2 Government bond yields and mark-to-market valuation

One of the most fundamental aspects of Solvency II is the mark-to-market valuation. Data from the European Insurance and Occupational Pensions Authority (EIOPA) shows that 61% of assets are invested in bonds.[37] Government-related debt instruments constitute almost half of this. Mark-to-market valuation therefore implies that the asset side of EU insurers is influenced significantly by government bond yields.

Since sovereign exposures are evaluated at market value (like all other assets), any change in their value (unrealised losses/gains) will directly affect the capital available to meet capital requirements when changes on the asset side are not matched by changes on the liabilities side. The value of liabilities is obtained by discounting future cash flows with proxies for risk-free rates (swap rates). Life insurance liabilities in particular have very long durations and are very sensitive to the discount rate used to calculate them. Therefore, a higher discount rate, all else being equal, reduces liabilities and thus strengthens the capital position, while a lower discount rate does the opposite.[38] Furthermore, an unrealised loss on government bonds results in a deterioration in the capital position by exactly that amount if the risk-free rate remains constant (unless the bonds are linked with products where the policyholder participates at least partially in investment losses).

37 European Insurance and Occupational Pensions Authority (2014b).

38 Note that a general increase in interest rates lowers both assets and liabilities, so the net effect on the capital ratio of an individual insurance company will depend on the respective durations of the assets and liabilities (i.e. the asset-liability mismatch). For life insurers, it is generally true that liabilities have a longer duration than assets. For other insurers, the net effect has to be considered on a case-by-case basis.

In recent years the spread between yields in some euro area countries would have represented a big issue for insurers under Solvency II, since asset holdings would have depreciated while liabilities remained more or less unchanged (assuming the risk-free rate has not increased). Thus, the capital position of a large part of the insurance industry would have deteriorated even in the case of temporary adjustment of spreads if evolutions in spreads had not reflected evolving risk premia and liabilities had been due in the long term.

Such developments have given rise to the argument that the market-consistent valuation of insurers' balance sheets in Solvency II has potential adverse effects under circumstances similar to those described above. Therefore, various mechanisms have been embedded in the Solvency II regime. These include matching adjustments to the risk-free rate for discounting certain long-term obligations, an adjustment to the risk-free rate to discount liabilities in a situation of stressed financial markets (known as volatility adjustment) or the possibility of extending recovery periods for an undertaking breaching the SCR.

1.5 Conclusions

The first chapter of the report describes the existing regulatory treatment of sovereign exposures, both in the global context (Basel) and in the EU legislative framework (CRD/CRR and Solvency). It appears that the regulatory framework for banks and insurance undertakings offers preferential treatment for sovereign exposures compared with other counterparties. The most prominent features of that favourable treatment of government exposures are summarised below.

Capital requirements (Basel II/CRR)

The Basel II framework allows banks to make a choice between two broad methodologies for calculating their prudential capital requirements for credit risk: the standardised approach and the IRB approach. Both methodologies result in relatively low regulatory capital charges for sovereign risk. For the standardised approach, this applies in general when compared with other categories of counterparties, and for the IRB approach, it applies whenever banks assess the risk of a given sovereign exposure to be particularly low compared with other categories of counterparties. To some extent, this may encourage banks to accumulate sovereign debt. EU regulations de facto grant zero risk weights for the majority of debt issued by EU sovereigns when treated under the standardised approach. The risk weights applicable to sovereign debt are based on the sovereign credit rating, ranging from 0% for highly rated sovereign countries to 150%. Furthermore, under the EU banking regulation, a 0% risk weight is applied to sovereign exposures – irrespective of their ratings – that are denominated in the domestic currency. Under the IRB approach, banks are required to assess the credit risk of individual sovereigns using a granular rating scale (regulatory formula). While this approach does not automatically result in producing a zero risk weight, it nevertheless allows banks to use a PD close to zero for sovereigns where they obtain a favourable internal rating. In consequence, as in the standardised approach, well-rated sovereign exposures may attract very low charges. Furthermore, IRB banks may be authorised – under certain conditions and subject to supervisory approval – to implement the standardised approach for sovereign exposures (applying a zero risk weight) and the IRB approach for other exposures. The 2011 EBA stress test reports that only

36 out of the 90 participating banks applied their own internal model to sovereign risk, a lower fraction than for the corporate, mortgage or retail asset classes.

Haircuts in credit risk mitigation and repo transactions (Basel II/CRR)

High-rated government bonds are subject to haircuts that are lower than for private debt in the context of collateralisation of credit risk. The lower haircuts for sovereign debt – which are also granted for repo transactions that are not primarily aimed at the mitigation of credit risk – result in high-rated government bonds representing more valuable collateral than other assets because the respective securities allow for a larger amount of exposure reduction. Accordingly, prevailing regulation incentivises the counterparties of banks, including other banks with a view to interbank markets, to preferably acquire sovereign debt rather than private debt because of the cost-saving potential in the context of risk mitigation and/or repo transactions. As a result, lower capital requirements apply for government bond-collateralised exposures owing to lower haircuts for high-rated sovereigns.

Liquidity requirements (Basel III/CRR)

Government bonds are generally categorised as highly liquid assets within the LCR and NSFR. The stock of liquid assets required within the LCR framework will consist of Level 1 assets, which can be included without limit and are not subject to any haircut, and Level 2 assets, which are limited to 40% of total liquid assets and subject to a 15%-50% haircut. Level 1 liquid assets principally comprise[39] high-rated sovereign bonds (which carry a standardised risk weight of 0%), and those issued by the domestic sovereign and denominated in the domestic currency.[40] Sovereign bonds with a 0% risk weight will also be counted as liquid assets within the NSFR framework, making them an attractive asset in terms of required stable funding. As a consequence, banks will need to hold a sufficient amount of liquid assets and will therefore be encouraged to purchase sovereign debt.

Large exposures limits (CRR/New Basel standard)

The large exposures regime requires banks to monitor and control their large exposures in a way that ensures diversification of the bank's holdings and avoids systemic risk associated with significant reliance by any bank on any given counterparty. To avoid risk concentration, current regulation therefore imposes limits on large exposures in the trading and the banking book: the amount of exposure to any counterparty must not exceed 25% of own funds. However, domestic and other 0% risk-weighted government bonds are explicitly exempted from the above limits on large exposures. The same rule also applies to a number of assets carrying the explicit guarantees of central governments. Sovereign exposures under such treatment in the large exposures regime can in turn be accumulated in banks' balance sheets, regardless of any potential concentration risk.

39 Along with cash and central bank reserves.

40 In addition, banks are allowed to hold the debt of foreign non-0% risk-weighted sovereigns, up to the amount of net stressed cash outflows in that currency.

Leverage ratio (Basel III/CRR)

The introduction of a non-risk-based Tier 1 leverage ratio, subject to a preliminary minimum of 3% in the Basel III framework, shall backstop the risk-based system of capital requirements. Sovereign exposures should be fully included in the denominator of the leverage ratio so that it ensures that even those banks investing heavily in sovereign debt hold equity equal to at least 3% of their non-risk-weighted assets. Just like for any capital ratio, the effectiveness of the leverage ratio eventually depends on whether the risk-based requirements or the leverage ratio are binding for the bank. For example, if a bank invests most of its funds in high-risk assets and a small proportion of its funds in sovereign debt, it is likely to be bound by the risk-based requirement rather than the leverage ratio, just as a bank that predominantly invests in low-risk assets is likely to be bound rather by the leverage than by the solvency ratio. So, at the margin, acquiring extra sovereign exposures by a bank would still require zero capital unless the bank is constrained by either of the two ratios. Overall, the non-risk-based leverage ratio helps to cover some of the risks associated with sovereign exposures.

Treatment of interest rate risk (Basel II/CRR)

Current Basel and EU regulation does not require any Pillar 1 capital charges to cover interest rate risk in the banking book. This rule applies equally to sovereign and other exposures.

Options for institutions (CRR)

Some preferences for sovereign exposures also stem from institutions' options under the CRR, allowing for some heterogeneity, particularly for the recognition of a third country's preferential treatment.

Insurance regulation (Solvency I and Solvency II)

Under Solvency I, there is no explicit capital requirement related to market risk. This means that insurers do not have to keep capital against the risk of holding financial assets unless national law has introduced a more risk-sensitive framework. Solvency II aims to improve on the serious drawbacks with the currently applicable legislation, and will be a completely revised regulatory framework. Solvency II introduces more risk-sensitive solvency requirements, aiming to enable better coverage of the real risks run by any particular insurer. The SCR shall be calibrated so as to ensure that all material and quantifiable risks to which an insurance undertaking is exposed (e.g. insurance, market, credit and operational risk) are taken into account. The SCR may be calculated using either a standard formula stipulated in the regulation or by means of an internal model that needs to be approved by the supervisory authorities. In addition to capital requirements, Solvency II includes comprehensive requirements on governance and risk management, including an ORSA.

Under Solvency II, insurers will need to hold capital against their sovereign bond holdings under the interest rate risk sub-module in the standard formula. Sovereign bond holdings will also have to be covered in the ORSA and risks related to sovereign holdings will have to be managed either by quantitative or qualitative measures, irrespective of the treatment of these risks in the standard formula. Importantly, however, preferential treatment of sovereign exposures is prescribed under the standard formula. In Solvency II, sovereign bonds issued by a Member State government in its own currency are exempted from the "spread risk" and "concentration risk" modules in the standard formula and thus subject to a zero capital charge for these

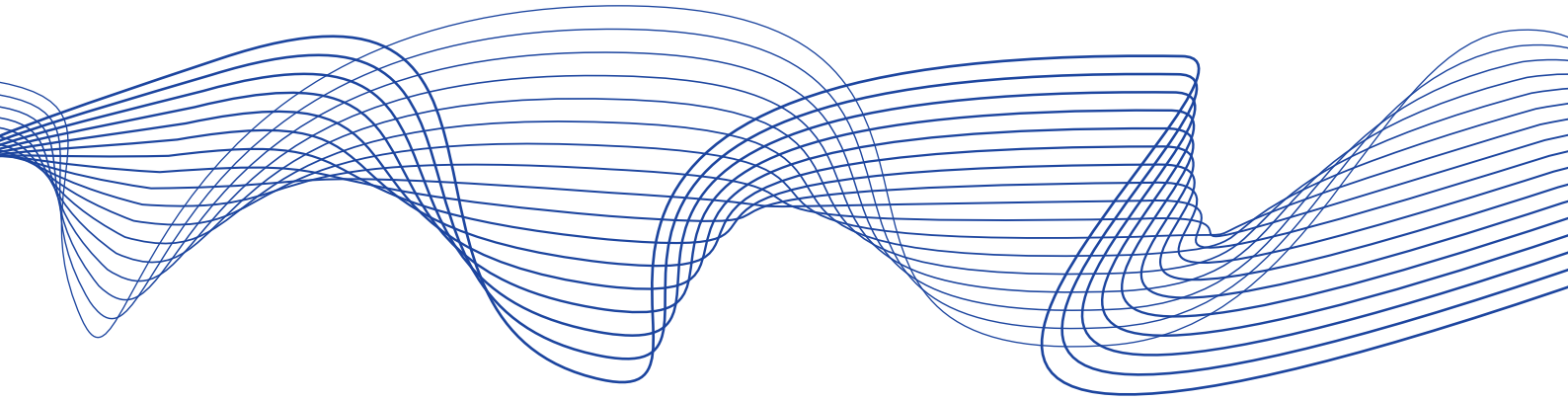
types of risk. This exemption could provide insurance companies with incentives to invest in sovereign bonds issued by the Member States, as they would be required to hold relatively less regulatory capital against such exposures. Undertakings using internal models would in principle have to take into consideration all risks posed to the insurer, including sovereign risk. However, it is still an open issue whether, in the validation process of internal models, insurers will have to demonstrate to national supervisors that the precedent provided by the standard formula enables them to have similar exemptions in their internal models. Should that be the case, insurers will have to demonstrate, in accordance with the statistical quality standards for internal models, that their sovereign exposures do not give rise to risks that are captured by the 99.5% VAR. The extent to which supervisors choose to impose capital add-ons or require the development of partial (or full) internal models to cover sovereign risks will depend on the extent to which a deviation on the underlying assumption is detected.

Other aspects

The incentives for financial institutions to invest in sovereign bonds stem not only from the prudential regulations, although this report is focused on that aspect. Sovereign debt is typically considered as a principal form of collateral in central bank monetary and liquidity operations. Thus, central bank collateral policies are another factor that affects banks' incentives to hold sovereign bonds. Moreover, government bonds play a critical role as a source of high-quality, liquid collateral in a wide range of financial transactions. In the EU, collateral in private repo markets is dominated by sovereign debt securities, which is linked in part to the historically lower volatility and greater liquidity of government securities, particularly in times of stress.

Section 2

Sovereign exposures and systemic risk



Sovereign exposures and systemic risk

2.1 Financial regulation and risk

2.1.1 Objectives of financial regulation and supervision

The purpose of financial regulation and supervision in a broad sense is to ensure the safety and soundness of financial institutions and to prevent individual institutions in the financial sector from harming the financial system and the overall economy. Traditionally, there have been three complementary approaches to this task. One approach attempts to limit certain risks that banks and insurers are taking. For instance, this is the purpose of rules about the assets banks hold, such as large-exposure rules, limits to bank lending, minimum reserve requirements, and other asset allocation rules. A second approach attempts to ensure that banks and insurers have sufficient capacity to absorb losses so that, if the risks they take turn out badly, the ability of banks to pay their debts is not impaired. This is the purpose of minimum capital requirements. Statutory deposit insurance is also intended to ensure that certain depositors are not impaired. These two approaches are linked when capital requirements are calibrated to the bank's asset risks and, in the LCR regulation for banks, liquidity requirements are calibrated to funding and liquidity risks. A third approach imposes restrictions on bank behaviour, e.g. by limiting the interest that can be paid on deposits.

Some of these regulations, which were mostly introduced after the banking crises of the Great Depression, disappeared in the 1980s and 1990s because they had become dysfunctional.[1] For example, in the United States, the regulation of deposit rates under Regulation Q threatened the funding of depository institutions when high inflation and monetary policy designed to fight inflation had driven interest rates in the money market well above 10% and recently developed money market funds were offering depositors the chance to benefit from these high rates. Also in the United States, territorial restrictions of intra-state banking, e.g. in the real-estate lending of savings institutions, prevented appropriate geographical diversification of risks, which, for example, resulted in Texan savings institutions falling victim to the oil price decrease of 1985 and the ensuing recession in the State of Texas.

In the Member States of the European Union, the main driver of deregulation was the desire to ensure that banks would be competitive in the coming internal market and monetary union. Many rules that had initially been justified as measures to enhance the safety and soundness of banks had in fact been turned into measures directing bank funds into government finance. Of particular importance in this context was the use of minimum reserve requirements forcing banks to provide the central bank, and indirectly the government, with low-interest loans. According to Bruni (1993), "the higher reserve coefficients imposed in Italy, Spain, Portugal and Greece correspond to what has been called the 'fiscal asymmetry' of Europe…

1 For overviews, see Baltensperger and Dermine (1987); Organisation for Economic Co-operation and Development (1992).

whereby southern countries have lower explicit tax revenues and more seigniorage."[2] Forcing banks to fund the government at below-market rates of interest is an implicit form of taxation. With the advent of the internal market, it was feared that this form of taxation would hamper the ability of banks to compete with financial institutions from other Member States.[3]

The use of banking regulation as a means to improve government finances by an implicit form of taxation may harm both financial stability and political accountability for government finance. Similarly, the use of banking regulation to direct bank funds into politically privileged private investments, in agriculture or in domestic real estate finance, dilutes the prudential purpose of the regulation. These practices also harm political accountability because they typically obscure the real costs of these policies. By contrast, some members of the expert group regard such practices as legitimate exercises of the sovereign powers of the responsible political authorities. They also believe that prudential regulation and supervision should be devoted to promoting more general policy objectives such as economic growth and financial and fiscal integration.

All in all, experience of such diversions of financial regulation and supervision to objectives other than the safety and soundness of financial institutions and the stability of the financial system has confirmed the old insight that it is advisable not to have more than one policy objective for a given policy instrument, especially if the execution of the policy is entrusted to an administrative authority. A mixing of policy objectives necessitates trade-offs, which require an exercise of judgment about the relative weights given to different objectives. For the banks themselves, this induces legal uncertainty. For the public, there is a lack of transparency as to what the policy-makers' pursuits of the different objectives cost. For example, with the use of asset allocation rules and minimum reserve requirements as a means of implicit taxation of the banking sector, the costs of this taxation were mostly hidden; in the discussion about the promotion of the internal market, the Cecchini Report on the costs of non-Europe indicated that these costs were substantial.[4]

Some members of the expert group point to the fact that trade-offs are unavoidable anyway and that, even if the objective of regulation is specified just in terms of the safety and soundness of banks and financial stability, any setting of rules and any non-trivial decision requires a weighting of the pros and cons of different alternatives. However, the unavoidability of trade-offs even in the pursuit of financial stability is not a good reason for enlarging the set of objectives that prudential regulation and supervision should pursue.

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2 Bruni (1993) lists reserve requirements in May 1988 as 25% for Italian banks, 15% for Portuguese banks and 18.5% for Spanish banks. For Italy in the 1980s, Bruni estimates the seigniorage from compulsory reserves at 1%-2% of GDP. Caminal, Gual, and Vives (1993), with a comment by Rafael Repullo, discuss the role of reserve requirements in Spain. For Portugal, Borges (1993) points to the fact that restrictions on lending made credit growth much lower than deposit growth, forcing banks to invest in government securities, with total holdings above 40%, far in excess of required reserves; both Borges and the comment by Jorge Braga de Macedo assert that the "hidden taxation" of the financial sector covered a substantial part of government finance. In Italy and Spain in 1987, claims on the government accounted for 35% and 37% of total assets of commercial banks (see Bruni, 1993).

3 This is a common theme in the contributions to Dermine (1993). See also Englund (1993); Mélitz (1993); Vives (1993).

4 Cecchini, Catinat, and Jacquemin, (1988); see also Bruni (1993) and Borges (1993).

2.1.2 A closer look at the objectives of capital regulation for banks: The rationale for risk weighting

Before the deregulation of the 1970s and 1980s, capital requirements for banks played a relatively minor role in banking regulation. Asset allocation rules and interest rate regulation were more important. When the BCBS took up its work in the mid-1970s, implementation of capital requirements was highly diverse across countries; the Anglo-Saxon countries and Italy had no statutory capital ratios at all but relied on supervisors assessing the adequacy of the banks' own funds.[5] Only in 1988, with the first Basel Accord, did capital requirements move to the centre of the regulatory debate. Whereas many other forms of regulation had become dysfunctional, capital regulation emerged as a focus of re-regulation on the basis of international harmonisation. In the first Basel Accord, risk calibration was very simple (zero risk weight for OECD member governments and for domestic sovereign exposures, 20% or 100% for interbank, 50% for residential mortgage loans and 100% for remaining balance sheet exposures).

At the time, the rationale given for capital requirements focused on loss absorption capacity. Capital was supposed to provide a buffer for possible losses. The 8% equity requirement for credit risk was based on past experience and estimates of what loan losses might be.

More differentiated treatment of risks was introduced in the debate about the extension of Basel I to market risks, from the 1993 proposal of the BCBS[6] to the 1996 amendment of the Basel Accord[7] to cover market risks. Whereas the 1993 proposal used standardised weights that were no different from the first Accord, the 1996 amendment to the Basel Accord allowed banks to use the model-based approach for market risks. By allowing the model-based approach, the regulatory community responded to the industry's claims that the 1993 proposal would provide poor incentives for proper risk management and that their own risk modelling and risk management practices were much more advanced than anything conceived by the BCBS.

The role of risk-taking incentives had also been stressed in the academic literature.[8] According to this literature, debt finance induces banks to take excessive risks, and capital regulation should limit excessive risk-taking (i) by limiting the extent of debt finance altogether, i.e. by improving shareholder liability, and (ii) by calibrating capital requirements to asset risks so that banks would have more of an incentive to take these risks into account in their investment decisions. The academic literature stresses in particular the need for precise calibration and the distortions that can arise if risk weights are not properly calibrated to the actual risks.

5 Goodhart (2011).

6 Basel Committee on Banking Supervision (1993), *The supervisory treatment of market risks*, April.

7 Basel Committee on Banking Supervision (1996), *Amendment to the Capital Accord to incorporate market risks*, January.

8 Koehn and Santomero (1980); Kim and Santomero (1988); Rochet (1992); Dewatripont and Tirole (1994). Hellwig (1995) and Blum (1999) also point to the fact that, in a multi-period setting, capital regulation might have perverse incentives for risk-taking. In a one-period setting, capital regulation reduces the risk-taking incentives arising from the fact that, whereas high pay-off realisation accrues to the bank's owners, an increase in the default probability hurts the bank's creditors. In a multi-period setting, an extra risk-taking incentive can be created by the anticipation that, with, say, a uniform 8% capital requirement, an increase in interim pay-offs of €1 allows additional borrowing and investments for €12.50; this anticipation enhances the incentive to choose investments with a large positive return realisation, even though the probability of such returns may be low. This effect is likely to be small, however, and outweighed by the risk-dampening effect of the initial capital requirement if the leverage allowed is small.

Some members of the expert group consider that the academic literature falls short in assessing the particular case of sovereign exposures. For example, it does not study the effects of losing risk-free assets in banks' portfolio decisions, nor does it consider the case of hardly diversifiable risks or the limitations in the portfolio models on which the Basel risk weights are built on. Thus, it is not straightforward to extrapolate insights from this literature to the regulatory treatment of sovereign exposures.

As a matter of fact, the results of the academic literature on the incentive effects of capital requirements make no assumptions about the availability of a risk-free asset or the degree of diversifiability of risks. As for the limitations of the portfolio models on which the Basel risk weights are built, the results of the literature showing that improperly calibrated risk weights can be very distortionary are highly relevant.

When incentive considerations were introduced into capital regulation, the traditional concern for loss-absorption capacity did not simply disappear. The two objectives have been pursued side by side, perhaps with too little attention being paid to possible conflicts between them. For example, the acceptance of certain kinds of hybrid securities as Tier 2 or even Tier 1 capital was based on the notion that these securities would provide loss-absorption capacity. Little attention was paid to the fact that, from the perspective of equity – and of management taking decisions under the auspices of "shareholder value" – these securities had the same effect as debt, namely privileged claims that enhanced the risk-taking incentives of equity. Such incentives are sometimes mitigated by covenants, but the effectiveness of such mitigation is usually limited.

More recently, the BCBS has been concerned with the fact that, in the financial crisis, hybrid securities that had been treated as Tier 2 or even Tier 1 capital were not called upon for loss absorption. The resulting insufficiency of loss absorption capacity has been a prominent concern in subsequent reform endeavours, as has been the inadequacy of many hedge contracts that allowed banks to economize on equity under the model-based approach. The dual objectives of loss absorption and proper incentives are thus still at the heart of the Basel approach to capital regulation.[9]

2.1.3 How do sovereign exposures fit in?

Any risk-weighting scheme that is used should be attuned to the objectives of the regulation. Since there are two objectives, there may be a conflict between them. However, if an asset is risky, an assignment of a zero risk weight to this asset violates the spirit of the regulation under either objective. From this perspective, an assignment of a zero risk weight to sovereign exposures is problematic unless these exposures in fact have no risk.[10] If the objective of the regulation is seen as providing for loss absorption capacity, it is compromised by a zero risk

9 According to Hellwig (2010), both objectives are geared too much towards the individual institution. From a system perspective, one also needs to care about procyclicality, which is particularly pronounced if risk weighting permits banks to have equity equal to 1%-3% of total assets, implying that, after a loss, they must sell assets worth 33-100 times the amount of the loss in order to re-establish the desired equity ratios.

10 The fact that this would not be the only violation provides little comfort. Failure to account for interest rate risk associated with assets in the banking book is also problematic. Whereas the bank may not wish to sell the assets, changes in market rates of interest will affect the bank's refinancing costs or, equivalently, the discounted present value of returns on the assets. The de facto insolvency of US savings institutions as of 1981 went unrecognised because they did not have to adjust the values of fixed-rate mortgages with 10 or 20 years to go to the fact that refinancing rates were twice the rates on those mortgages.

weight rule. The objective of providing proper incentives for risk choices is also compromised if zero risk weights are assigned to assets that are in fact risky.

Some members of the expert group consider that sovereign exposures are seldom well diversified in practice, and therefore believe that it is impossible to say that an assignment of a zero risk weight to this asset violates the spirit of the regulation. Rather, they think it has to be conceded that the calibration of truly loss-absorbent capital requirements for such concentrated exposures is impossible.[11] In the first place, however, this suggestion neglects the role of regulation as an incentive device. The factual statement that sovereign exposures are seldom well diversified in practice is true in some countries at some times, but not in other countries or at other times. Lack of diversification is therefore not a necessity, but a result of incentives. The argument that capital requirements cannot ensure true loss absorbency in the case of highly concentrated holdings does raise serious questions about the overall logic of the regulation. However, sovereign exposures are not the only undiversified risks borne by financial institutions. Institutions engaging in substantial maturity transformation are exposed to substantial undiversified risk from changes in interest rates. Institutions involved in large-scale business and real estate lending are exposed to substantial undiversified risks from the macroeconomy or the development of real estate prices (and interest rates). Regulatory capital is hardly ever sufficient to provide for full absorbance of losses from such macro shocks.[12] By the logic that an assignment of a zero risk weight does not violate the spirit of the regulation if exposures are concentrated, it might seem appropriate to assign zero risk weights to all such undiversified exposures to macro risks.

The exception of certain sovereign exposures and in particular domestic sovereigns from the large exposure regulation is potentially problematic unless the exposures are riskless. This regulation is intended to reduce the impact of a traumatic loss hitting the bank all at once, independent of the probability of that loss incurring. If holdings of sovereign debt are large and there is risk attached to them, the exception violates the spirit of the regulation.

Given the abovementioned discussion, it is important to assess the nature and the root of the risk from sovereign exposures, as well as the potential dangers to institutions and to the financial system. This is the subject of the present chapter.

2.2 Are sovereign exposures risky?

2.2.1 Sovereign risk

Sovereign risk arises from the fact that a sovereign may, for a significant time, have higher expenditures than tax revenues and go so much into debt that, eventually, it finds it impossible

11 For a concentrated portfolio, capital requirements are not so effective, or in the extreme, are ineffective: if there is a single borrower of €100, LGDs equal 50% and the PD of the borrower is 0.01% (which could be seen as an example of an AAA-rated central government borrower), the capital requirement is excessively high in 99.99% of the possible states of the world because no loss is incurred whatsoever, and insufficient to absorb the losses in the other 0.01% of the possible states (in the latter case, the bank loses €50 euro, but has only €8 of capital).

12 For a discussion of this point, see Hellwig (1995); Blum and Hellwig (1996).

or undesirable to pay its debts as they fall due or, more generally, may not comply with its contractual debt obligations. This risk clearly falls under the category of credit/default risk.[13]

The possible causes of fiscal imbalances are manifold: excessive public spending, in particular on wars, construction and wasteful economic projects; insufficient tax revenues, in particular due to lagging growth or even decline, tax evasion or a political unwillingness to raise taxes and make citizens aware of the costs of the policies that have been pursued. The authoritative account of Reinhart and Rogoff (2010b) shows that, over centuries, the breakdowns of fiscal governance have followed the same logic.

In Europe today, analysts raise the additional concern that some sovereigns' ability to pay is threatened by investors fearing that the sovereigns will not be able to pay and asking for interest rates that are so high that, in the end, they cannot actually be paid. In this account, the risk is due to self-confirming expectations. If investors expected the sovereigns to be safe, interest rates would be lower, and the sovereigns would actually be safer.

In order to avoid defaulting on its debt obligations, a sovereign may undertake a number of actions. In the first place, it may adjust fiscal policy, lower expenditures and raise taxes to reduce public sector borrowing requirements and, eventually, the burden of the debt. Depending on the situation, however, this may be unfeasible or undesirable. If this is the case, its scope for further action depends on whether or not it is able to borrow more and, if so, under what conditions. However, borrowing more without removing the basic imbalances would merely defer the resolution of the problem. Without additional borrowing, the scope of action depends on whether or not the debt is denominated in the sovereign's domestic currency and whether or not the sovereign is able to print the amount of the domestic currency that is needed to pay creditors.

The printing of domestic currency usually entails a loss of internal and external value of the currency. Therefore, the sovereign's ability to create the money it needs to pay its debts depends not only on domestic legal arrangements, but also on whether the internal currency devaluation (inflation) is politically acceptable and on whether the external devaluation is compatible with international agreements to which the country might be a party. If inflation is extremely high, i.e. in the case of hyperinflation, there is the additional problem that, because of lags between the time when tax obligations are incurred and the time when taxes are received, real fiscal deficits may actually be increased by the inflationary policy (the so-called Olivera-Tanzi effect).

While eliminating outright credit risk, money creation to pay sovereign debt may entail some other forms of risk, which are related to internal and external devaluation and associated adjustments in markets.

13 The general category of credit/default risk also includes specific risks like migration risk (due to rating downgrades) or spread risk (due to increases in the spread between yields registered on the secondary market and corresponding risk-free rates).

Monetisation of debt

If the debt is denominated in the sovereign's domestic currency and the sovereign is able to print any amount of that currency, then the most effective action that the sovereign can undertake to avoid a formal default is to print whatever amount of money is needed to pay its debts as they fall due, i.e. to monetise its debt.

This is the main reason why, among various kinds of debtors, governments are usually viewed as the only entities – if any – that may be considered "default free". As Damodaran (2010) puts it: "The only entities that have a chance at issuing risk-free investments are governments, since any private business or entity will have at least a residue of default risk. Governments, when issuing debt in the local currency, have the unique power to print money to pay their obligations and thus can avoid default."

A common assumption is that a sovereign state has monetary sovereignty. This is not necessarily the case nowadays, as many countries have chosen to leave the conduct of their monetary policy to independent central banks. In particular, in all EU Member States (with the exception of the United Kingdom[14]), monetary policy has to be conducted by an independent central bank in accordance with Article 130 TFEU. The euro area countries in particular have transferred their monetary sovereignty to the Eurosystem, which is comprised of the ECB and their national central banks. The idea is that independent central banks are in a better position to guarantee monetary credibility and stability. However, the question arises whether, within a country with an independent central bank, the parliament may still have the option, however complicated, of changing the country's law or even constitution to let the central bank monetise sovereign debt. This is not the situation in the EU, where the central bank's independence in conducting monetary policy not only lies outside the remit of an individual country's governments, but central banks are also prohibited from state financing pursuant to Article 123 TFEU. Thus, the risk of monetising debt, as described above, does not exist in the EU, and particularly not in the euro area.

This has led to the theory of monetary dominance, which assumes that "the monetary authorities do not monetise government debt. This implies that if the government is insolvent, there must be a fiscal adjustment or a default" (Jeanne, 2011). The status of the ECB in European law reflects that stand. As a consequence, without the option of devaluation, a country that would delegate all monetary sovereignty would have no other choice than outright default (Alesina et al., 1992). This is particularly true in the EU (see above), in which no national parliament has the power to force the central bank to monetise its debt.

As pointed out by Jeanne (2011), there are very few cases in history where monetary dominance has been effective – in most cases, excessive debt has been resolved thanks to high inflation. It should, however, be noted that sovereigns have also been defaulting formally for centuries, as presented in Section 2.2.2. In the Economic and Monetary Union (EMU), monetary dominance is guaranteed by the Treaty, but in the recent financial crisis, this monetary dominance has been questioned, and there have been many calls on the EU central banks to act as a lender of last resort for governments as well as banks.

14 See Article 4 of Protocol No 15 to the Lisbon Treaty on certain provisions relating to the United Kingdom of Great Britain and Northern Ireland.

Extensive monetisation of public debt typically generates inflation. As reminded by Thornton (1984), the phrase "monetising the debt" originates in the US Federal Reserve System's experience in the years following World War II: "At the time, the Federal Reserve had a tacit commitment to the US Treasury to stabilise the Treasury's cost of financing the war debt. After the war, individuals began liquidating their holdings of Liberty Bonds. Because of its agreement with the Treasury, the Federal Reserve purchased substantial amounts of government debt. These purchases increased the reserves of the banking system and, consequently, the money stock; the Federal Reserve was said to have monetised the debt." Another interesting instance of debt monetisation is the situation of Italy in the 1970s, where the Banca d'Italia was obliged to purchase those Treasury securities that were not taken up by the market. The resulting high levels of inflation (double-digit yearly Consumer Price Index from 1973 to 1983, reaching 20% in 1976) had damaging consequences for the economy (expropriation through inflation, financial instability).

Monetisation of government debt, though not a formal default, is, however, interpreted by many as a real default by inflation, as the creditors' claims lose value just as in a formal default (Goodhart, 2012; Reinhart and Rogoff, 2010b).

Devaluation of the domestic currency

If the debt is denominated in the sovereign's domestic currency and the sovereign pays the debt by creating additional money, the result is usually a devaluation of the currency, both internally and externally. Sovereign credit risk is eliminated, but the devaluation of the currency itself is a source of risks.

If internal and external devaluation are not perfectly synchronised, external devaluation may briefly improve the country's trade competitiveness, foster gross domestic product (GDP) growth and tax revenues, which would help the sovereign pay its debts as they fall due. However, as internal devaluation, i.e. inflation, catches up with external devaluation, these effects disappear again. Experience has shown that such real exchange rate movements in inflationary processes are mostly temporary. If external devaluation occurs more slowly than internal devaluation, the overall process may actually hurt the country's trade competitiveness as there is a real revaluation. If inflation becomes very high, fiscal capacity itself is hurt because the real value of tax revenues goes down as taxes are collected much later than tax obligations arise.

Internal and external devaluation of the currency make investors worse off. Devaluation risk (or depreciation risk, in a floating rate regime) has therefore long been identified in market debt as a key component of sovereign risk, along with default risk (see Alesina et al., 1992; Artus, 2003). Artus (2003), for example, splits the yield applied to emerging countries' debt into two components:

- an exchange risk premium related to the probability that the authorities in the country opt for devaluation;
- a default risk premium related to the risk of private or public borrowers going bankrupt when the economic situation deteriorates.

The Argentinian financial crisis in 2001-02 provides an example of devaluation subsequent to a sovereign crisis. Calomiris (2007) shows that Argentina was particularly vulnerable to devaluation

risk at that time, and that "the risk of devaluation was widely understood by market participants long in advance of the crisis and considered substantial by the market by mid-2001."

Calomiris notices in particular that sovereign risk (as measured by the sovereign yield spread on Argentina's international bonds) and devaluation risk (as measured by the interest differential between the interest rates on 30-day dollar-denominated deposits and the interest rates on 30-day peso-denominated deposits) followed the same patterns in 2001 and 2002 – which, he infers, reflects the fact that those two risks were driven by a common factor, namely an unsustainable fiscal policy.

From the perspective of financial institutions, devaluation risk can be neglected if they are funded in the same currency in which the debt is denominated. In this case, their own debt devalues at the same rate as the institution's financial assets. For example, banks emerged stronger from the German hyperinflation of 1923 as their debt was wiped out along with their nominal assets, and they benefited from the fact that some of their assets were not denominated in the domestic currency.

Banks are, however, subject to risks from investor reactions to the prospect of devaluation and inflation. One possibility is that nominal interest rates will rise to reflect the risk of devaluation. This increase in nominal rates would affect the banks' funding and/or solvency. For example, in the mid-1970s and early 1980s, US depository institutions lost funding when Regulation Q prevented them from adapting their deposit rates to market developments. When Regulation Q was lifted, these institutions had the problem that the rates they earned on long-term loans and mortgages were much below the rates they had to pay for deposits.

Raising financial resources in the domestic currency through taxation

Finally, independently of the fact that a sovereign is able to print or devalue the domestic currency, one action that it can always undertake to avoid a default is simply to raise the amount of taxes it collects from its citizens (or cut expenditures) and use the proceeds to pay its debts when they fall due.

Raising taxes can work, but there are limitations which very much depend on the initial fiscal conditions in the country/region, in particular the scope for enforcement, and the extent of the shock. If the increase in tax rates is perceived as excessive, it may disincentivise work and production and therefore (paradoxically) reduce the overall amount of tax revenues, driving the economy into a recession. Moreover, the ability to increase government revenues by raising tax rates is limited if enforcement is weak and important segments of the population are able to evade taxes.[15]

15 In the context of the Latin-American debt crisis of the 1980s, Reisen (1987) has shown that the internal transfer problem of raising sufficient taxes to even achieve a primary surplus was even more vexing than the external transfer problem of raising the foreign exchange to pay foreign creditors.

2.2.2 Sovereign defaults

In their account of sovereign borrowing and sovereign debt crises, Reinhart and Rogoff (2010b) show that the answer to the question on whether sovereigns can default on their obligations is "yes". Sovereigns do default on their obligations (see also Das et al., 2012).

Outright defaults are most prevalent when sovereign debt is denominated in foreign currencies, more precisely in a currency whose supply the sovereign could not manipulate. This was the case in the Latin American debt crisis of the 1980s, for example, where debts were denominated in dollars. In earlier times, sovereign debt that was denominated in gold or other precious metals was also subject to a serious risk of default. In those times, default might also take the form of a debasement of the currency, reducing the metal content of the coinage, an early version of manipulating the money supply.

Reinhart and Rogoff (2010b) suggest that the problem of foreign currency borrowing and default is most serious for countries that are struggling to transform themselves from emerging markets to advanced economies. These countries may have to rely on foreign capital for investment and growth. They may also have a high need for public investment, as well as vulnerable tax revenues. Reinhart and Rogoff suggest that, based on recent experience (i.e. since the 1940s or so), it seems that most developed economies have "graduated" from sovereign crises (but not from banking crises).

However, they also argue that major default episodes are typically spaced some years or decades apart, creating an illusion among policy-makers and investors when the next cycle begins that "this time is different". Each lull and each new cycle, however, have invariably been followed by a new wave of defaults.

There is a view that both countries and creditors have learned from some of their previous mistakes. Thanks to better-informed macroeconomic policies and more discriminating lending practices, it is argued, the world is not likely to see a major wave of sovereign defaults again. Such celebrations may be premature, since "the ability of governments and investors to delude themselves, giving rise to periodic bouts of euphoria that usually end in tears, seems to have remained a constant" (Reinhart and Rogoff, 2010b).

Over the past decade many foreign investors and policy-makers seem to have been lulled by the fact that many emerging market governments have become less reliant on foreign currency external borrowing than in the past. An often-cited reason these days why "this time it's different" for the emerging markets is that governments are relying more on domestic debt financing. Reinhart and Rogoff (2010b) also show that the popular notion that today's emerging markets are breaking new ground in their extensive reliance on domestic debt markets is hardly new. Contrary to many contemporary opinions, domestic debt constituted an important part of government debt in most countries, including emerging markets, over most of their existence. Reliance on domestic debt is hardly new, and the view that domestic debt can be largely ignored in looking at external debt sustainability is hard to reconcile with the extensive historical experience. The only difference is that, with domestic debt, there is no legal default

but devaluation through inflation. Because the internal devaluation is usually accompanied by an external devaluation, this form of "default" on domestic debt actually increases the burden of the foreign debt and makes an explicit default on the foreign debt more likely.

However, sovereigns sometimes also default on their domestic currency-denominated debt. This is the case even when they can print or devalue their domestic currency and raise taxes.

The bottom line, then, is that sovereign exposures are risky, if the relevant risk category is credit/default risk.

In terms of the analysis presented here, the situation of euro area sovereigns represents a new reality.[16] On the one hand, the euro is the domestic currency of euro area countries. On the other hand, the Treaty provides for central bank independence and takes control over monetary policy out of the national domain. Under the existing legal structure, the situation of Member State governments that issue euro-denominated debt is more similar to that of a government issuing debt that is denominated in gold or in a foreign currency than to that of the government of the United States issuing debt that is denominated in dollars.

2.2.3 Sovereign risk and financial regulation

If sovereign exposures are risky and financial firms do not pay enough attention to credit/default risk in sovereign exposures, their own solvency may be at risk. Considering that the safety and soundness of financial institutions and the stability of the financial system are an ultimate and exclusive objective of financial regulation[17], then prudential regulation must take account of sovereign risk if such risk exists.

A regulatory system in which prudential requirements do not properly reflect the risks in sovereign exposures may lead financial firms to (over)invest their funds in ways that enhance risks to their own solvency. Moreover, a regulatory system that favours sovereign rather than private exposures (because prudential requirements do not properly reflect the risk embedded in sovereign exposures) can do harm to the overall economy, if lending to the economy is crowded out by funding of sovereign debt. Finally, if financial firms overinvest in risky sovereign exposures and risks associated with these exposures are realised, the functioning of the financial system as a whole may be impaired. Responsible authorities may in turn find themselves forced to take measures that endanger their primary policy objectives but are needed to avert even more serious damage to the financial system and to the overall economy. In particular, governments may find it necessary to provide support to banks suffering from the consequences of sovereign exposures in other countries, and central banks' scope for maintaining monetary stability may be constrained by financial stability concerns. It is also quite possible that responsible authorities in one Member State might anticipate problems arising and, to prevent being affected by another Member State's risks, put pressure on financial institutions in their jurisdictions to reduce their

16 Historically, there have been only a few instances of sovereign debt restructuring within a monetary union (Das et al., 2012).

17 It should be noted, however, that macro-prudential authorities should not ignore the effects and spillovers of macro-prudential policy on the economic policy of the government (for example effects on growth). Certain central banks have already considered the interaction with broader economic policy authorities in the organisational structures of the macro-prudential bodies.

exposures which might in fact reinforce the risks concerned. In other words, perverse feedback effects could be at work.

Thus, the approach should be to try to design adjustments to the current regulatory treatment, with the aim of enhancing banks' incentives to take account of sovereign risk and increasing their resilience to such risk.

Namely, under the logic of the Basel framework, risk weights for credit exposures should depend on proper risk assessment. The Basel framework itself recognises that sovereign exposures can be risky and, for the standardised approach, provides a ratings scale for risk weights. However, the carve-out for sovereign exposures in domestic currency, which is allowed though not mandated in the Basel Accord, makes a special exception that seems to be based on the argument that the sovereign can always pay the face value of such debt by monetisation. But, as discussed in Section 2.2.1, this argument may be invalid in certain monetary constitutions involving truly independent central banks – as required by the EU treaties – concerned with the effects of inflation from this type of action. The argument also ignores the negative side-effects of debt monetisation, including the increased interest rate risk to which banks may be subjected.

Diversification requirements should also be re-analysed. Namely, the exemption of sovereign exposures from the large exposures regime is another example of distinctive treatment between risks from public and private sector borrowers.

A small minority of the members of the expert group take a different view, as they consider that effective prudential measures are difficult to design to properly deal with sovereign risk. They believe in the first instance that it is the root cause of the sovereign risk problem itself that should be addressed. This means, for example, applying measures which seek to ensure the implementation of sound intertemporal fiscal policies and the maintenance of sustainable aggregate sovereign debt levels (see Box 1 below with the description of the type of policies that the EU and its Member States have already started to implement). These members consider that such an approach, apart from tackling the root cause of the sovereign risk problem, contributes to enhancing financial integration and coordination of fiscal policy in the EU. These members of the group also point to the fact that sovereign debt is very different and distinctive when compared with other types of banks' exposures. For example, the frequency of default is extremely low for developed countries, as sovereign debt crises have become very rare events in these countries (see Reinhart and Rogoff, 2010b). However, in the few cases when sovereign crises do occur, they have far-reaching effects on the whole economy, including banks. The very low frequency but very high impact of sovereign risk serves to explain why it is a risk – particularly in the case of domestic sovereign risk – from which it is very difficult to protect or isolate oneself. Moreover, sovereign risk tends to be highly concentrated, as there are a limited number of issuers and it is usually seen as a kind of "floor" to other risks in the economy. They fear that, given the very special features of sovereign risk, using some type of prudential policy measures could actually increase systemic risk at the EU level, for example by exacerbating the effects of procyclicality in CRA ratings.

While agreeing that it is important to address the problem of sovereign risk at its roots, this report recognises that there is a danger that financial institutions could still be exposed to

excessive amounts of risks stemming from their holdings of sovereign exposures. To forestall this danger, prudential regulation should take account of the risks that are effectively there. If the policies that are being put in place by the EU and its Member States to address the problem at its roots are effective, regulation should have enough flexibility to acknowledge this.

In conclusion, there are different prudential policy measures the expert group will explore to address the risks or concerns related to the treatment of financial institutions' sovereign exposures. As a result of the very special characteristics of sovereign risk, a proper policy analysis must take account of these issues and should carefully evaluate the pros and cons, as well as the costs and benefits, of the various options available to policy-makers.

Box 1

Strengthening the economic governance framework in the EU

The development of major economic and fiscal imbalances that led to the sovereign debt crisis in Europe was due, among other factors, to significant weaknesses in EU economic governance. The lack of rigorous fiscal discipline was especially problematic, as the loss of independence regarding monetary power (meaning the impossibility for euro area countries to monetise debt) was not offset by fiscal federalism in the face of asymmetric shocks.

The most significant measures and substantial institutional reforms introduced to strengthen economic governance in the EU are presented below:

- **"Euro Plus Pact"** (adopted in March 2011).
- **"Six-pack"** (entered into force in December 2011).
- **"Five-point plan for stability and growth in Europe"** (adopted in October 2011), which called for decisive action in five areas: (1) financial assistance to Greece, (2) measures to stabilise the euro, (3) a recapitalisation of banks through a sovereign buffer and temporarily higher capital requirements, (4) growth-enhancing policies, and (5) measures to enhance economic governance.
- **"Two-pack"** (proposed in November 2011), which is aimed at reinforcing economic and budgetary surveillance mechanisms in the euro area and comprises two proposals based on Article 136 TFEU:
  - A Regulation on the strengthening of **economic and budgetary surveillance** of Member States experiencing or threatened with serious difficulties with respect to their financial stability;
  - A Regulation on common provisions for **monitoring and assessing draft budgetary plans.**

- Two temporary financial assistance facilities (established in 2010): **the European Financial Stability Facility** (EFSF) and **the European Financial Stabilisation Mechanism** (EFSM).

  – The **EFSM** was a funding mechanism guaranteed by the EU budget and aimed at providing loans and credit lines to Member States of the EU in economic difficulty. The EFSM provided funds to Ireland (€22.5 billion) and Portugal (€26 billion).

  – The **EFSF** was an independent entity established via an intergovernmental agreement among the euro area countries. It could issue bonds or other debt instruments on the market to provide loans or credit lines to euro area countries in financial trouble, recapitalise banks or purchase sovereign debt on both the primary and secondary markets. It had a lending capacity of €440 billion. Commitments by the EFSF included €17.7 billion to Ireland (to which an additional €4.8 billion was provided in bilateral loans), €26 billion for Portugal, €109 billion for a second Greek programme and €100 billion for the specific purpose of recapitalising Spanish banks (although undisbursed amounts were transferred to the permanent mechanism, ESM, once that entered into force).

- A permanent crisis resolution mechanism – **the European Stability Mechanism** (ESM) has since 2012 taken over the EFSF and the EFSM. The ESM is an international financial organisation established via an intergovernmental treaty concluded by the euro area countries. The ESM has the competence to provide financial assistance, subject to the implementation of conditionality appropriate to the instrument used to euro area countries experiencing severe financial difficulties. It has a lending capacity of €500 billion and, like the EFSF, operates by borrowing on the market in order to provide financial assistance to beneficiaries in several forms – either as loans subject to a macroeconomic adjustment programme, loans for the purpose of recapitalising financial institutions, precautionary credit lines, or primary or secondary market purchases.

- The establishment of the **banking union** in 2014 has introduced a complementary set of interventions instrumental for breaking the link between banks and sovereigns, which is at the root of the problems in several Member States. The banking union includes the following main elements:

  – The **Single Rulebook** is the basis of the banking union and consists of the legislation that all financial institutions in the EU have to comply with. These legislations include, among other things, the EU banking and insurance regulation described above.

  – The **Single Supervisory Mechanism** (SSM) gives the ECB responsibility for supervision over banks in the euro area and in those non-euro area countries that decide to join the SSM. Since November 2014, the ECB has been responsible for the direct supervision of the largest banks, while supervision of other banks remains vested in the national supervisory authorities.

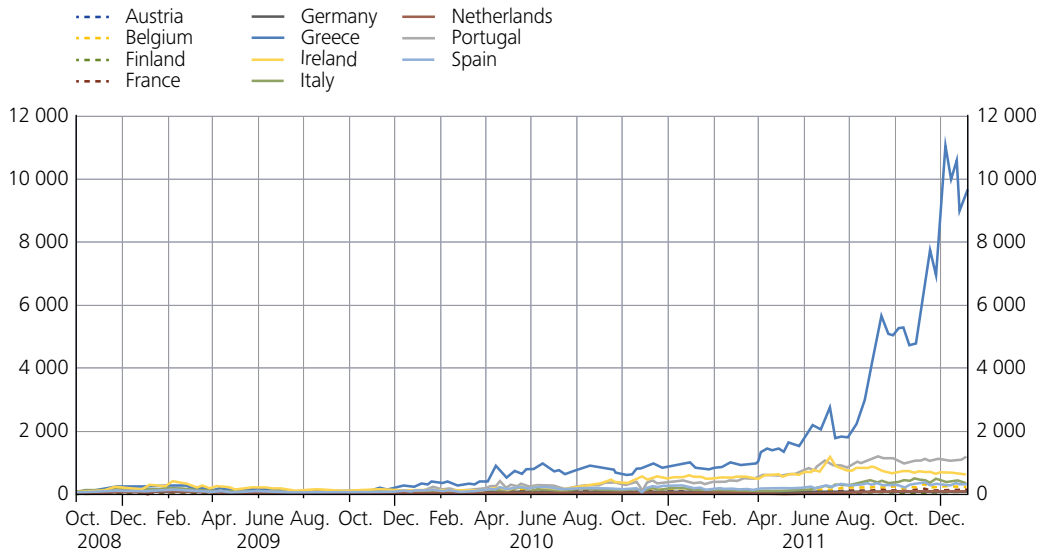
– The **Single Resolution Mechanism** (SRM) applies to all banks covered by the SSM and should enable effective bank resolution management. The SRM has established a Single Resolution Board (SRB) for the SSM member states which began its work on 1 January 2015 and will be fully operational as from 2016. It will prepare resolution plans, carry out the resolution of banks in trouble and manage the so-called Single Resolution Fund (SRF).

2.3 Systemic implications of sovereign risk

2.3.1 Sovereign crisis in 2010

Sovereign spreads in Europe widened in the autumn of 2008 in the wake of the Lehman crisis (see Chart 1). Discrimination among sovereign issuers may initially have reflected the relative liquidity of different government bond markets, with a flight to safety that could be found in the most liquid sovereign bond markets – such as the benchmark Bunds (Sgherri and Zoli, 2009). However, the attention of investors quickly turned to country-specific solvency concerns, with a clear link being made between government debt risk and weaknesses in the banking sector (Ejsing and Lemke, 2011; Mody, 2009). In Ireland, for example, sovereign spreads started to increase after the government extended a guarantee to Irish banks. But the causality between bank fragility and government debt fragility was going both ways: investors could also see that increased sovereign risk would have a negative impact on the banks that were holding government debt.

Chart 1
CDS spreads in Europe
(Basis points)



Sources: Bloomberg, Datastream.

The EU sovereign debt worries started to turn into a fully-fledged crisis in November 2009, when the new Greek government revealed that the fiscal deficit was twice as large as previously believed. As can be seen from the CDS spread data reported in Chart 1, the Greek CDS spread increased rapidly to more than 4% in early 2010, reflecting a significant increase in market expectations of a Greek default or debt restructuring. But until March 2010 there was relatively little contagion to other European economies – it was still believed by many at the time that the impact of a Greek credit event could be contained, as Greek debt amounted to a small fraction of total euro government debt.

However, it became increasingly apparent in March that, as the European economic recovery was weak, the fiscal austerity measures adopted in Greece were not reassuring investors, and the crisis was starting to spill over to other European countries. The main concern was that a Greek default would lead investors to lose confidence in other euro area countries with less severe but similar debt and deficit problems, such as Portugal and Ireland, and perhaps even to larger countries such as Italy or Spain. If the crisis were allowed to spill over to a large fraction of euro area government debt, it could then engulf the whole euro area banking system, including the banks of countries such as Germany or France, where government debt itself was not perceived to be a problem. Another concern was that a downgrading of the riskiest government debts by rating agencies would destabilise the euro interbank lending market, as the ECB would no longer accept such debts as collateral.

In March 2010, EU countries announced that they – together with the International Monetary Fund (IMF) – were setting up a crisis lending mechanism for Greece or other countries that might need it. The effect of this announcement on market confidence, however, was limited by several factors, including Germany's perceived reluctance to rescue Greece, and the insufficient size of the funds committed to the mechanism if countries other than Greece had to be helped.

The crisis entered its most acute phase at the end of April 2010. After Greece posted a worse than expected budget deficit, market participants started to worry that the Greek government would not be able to roll over a relatively large amount of debt that was becoming due in May if a rescue package was not quickly put in place. On April 23, the Greek government requested that the EU/IMF crisis lending mechanism be activated. On April 27, the Greek debt rating was downgraded to BB+ (junk status) by Standard & Poor's, making the Greek government debt ineligible as collateral with the ECB. Portugal's simultaneous downgrade to A- and Spain's subsequent one added to the negative sentiment. CDS spreads for Greek debt rose to more than 900 basis points, a level that had only been seen before in emerging and developing economies.

European equity markets fell, and the euro depreciated against major currencies. Soon, the impact spread beyond Europe, causing a sell-off in global equity markets. The crisis spilled over into interbank money markets, reviving the same concerns about rising counterparty risk as in the autumn of 2008.

Gripped by a sense of urgency, the EU authorities reacted with a number of far-reaching measures. In early May 2010 a crisis loan agreement was reached with Greece for a total of €110 billion, enough to cover Greece's funding needs until 2012. The ECB modified its rules and declared that Greek bonds would remain eligible as collateral even with junk status,

before announcing a policy of supporting the price of certain government debts through open market purchases. A new entity, the EFSF, was created to grant conditional crisis loans to euro area governments affected by contagion from the Greek crisis.[18] The EFSF was endowed with enough resources to cover the budget financing needs of Greece over 2009-12 (Blundell-Wignal and Slovik, 2010).

Asset price movements immediately following these announcements initially suggested that contagion from the Greek crisis was abating. Euro sovereign credit spreads narrowed and the euro appreciated. The relief in markets turned out to be temporary, however, as investors continued to worry about the mutually reinforcing negative interactions between fiscal retrenchment, banking problems and economic recession. In June 2010, EU government leaders, inspired by the earlier success of the US stress test, sought to dispel the worst fears of investors about the health of EU banks by announcing the publication of the results of a stress test covering 91 banks. The main focus of the stress test was the exposure of banks to government debt. The results of the stress test released in July showed that all banks passed the test except for seven (five in Spain[19], one in Greece and one in Germany), which were asked to raise new capital.[20]

Even after these measures taken by the EU authorities, the spread on Greek debt remained elevated. Further, at the end of 2010 the spread on Irish debt increased sharply. The Irish crisis differs from the Greek one in that it originated in the banking sector and spilled over to government debt. After several bailouts of Irish banks by the Irish government, the Irish banking system had to rely on liquidity provision by the ECB, while the Irish government was losing access to private markets, with spreads over German Bunds reaching 600 basis points. At the end of November 2010 the Irish government requested and obtained an €85 billion package from the EU and the IMF.

One observation from the crisis, as pointed out by Bolton and Jeanne (2011), is the extent to which economic and financial interdependence may be intensified by the fact that euro area banks hold euro area government debt. But, of course, this is by no means the only or the most significant factor explaining the correlation between banking and sovereign distress. An obvious source of connection is the widespread deterioration of the economies (e.g. sharp falls in GDP) during a crisis such as the one we have been experiencing. As a consequence of financial integration, euro area banks are exposed to systemic risks in the euro area, and not only to the risk on their home country. However, as presented in Chapter 3, in almost all euro area countries the sovereign debt exposure of banks is overwhelmingly towards their domestic issuer. Since no government can be indifferent to the health of its banking system, this implies that distressed government debt tends to become a liability for all governments in a crisis. All in all, the recent crisis shows that further work is needed in order to find the best way to deal with this type of system-wide effects in the EU.

18 See Section 2.2.3 for more information on the EFSF.

19 It should be noted that the stress test exercise for Spain included all the banks in the system (i.e. small, medium-sized and large institutions), while this was not necessarily the case for the rest of the countries (i.e. only larger banks were included in some cases).

20 In order to pass the stress test, a bank needed to have a Tier 1 capital ratio in excess of 6%, in line with the benchmark used in the US stress test.

2.3.2 From sovereign exposures to systemic risk

The financial crisis and the economic downturn have put pressures on the public finances of several euro area and other advanced countries, raising concerns about sovereign risk. Elevated levels of sovereign debt in these countries may now imply that their debt is no longer regarded as having zero credit risk and may also not be liquid. Indeed, as discussed in Section 2.2, sovereigns do default on their obligations and the implications of sovereign credit/default risk now pose a challenge for both the banking and the insurance sector.

Owing to the pervasive role of government debt in the financial system and the impact of its management on the macroeconomic environment, there are several channels through which a rise in sovereign risk may affect the banking and the insurance sector and have systemic implications. On the basis of the findings of previous research and reports, this section discusses these main channels and the potential spillover effects to the real economy.

As the recent crisis has shown, higher sovereign risk has impacted the banking system, in line with the deterioration in the creditworthiness of the (home) sovereigns, by increasing the cost of funding for banks and reducing their market access.[21] The driver of the increase in sovereign risk and the causality from sovereign to banks or vice versa may differ across countries. In some countries (e.g. Greece), the financial crisis has exacerbated an already weak fiscal position. In other countries (e.g. Ireland), the government's fiscal position was considered strong before the crisis, but has been severely affected by the cost of supporting banks. As indicated in Committee on the Global Financial System (2011a): "Nonetheless, even where the original causality is from banks to the sovereign, sovereign risk eventually acquires its own dynamics and reaches the point where it is compounding the problems in the banks and financial markets". However, the initial conditions should be considered to assess the potential procyclical effects of changes to the capital requirements.

On the one hand, in times of stress, banks' sovereign exposures can act as a contagion channel between sovereigns and those companies with potentially large effects on the real economy. This is due to the fact that it is very hard for banks to isolate themselves from sovereign risk and the typical and very widespread effects of a banking crisis that is then followed by a sovereign crisis. In addition, this may be marginally amplified by exposures to sovereign debt, as valuation losses on holdings of these assets might lead to concerns about the solvency situation for the banks. The banks' equity decreases if there are losses on the holdings of government debt. The contagion channel between sovereign and banks is illustrated later in this section. On the other hand, the banking sector can help to mitigate risks stemming from unfounded uncertainty, procyclicality in credit risk assessments and short-term speculative attacks on the sovereign. For example, the banking sector could to some extent help in the issuance strategies of the sovereigns during times of distress. The challenge for the authority is to consider the trade-offs in banks' funding and the spillover effects on the real economy.

21 "For banks headquartered in countries with acute sovereign debt concerns, the share of funding derived from retail deposits, short-term wholesale debt and cross-border liabilities has fallen. The cost of wholesale debt and deposit funding (increasing competition for deposits) has risen significantly for banks from weak euro area countries; for some large European cross-border groups issuing bonds in different jurisdictions, the costs of issuing in their home country has been higher than the costs of borrowing via subsidiaries in AAA-rated countries" (Committee on the Global Financial System, 2011a).

The characteristics of the insurance business models make failure events occur in a mode and at a time which are very different from those experienced in failure events in the banking industry. In particular, insurance companies provide services that allow firms and consumers to diversify risk and smooth consumption over time. Insurers provide protection by accepting risk from policyholders and are able to pool these risks, actively manage them and potentially transfer them to other players in the financial markets. Insurers hold large amounts of direct investments under their management to back future claims to policyholders and, given the time horizon of these future claims, are able and willing to take a longer-term perspective in comparison to banks or other financial institutions.

Owing largely to these differences in business models, insurance failures do not occur overnight, as insurance obligations are generally not callable. Instead, the nature of the insurance business dilutes developments that ultimately lead to economic losses for stakeholders, over a much longer time span.[22]

However, other non-core activities performed by insurers may have significant systemic implications to consider (e.g. mismanagement of short-term funding, such as investing collateral in illiquid assets; derivatives speculation). In this regard, the International Association of Insurance Supervisors (IAIS) has noted that "as recent crisis history suggests, insurance groups tend to suffer distress as a result of an increased exposure to non-insurance activities. These activities, which at times were only lightly regulated or not regulated at all, appear to be an important source of risk that may become systemic. Therefore, non-traditional insurance business and non-insurance activities are likely to play a pivotal role in the future G-SIFI methodology developed by the IAIS." This is consistent with the real-world case of AIG, which used to provide coverage on the derivative markets and experienced trouble during the financial crisis when it was margin-called by its financial counterparties.

Moreover, insurance companies are also significant long-term investors in real and financial assets. The overall size of their asset holdings suggests that changes affecting the insurance industry may have significant financial market implications (Committee on the Global Financial System, 2011b). Moreover, through their role in the financial system and various financial activities, they are interconnected with other financial institutions. As a result, developments that affect their services and investment strategies can have important implications for the financial system and the economy more broadly.

Main channels through which sovereign risk may affect banking and insurance sectors and have systemic implications

Direct channels

1) Sovereign risk is a fundamental source of systemic risk

An increase in the risk of the sovereign typically affects all assets denominated in a given currency. This contributes to the view of the sovereign as a "floor" to the level of risk in an economy.

22 In the paper "Insurance and Financial Stability - 2011", the IAIS considers traditional insurance activities not to be a source of systemic risk and adds the argument that "the loss of one carrier is unlikely to cause widespread or systemic issues and problems for policyholders and the real economy. On almost every occasion an insurer has failed in the past, the impact has been local".

The connections between sovereign risk and the risk of assets in the economy are deep, strong and multiple. Many aspects of these connections are independent of the actions or characteristics of the financial system. For example, sovereign crises are usually associated with periods of fiscal tightening which are expected to affect the growth prospects, at least in the short run. This, in turn, affects assets all across the board in the economy. In addition, sovereign crises are usually associated with potential changes in the real exchange rate. This may have significant balance sheet effects depending on the composition of local and foreign-denominated assets and liabilities in the system. Finally, pricing in securities markets is in general affected by movements in sovereign risk.

CRA ratings are another important source of spillovers going from the sovereign to the rest of the externally rated assets in a given economy. CRAs usually apply "sovereign floors" to their assessment of local securities or entities. This contributes to the systemic effect of sovereigns on the rest of the economy. Moreover, CRA ratings on sovereigns – as has also been evident with structured products – are prone to procyclical "cliff effects". These effects amplify shocks to the economies and contribute to increasing systemic risk. It could be argued that a system that protects the sovereign from such effects would contribute to a reduction of systemic risk.

2) Asset holdings

Increases in sovereign risk lead to a deterioration of the balance sheets of the intermediaries (banks and insurers) holding government debt or being exposed via CDS positions, whether or not valuation losses are realised. Generalised falls in government bond prices may thus increase the perceived riskiness of these intermediaries and may have a negative impact on their cost of debt. Capital losses in the trading book may eventually lead to an erosion of the capital base, which could put further pressure on their cost of debt or cost of equity.

Banks and insurers have multi-billion exposures to sovereign debt. According to Moody's (UK House of Lords European Union Committee, 2011), national governments are the largest capital market borrowers, accounting for more than 60% of debt issuance. The holdings of sovereign debt kept by euro area banks and insurers are more than eight times higher than their holdings of debt issued by non-financial corporations. As data on sovereign holdings reported in Chapter 3 also show, banks, insurance companies and pension funds typically have strong home bias in their sovereign portfolios. Hence, a deterioration of the home sovereign's creditworthiness is particularly damaging.

That these exposures are so substantial can to a large extent be explained by the fact that they are perceived as safe and liquid (Krishnamurthy and Vissing-Jorgensen, 2012). However, as shown by recent events, these exposures may actually become more risky and less liquid.[23] That these exposures are in fact risky can lead to write-downs on the banks and insurance companies' holdings of sovereign debt. This means that these exposures lead to widespread increased solvency risks for those financial institutions and thereby potential system vulnerabilities. As these exposures can affect the institution's solvency, it can result in recapitalisation demands and procyclicality of deleveraging. The market liquidity for sovereign debt can also decrease as a result of some uncertainty about the sovereign. That the liquidity decreases will not only imply that it will be harder for the institutions to sell their holdings of sovereign debt in private markets, it will also have an impact on how these assets can be used as collateral, as explained later.

23 In general, however, the sovereign remains the most liquid asset in local currency.

The available data in Chapter 3 shows that, although strong home bias exists, banks and insurance companies also hold significant quantities of debt issued by foreign sovereigns (inter alia, by stressed euro area countries).

In the banking sector, the main spillover effect of sovereign risk to banks is that it affects the banks' ability to get funding and costs of funding. If the bank's balance sheet is weakened due to the systemic effects of sovereign risks and a fall in the price of government bonds, the riskiness of the banks will increase in that it will make funding more costly and difficult to obtain. However, how much the equity decreases depends on when the value falls on government bonds, on the accounting rules and other regulations, where government bonds that are held to maturity will, under the current principles, not affect the financial situation. That means that there will not be direct and immediate effects on banks' equity and solvency situation, for these holding losses are recorded only when the securities are impaired, i.e. when a sovereign restructuring or default is realised or becomes very likely. However, as pointed out in Committee on the Global Financial System (2011a), these exposures may affect bank funding conditions prior to the losses being recorded as investors become concerned about the solvency of the bank.

There are at least two explanations why banks do not want to sell their holdings of sovereign debt and instead use it as collateral to get funding. The first is that losses on such holdings will only be materialised when the banks sell these assets if the holdings are reported in their income statements as held to maturity.

The other explanation is related to the downward liquidity spiral discussed in Brunnermeier and Pedersen (2009). A bank that holds a significant amount of an asset will not be able to sell all of its holdings of that asset during periods of stress owing to limited market liquidity. When it does sell some of its holdings, the price will drop significantly on that asset as the markets are under stress. Thus, the value of its remaining holdings will fall, increasing the solvency problems for the bank. If it wants to sell more, the price impact will be even bigger because the liquidity has worsened. So instead of running the risk of getting caught in this kind of downward spiral, the bank holds on to its assets, for example sovereign debt, in periods of stress. Banks, aware of the system-wide and hardly diversifiable effects resulting from a deterioration in the sovereign, will try to avoid a further worsening of the stress situation. This is logical, as it is in the banks' own interest to try to reduce some of the negative effects that a sovereign crisis has on the overall economy. In this sense, banks can contribute to lessening the pressure on sovereigns to some extent.

Similarly to banks, the investments of insurers and pension funds also provide substantial funding to financial institutions and the public sector. Sovereign debt accounts for a large share of the investments of the insurance sector.[24] In Europe, government bond holdings make up roughly a third of total investment assets. Aggregated ECB statistics show that the insurance and pension funds sector holds 18% of the stock of debt securities issued by euro area governments (Committee on the Global Financial System, 2011b). 28.4% of its euro area debt securities exposure is to monetary and financial institutions (MFIs), which represents some 11% of the outstanding stock of debt securities issued by euro area MFIs.

24 The holdings of sovereign debt kept by euro area insurers are seven times higher than their holdings of debt issued by non-financial corporations.

The high volume of sovereign exposures on the balance sheets of insurers implies that any sizeable shifts in the government bond space may lead to noticeable financial market implications (Hannoun, 2011). Indeed, the most apparent systemic implication of insurance companies' sovereign exposures would come from the importance of the asset class on the balance sheet. Clearly, increased spreads on sovereign bonds, let alone defaults, could make the capital position of insurers challenging on a market-value basis. In times of stress, these large sovereign exposures may also act as a contagion channel within the insurance sector, between the insurance and the banking sector, and even between the insurance sector and the government itself. Many of the channels through which sovereign risk can have systemic implications and which are discussed below concern the insurance and pension funds sector through their exposures to the banking and public sector. In contrast to banks, however, the duration of liabilities is typically longer in insurance companies than that of its assets, as premiums are received (and invested) prior to the payment of liabilities, which may only occur several years later. This makes insurance companies less subject to the short-term volatility of financial markets, as their liabilities are payable in the long term and assets may be held until maturity.

3) Collateral value

A decrease in the price of government bonds due to higher sovereign risk reduces the value of the collateral ("liquidity channel") that banks can use to secure their wholesale funding from repo markets, central banks and covered bond issuances or back over-the-counter (OTC) derivatives transactions. This will have an impact on banks and the real economy, as the repo markets are a significant source of funding for some banks and are very sensitive to changes in perceived riskiness. If the government debt asset has already been posted in specific transactions, mark-to-market valuation of collateral could trigger a margin call, meaning that more collateral has to be posted.

Higher sovereign risks can also lead to higher haircuts being applied to sovereign securities because of the uncertainty about collateral value, market liquidity and credit risk. A large increase in the sovereign risk (due, for example, to expectations about private sector involvement – PSI) and/or a downgrade of the sovereign debt could even exclude a government's bonds from the pool of collateral eligible for specific operations or accepted by specific investors in private markets. However, this is hardly the case with its own central bank. In mid-2010, market participants were reluctant to lend to banks from countries affected by sovereign tensions against collateral made up of their home sovereigns.[25]

However, it should be noted that, during this crisis, these problems have so far been contained by the interventions of central banks, which have changed the eligible types of collateral used in funding from the central banks as well as haircuts of different types of collateral. This has resulted in a shift of risk onto the central bank. Heavy losses borne by a central bank are by definition a systemic risk whose importance should not be underestimated. On the other hand, sovereign risk could also lead to the exclusion of sovereign securities from collateral pools and thereby impair banks' ability to obtain secured funding through, for example, covered bonds. According to the Committee on the Global Financial System (2011a), sovereign debt is widely used by banks as collateral in covered bond issuances.

25 Committee on the Global Financial System (2011a).

4) Benefits from implicit and explicit government guarantees

A worsening of the sovereign fiscal position and a reduced perception of a sovereign's ability to provide backup facilities for the financial system reduce the funding benefits that banks and insurance companies derive from implicit and explicit government guarantees. Massive government interventions during the financial crisis have indeed confirmed that government support can lower the probability that a bank (or an insurance company) will default. If a country's public finances deteriorate, the government will not be able to bail out the banks, since there will not be any budgetary resources to do so.[26] That the value of explicit and implicit government guarantees is decreased will result in higher credit and liquidity risks for the banks and insurance companies, and particularly higher funding costs for those banks and insurance companies benefitting from such guarantees. Several recent international regulatory initiatives were aimed at ensuring the resolvability of banks and insurers without government support (e.g. resolution regimes and recovery and resolution plans)[27] thus reducing the likelihood that taxpayer funds will be used to bail out banks. If these reforms succeed in reducing the probability of government interventions, it is likely that they will lead to a reassessment of sovereign implicit guarantees with an immediate impact on the funding profiles of banks. At the same time, this effect could be offset by an increase of institutions' stand-alone creditworthiness in countries that follow more prudent policies.[28]

5) Impact of sovereign ratings on financial companies' ratings

As mentioned before, sovereign downgrades normally translate into lower ratings for domestic banks and insurance companies as well[29], affecting their market funding costs (although insurers rely much less on market financing than banks). According to Reinhart and Rogoff (2010b), sovereign rating downgrades limit banks' access to foreign financing, leading to sudden stops or higher borrowing costs. This is due to the strong links between banks and the sovereign. Moreover, rating agencies determine the long-term rating of financial institutions on the basis of the probability that these will receive external support from their parent/government in the case of distress and this probability depends on the creditworthiness of the parent/sovereign. As already mentioned, the large exposures of insurance and pension funds to the financial and public sectors could act as a contagion channel in times of stress. Moreover, the trigger of wider financial market implications could also be a result of mass sell-offs following rating downgrades, as several insurers may have similar internal portfolio guidelines or be under the same legislative framework covering portfolio diversification.

6) Interconnectedness within the banking sector

The channels discussed above (systemic sovereign risk, asset holdings, value of collateral and explicit/implicit government guarantees, sovereign rating downgrades) all affect the stability and the costs of funding for banks and can act as a contagion channel, with negative spillover to the real economy in times of stress. Valuation losses on holdings of sovereign debt might lead to concerns about the solvency situation for the banks. As the bank's equity is the residual of

26 See also Acharya et al. (2011).

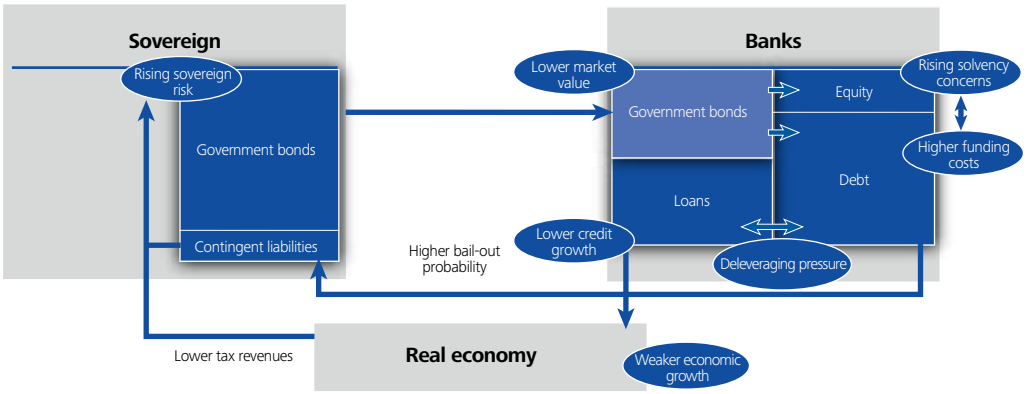
27 For the EU in particular, see Directive 2014/59/EU of the European Parliament and of the Council establishing a framework for the recovery and resolution of credit institutions and investment firms (BRRD), OJ L 173, 12.6.2014, p. 190.

28 In order to determine its long-term ratings, rating agencies' methodologies take into account the intrinsic creditworthiness of an institution and the probability that the institutions will receive support from their parent/government in the case of a crisis. Moreover, banks and insurance companies often take account of the likelihood of support in their internal assessments of their bank counterparties, with an impact on the calculation of capital regulatory requirements.

29 Sovereign ratings generally represent a cap on the ratings of banks with a consequent impact on market access for banks.

Chart 2

The contagion channel between sovereign and banks



Source: IMF.

its assets and debt, the banks' equity decreases if there are losses on the holdings of sovereign exposures. The contagion channel between sovereign and banks is illustrated in Chart 2. As higher funding costs can lead to deleveraging, this is another contagion channel between banks and sovereigns with negative consequences for the real economy. Thus, this is an additional systemic implication of banks' sovereign exposure.[30]

The potential systemic implications of the holdings of sovereign debt by insurers may also increase due to the interconnectedness with the banking sector. Banks may come under pressure and curtail credit and payment services if insurance companies were to suddenly reduce their holdings of banking sector debt and equity. Conversely, institutional investors may be exposed to losses through their bank counterparties in derivative contracts. Uncovered derivative positions are potential sources of liquidity risk as well.[31]

Even if the importance of premiums in the financing of insurers would be expected to reduce the scope of direct linkages between insurers and banks, interconnectedness may also stem from common exposures. For instance, the tail dependence and overall correlation between the asset prices of insurers and banks may stem from this source of interconnectedness.[32] If regulatory treatment of sovereign debt leads to less diversification and an overweight in this asset class both in the banking sector and in the insurance sector, the systemic spillover effects may be aggravated. Common exposure to real estate and possibly structured products as well as large holdings of bank liabilities by insurance companies may also add to this.

7) International spillovers

International spillovers can be generated by the close links among financial markets. Key channels are the holding of foreign sovereign debt by banks, insurance companies and pension funds. With regard to interbank exposures and banks' claims on non-financial entities in countries perceived as vulnerable, "market participants seem to take into account also

30 See also Merler and Pisani-Ferry (2012) for a discussion of this contagion channel.

31 Committee on the Global Financial System (2011b).

32 See for example Nyholm (2012); Committee on the Global Financial System (2011b).

the potential indirect exposures when assessing bank risk. Bank nationalities with the larger exposures to either banks or the non-bank private sector in peripheral Europe have CDS premiums that co-move significantly with sovereign CDS of those countries."[33]

8) Risk aversion

Sovereign tensions may cause a rise in investors' risk aversion, which would in turn increase the premia demanded by investors on banks' liabilities or reduce funding availability. A rise in risk aversion may also cause a generalised decline in asset prices, which can trigger further losses for banks. Some indicators[34] (see Committee on the Global Financial System, 2011a) suggest that the increase in investors' risk aversion related to sovereign crises is not financial-sector specific, but has been similar in other sectors of the economy in vulnerable countries.

In addition, any turbulence in government bond markets might trigger a "fire sale" in financial markets, thus exacerbating the crisis.

9) Crowding-out effect of government borrowing needs on banking sector debt issuance

It could be argued that the strong increase in government borrowing needed to finance public deficits may crowd out private sector borrowing by increasing the competition to obtain the funds, thus leading to a generalised increase in the overall cost of funding for banks. This was in fact a main criticism of the use of prudential regulation to ensure bank funding of governments in certain countries in the 1970s and 1980s.[35] At this point, however, as highlighted in Committee on the Global Financial System (2011a), it is difficult to assess the impact of this channel because it depends on several factors (e.g. how investors view government bonds as a substitute for bank debt, the supply of global savings). In fact, it is very likely that the "standard" negative effects of the crisis on the general economy (e.g. fall in GDP, widespread uncertainty) are the main factors explaining the reduction in banks' lending.

10) Other channels

To the extent that an increase in sovereign risk causes a decline in asset prices, it reduces the market value of the portfolios of financial assets managed on behalf of the clientele, and thus lowers the fees associated with asset management services. Moreover, tensions in government bond markets may lead to a retrenchment of investors' propensity to take risks (as mentioned above regarding risk aversion) and may thus lead to a rebalancing of investors' portfolios towards low-risk assets, which typically generate lower management fees. Reduced risk appetite may have an impact on brokerage fees owing to a reduction in equity trading volumes. Higher volatility of government bond yields may cause a decline in the turnover of financial markets and thus a contraction in banks' trading income. Finally, an increase in sovereign credit spreads/risk stems from the increase in funding costs, which may reduce interest rate margins. The portfolio losses and the lower value that the markets could assign to the explicit or implicit government guarantees, as well as the rise in the cost of default protection, would in fact lead market counterparties and risk agencies to reassess the risks associated with the exposures to the banks.

33 Committee on the Global Financial System (2011a).

34 Risk aversion implied in options written on a main European banks stock index and risk aversion implied in options on (low-risk) German government bonds.

35 See Borges (1993); Bruni (1993); Caminal, Gual and Vives (1993).

This would result in an increase in the financing costs for the banks, or even make it impossible to access certain types of financing, particularly on the wholesale markets. Banks in the country may then be forced to assume higher charges on their net interest income, or they may try to increase their deposit base. Competition among banks then increases, as does the interest paid on deposits and hence the cost of deposit-based funding. Moreover, the higher financing costs for the banks would affect their credit policies in terms of interest rates and/or the quantity of loans granted to customers.

The same observations made for the banking sector are valid for the insurance sector to the extent that the decline in asset prices and increase in risk aversion have an impact on the financial markets and on the value of their investments, as well as on the banks to which insurance companies are connected.

Relative importance of the main channels through which sovereign risk may affect the financial sector

Vuillemey and Peltonen (2013) model sovereign credit events and their spillovers to the European banking system using public data on 65 major European banks from the EBA's EU capital exercise 2011[36] to study the jumps-to-default of four stressed European countries (Ireland, Italy, Portugal, Spain). Their model features five channels through which sovereign credit events may affect banks: (i) direct losses on sovereign bond holdings; (ii) write-downs on other (available-for-sale and held-for-trading) sovereign exposures; (iii) direct CDS repayments triggered by the credit event; (iv) increased collateral requirements on other non-defaulted CDS reference entities; and (v) contagious propagation of counterparty failures.

According to the simulation results, overall, losses for all simulated countries that were due to sovereign bond exposures appear to be significantly more important in magnitude than losses that were due to pure CDS exposures and to counterparty risk on the CDS market. However, for all simulated countries, the number of bank failures and the relative importance of each bank failure channel is found to depend significantly on the recovery rate of the sovereign bonds. When the recovery rate is low, bank failures due to insolvency play a predominant role and are mainly driven by failures due to write-downs on correlated sovereign exposures. Failures due to direct losses on sovereign bonds increase in number when the recovery rate decreases, but are limited in most cases to domestic banks (home bias). When the recovery rate increases, the relative importance of bank failures due to insolvency decreases, whereas failures due to a collateral shortage become more prominent. For higher recovery rates, only a few (if any) failures of banks due to their inability to meet collateral calls are observed. Regarding CDS-related bank failures, interestingly, they find the collateral shortage on the CDS market to be a more important vulnerability than direct CDS repayments for the settlement of contracts on the defaulted reference entity.

36 This dataset includes both the sovereign bond holdings and the corresponding gross CDS exposures for 65 major European banks – bonds and CDS data are available for 28 sovereigns.

Second-round effects

1) Spillovers from the banking and insurance sectors to sovereigns and possible feedback loops

Sovereigns can be perceived as riskier than they used to be, either because of the increase in contingent liabilities towards those banks that have been granted state support or because of markets' perception of governments' implicit guarantees.

As pointed out in Committee on the Global Financial System (2011b), a weak domestic banking system can negatively affect the strength of the sovereign through two main channels: it drains public resources (through bank bailouts) and it reduces economic growth and amplifies (rather than absorbs) shocks to the economy. Thus, there could be a negative spiral, where a decrease in the valuation of sovereign debt leads to solvency problems for the banks which lead to bank bailouts which in turn lead to more severe problems for the government, which lead to further write-downs of banks' holdings of sovereign debt, etc. There is an increased risk of such a negative spiral in times of stress when the banks have large sovereign exposures. The negative impact of such a spiral will also depend on the size of the exposures. This negative spiral could arise as a consequence of problems within some banks that are accompanied by a government bailout, or of bad news regarding the sustainability of the sovereign debt, as pointed out in Gennaioli et al. (2014).

If banks' ability to obtain funding suddenly decreases, as discussed in the sections above, they may be prompted to conduct "disorderly" deleveraging which, as pointed out in International Monetary Fund (2012), can in turn lead to a dampening effect on economic growth and, in the end, lower tax revenues, for example. Thus, this could exacerbate negative feedback loops between the sovereign and the domestic banks. As the bank balance sheet will weaken more if the bank has a large exposure to the sovereign, the magnitude of deleveraging will, as shown by Gennaioli et al. (2014), be greater the larger the bank's exposure is to sovereign debt in periods of increased sovereign stress. Also, Panizza and Borensztein (2008) argue that there could be a credit crunch, i.e. deleveraging as a result of banks reducing their lending owing to capital losses, as well as uncertainty about creditor rights and the drop in confidence that comes with sovereign debt problems.

In severely stressed scenarios, it is also possible that insurers might need to be bailed out, e.g. following large losses on their portfolios. This may lead to similar negative feedback loops between the insurance and the public sector to those discussed above for banks. For instance, if a life insurer or a pension fund were to invest a large share of its assets in government bonds and the spread on those bonds increased, the assets of the company would decrease. In extreme situations, this could render the company unable to fulfil its obligations, possibly necessitating aid from the government, with negative effects for the financial situation of the sovereign. This could lead to increased spreads on the government bonds, further reducing the value of the assets of the insurer, and thus lead to a negative spiral. However, the resolution regimes for insurers generally do not require as fast a resolution as that required for banks, often allowing a struggling insurer more time to address the issues, for instance through retained earnings or the raising of capital.

2) Worsening of the profit outlook owing to fiscal consolidation

Pressures on financial institutions' profitability may arise from fiscal consolidation because of its impact on economic growth and borrowers' creditworthiness.

2.3.3 Conclusions

Owing to the intrinsically systemic nature of sovereign risk, the role of government debt in the financial system and the impact of its management on the macroeconomic environment, a rise in sovereign risk may have systemic implications through its impact on the banking and the insurance sector. The banking sector is affected mainly through a reduction in the availability of (wholesale) funding and an increase in its costs. This forces banks to sell assets and/or restrict the flow of new lending, causing financial market and macroeconomic instability. Their long-term liabilities provide insurers and pension funds with some insulation from this risk. However, they are large investors in government bonds and/or banking liabilities, thus a failure in the insurance sector or, more likely, any turbulence in either the government bond markets or the banking industry might trigger a "fire sale" in the insurance industry, thus exacerbating the crisis, with important implications for the financial system and the economy more broadly. This is why it is crucial that policies are oriented towards: (1) addressing the root causes of sovereign risk in the EU; (2) reducing any incentive to procyclical behaviour induced by the regulation; and (3) increasing diversification on the insurance companies' asset side, even if the correlations between different asset classes tend to increase during periods of financial turbulence.

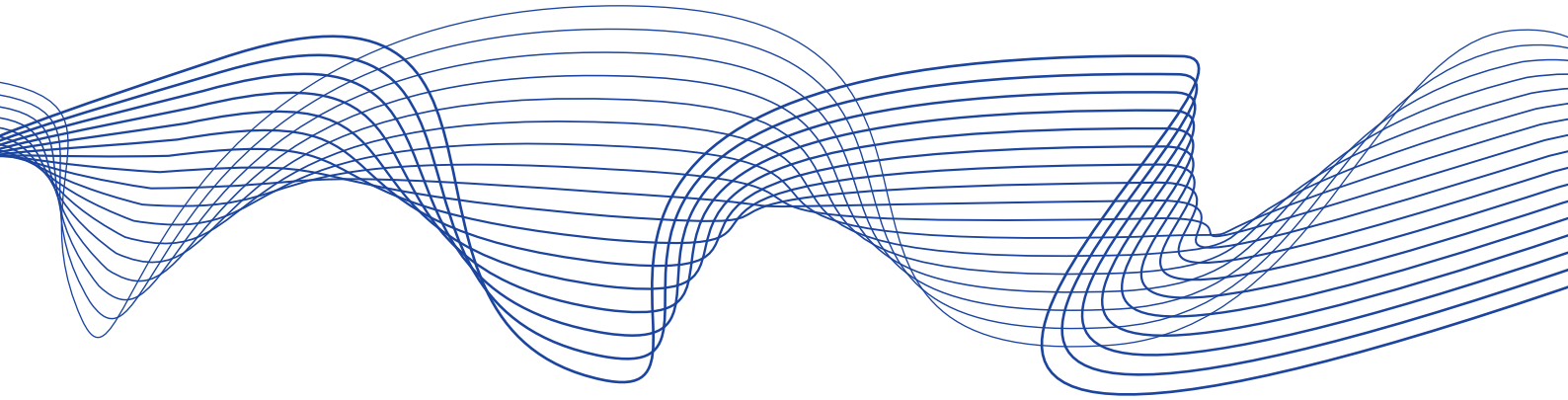
Moreover, it is important to consider how decisions on sovereign debt management, in particular those concerning the maturity structure of outstanding government debt, affect financial stability and the propagation of financial stress. The most obvious example from the crisis is sovereign rollover risk, which, when combined with financial institutions' exposures to sovereign debt and fiscal sustainability concerns, showed that yields and spreads on sovereign bonds can strongly drive those on bank credit, creating a potent channel for the spread of financial stress.

Maturity choices can affect investors such as pension funds and insurers that generally seek to match durations of assets and liabilities. The current extended low interest rate environment, in addition to the effects related to the higher sovereign risk, is contributing to ongoing strains on their financial positions.[37]

37 See Committee on the Global Financial System (2011b) for more discussion on this.

Section 3

Empirical analysis



Empirical analysis

This chapter presents evidence on the following five issues:[1]

1. How much sovereign debt is held by banks, insurance companies and other financial institutions, and how much of it is domestic debt?
2. How have bank/insurance sovereign exposures evolved over time, especially recently, and does their time pattern differ for domestic and non-domestic sovereign debt?
3. In which financial institutions are sovereign exposures concentrated?
4. Do banks' sovereign exposures respond to sovereign yields, after controlling for country-level macroeconomic determinants and for common euro area shocks? If so, which banks have engaged in such portfolio shifts?
5. Have sovereign exposures affected the risk of financial institutions and, if so, which ones?

The evidence on these issues presented below is based on data regarding sovereign debt holdings drawn from three sources:

- Monthly balance sheet data for MFIs in the euro area which provides a detailed monthly balance sheet for statistical purposes. The data was taken from the ECB's Statistical Data Warehouse (SDW) under "MFI balance sheet item" for securities issued by the general government of all euro area countries. These data contains the holdings by the MFIs in each euro area country of (i) debt issued by all euro area governments and (ii) domestic government debt from January 2000 to September 2014.
- Bank-level data drawn from the EBA stress test data for the participating banks of 2009, 2010, 2011 and 2014. Sovereign exposures in this database mean cash (e.g. debt securities), gross direct long exposures (immediate borrower basis approach) and derivatives towards sovereign and indirect sovereign exposures. Net direct positions represent the gross long positions of the banks held in the different books (trading, banking) net of cash short positions, ordinarily held in the trading book. The reference dates are the following: 31 December 2009, 31 December 2010, 30 September 2011 and 31 December 2013. The number of banks varied between 61 and 123, which in each case provided coverage for well over 50% of the total assets of each banking system.
- The ECB's quarterly aggregated statistics on insurance corporations and pension funds (ICPFs) that are based on existing information available at the national level. The data is available from the first quarter of 2008 until the second quarter of 2012. This time availability allows for a time series analysis. A caveat on the ECB data is the lack of transactions data. Therefore, the analysis is performed on outstanding amounts; this implies that comparisons with previous periods may be affected by valuation changes and reclassifications. Furthermore, the data collected is not fully harmonised across countries, so a caveat will appear when using them to draw cross-country comparisons.

1 As the country-by-country data on exposures of banks in non-stressed countries to stressed countries was not available to the expert group, Chapter 3 does not present an empirical analysis of cross-border sovereign lending and subsequent risk incidence.

For the MFIs and ICPFs, the reporting population comprises all solo entities resident in the euro area, including those which are foreign-owned subsidiaries or branches of foreign entities. Branches and subsidiaries abroad of domestically owned entities are not included. In turn, the EBA bank-level data refers to the highest level of consolidation of the banking group, covering all subsidiaries and branches operating in foreign countries.

It should be mentioned clearly that the expert group faced difficulties in obtaining the necessary data for the study. Such difficulties imply, for example, that the empirical analysis presented in this chapter focuses on the euro area countries, and not on all EU Member States. Additionally, the chapter is also focused more on banks than on insurance companies, as the data available at the time of analysis was more detailed for banks.

Each of these data sources has its strengths and weaknesses. The SDW data offers reasonably long time series of exposures, but provide only the breakdown between the debt issued by the domestic government and that issued by other euro area governments. Similarly to the SDW data, the ECB statistics on insurance corporations can be used for structural and time series analysis but provide only the breakdown between debt issued by the domestic government and that issued by other euro area governments. Nevertheless, ICPF statistics cannot split between unit-linked and non-unit-linked business, so ICPF statistics also include unit-linked business, where the investment risk is taken and borne by the policyholders (not by the insurers). Finally, the EBA stress test data is the only data that allows a bank-level cross-sectional analysis (albeit for a limited sample of mostly large banks), but lack an appreciable time-series dimension, since the stress test data refers only to three points in time, and sovereign exposure data is available mostly for the period of 2009-2011. It should also be noted that the EBA dataset covers both central and local government exposures, and not only sovereign securities but also the loan exposures. This should be considered when comparing the results based on different datasets.

3.1 Holdings of sovereign exposures by euro area financial institutions

Table 6 shows data on the sovereign exposure of the banking sector of euro area countries[2], measured as the average value of sovereign debt held in the period from the third quarter of 2010 to the third quarter of 2011 by the MFIs of that country as a fraction of their total assets. Columns 1 and 2 report SDW data for the total euro area sovereign debt exposure and for the domestic sovereign debt exposure of each country's banks.

In most countries, the banks' exposure to domestic sovereign debt exceeds their sovereign exposure to other euro area countries. The domestic sovereign debt exposure of banks in Austria, Belgium, France, Germany, Greece, Italy, Portugal, Slovakia and Spain is over 50% of their total euro area sovereign debt exposure (as indicated in column 3). In particular, in Greece, Italy, Slovakia and Spain, the sovereign debt portfolios of banks feature an extreme degree of "home bias" exceeding 90%. Exposure to domestic sovereign debt is much lower for Finnish, Irish, Dutch and Luxembourg banks.

2 With the exception of Estonia, Latvia and Lithuania, since they joined the euro area after the end of the third quarter of 2010.

Furthermore, the SDW data indicates that some of the countries where banks have the largest sovereign debt exposures (as a proportion of total assets) are also those where they are most exposed towards their respective national sovereign. Indeed, in most of these countries, banks' sovereign holdings feature a very strong home bias.

Table 6
Holdings of sovereign debt by MFIs as a proportion of total assets: average for Q3 2010-Q3 2011
(percentage values)

	Total euro area sovereign debt	Domestic sovereign debt	Home bias (in percentage)
	(1)	(2)	(3) = (2) / (1)
Austria	3.00	1.83	61
Belgium	9.48	5.35	56
Germany	3.98	2.62	66
Spain	5.07	4.68	92
Finland	1.59	0.64	40
France	3.40	1.86	55
Greece	9.31	9.07	97
Ireland	3.09	0.77	25
Italy	6.37	6.16	97
Luxembourg	5.82	0.06	1
Netherlands	4.35	1.40	32
Portugal	4.63	3.92	85
Slovakia	21.45	19.90	93
Malta, Cyprus and Slovenia	11.19	3.56	32

Source: The sovereign exposures and bank asset data was drawn from the SDW.

Tables 7 and 8 report the more detailed figures for the banks involved in the 2011 and 2014 EBA stress tests. Since the expert group conducted its analysis on the basis of the 2011 stress test data, the following comments focus mainly on Table 7. In this table, the sovereign debt issued by country *j* and held by *all* the banks of country *i* present among the 91 banks surveyed by EBA in 2011 is summed and this amount is divided by the sum of the total assets of these same banks. Each row corresponds to a "holding country" and each column to an "issuing country". For instance, the cell in row 2 and column 9 shows that the average aggregate exposure of Belgian banks (represented in the EBA sample) to the Italian sovereign amounted to 2.59% of their total assets. Some differences can be expected compared with Table 6 for the following reasons: (1) the sample used by the EBA in its 2011 stress test overweighs large and systemically important institutions; (2) the SDW data is based on resident and criteria (on an individual basis), whereas in the EBA stress test, data is on a consolidated basis; and (3) the EBA dataset – contrary to the SDW data – covers not only sovereign securities but also the loan exposures.

The cells along the diagonal in Tables 7 and 8 indicate the fraction of banks' total assets invested in domestic sovereign debt in each euro area country. In general, the EBA data from the 2011 stress test indicates that, in many countries, banks' sovereign exposures are larger than suggested by the SDW data. This is probably due to the fact that the EBA stress test only considers a subset of mostly large banks, although it covers at least 50% of assets in each EU country.

Comparing the data in the diagonal of Table 7 with the total euro area exposures shown in column 14 of that table, one sees that the EBA 2011 stress test data confirms **the strong home bias in banks' sovereign debt portfolios** apparent in Table 6. Actually, in some of the countries, the banks involved in the EBA stress tests feature an even stronger home bias than that suggested by the SDW data. Again, this bias is strongest in some of the countries where banks have the largest euro area exposure, namely Spain, Greece, Italy, Portugal and Malta. Also, German banks have one of the largest euro area exposures and a higher home bias (75%) than in the SDW data. The only exceptions here are Austria, Belgium, Finland, France and Luxembourg, whose banks' sovereign holdings are large but more diversified.

Table 7

Holdings of sovereign debt by MFIs as a proportion of total assets

(percentage values)

Sovereign issuer → / Holding country ↓	Austria	Belgium	Germany	Spain	Finland	France	Greece	Ireland	Italy	Luxembourg	Netherlands	Portugal	Malta	Total euro area sovereign debt
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Austria	3.80	0.11	0.38	0.05	0.03	0.11	0.12	0.01	0.31	0.01	0.03	0.04	0.02	6.71
Belgium	0.27	3.59	1.66	0.35	0.03	0.46	0.47	0.03	2.59	0.02	0.04	0.25	0.00	10.12
Germany	0.23	0.13	6.37	0.38	0.02	0.27	0.16	0.02	0.74	0.04	0.09	0.07	0.00	8.55
Spain	0.01	0.03	0.10	10.66	0.02	0.18	0.02	0.00	0.34	0.00	0.02	0.25	0.00	11.63
Finland	0.00	0.20	0.24	0.00	0.54	0.26	0.00	0.05	0.00	0.00	0.00	0.00	0.00	1.30
France	0.09	0.59	0.82	0.26	0.04	2.13	0.18	0.04	0.95	0.01	0.25	0.09	0.00	5.49
Greece	0.00	0.00	0.11	0.00	0.00	0.04	14.43	0.00	0.03	0.00	0.00	0.00	0.00	14.70
Ireland	0.14	0.06	0.18	0.10	0.01	0.36	0.01	3.72	0.25	0.00	0.16	0.07	0.00	5.07
Italy	0.16	0.02	1.01	0.16	0.01	0.04	0.07	0.01	8.11	0.03	0.01	0.02	0.00	9.85
Luxembourg	0.29	0.42	0.00	0.45	0.02	0.07	0.22	0.00	6.28	7.67	0.08	0.47	0.00	16.02
Netherlands	0.12	0.60	1.29	0.11	0.05	1.15	0.06	0.02	0.50	0.01	2.21	0.04	0.00	6.18
Portugal	0.00	0.00	0.00	0.07	0.00	0.16	0.40	0.15	0.29	0.00	0.00	5.61	0.00	6.72
Malta	0.00	0.02	0.22	0.00	0.00	0.24	0.16	0.11	0.06	0.00	0.00	0.04	11.50	12.53

Source: EBA stress test 2011.
Note: The total euro area sovereign exposure in column 14 may exceed the sum of the value in columns 1-13 because the table does not show exposures towards all euro area sovereign issuers (for example, it omits those towards Slovenia and Slovakia).

Table 8

Holdings of sovereign debt by MFIs as a proportion of total assets

(percentage values)

Sovereign issuer → / Holding country ↓	Austria	Belgium	Germany	Spain	Finland	France	Greece	Ireland	Italy	Luxembourg	Netherland	Portugal	Malta	Total euro area sovereign debt
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Austria	4.89	0.11	0.24	0.04	0.05	0.18	0.00	0.03	0.20	0.00	0.10	0.01	0.01	5.87
Belgium	0.13	8.85	2.76	0.18	0.03	0.85	0.00	0.08	3.11	0.00	0.17	0.30	0.00	16.45
Germany	0.45	0.20	9.50	0.46	0.08	0.50	0.00	0.06	1.08	0.03	0.41	0.10	0.00	12.87
Spain	0.01	0.02	0.11	8.86	0.00	0.13	0.00	0.00	0.27	0.00	0.05	0.11	0.00	9.56
Finland	0.00	0.18	1.01	0.00	0.21	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.52
France	0.11	0.62	0.96	0.29	0.04	5.45	0.00	0.02	1.17	0.02	0.21	0.03	0.00	8.90
Greece	0.00	0.02	0.03	0.00	0.00	0.02	5.76	0.00	0.03	0.00	0.02	0.00	0.00	5.89
Ireland	0.05	0.00	0.15	0.00	0.03	0.29	0.00	5.29	0.09	0.00	0.16	0.00	0.00	6.05
Italy	0.56	0.03	1.28	0.13	0.00	0.09	0.00	0.00	12.08	0.00	0.01	0.01	0.00	14.20
Luxembourg	0.59	2.03	0.53	0.41	0.04	1.16	0.00	0.39	2.18	3.82	0.27	0.28	0.00	11.71
Netherlands	0.18	0.93	1.38	0.05	0.13	0.84	0.00	0.01	0.20	0.02	4.99	0.02	0.00	8.75
Portugal	0.00	0.01	0.00	0.04	0.00	0.10	0.00	0.09	0.48	0.00	0.00	10.03	0.00	10.76
Malta	0.00	0.00	0.28	0.00	0.00	0.00	0.00	0.08	0.03	0.00	0.00	0.04	11.49	11.92

Source: EBA stress test 2014.
Note: The total euro area sovereign exposure in column 14 is the sum of the value in columns 1-13.

In summary, Tables 6 and 7 suggest the following broad conclusions regarding the sovereign exposures held by banks in 2011:

– first, **the euro area countries where banks have the largest sovereign debt exposures (as a proportion of total assets) are Belgium, Spain, Greece, Italy, Luxembourg, Portugal, Slovakia and Malta**, and those where banks have the lowest exposures are Austria, Finland, France and Ireland. Germany and the Netherlands appear to be in the middle;

– second, in almost all euro area countries, the sovereign debt exposure of banks is overwhelmingly towards their domestic issuer, and **this home bias is particularly strong in the countries where banks' total euro area sovereign exposure is largest (as a proportion of total assets)**.

The expert group has also analysed the amount of sovereign exposures held by the insurance sector. The data source is the low yield sample from the EIOPA's 2014 stress test, covering end-2013 data from individual undertakings (solo information). The data excludes unit-linked

policies. The overall sample coverage for the low-yield exercise was at a minimum 50% market share (on solo level), expressed in terms of gross technical provisions by year-end 2013 in each Member State. The detailed sample information is provided in the EIOPA's Stress Test 2014 report.[3] Table 9 presents the holdings of sovereign debt in insurance companies' portfolios.

The euro area countries in which insurers have the largest sovereign debt holdings as a share of total assets are Italy (55%), Lithuania (54%), Belgium (45%), Spain (41%), Slovakia (38%) and Portugal (38%), while those euro area countries in which insurers have the lowest sovereign debt holdings are Malta (11%), Cyprus (13%), Finland (15%), Germany (15%) and Austria (17%). Where the remaining EU countries are concerned, the countries in which insurers have the largest sovereign debt holdings in comparison with total assets are Hungary (66%), Croatia (52%), Poland (41%), Romania (40%) and Czech Republic (38%), while the lowest sovereign holdings are in the United Kingdom (8%), Denmark (13%) and Sweden (14%). The share of sovereign debt holdings in the euro area countries is slightly higher, on average, than that in non-euro area countries.

Table 9 also presents the holdings of sovereign debt of domestic insurance companies, as well as the home bias.

In 18 of the 28 EU countries, more than 50% of the domestic and euro area sovereign debt holdings of the insurance companies covered are accounted for by domestic sovereign debt. The home bias in non-euro area countries in this table is almost equal to that of euro area countries. It should also be noted that the home bias is especially significant in the stressed euro area countries (60% and more), with Greece being the sole exception.

The home bias calculated in Table 9 compares the holdings of domestic sovereign debt with the combined holdings of domestic sovereign debt and euro area sovereign debt. For insurers in the euro area this can be considered the most suitable comparison, as exposures in the same currency are compared. For insurers outside the euro area however, sovereign debt holdings outside the home country and outside the euro area are also relevant for the calculation of the home bias. Table 10 shows the distribution of the portfolios of sovereign debt holdings across the different issuers. The diagonal figures highlighted in yellow depict the home bias, where all sovereign exposures are taken into consideration for the denominator (i.e. not only the euro area exposures). The results are similar to those in Table 9, although the home bias of non-euro area countries is slightly smaller.

3 European Insurance and Occupational Pensions Authority (2014a).

Table 9

Holdings of sovereign debt

(2013, excluding unit-linked policies)

Country	Holdings of sovereign debt (domestic and other Member States) as a share of total assets (in percentages)	Holdings of domestic sovereign debt (EUR billions)	Holdings of sovereign debt (domestic and euro area, EUR billions)	Home bias** (holdings of domestic sovereign debt/holding of domestic + euro area sovereign debt, in percentages)
Belgium	45	50.83	74.53	68
Germany	15	46.85	90.36	52
Estonia	31	-	0.13	0
Ireland	18	1.69	10.37	16
Greece	18	0.40	1.75	23
Spain	41	47.05	52.39	90
France	27	236.97	357.28	66
Italy	55	164.76	172.86	95
Cyprus	13	0.13	0.22	60
Luxembourg	29	0.09	2.60	4
Malta	11	0.47	0.83	57
Netherlands	32	27.24	73.45	37
Austria	17	2.49	7.18	35
Portugal	38	5.66	8.03	71
Slovenia	31	0.90	1.64	55
Slovakia	38	1.67	1.85	90
Lithuania	54	0.07	0.20	36
Croatia	52	1.56	1.59	98
Finland	15	0.85	4.38	19
Bulgaria	36	0.10	0.12	82
Czech Republic	38	2.84	3.01	94
Denmark	13	6.05	15.64	39
Hungary	66	2.44	2.45	99
Poland	41	8.36	8.53	98
Romania	40	0.75	0.75	100
Sweden	14	21.38	29.11	73
United Kingdom	8	25.32	34.52	73
Euro area	29*	588.12	859.92	63*
European Union	26*	656.92	955.77	67*

Source: EIOPA stress test 2014.
** Note: = weighted average;*
*** Note: In this table, the home bias is defined with euro area sovereign debt in the denominator. While this definition allows a comparison with singly-currency exposures for euro area countries, the definition may be less suitable for non-euro area countries. Table 5 therefore provides additional breakdowns to allow a broader assessment of home bias.*

Overall, the data collected by EIOPA indicates a generally high degree of home bias in the portfolios of insurers, although with significant differences across countries. Unfortunately, this data does not allow a detailed analysis of the reasons for the observed home bias. However, several factors may explain the observed home bias for insurance companies. Please note that the reasons for the home bias in the portfolios of banks are discussed in Section 3.4.

First, insurers need to match their assets and liabilities (asset-liability matching – ALM). Traditionally, if insurance business is written in one country (e.g. liabilities are domestic), an ALM study could also call for a home bias in investments. This would particularly be the case if the domestic currency is not part of a common currency regime. The interpretation that home bias could result from an avoidance of foreign exchange rate risk is supported, to some extent, by the data presented in Table 10. The unweighted average of home bias in sovereign exposures is lower for euro area countries than for non-euro area countries (the simple average is 55% for the euro area countries, compared with a simple average of 80% for non-euro countries).

Some home bias could also be driven by differences in the discount curves used to calculate the present value of liabilities. Under Solvency I, there is no fully harmonised approach, and liabilities may be discounted by, for instance, sovereign bond yields, or by the level of guaranteed returns offered to customers. In the case of the former, a home bias in investment would result since

Table 10

Distribution of portfolios of sovereign debt holdings across issuers

(year-end 2013; percentages)

Insurer	Issuer																											
	AT	BE	BG	HK	CY	CZ	DK	EE	FI	FR	DE	GR	HU	IE	IT	LV	LI	LU	MT	NL	PL	PT	RO	SK	SI	ES	SW	UK	USA	Grand Total
Austria	30	5	1	1		4			2	12	4		1	3	1		1	6		4	9		2	9	3	1			1	100
Belgium	4	69							1	12	3			1	5					1	1			1		2				100
Bulgaria			73	1						4	3				1					6	2		1	3					6	100
Croatia				97							1										1			1						100
Cyprus	2	3			55				2	13	2	1			8					1	10			1	1		1			100
Czech Republic						90															3		2	4	1					100
Denmark	2	3					35		3	7	12			2	14			1		3						7		2	8	100
Estonia	1	3		1		7			4	6	8		5		6	9	13			11	10	2		11	3					100
Finland	2	5							21	10	38				3					16						1	4			100
France	5	7								67	2			1	10			2		1		1				4				100
Germany	7	4							2	15	50			1	10			1		2	3	1		1		1			2	100
Greece	1	4								19	10	22		2	13			6		5	2	5	1	1		6			3	100
Hungary													100																	100
Ireland	6	3							1	15	16			13	7					6						2		26	5	100
Italy											2				96											2				100
Latvia									24							55	3			18										100
Lithuania	8	6				2			5	11	17		1	1	1	4	36			5	1				1	1				100
Luxemburg	5	25							1	33	9			1	12			3		3	1	1		2		2		1	1	100
Malta	5	2				1			4	5	16				1				52	4	1			1		2			6	100
Netherlands	9	5							2	10	33				1					38	1					1				100
Poland																					98		1		1					100
Portugal	1	3								6	1				9					1		71				8				100
Romania																							99				1			100
Slovakia	3			1		2				4										1	6			82	1					100
Slovenia	3	4				1			1	4	16		1		3		1	2		3	4			3	52	2				100
Spain		1								1	1				6											91				100
Sweden							1		1	7	7			1	2			1								2	64	5	9	100
United Kingdom	1	2								7	13				1					1								66	9	100

Source: EIOPA (2014b).

Note: Illustrative examples of the calculations for the risk-free interest rate term structures.

this would allow assets and liabilities to react similarly to changes in interest rates and therefore be part of an ALM strategy. The fact that insurers in countries with relatively low-yielding government debt also exhibit home bias may suggest that a certain level of home bias would follow from a proper ALM and risk management framework. Unfortunately, the data available to the expert group does not allow a detailed assessment of the underlying causes of the observed home bias.

3.2 Evolution of sovereign exposures over time

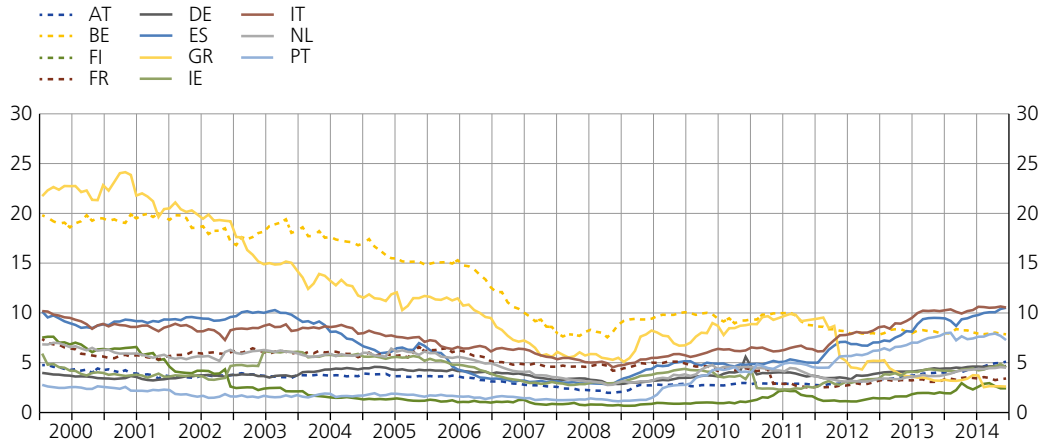
Chart 3 shows the time series of the *total* euro area sovereign exposure of banks in selected euro area countries. Specifically, it plots the monthly values of the euro area sovereign debt holdings of each country's banks (drawn from the SDW database) scaled by the total assets of those banks. In most of these countries, **euro area sovereign debt exposures of banks (as a proportion of total assets) were considerably larger at the inception of the EMU than they are now. Such exposures were progressively reduced until the beginning of the crisis**. At one end of the spectrum, MFIs in Belgium and Greece reduced their sovereign debt holdings from over 20% of total assets in 2000 to less than 8% in 2014. Over the same period, Italy and Spain first reduced their holdings from over 10% in 2000 to less than 5% in 2008, but they exceeded 10% again in 2014. At the other end of the spectrum, there is Germany, which is the only country where MFIs' sovereign debt holdings remained stable, at around 4%-5% of total assets.

The chart shows that, after a reduction in the first half of the decade, **banks in Greece, Italy, Portugal and Spain have gradually increased their euro area sovereign debt holdings again (as a proportion of total assets) in the last six years. Interestingly, the sovereign exposures of banks in most stressed euro area countries and those in non-stressed euro area countries diverged between November 2011 and March 2012**: Italian, Spanish and Portuguese banks increased their euro area sovereign exposure by 1.7%, 2.1% and 1.2% of their assets respectively, French banks continued to reduce their euro area sovereign debt exposure, German banks have started reducing their exposure again since late 2010 and Belgian banks since mid-2011. Greek banks also sharply reduced their sovereign exposures in the first three months of 2012 as a result of PSI. The PSI entailed a 53.5% haircut on the face value of Greek government bonds (GGBs). Moreover, the old GGBs were partly exchanged for bonds issued by the European Financial Stability Fund, further decreasing the exposure of Greek banks to Greek sovereign debt.

Chart 3

Total euro area sovereign debt holdings of MFIs as a percentage of total assets, January 2000-September 2014

(percentages)



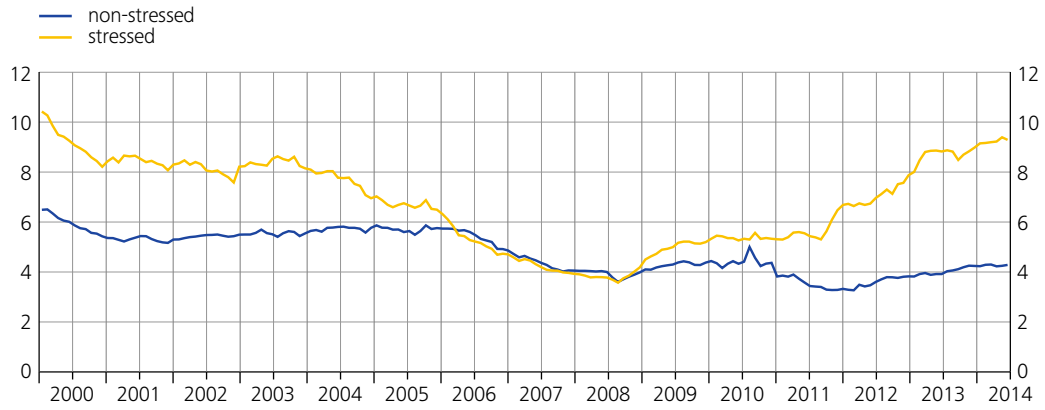
Source: SDW.

The differences in behaviour between banks from the stressed euro area countries concerned and those in non-stressed countries in the euro area are brought out more clearly in Chart 4, where the values shown in Chart 3 are averaged across the two groups of countries. In both groups of countries, the average euro area sovereign debt exposures of banks feature a similar trend until 2008, with banks in the stressed euro area countries actually reducing their sovereign exposures proportionately more, but started to diverge after 2008, with banks in stressed countries increasing their euro area sovereign exposures and banks in non-stressed countries initially increasing them less and eventually stabilising at the 2008 level. This divergence coincides with a similar divergence in macroeconomic fundamentals (see Chart 12 in Section 3.4).

Chart 4

Euro area sovereign debt holdings of banks in certain stressed euro area countries* versus those of banks in certain non-stressed euro area countries as a proportion of total assets, January 2000-September 2014**

(percentages)



Source: SDW.
** Note: The stressed euro area countries are Greece, Ireland, Italy, Portugal and Spain.*
*** Note: The non-stressed euro area countries are Austria, Belgium, Finland, France, Germany and the Netherlands.*

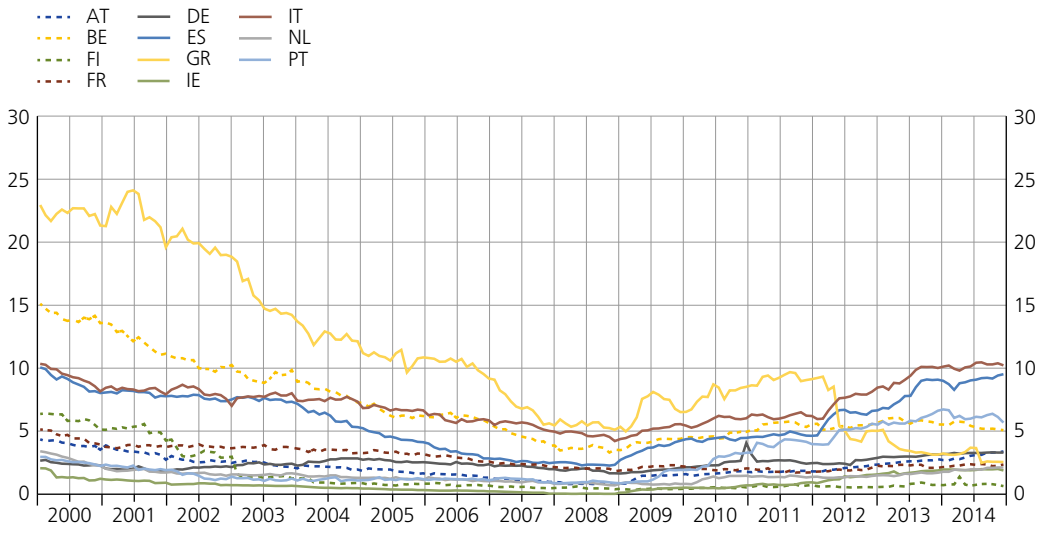
Charts 5 and 6 show that similar patterns emerge in banks' *domestic* debt exposures. Chart 5 plots the monthly values of the domestic sovereign debt holdings of each country's banks (drawn from the SDW database) scaled by the total assets of those banks. The increase in the domestic sovereign exposures of banks in Italy, Portugal and Spain between March 2008 and August 2014 coincides almost precisely with the increase in their total euro area sovereign debt exposures, which indicates that, in all three countries, banks considerably increased the home bias of their sovereign debt portfolios. Chart 9 shows banks' average domestic sovereign exposures in stressed and non-stressed countries as a whole. In this case, the post-2008 divergence between banks in stressed countries and those in non-stressed countries is less marked: even banks in non-stressed countries appear to have somewhat increased their domestic exposures post-2008, though less markedly.

One may suspect that the different behaviour of the time series for the bank sovereign exposures in stressed and non-stressed countries illustrated in Charts 7 and 9 is driven more by the different time pattern in their total assets, rather than by that of their sovereign holdings. Specifically, one may suspect that the different time patterns in those figures may reflect the fact that the balance sheets of banks may have shrunk more in the stressed countries than in the non-stressed countries of the euro area, rather than a different portfolio choice made by the two sets of banks. To investigate this point, Charts 5 and 6 show the time series of the *level* of the domestic and non-domestic euro area debt holdings of banks in stressed and non-stressed countries (in billions of euro). The two figures show that the *levels* of banks' sovereign debt holdings – not just their *ratio* to total assets – have indeed behaved differently in the two groups of countries since late 2008.

Chart 5

Domestic sovereign debt holdings of MFIs as a percentage of total assets, January 2000-September 2014

(percentages)

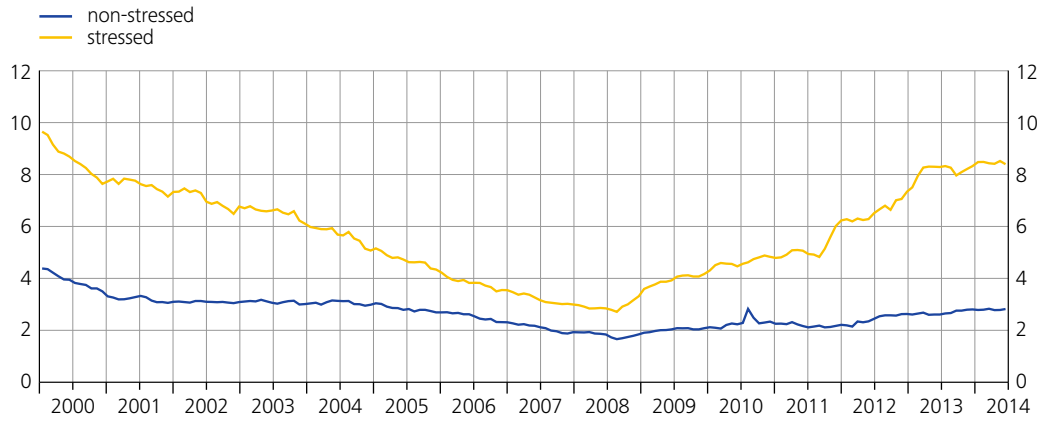


Source: SDW.

Chart 6

Domestic sovereign debt holdings of banks in certain stressed euro area countries versus those of banks in certain non-stressed euro area countries as a fraction of their total assets, January 2000-September 2014

(percentages)



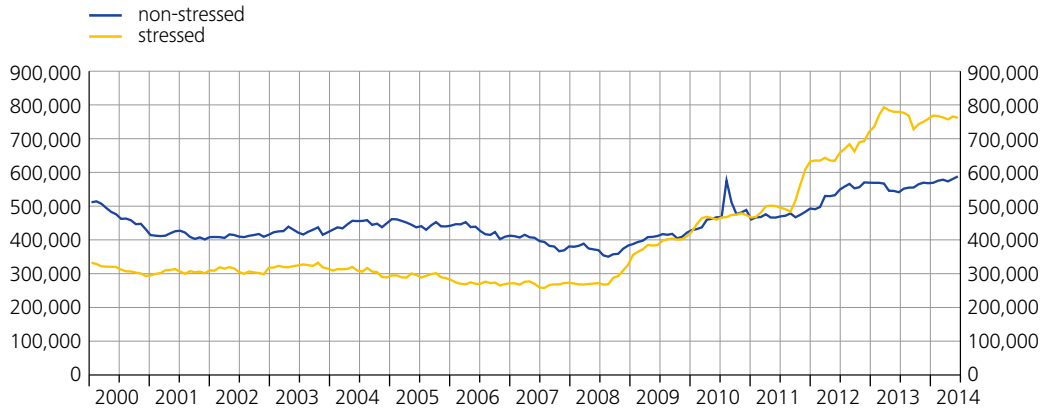
Source: SDW.
Note: See footnotes to Chart 4.

Specifically, Chart 7 shows that, while in both groups of countries, banks have increased their domestic sovereign debt holdings, they have done so to a much larger extent in the stressed countries than in the non-stressed countries: between September 2008 and June 2013 the domestic sovereign debt holdings of banks in the former rose from €268 to €793 billion, while those of banks in the latter rose from €354 to €568 billion (resulting in increases of 196% and 60% respectively). By contrast, Chart 8 shows that banks in the non-stressed countries have reduced their holdings of non-domestic debt more. In other words, banks in those countries also increased domestic concentration in their sovereign portfolio.

Chart 7

Domestic sovereign debt holdings of banks in certain stressed euro area countries versus those of banks in certain non-stressed euro area countries, January 2000-September 2014

(EUR million)

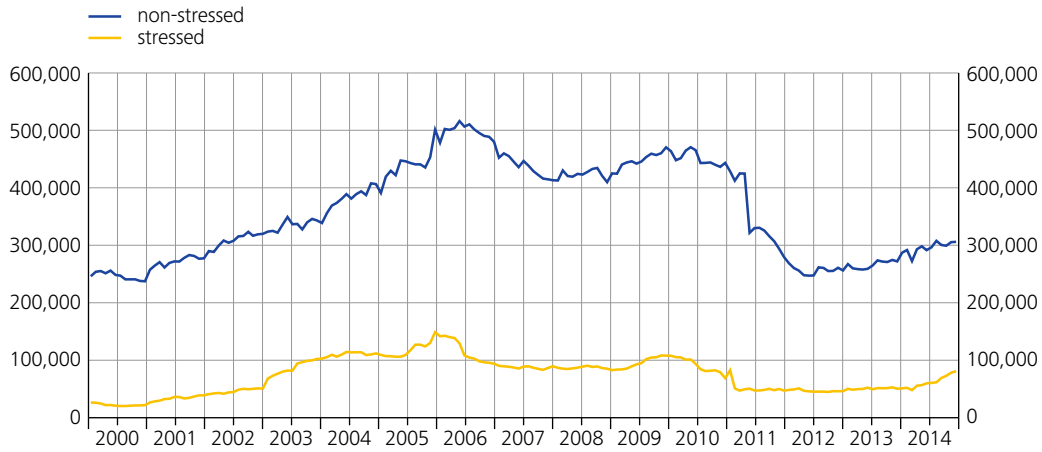


Source: SDW.
Note: See footnotes to Chart 4.

Chart 8

Non-domestic euro area sovereign debt holdings of banks in certain stressed euro area countries versus those of banks in certain non-stressed euro area countries, January 2000-September 2014

(EUR million)



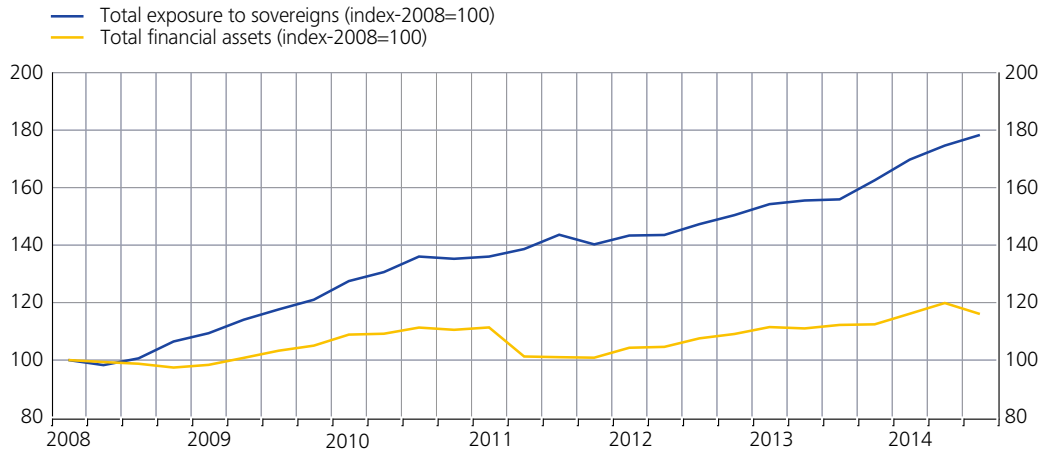
Source: SDW.
Note: See footnotes to Chart 4.

Taken together, Charts 7 and 8 indicate that **the recent increase in banks' holdings of domestic sovereign debt has resulted at least partly from a move away from debt issued by foreign euro area sovereigns**: starting from 2006, banks in each group of countries feature a general medium-term decrease (that is particularly evident towards the end) in the holdings of debt issued by non-domestic euro area sovereigns, and therefore increased the home bias of their sovereign debt portfolios. However, in absolute terms, this reallocation has been modest for banks in the stressed euro area countries, whereas it has been very sharp for banks located in the non-stressed countries: from September 2008 to June 2013, foreign sovereign exposures of banks in the stressed countries decreased from €86 billion to €51 billion, whereas banks in the non-stressed countries reduced their holdings of sovereign debt issued by stressed countries from €421 billion to €272 billion (although the downward trend stopped in April 2012 in both groups of countries). Hence, the overall picture is that of banks in non-stressed countries reallocating their portfolios away from sovereign debt of stressed countries and towards the debt issued by their domestic governments. Indeed, their shift away from foreign euro area sovereign debt has been so large as to exceed their investment in domestic sovereign debt, meaning that their euro area sovereign holdings have decreased since late 2010. This has not been the case for banks located in the stressed euro area countries, whose total holdings of euro area sovereign debt have increased sharply.

In many countries, government securities have traditionally accounted for a substantial proportion of insurers' overall investment portfolios. Since the financial crisis, this proportion has increased significantly. Chart 9 shows that total financial assets of euro area insurers have increased by less than 20% since 2008, while their holdings of sovereign debt have increased by almost 80% over the same period.

Chart 9

Evolution of total financial assets and sovereign debt held by euro area insurers since 2008

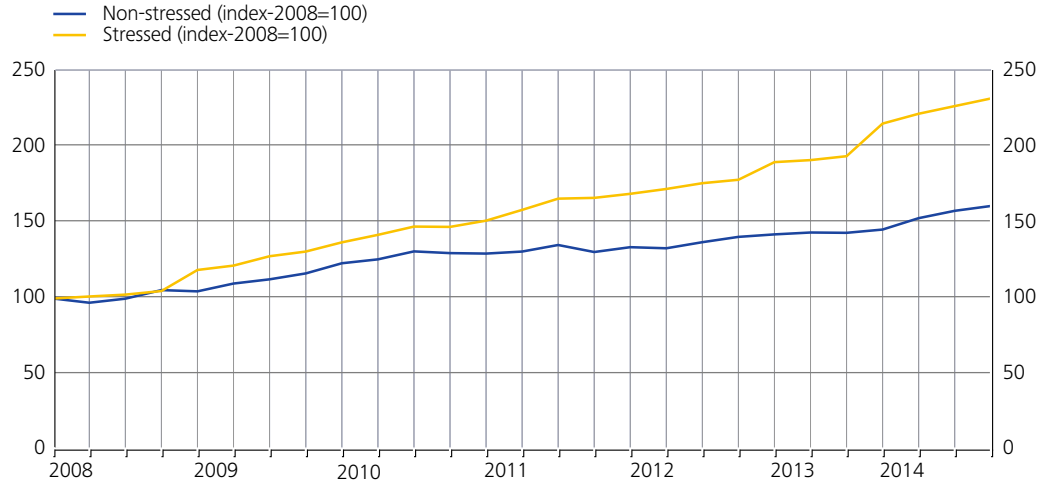


Source: ECB.
Note: The ECB's database includes data on the vast majority of all insurance companies (solo entities in the euro area). The countries covered are: Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, Slovenia and Spain. Sovereign debt holdings are holdings of both domestic sovereign debt and sovereign debt of other euro area countries. For Cyprus, Ireland and Italy, the holdings also include the holdings of pension funds. For Italy, the holdings include only the holdings of domestic sovereign debt. Please note that the database used for the figures in this section differs from that used for the tables in Chapter 3.1, as the ECB's database contains more extensive historic data on sovereign exposures.

This increase was sharper for stressed euro area countries than for non-stressed euro area countries, as shown in Chart 10.

Chart 10

Evolution of total exposure to sovereign debt of insurers in certain stressed and non-stressed euro area countries



Source: ECB.

3.3 Concentration of sovereign exposures in specific financial institutions

The EBA stress test data can be used to investigate whether, within that sample of banks, sovereign exposures are concentrated in systemically important financial institutions (SIFIs) or are concentrated in banks of the stressed euro area countries. Such an analysis was carried out for the 2011 EBA stress test data, and the results are shown in Table 11.

Table 11

Relationship between bank sovereign exposures and bank characteristics in the 2011 EBA stress test sample

Variable	Bank characteristic	Number of obs.	Mean	H_0: two-tailed test	Reject H_0 at 1%
Sovereign exposure to stressed euro area countries/ Total assets	non-SIFI	75	0.055	Mean=0	Yes
	SIFI	15	0.017	Mean= 0	No
T-test difference			0.037	Mean non-SIFI banks – mean SIFI banks= 0	No
Sovereign exposure to stressed euro area countries/ Total assets	Non-stressed countries	47	0.013	Mean= 0	No
	Stressed countries	43	0.087	Mean= 0	Yes
T-test difference			-0.074	Mean non-stressed countries banks – mean stressed countries banks= 0	Yes
Domestic sovereign debt/ Total assets	Non-stressed countries	47	0.056	Mean= 0	Yes
	Stressed countries	43	0.084	Mean= 0	Yes
T-test difference			-0.028	Mean non-stressed countries banks – mean stressed countries banks= 0	No
Core tier 1 capital/ Risk-weighted assets	Non-stressed countries	47	0.099	Mean= 0	Yes
	Stressed countries	43	0.086	Mean= 0	Yes
T-test difference			0.013	Mean non-stressed countries banks – mean stressed countries banks= 0	No
Core tier 1 capital/ Risk-weighted assets	non-SIFI	75	0.093	Mean= 0	Yes
	SIFI	15	0.091	Mean= 0	Yes
T-test difference			0.001	Mean non-SIFI banks – mean SIFI banks= 0	No

As this table shows, **the sovereign exposures of SIFI are not statistically different from those of non-SIFI included in the 2011 EBA stress test.** With regard to banks' exposures to sovereign debt issued by stressed countries, these are significantly larger for banks located in the stressed euro area countries than for those located in non-stressed countries: the difference is also economically large, with the stressed country banks' average exposure being 8.76% of total assets against 1.35% for banks in non-stressed countries. Instead, the domestic sovereign exposure is not statistically different for the two groups of banks: banks in non-stressed countries also have a considerable exposure towards their own sovereigns. Finally, there is no significant difference in solvency as measured by Core Tier 1 (CT 1) capital (scaled by risk-weighted assets) between banks in stressed and non-stressed countries, as well as between SIFIs and non-SIFIs. These results are confirmed by regression analysis (not reported for brevity).

Hence, on the whole, the only statistically significant evidence regarding differences between sovereign exposures in the EBA stress test data is that **the exposure towards stressed euro area countries is much larger for banks located in those countries than for those located in non-stressed countries**. Banks located in the stressed euro area countries appear to have a greater home bias than other EU banks. It should be stressed that, in December 2011, the EBA issued a recommendation to national authorities that banks participating in the stress test raise their CT 1 to 9%, after accounting for an additional buffer against sovereign risk holdings. The 2011 stress test data used does not reflect the completion of this recapitalisation initiative, more so in the banks of stressed countries where sovereign exposures were larger (as a proportion of total assets).

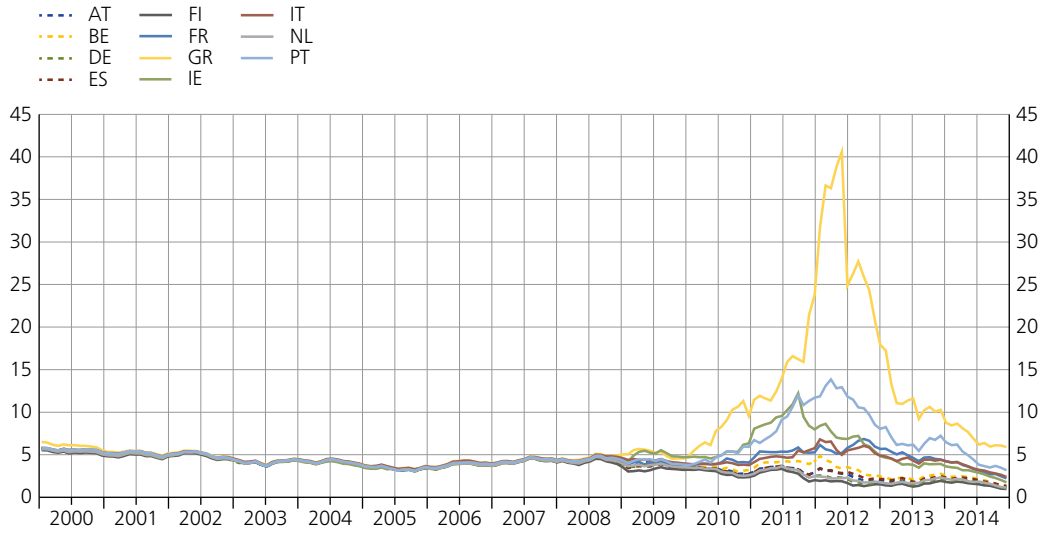
3.4 The response of sovereign exposures to bond yields and macroeconomic fundamentals

Why did the reversal in the time pattern of sovereign debt investment by the stressed countries occur? In the present report, two not mutually exclusive explanations are examined in greater detail: (i) the *carry trade hypothesis*, which relies on the dynamics of government bond yield differentials; and (ii) the *deficit absorption hypothesis*, which hinges on the evolution of macroeconomic fundamentals and fiscal imbalances across time. These two hypotheses can be tested and are at the heart of the empirical work conducted in this report. However, they are not the only possible explanations. Other hypotheses that are broadly consistent with the data are discussed at the end of this section.

The issue of what motivates the holding of sovereign exposures is relevant for the design of policy options. Prudential regulation increases the resilience of financial institutions by ex ante reducing their incentives for risk-taking and ex post ensuring that they are sufficiently capitalised (or liquid) to withstand a shock. If what drives sovereign exposures is a profit-maximising motive such as carry trades, then regulation that alters the risk-return trade-off by imposing a capital charge commensurate to risk will have both ex ante and ex post effects. If instead the main driver is exogenous to banks, as in the deficit absorption hypothesis which views banks as residual buyers of government debt, regulation has only ex post effects and therefore needs to be more invasive.

As illustrated in Chart 11, government bond yields started diverging from 2009, with stressed countries' yields gradually increasing and those of non-stressed countries declining. The opening of these interest differentials in a still integrated money and bond market may have induced banks to engage in **carry trades**, meaning that they borrowed at relatively low interest rates in the capital market of non-stressed countries to invest in comparatively higher-yielding sovereign bonds of stressed countries.

Chart 11
Yields of ten-year euro area sovereign debt, 2000-2014
(percentages)



Source: Datastream.

As generally happens with carry trades, such positions were risky, as indeed became increasingly apparent in 2010-11: far from converging, the yields of stressed countries continued to increase and those of German Bunds continued to decrease, inflicting severe losses on anyone who had a portfolio long in stressed-country sovereign debt and short in non-stressed-country debt. Clearly, to the extent that banks in the stressed euro area countries engaged in such trades, their behaviour has increased their risk of insolvency, and therefore investigating the response of these banks' sovereign exposures to yields is important to assess the systemic implications of the recent financial crisis.

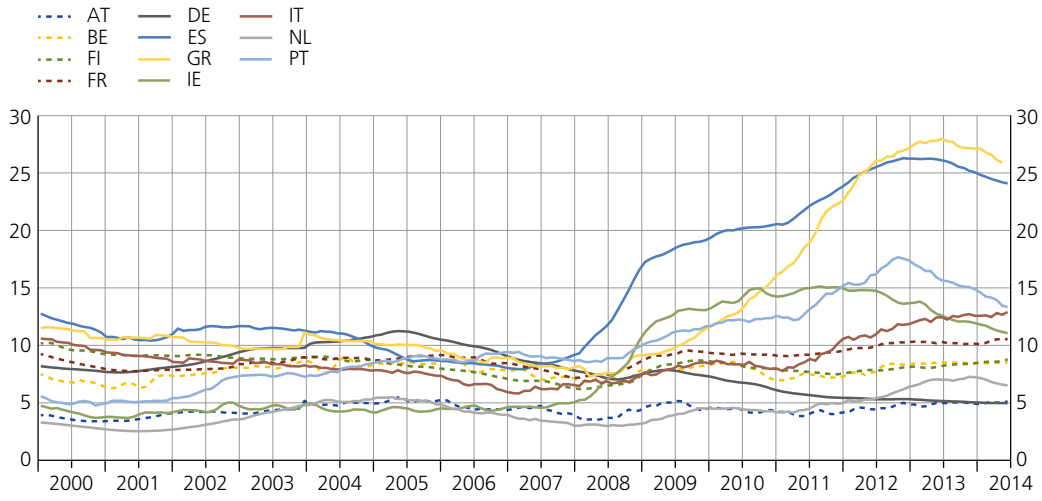
Such a profitable, albeit risky, opportunity may have been more attractive to banks in stressed countries than to those in non-stressed countries for three reasons: (i) easier access to the high-yield side of the trade; (ii) because they are hedged against redenomination risk if they invest in domestic sovereigns, since most of their liabilities are towards domestic residents; and (iii) in the period under consideration, banks in stressed countries might have been less capitalised, and less capitalised banks could be more prone to undertake hazardous strategies as a gamble for upside.

The carry trade hypothesis is consistent with stylised facts for banks in stressed countries, but it does not explain why non-stressed-country banks did not engage in such activities, unless one

also takes into account **redenomination risk**: insofar as the widening spreads reflected the risk of a collapse of the euro and eventual redenomination of sovereign debt,[4] non-stressed-country banks had no incentive to embark on carry trades in stressed-country sovereign debt. Indeed, they had an incentive to divest from stressed-country debt and invest in debt of non-stressed countries – an incentive possibly reinforced by their domestic regulators' pressure to reduce the riskiness of their sovereign portfolios.

An alternative hypothesis that may explain the shifts in banks' domestic sovereign exposures documented in the previous sections relies on **macroeconomic fundamentals**: deteriorating domestic macroeconomic conditions tend to prompt larger fiscal deficits, and the ensuing public debt issuance is (at least partly) absorbed by domestic banks, which act as residual buyers, via an increase in their domestic sovereign debt holdings. Indeed, Chart 12 shows that most of the stressed countries experienced large increases in unemployment from 2008: Spain, Greece and Ireland in particular have experienced very sharp recessions. In contrast, the recession has been milder in the non-stressed countries of the euro area, and has not occurred at all in Germany, which instead has experienced a remarkable drop in unemployment and an expansion in macroeconomic activity.

Chart 12
Seasonally adjusted unemployment rates, January 2000-September 2014
(percentages)



Source: SDW.

This, which may be labelled as the **deficit absorption** hypothesis, suggests that variables capturing diverging macroeconomic and fiscal situations across the euro area represent possible causes of the increase in the domestic sovereign exposure of stressed-country banks. Hence, it is worth studying the role of macroeconomic factors, which also potentially seem consistent with the stylised facts in stressed countries. However, it should be noted that this hypothesis is also not equally consistent with the behaviour of non-stressed-country banks: in particular, it is at odds with the fact that German banks increased their domestic sovereign exposures at a time

4 For evidence on this, see Di Cesare et al. (2012).

(2009-2012) when the German economy was not in a recession and its fiscal position was not worsening (this could be explained by the need for collateral to face possible liquidity squeezes; more on the role of liquidity later).

It should be noted that the dynamic patterns of sovereign yields and macroeconomic fundamentals do not exhaust the list of possible explanations for banks' portfolio decisions on their sovereign debt holdings. However, most of these other hypotheses, which are described below in Section 3.4.3, are observationally equivalent to the carry trade and deficit absorption hypotheses. In order to investigate how the two hypotheses just outlined compare in explaining the dynamics of euro area banks' exposures to domestic sovereign debt, the report resorts to two types of evidence, which rely on country-level and bank-level data respectively:

- First, by means of a **multivariate time-series analysis of country-level data**, it examines how aggregate domestic bank sovereign exposures in selected euro area countries correlate with (i) the relative yields of the domestic ten-year government bond and the ten-year yield on the Bund, and (ii) two macroeconomic variables, namely the domestic industrial production index and the domestic unemployment rate. The analysis presented below is based on a preliminary assessment of the stationarity of the relevant data (Annex 1), a discussion of econometric models on a country-by-country basis (Section 3.4.1), and extensions to a multi-country framework (Section 3.4.2). Annex 6 summarises the main findings, strengths and limitations of the four econometric models that the expert group tested as part of the empirical work for Chapter 3.
- Second, the report draws on a more indirect **return-based method with bank-level data** first proposed by Acharya and Steffen (2013) (Section 3.4.3). In particular, this approach is based on the idea that, insofar as banks engaged in carry trades, their stock returns should be positively correlated with the sovereign bond returns of stressed countries and negatively with German Bund returns, so that these correlations provide an imputed measure of banks' sovereign exposures. This methodology also allows non-stressed country banks' exposure to the stressed countries to be studied, albeit indirectly. The conclusions based on aggregate and bank-level data are described in Section 3.4.5.

The data used in the report's time-series analysis is drawn from a diverse pool of sources: (i) sovereign exposures, computed as the ratio between banks' aggregate holdings of domestic sovereign debt securities and their total assets, as well as the two macroeconomic variables, domestic industrial production and unemployment rates, are obtained from the SDW for each country in the sample; (ii) ten-year government bond yields are drawn from Datastream; (iii) data to compute flows of bank aggregate bilateral exposures of each pair of countries in the sample is drawn from the database of the Bank for International Settlements (BIS), and (iv) two indicators created by the ECB and published in the ESRB risk dashboard, namely the composite indicator of systemic stress (CISS) and the global risk aversion indicator, are respectively based on Thomson Reuters data, and on Bloomberg, Bank of America Merrill Lynch, UBS and Commerzbank data.

In the estimates reported below (unless otherwise indicated), the sample period ranges from January 2000 to March 2012 for all countries except for the so-called programme countries, i.e. Greece, Ireland and Portugal, where the time interval under consideration ends at the start of the economic and financial adjustment programmes led by international institutions such as

the IMF and the ECB. In particular, the sample period for Greece, Ireland and Portugal excludes observations following April 2010, December 2010 and April 2011 respectively. The rationale for such an exclusion is that the adjustment programmes helped tighten stressed euro area countries' yield differentials and decrease public deficits, set aside funds to recapitalise banks and contained provisions about banks' operations. Hence, during the most recent period, banks' portfolio decisions were likely to be explained by phenomena other than carry trades or deficit absorption, and the present analysis may be biased by including data for the programme regime for the affected countries.

Finally, it should be emphasised that the role (or lack) of regulation cannot be analysed, since sovereign exposures benefited from the zero risk weight exemption during the whole sampling period (regulation would need to change to understand its effects by comparison). Therefore, this section is only concerned with the role of incentives and of macroeconomic considerations.

3.4.1 Aggregate domestic sovereign exposures, bond yields and macroeconomic fundamentals – a vector error-correction model

This subsection analyses the dynamic relationships between the exposure to the domestic euro area sovereign debt of banks in a given country, the corresponding country's ten-year yield, the German ten-year Bund yield, the domestic industrial production index and unemployment rates; this allows both the carry trade and the deficit absorption hypotheses to be tested simultaneously.

The carry trade hypothesis predicts domestic sovereign debt exposure to be positively correlated with domestic yields, and negatively correlated with the German yield, taken to be the funding rate (for simplicity, all relevant empirical work uses the spread between the two, with an expected positive sign). On the other hand, were the deterioration of a country's macroeconomic conditions to be a relevant determinant of banks' domestic sovereign exposures, the latter should be negatively affected by a rise in industrial production, and positively affected by an increase in the unemployment rate.

The model

The present analysis intends to shed light on the response of sovereign exposures to movements in interest rates and macro variables. However, feedback effects stemming from bank sovereign exposures and affecting yields and unemployment/industrial production may not be ruled out. Moreover, to have a correctly specified model, the possible non-stationarity of the variables must be accounted for (see Annex 1). Finally, banks may adjust their sovereign debt portfolios towards their desired composition only gradually due to adjustment costs stemming from illiquidity and uncertainty about the persistence of yield differentials. Equivalently, shifts in portfolio composition at an aggregate level might be detected only after a sufficient number of banks have rebalanced their portfolios. Therefore, the econometric model must allow for the joint estimation of both (i) the long-run relationship between sovereign exposures and yields and/or macro variables, and (ii) the short-run dynamic response of the variables to shocks as banks adjust their portfolios towards their desired long-run composition.

On the basis of the analysis of the data described in Annex 1, many time series in the model are non-stationary and cointegrated. In this case, the standard VAR in levels is inappropriate

(see Lütkepohl and Krätzig, 2004). Likewise, a VAR in differences is incompatible with systems of cointegrated variables, since it omits the error correction term and ignores cross-equation constraints, hence producing inefficient estimates and unreliable test statistics. In comparison, a VEC model is a more general and robust framework; in particular, it allows for an error-correction term that addresses issues raised by cointegration and non-stationarity, and it can be interpreted as a standard VAR (while a VAR in differences only explains the dynamics of the changes in the variables). Hence, a VEC model is to be preferred to a VAR approach.

Therefore, a VEC model is estimated that allows for all possible patterns of time-precedence among variables. At the same time, this model can capture the gradual adjustment of sovereign exposures to long-run values determined by relative yields of domestic and German sovereign debt, and by industrial production and unemployment rates. The VEC specification allows the long-run behaviour of the endogenous variables to converge to their long-run equilibrium relationships.

As for the carry trade hypothesis, since the data here refers to domestic exposures, and yields in stressed countries are those that diverged most from the German yield in the second part of the sample period, it is primarily in stressed-country banks and for the past few years that we can expect to find evidence of a response of domestic exposures to yields. Specifically, the incidence of carry trades would be confirmed by the presence of significant long-run positive effects of domestic sovereign yields and negative effects of German sovereign yields on banks' domestic sovereign exposures in stressed countries. The deficit absorption hypothesis, on the other hand, should in principle be valid along the whole sampling period although, as Chart 12 shows, the macroeconomic environment started to deteriorate significantly in stressed countries with the crisis.

Annex 2 describes the properties of a baseline model, which, for simplicity and for illustrative purposes, only includes domestic sovereign and Bund yields. The results discussed below are derived from an estimation model that includes yields (in the form of *spread*, the difference between domestic sovereign and Bund yield), unemployment and industrial production.

As for the details of the estimation, the restriction on the cointegrating vector is imposed following an economic logic. In this respect, normalising the coefficient on the dependent variable to one and estimating the remaining parameters appear the most sensible solution to the identification problem (normalising the coefficient of *spread* would be an inferior choice, since the whole purpose of the exercise is to verify the significance of its parameter).

Results

The results of the estimation of the model are shown in Table 12. The estimated long-run coefficients on *spread* are significant in every country except Ireland, and have the expected positive sign. Hence, the evidence is consistent with the carry trade hypothesis: banks react to increases in spreads by increasing their holdings of domestic sovereign debt.

Table 12

VEC estimates for stressed countries in the macro-augmented model

(long-run parameters)

		Belgium	Greece	Ireland	Italy	Spain	Portugal
Δ *d_debt*	*lag 1 d_debt*	-0.043***	-0.012***	-0.046	-0.037***	-0.017***	0.013***
		0.000	*0.000*	*0.189*	*0.000*	*0.000*	*0.002*
	lag 1 spread	0.089***	0.374***	0.006	0.069***	0.096***	0.010***
		0.000	*0.000*	*0.189*	*0.000*	*0.000*	*0.002*
	lag 1 ip	-1.262***	0.352***	-0.186	0.034***	-1.802***	-0.047***
		0.000	*0.000*	*0.189*	*0.000*	*0.000*	*0.002*
	lag 1 unemp	-0.001***	0.079***	0.000	0.014***	-0.033***	0.005***
		0.000	*0.000*	*0.189*	*0.000*	*0.000*	*0.002*
	constant	1.465***	-1.273***	0.204	0.054***	2.185***	-0.009***
		0.000	*0.000*	*0.189*	*0.000*	*0.000*	*0.002*
Obs		145	118	145	145	145	145

Conversely, empirical evidence for industrial production (*ip)* and unemployment (*unemp)* sometimes conflicts with the theoretical motivation to add them to the model. From an economic perspective, according to the deficit absorption hypothesis, were *ip* to be a meaningful determinant of sovereign exposures (*d_debt)*, its long-run coefficient should have a negative sign, yet *ip* turns out to positively affect *d_debt* in Italy and Greece. Likewise, the deficit absorption hypothesis suggests that increases in *unemp* call for an increase in *d_debt*; yet again, the long-run coefficient on *unemp* is negative for Belgium and Spain. These results appear to conflict with the predictions regarding the dynamic effect that these proxies of macroeconomic conditions should have on banks' holdings of domestic sovereign debt.

The estimated parameters of the cointegrating vector *β* (not reported) show that *spread* enters significantly the cointegrating equation consistently across all the sampled countries. The opposite can be said of the coefficients of *ip* and *unemp*: *ip* does not significantly belong to the cointegration relation Greece, Italy and Portugal. The cointegrating parameter for *unemp* is not significant in three countries (Belgium, Ireland and Italy). In conclusion, the long-run relationship of domestic sovereign exposures with spreads stands on more solid ground than that with macroeconomic variables, such as industrial production and unemployment.

The (orthogonalised) impulse response functions in levels of *d_debt* with respect to the explanatory variables of the system confirm the findings described above (see Annex 3). The net effect of shocks in *spread* is consistent with the presence of carry trades: in all stressed countries, *d_debt* is positively affected by disturbances originating in *spread*. The deficit absorption hypothesis appears consistent with the dynamic response of domestic sovereign exposures only for some of the countries being considered: the response of sovereign exposures (*d_debt*) to an increase in industrial production (*ip*) is consistent with this hypothesis for

Belgium, Ireland and Spain, but not for Greece and Italy. Also, a shock in *unemp* elicits no response in domestic sovereign exposures in Belgium and Italy.

Unreported sample splits show that the long-run relationship holds mostly when the crisis period is included. This is perfectly consistent with the carry trade hypothesis, since it is only around that time that spreads widened enough to offer an interesting profit opportunity.

The evolution of banks' domestic sovereign exposures in the euro area might also depend on the presence of common drivers among the variables of the different countries. For example, domestic sovereign bond holdings and bond yields (or spreads) might include a contagion component, market-driven risk aversion and interactions among financial institutions, and between them and the public sector, which have not necessarily been confined to country boundaries, especially in recent years. These common drivers can be treated in a country-by-country VEC framework, for example by decomposing spreads into country-specific and common factors with a dynamic factor model (including a peripheral country factor), as done by Battistini, Pagano and Simonelli (2014), who still find evidence consistent with the carry trade hypothesis.

An alternative way of dealing with the issue of common drivers is to use a multi-country framework. This issue is addressed in the following section.

3.4.2. Aggregate domestic sovereign exposures, bond yields and macroeconomic fundamentals – a global value-at-risk model

The analysis conducted thus far has relied on a country-by-country estimation of VEC models. These single-country models may capture partially observed common effects via macroeconomic indicators such as unemployment rates or industrial production, which are likely to co-move across countries. Yet this approach may neglect other common effects occurring at the euro area level and unobserved components stemming, for instance, from contagion.[5] There is weak evidence of the relevance of the problem of possible omitted factors in the correlation of residuals of the VEC estimations (statistically significant but very small in magnitude). Therefore, to possibly improve inference, it is worth exploring the data in a multi-country framework.

In this subsection, a thorough analysis is carried out, exploiting both the cross-sectional and the time series dimension, and the results of the model are presented in a multi-country framework by means of a GVAR analysis. From an econometric perspective, the GVAR is in fact a G-VEC, and shares the comparative benefits of the VEC relative to a VAR (robustness to cointegrated data, more general framework, ease of interpretation). It is therefore a preferred option with respect to simple multi-country VAR models. GVAR models have their own limitations: to perform well, they need a large cross-section,[6] while the present analysis includes 10 countries at most. Therefore, the results of the GVAR should be interpreted as complementing and qualifying the results of the VEC exercise, rather than superseding them.

5 Although, as mentioned, Battistini, Pagano and Simonelli (2014) perform a country-by-country analysis that deals with this issue and by and large provides the same results.

6 See Dees, Di Mauro, Pesaran and Smith (2007).

As shown by the expanding macroeconometric literature on multi-country models,[7] the GVAR framework accounts for the presence of observed and unobserved common factors, non-stationarity and cointegration of time series.[8] Regarding the modelling choice, Pesaran (2004) argues that, when the cross-sectional dimension is small (e.g. ten or fewer cross-sectional units) and the time dimension of the panel is sufficiently large, the cross-correlations of the errors can be modelled within a seemingly unrelated regression equation (SURE) framework, such as a GVAR model. The main difference between this approach and the country-by-country framework used in Section 3.4.1 lies in the structure of the residuals. More specifically, in a SURE framework, the model accounts for the possible cross-country correlations of the residuals, and improves the efficiency of the estimates and the reliability of inference.[9]

Based on the analysis of the data in the previous subsection, this report estimates a GVAR where each country *i*'s model contains (i) an unobserved common factor explaining co-movements in yield spreads, and (ii) observed measures of risk aversion and systemic stress (namely, a global indicator of risk aversion and the CISS).[10] The GVAR framework allows for country-specific unobserved common factors, proxied by cross-sectional weighted averages of the non-domestic counterparts of the endogenous variables included in each country's model. The addition of these variables is an essential step of the multi-country analysis, since it models the common drivers that motivate the choice of this estimation framework.

In the multi-country framework, the evidence in favour of the carry trade hypothesis is weaker than in the country-by-country models. Banks' sovereign exposures react positively to a shock to yield differentials in Italy, Ireland and Spain, while the response for Greece is negative, and that for Portugal is positive only in the short run. The fact that the evidence is weaker might be due to limitations in the power of statistical tests when the cross-section is small (only six cross-sectional units, referring to the five stressed countries in our sample and a single economic region composed of the five non-stressed countries), as mentioned above.[11] A detailed explanation of the estimated model, including its impulse response functions, is provided in Annex 4.

Apart from VEC and GVAR models, the expert group also conducted estimates using VAR and extended VAR models. The main findings, strengths and limitations of the four econometric models used are summarised in Annex 6.

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7 See, for instance, Dees, Di Mauro, Pesaran and Smith (2007); Bussiére, Chudik and Sestieri (2009); Chudik and Fratzscher (2011); Eickmeier and Ng (2011).

8 The results presented in this paragraph are obtained using the GVAR Toolbox 1.1 by Smith and Galesi (2011). More detailed results are available from the authors upon request.

9 However, note that a SURE only marginally improves upon models with single cross-sectional units if the same specification (in terms of variables and lags) for each unit is chosen, as in the single-country models previously discussed.

10 The results presented in this subsection are robust to the inclusion of further common variables, such as the VIX index, the VSTOXX index, the dollar-euro exchange rate and the euro effective exchange rate against the euro area's 20 most relevant trading partners.

11 See, for instance, Pesaran (2004). Also, in their study of the international links affecting euro area economic activity, Dees, Di Mauro, Pesaran and Smith (2007) use a sample of 35 countries.

3.4.3 Bank-level sovereign exposures and bond yields

The evidence presented in the previous subsection is based on aggregate data, and suffers from the limitation that the aggregate SDW time series for sovereign exposures only offer the breakdown between domestic and foreign exposures, not that to individual sovereign issuers. This makes it impossible to investigate how non-stressed-country banks changed their sovereign exposures to stressed-country debt in response to changes in stressed-country yields, and therefore prevent the investigation of whether banks in non-stressed countries also engaged in carry trades, and to what extent. This investigation would require a complete matrix of sovereign exposure data by holders and by issuers at the individual bank level. So far the only publicly available data is that produced by the EBA stress tests, which refers only to a few points in time.

These issues can be partially overcome by (i) imputing banks' sovereign exposures from the correlations between bank returns and government debt returns, and/or (ii) using the cross-sectional snapshots offered by the EBA stress tests, and therefore almost completely forgoing the time-series dimension. The rationale of this imputation procedure is that the larger a bank's exposure to a sovereign, the more correlated its assets should be with the return on the debt issued by that sovereign. This imputation, which also allows exposures of banks in non-stressed countries to stressed countries to be studied indirectly, may suffer from three limitations:

- First, a bank's stock return may correlate with the return on its domestic sovereign's debt not because the bank has a large financial exposure to the sovereign but because the sovereign is the ultimate backstop for the bank. For instance, bad news about the solvency of the sovereign which is associated with a drop in the price of domestic sovereign debt may also increase investors' concerns about the solvency of domestic banks, and therefore induce a drop in their stock prices.
- Second, bank *i* may extend loans to firms in country *j* and underwrite their bonds, and the return on these assets may be correlated with that of country *j*'s sovereign debt. Hence, the correlation between the stock return of bank *i* and the return on the sovereign debt of country *j*
  may also to some extent capture bank *i*'s exposure to the private sector of country *j*, and not just to its sovereign. Of course, exposures to private-sector entities in high-yield, high-risk countries may also qualify as the foreign leg of a carry trade. However, the point remains that the correlation may not just reflect bank *i*'s exposure to country *j*'s sovereign debt.
- Third, these correlations may actually reflect common risks of banks and sovereigns in the euro crisis, not necessarily causality from sovereign yields to banks. For instance, internationally active euro-area banks are likely to have been active investors in the most stressed euro area economies. Even a bank with no exposure to peripheral debt or any other business in peripheral countries may see its equity price severely affected by changes in peripheral sovereign yields to the extent that they reflect market concerns about the survival of the euro (redenomination risk).

A recent study by Acharya and Steffen (2013) applies this imputation methodology to a sample of 50 publicly listed banks subjected to the EBA stress tests conducted in July 2010, July 2011

and December 2011.[12] First, they infer these banks' sovereign exposures from the correlations between their weekly stock returns and weekly bond returns on the sovereign debt of stressed countries and of Germany. Second, they test whether these imputed exposures are cross-sectionally correlated with those resulting from the EBA stress test data. This second step is of crucial importance to overcome the three limitations just discussed: insofar as the correlations used to impute sovereign exposures are themselves correlated with actual exposures, at least for the subset of banks included in the EBA stress tests, they are less likely to reflect other determinants than those discussed above.

Table 13 presents the coefficient estimates obtained by Acharya and Steffen (2013) in regressions of bank stock returns on sovereign bond returns, using daily data for the period from January 2006 to February 2012. Columns 1 to 5 show factor loadings on stressed-country sovereign bond returns individually for Greece, Portugal, Italy, Spain and Ireland and collectively for stressed countries in column 6. All regressions include German government bond returns. The specification in column 7 also includes home country bond returns as an additional control.

To interpret the results in Table 13, consider the estimates shown in column 1: these indicate that the stock returns of the 50 banks in the sample correlate positively with the returns on Greek sovereign debt, the relevant factor loading being 0.193, and negatively with German sovereign debt, which has a factor loading of -2.299. Hence, on average over the sample period, their stock prices reacted positively to increases in the price of Greek sovereign debt and negatively to increases in Bund prices. Columns 2 to 5 show that similar results are obtained for the response of bank stock returns to the returns of other sovereign issuers in stressed euro area countries: Italy and Spain are the countries whose sovereign debt returns appear to be more correlated with the stock prices of the banks in this sample, as they have factor loadings of 0.649 and 0.578 respectively. Column 6 estimates jointly all five stressed-country factor loadings. Only those of Greek and Spanish sovereign debt turn out to be significant, possibly because stressed-country sovereign yields are very highly correlated (in Acharya and Steffen's, 2013, sample, the correlations of Italian sovereign yields with Spanish and Greek ones are 0.98 and 0.97 respectively, and those of Irish yields with the Spanish and Greek ones are 0.93 and 0.92 respectively).

The estimates in column 7 show that the home-country factor loading is positive, large and precisely estimated, while the individual country factor loadings are again significant only for Greece and Spain, as in column 6. This indicates that the correlations between stock returns and sovereign debt returns are not driven only by the holdings of the respective domestic banks, whose effect is already controlled for by the "home country" coefficient. This is an important point because, as already noted above, the correlation between a bank's stock return and its domestic sovereign return may partly stem from changes in the domestic government's ability to act as a backstop for the bank in the event of distress, not just from the bank's domestic sovereign holdings. Obviously this criticism does not apply to the correlation between a bank's stock return and the return on foreign sovereign debt, which captures the impact of foreign sovereign holdings, unless it is redenomination risk that moves at the same time as the Bund and domestic yields. The fact that foreign sovereign holdings generate such sizeable correlations in spite of their small and declining entity in the aggregate (as shown by the figures in the off-diagonal cells of

12 Other recent papers that empirically analyse the correlation between bank and sovereign risk in the context of the euro debt crisis are Mody (2009), Gerlach, Schulz and Wolff (2010) and Barth, Prabhavivadhana and Yun (2011).

Table 7) may be due to the fact that the sample used in the study by Acharya and Steffen (2013) mainly includes large banks which were internationally active during the crisis.

Table 13

Regressions of bank stock returns on sovereign bond returns

(from Table VI in Acharya and Steffen, 2013)

	(1) Greece	(2) Italy	(3) Spain	(4) Portugal	(5) Ireland	(6) Stressed countries	(7) Stressed countries
Greece	0.193***					0.150***	0.129***
	(6.98)					(7.79)	(6.35)
Italy		0.649**				-0.020	-0.018
		(3.47)				(-0.97)	(-0.92)
Spain			0.578***			0.603***	0.518***
			(4.14)			(2.69)	(2.54)
Portugal				0.182***		-0.107	-0.073
				(2.11)		(-0.48)	(-0.35)
Ireland					0.347***	0.113	0.091
					(3.15)	(1.32)	(1.17)
Germany	-2.299***	-2.469***	-2.522***	-2.370***	-2.393***	-2.401***	-2.598***
	(-12.74)	(-11.73)	(-12.58)	(-12.05)	(-12.23)	(-13.37)	(-14.69)
Home country							0.180***
							(3.02)
Constant	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(-1.00)	(-1.43)	(-1.36)	(-1.34)	(-1.30)	(-1.05)	(-0.93)
Observations	63,105	63,105	63,105	63,105	63,105	63,105	56,234
R-squared	0.12	0.12	0.12	0.11	0.12	0.13	0.14

Source: Bank asset data is drawn from the SDW.
*Note: Standard errors are clustered at two dimensions, bank level and quarter. T-statistics are reported in parentheses. ***, **, * denote significance levels at the 1%, 5% and 10% confidence level respectively.*

The results in Table 13 suggest that euro area banks have significant correlation, on average, with stressed-country sovereign debt, and that their stock returns correlate negatively with German bond returns: as German bond prices increased, banks equity prices fell on average. Acharya and Steffen (2013) interpret this as an indication of EU banks having long positions in stressed-country sovereign debt, funded by shorting sovereign bonds of non-stressed countries or, equivalently, borrowing in those countries. At the peak of the crisis, these carry trades produced losses, as a result of the flight to quality that pushed up Bund prices and depressed peripheral bond prices, reflecting concerns about the fiscal deficits in stressed countries. On the other hand, in unreported estimations performed for the expert group, Acharya and Steffen found no significant relationship between banks' stock returns and macro variables such as unemployment and industrial production.

However, the correlations between returns on bank stocks and on stressed-country sovereign debt documented by this table cannot be taken per se as evidence that sovereign exposures increased the risk of banks. To investigate this point, one must test whether these return correlations are larger for banks with bigger sovereign exposures. Otherwise, as already

mentioned above, while consistent with the carry trade interpretation, these correlations may equally well arise from other exposures of banks – e.g. from lending to firms located in the jurisdiction of stressed-country sovereign issuers whose credit risk is correlated with that of their sovereign.

To resolve this issue, Acharya and Steffen (2013) repeat the estimation shown in the first three columns of Table 13 for Greece, Italy and Spain over an interval spanning 120 days around the EBA stress tests' reporting dates, and then regress the factor loadings estimated for individual banks and intervals on two alternative measures of banks' sovereign holdings: (i) the corresponding sovereign bond holdings (in levels), and (ii) the same variable scaled by the total assets of the relevant bank. The estimation is performed on the natural logarithms of all three variables.

For brevity, Table 14 reports only the results obtained with the first of these measures, in two specifications: one without and one with fixed effects. On the whole, the table documents that banks with higher sovereign holdings on the date of the EBA stress test feature higher correlation of their stock return with the bond return of the respective sovereign. This result is robust to the inclusion of stock-level fixed effects for Greece and Italy, but not for Spain, as shown by the estimates reported in columns 2, 4 and 6. One limitation of the Acharya and Steffen (2013) approach is that both equity prices and sovereign yields might be affected by redenomination risk: when it increases, stock prices of stressed-country banks decrease (we have no prior for stock prices of non-stressed-country banks), Bund yields decrease because of flight to quality and stressed-country sovereign yields increase. This explanation is by and large observationally equivalent to banks engaging in carry trades.

Table 14

Regressions of sovereign bond returns' factor loadings on sovereign bond holdings

(from Table V in Acharya and Steffen, 2013)

	(1) Greece	(2) Greece	(3) Italy	(4) Italy	(5) Spain	(6) Spain
Log (holding)	0.171***	0.236***	0.104**	0.609***	0.157***	0.285
	(4.00)	(2.08)	(2.23)	(2.38)	(3.02)	(0.73)
Constant	-2.717***	-3.128***	-0.903**	-4.452**	-1.492***	-2.351
	(-8.85)	(-4.33)	(-2.30)	(-2.48)	(-3.40)	(-0.90)
Bank fixed effects	No	Yes	No	Yes	No	Yes
Observations	93	93	83	83	76	76
R-squared	0.11	0.03	0.05	0.12	0.08	0.01

*Note: The dependent variable is the logarithm of factor loadings, and the independent variable is the logarithm of the corresponding sovereign holdings. Standard errors are clustered at bank level. T-statistics are reported in parentheses. ***, **, * denote significance levels at the 1%, 5% and 10% confidence level respectively.*

Despite the differences in methodology and data used, these bank-level cross-sectional results are consistent with the aggregate time-series evidence reported in Section 3.4.1 that a significant portion of euro area banks have responded to large yield differentials between stressed-country and non-stressed sovereign debt by taking large positions in stressed-country sovereign debt. Interestingly, Acharya and Steffen (2013) also provide evidence consistent with the idea that more leveraged banks have greater incentive to take long positions in risky sovereign debt, as the carry trade hypothesis would predict: they document that banks with lower Tier 1 capital ratios tend to have greater exposure to the bonds issued by stressed countries. They also show that banks with greater exposure to these bonds depend more on ECB funding relative to other sources of finance in the following year, and that, after each of the three longer-term refinancing operation (LTRO) events,[13] there is a jump in the correlation between bank stock returns and Italian bond returns, consistent with the idea that these liquidity injections allowed banks to increase their exposures to risky sovereigns.

The previous results are consistent not only with the evidence based on aggregate data reported earlier in this chapter, but also with that reported by Merler and Pisany-Ferry (2012), who assembled data on sovereign exposures from national sources (national central banks, statistical authorities, treasuries), and document that the share of domestic sovereign debt held by domestic banks increased significantly between 2007 and 2011 in all stressed countries. They conclude that these increased holdings increase the potential for negative feedback loops between sovereign stress and banking stress. In contrast, Angeloni and Wolff (2012), who analyse data for 65 banks included both in the EBA's recapitalisation exercise published in December 2011 and the July 2011 stress test, find a reduction of sovereign exposure in peripheral countries when measured in percentage of CT 1 capital. Specifically, they document that "for France and Germany there is a clear reduction in exposure expressed both in € billions and the percentage of Core Tier 1 capital; for the stressed countries the reduction in exposure is evident when expressed in percentage of Core Tier 1 capital, but less so in absolute amounts".

The apparent contrast in results derives from the fact that Angeloni and Wolff (2012) (i) focus on 2011, a year in which banks slowed or reversed their earlier increase in sovereign exposures towards stressed-country sovereigns, and (ii) look mainly at the ratio of exposures to CT 1 capital, rather than to total assets and, as they point out, most of the banks in the EBA dataset "followed a strategy of increasing the amount of equity (Core Tier 1 capital), rather than of selling huge amounts of government debt securities". The June 2012 data of the EBA capital exercise confirms this result. Hence, the evidence suggests that, owing to the EBA's intervention, banks are no longer increasing their exposures to sovereign debt regardless of solvency implications (since they are simultaneously increasing equity levels), and are actually reducing their holdings of the riskier types of sovereign debt.

3.4.4 Other theories

Thus far, the report has focused only on the carry trade and the deficit absorption hypotheses. In fact, banks' portfolio decisions on sovereign exposures might have further explanations. However, most of these alternative explanations yield predictions about the correlations of

13 Including the first 12-month LTRO conducted in 2009 and also two 36-month LTROs conducted in December 2011 and February 2012.

aggregate domestic exposures and other variables that are observationally equivalent to those of the two hypotheses considered so far, while others would require additional, bank-level data to be tested empirically. Specifically, one can think of the following other possible explanations for the responses of the domestic sovereign exposures to yields and macroeconomic factors, not all of which are equally promising in terms of internal consistency or realism:

- *Moral suasion by governments*: In the stressed euro area countries, banks may have been under pressure from their respective governments to absorb more domestic sovereign debt precisely when this, being perceived as a riskier investment, offered higher sovereign yields. For example, in December 2011 the then French President, Nicolas Sarkozy, publicly suggested that banks use the liquidity provided by the ECB via the LTRO to buy more sovereign bonds. This explanation is observationally equivalent to the carry trade story.[14]
- *Greater liquidity requirements for banks*: Another explanation for the increased domestic sovereign holdings of banks in the stressed euro area countries may be their desire to increase their liquid assets to satisfy the tighter regulatory requirements of the new CRD IV/CRR. Negotiations in Basel on the introduction of new liquidity standards started around 2008. From the very beginning it was clear that cash, central bank reserves and sovereign bonds would be part of the highly liquid assets for the liquidity buffers. Supervisors and banks were all aware of the need to gradually increase their holdings of HQLAs in order to meet the upcoming requirements. An important part of the recent increase in banks' holdings of sovereign debt may be attributed to the new Basel liquidity standards. Indeed, many banks in the EU may still need to continue increasing their HQLAs holdings to meet the new requirements. This explanation is consistent with higher total holdings of sovereigns, but does not explain why stressed-country banks increased their exposure to domestic debt while divesting from foreign sovereign debt. If anything, given the importance of liquidity for this regulation, there should have been a massive move towards higher-rated sovereigns. Furthermore, since implementation only started on 1 January 2015, portfolio shifts in 2009-2012 would have been very much forward-looking, although it should be acknowledged that, at least in some cases, there might have been pressure from markets to frontload the requirements.
- *Change in private sector demand for lending*: Yet another possible explanation for the evidence is that, since 2008, banks in the stressed euro area countries have faced declining demand for private sector credit in their respective countries, in contrast to banks in non-stressed countries, and this has induced them to invest in sovereign debt more than their non-stressed-country counterparts. But again, this does not explain why banks in the stressed euro area countries increased their holdings of domestic debt, and even reduced those of non-domestic sovereign debt (see Chart 8). They could have invested their spare lending capacity in non-domestic euro area debt, or at least in a well-diversified sovereign debt portfolio. Furthermore, given the funding constraints faced by banks in the stressed euro area countries, deleveraging would have been a more sensible option. In any event, from an econometric viewpoint, this hypothesis is observationally equivalent to the deficit absorption hypothesis, since it predicts that banks will increase their sovereign holdings in response to recessions.

14 Angelini, Grande and Panetta (2014) provide evidence that the moral suasion hypothesis is inconsistent with the pattern of sovereign bond purchases observed among Italian banks in the period 2008-2013.

- *Self-preservation hypothesis*: Distress in sovereign bond markets not only affects most of the banks' balance sheet structures, but also has a far-reaching impact on the whole economy. Even a bank with zero exposure to its own sovereign is heavily exposed to a situation of stress in the sovereign due to the many interconnections between sovereign and banking risk (see Chapter 2). In this sense, by investing in domestic sovereign debt, banks could be reducing the probability of sovereign default, and the negative spillovers and implications of sovereign risk on their own performance. In short, under this hypothesis, it would be self-preserving for banks to help mitigate a deterioration in the sovereign stemming, for example, from systemic illiquidity, procyclicality in credit risk assessments or short-term speculative attacks in sovereign markets. In the best case scenario, this hypothesis relies on the assumption that banks have a better perception than other domestic and foreign investors about whether the sovereign's problems are due to illiquidity or insolvency, and trust that their intervention can change the dynamics of the crisis. In the worst case scenario, banks would be simply gambling for resurrection on behalf of the government. Considering that most information about the public sector is public and that the size of its needs relative to banks' free cash flow is high, both assumptions seem dubious. Furthermore, from an individual perspective, a bank would have an incentive to let other banks take the gamble of sustaining the sovereign while it invests in safer assets. In any event, from an econometric viewpoint, this hypothesis is observationally equivalent to the moral suasion and carry trade hypotheses, since all three predict that banks will increase their domestic sovereign holdings in response to an increase in yields.

In conclusion, most of the explanations can be grouped into two broad observationally equivalent categories (in turn not necessarily mutually exclusive):

- Hypotheses predicting that banks will increase their domestic sovereign exposures in response to increases in domestic sovereign yields relative to a risk-free benchmark rate: they may do so (i) to seek profitable carry trades, (ii) under the pressure of moral suasion by regulators, or (iii) to seek self-preservation. In all three cases, what changes is only the motivation of banks' behaviour, not the prediction about it.
- Hypotheses predicting that banks will increase their domestic sovereign exposures in response to a drop in domestic macroeconomic activity and worsening fiscal deficit: the prediction is the same whether banks do so seeking to (i) absorb the newly issued government debt, (ii) replace the drop in private loans, or iii) respond to moral suasion, which could also be exerted in the absence of a significant rise in yields if, for example, the government is wary of tapping financial markets. Again, aside from the motivation of banks' behaviour, the prediction about observables is the same.

Hence, the evidence produced in the previous sections about the carry trade and deficit absorption hypotheses can be read as providing observationally equivalent support for the other hypotheses grouped in the previous two categories respectively. (The only hypothesis that does not appear to generate predictions that can be testable with country-level data is the liquidity requirement hypothesis, which would require bank-level data currently unavailable.)

3.4.5 Conclusions

The results obtained from the different empirical analyses performed on aggregate and individual data to explore the response of banks' sovereign exposures to their spreads and to macroeconomic variables can be summarised as follows:

- The estimation of country-by-country VEC models (Section 3.4.1) yields significant evidence of (i) a positive correlation between domestic exposures and domestic yields (or spreads) in most stressed euro area countries, consistent with the carry trade hypothesis, and (ii) for some of those countries, a positive correlation with indicators of macroeconomic contraction, such as unemployment, consistent with the deficit absorption hypothesis.
- The estimation of a multi-country GVAR model that includes observed and unobserved common factors (Section 3.4.2) provides weaker evidence in favour of the carry trade hypothesis: a positive response of domestic exposures to domestic yields is found only for Ireland, Italy and Spain.
- The estimation with bank-level data of the correlation of banks' stock returns with the returns on domestic sovereign debt matched with exposure levels (Section 3.4.3) provides evidence that is consistent with the carry trade hypothesis, and also with redenomination risk being a common driver.

From a prudential perspective, the key point emerging from the evidence in this section is that, even controlling for macroeconomic factors, banks in stressed countries raised their domestic sovereign holdings in correlation with increases in their yield differentials. Since the latter reflected increases in credit risk, as witnessed by the concomitant increases in CDS premia and worsening of credit ratings (however reliable these might be), these banks increased their exposure to an increasing risk. Based on the discussion of Chapter 2, this would call for prudential regulation.

3.5 The effect of sovereign exposures on the risk of financial institutions

Did the changes in the sovereign exposures increase the risk of euro area banks between 2006 and 2012, as suggested by the evidence produced so far in this chapter? This section digs further into this issue by drawing on the country-level aggregate data from the SDW. Recalling from Section 3.2 that banks' sovereign exposures are heavily biased towards their domestic issuers, the strategy involves two steps: first, computing time-varying correlations between the returns on bank stocks and the returns on the respective country's domestic sovereign debt; second, investigating whether such correlations are associated with the respective banks' domestic sovereign exposures, scaled by total assets. The spirit of the exercise is to match at the aggregate time-series level the bank-level analysis by Acharya and Steffen (2013) shown in Table 13 above.

Charts 13 and 14 present the resulting country-level evidence for banks located in the stressed euro area countries and in the non-stressed countries respectively. Each graph in these two figures shows two lines. The blue line is the moving correlation between bank-sector monthly stock returns and the ten-year domestic sovereign debt return for that country, from January 2001 to May 2011 (both drawn from Datastream). The observation for each date is the correlation computed using the returns for the 24 months centred on that date (the 11 previous months, the current month and the 12 subsequent months). The values of this correlation are measured on the left axis of each graph on a common scale for all countries. The yellow line in each graph instead plots the domestic sovereign debt exposures of the banks in that country from January 2001 to March 2012 (drawn from the SDW). Sovereign exposures are measured on the right axis of the graph, again on a common scale for all countries (except Greece). In the following, correlations do not strictly imply causation, but they hint at a possible causal relationship that could be ascertained via an empirical analysis such as the one illustrated in Sections 3.4.2 and 3.4.3.

Chart 13 shows that, in the stressed euro area countries, the correlation between bank stock returns and sovereign debt returns is typically negative or zero before 2009, when banks in this area were reducing their sovereign exposures. The correlation turns positive in late 2008 in Greece, Ireland, Italy and Portugal, and in 2009 in Spain, and subsequently tends to increase as banks in these countries increase their domestic sovereign exposures. In the last year of the sample (from June 2010 to May 2011), the correlation between stock and sovereign debt returns becomes on average 37% in Greece, 28% in Ireland, 39% in Italy, 37% in Portugal, and 53% in Spain,[15] all significantly different from zero at the 1% confidence level. As shown in Table 15, the correlation between the two series turns from being negative and significant (for Ireland, Italy and Spain) or not significantly different from zero (for Greece and Portugal) in the pre-Lehman period to being positive and significant for all stressed euro area countries in the post-Lehman period.

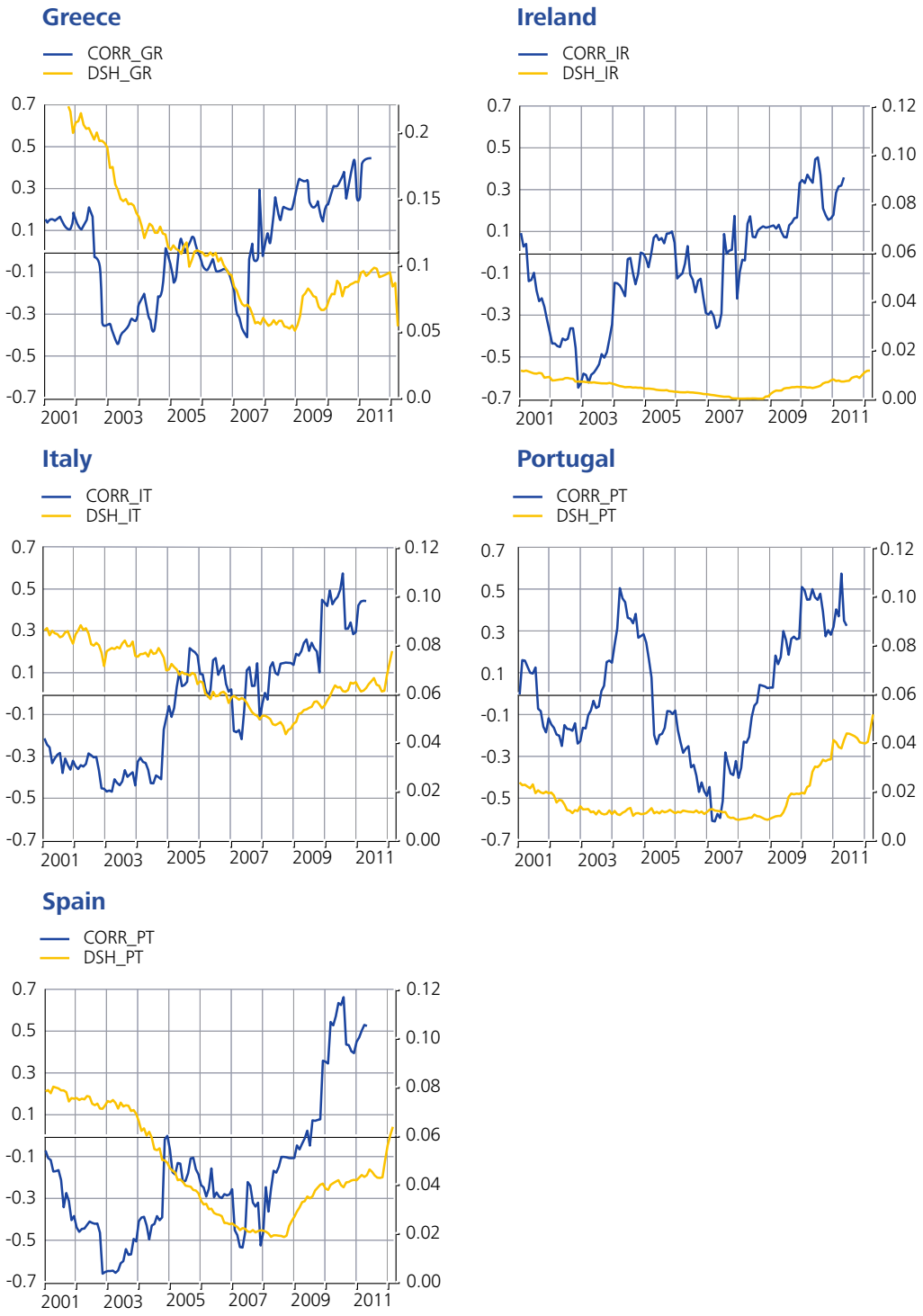
Chart 14 shows that the correlation between non-stressed-country bank stock returns and non-stressed sovereign debt returns is instead negative or zero throughout the sample period,[16] while the sovereign exposures of non-stressed-country banks stay small throughout the sample period, except in Belgium. The only case in which the correlation turns large and positive is Belgium in late 2010 and early 2011, when it is on average 44% between January and April 2011. Interestingly, in this period Belgian banks are the only non-stressed-country banks whose exposures increase above the 5% mark. Table 14 confirms that Belgium is the only country where domestic exposures have been destabilising after the Lehman bankruptcy.

15 The only instance in which the correlation is positive and large before 2008-09 is in Portugal during 2004, when Portuguese banks' sovereign holdings were still below 2%.

16 A simple zero correlation implies only no linear correlation, but the variables could still be co-dependent in a non-linear model.

Chart 13

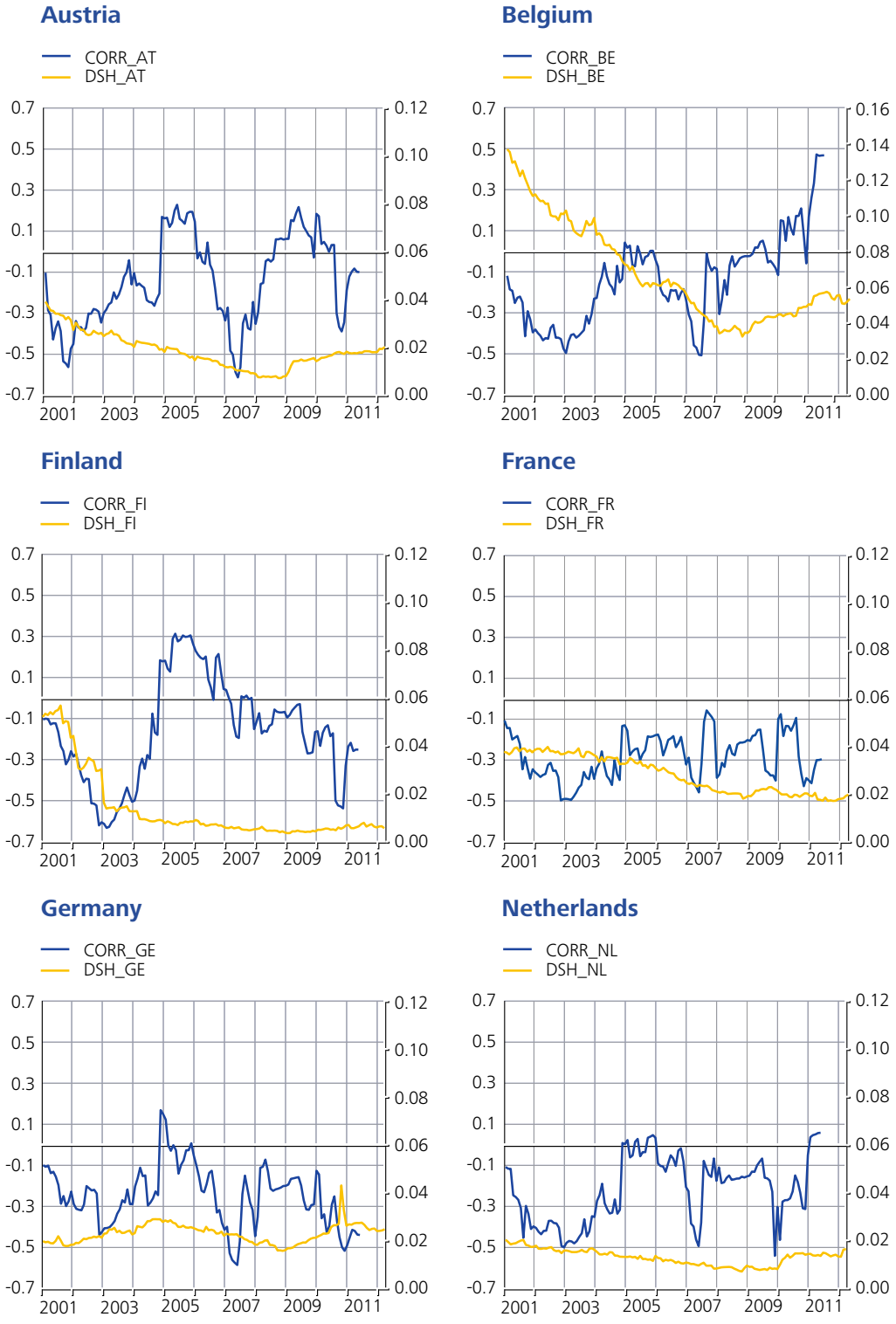
Two-year moving correlation between bank sector monthly stock returns and ten-year domestic sovereign debt returns (left axis, 2001-11) and domestic sovereign exposures of banks in certain stressed euro area countries (right axis, 2001-12)



Source: SDW and Datastream.

Chart 14

Two-year moving correlation between bank sector monthly stock returns and ten-year domestic sovereign debt returns (left axis, 2001-11) and domestic sovereign exposures of banks in certain non-stressed euro area countries (right axis, 2001-12)



Source: SDW and Datastream.

Table 15

Correlation between domestic sovereign exposures and bank-sovereign returns before and after the Lehman bankruptcy

	January 2001 – September 2008		October 2008 – May 2011	
	correlation	*p*-value	correlation	*p*-value
Austria	-0.272	0.008	-0.529	0.002
Belgium	-0.424	0.000	0.817	0.000
Finland	-0.347	0.001	-0.509	0.003
France	-0.331	0.001	-0.165	0.367
Germany	0.319	0.002	-0.784	0.000
Greece	0.121	0.247	0.650	0.000
Ireland	-0.446	0.000	0.385	0.030
Italy	-0.779	0.000	0.699	0.000
Netherlands	-0.448	0.000	0.174	0.341
Portugal	0.148	0.157	0.631	0.000
Spain	-0.360	0.000	0.823	0.000

On the whole, the evidence presented in Charts 13-14 and in Table 15 squares with the hypothesis that, for the banking sectors of the stressed countries, the sovereign crisis has increased the correlation between the equity market and the sovereign debt market. The increasing correlation shows the systemic impact of sovereign crises, especially when combined with banking crises.

In closing, it is worth mentioning that the fact that in many euro area countries credit risk originated from the public sector and then affected banks is broadly consistent with results from Granger causality tests carried out on CDS premia of banks and sovereigns (not reported for brevity): in Austria, Belgium, Italy and Spain, public debt CDS premia Granger-caused bank CDS premia, but not vice versa; in France, Ireland and Portugal, there was mutual feedback between public finances and banks, with Granger causality going in both directions. Granger causality goes from bank CDS premia to government debt premia only in the United Kingdom and Germany (only during the crisis period in the latter), while no Granger causality is present in either direction for the Netherlands, Norway and Sweden. However, Granger causality only captures time precedence relationships, not causality in an economic sense, so that, based on this evidence, it also does not seem appropriate to neglect possible feedback effects from banks to public finances in countries such as Spain, where the banking crisis has put public finances under considerable strain.

To summarise, the evidence reported in this section supports the view that, since 2008, domestic sovereign exposures in the banks of the stressed euro area countries and in Belgian banks have been associated with greater risk, as measured by the sensitivity of their stock price to changes in the price of domestic government debt. No such sensitivity is detected for banks in the stressed euro area countries until 2008, nor for those in non-stressed countries (except Belgium) even after that date. Hence, the contribution of sovereign exposures to bank risk appears closely related to the perceived increase in sovereign credit risk since late 2008. The evidence from the aggregate time-series data appears well-aligned with the bank-level evidence reported by Acharya and Steffen (2013).

3.6 Conclusions

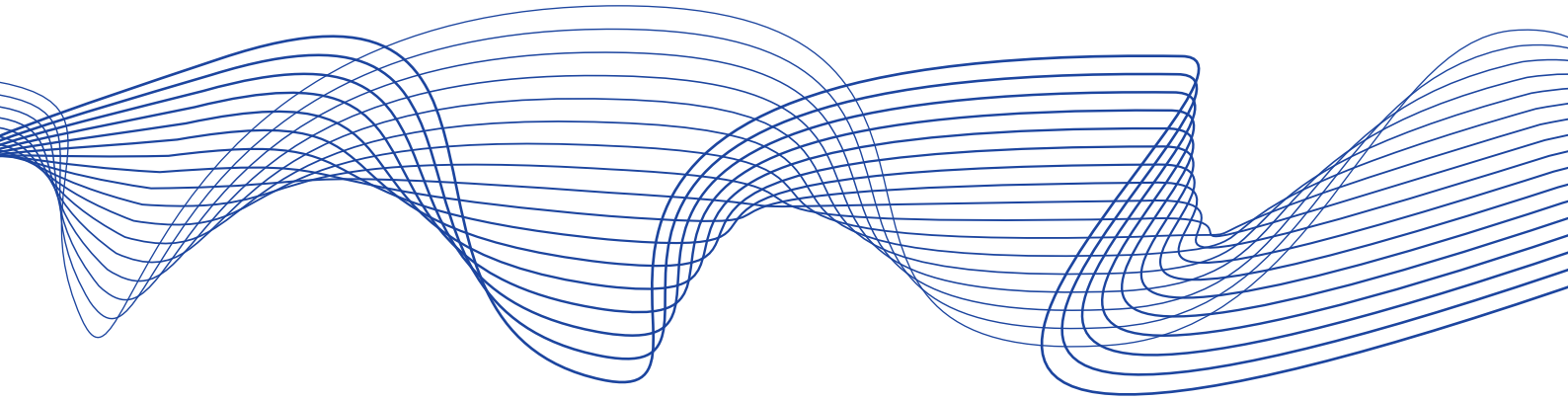
Chapter 3 presents the stylised facts regarding the sovereign debt held by banks and insurance companies, as well as the results of an empirical analysis aimed at understanding the determinants of sovereign exposures. The main conclusions from the analysis are the following:

- In most euro area countries, euro area sovereign debt exposures of banks (as a proportion of total assets) were considerably larger at the inception of the EMU than now. After a reduction in the first half of the 2000 decade, banks in Greece[17], Italy, Spain and Portugal have gradually increased their euro area sovereign debt holdings (as a proportion of total assets) again in the last six years. In contrast, banks from other euro area countries continued to reduce, or stabilised, their euro area sovereign debt exposure.
- In almost all euro area countries, banks' exposures to their domestic sovereign (in relation to total assets) followed a declining trend between the end of the 1990s and September 2008, when the Lehman default occurred. This date coincides with a reversal of this trend: the home country bias increased until it stabilised in 2014. For banks in non-stressed countries, the increase was less marked.
- In almost all euro area countries, the euro area sovereign debt exposure of banks is now overwhelmingly towards their domestic issuer, and this home bias is particularly strong in the countries where banks' total euro area sovereign exposure is largest (as a proportion of total assets).
- In the insurance sector, the data indicates a high concentration of domestic sovereign securities in the portfolios, although with significant cross-country differences, a trend which has continued to increase in recent years.
- There is no significant difference in sovereign exposures held by SIFI and non-SIFI.
- In general, the increase in exposure to the domestic sovereign debt of banks in the stressed euro area countries and in Belgium is correlated with increases in its yield (some members of the expert group argue that this finding is relatively weak). This response may have been motivated by different factors, including banks' search for yield by engaging in carry trades that take into account redenomination risk, the desire to increase holdings of liquid assets, moral suasion exerted by sovereigns, or banks' attempts to preserve the stability of their respective countries. For a more limited range of countries, there is also some evidence that stressed-country banks increase their sovereign exposures in response to worsening domestic macroeconomic conditions.
- Whatever the motive, the exposure of stressed-country (and Belgian) banks to domestic sovereign debt has increased concurrently with an increase in the risk of such debt, therefore increasing risk in these banks' balance sheets and reinforcing the banks-sovereign link, which is itself a source of systemic risk.

17 As a result of PSI (March 2012) and the debt buyback programme (December 2012), the sovereign debt exposure of Greek commercial banks has decreased dramatically, in some cases to almost zero, and henceforth consists mainly of Treasuries.

Section 4

Policy options – long term and transition



Policy options – long term and transition

Based on the results of the analysis presented in the first three chapters, the expert group identified and discussed some potential policy options to address the recognised systemic risks related to the regulatory treatment of sovereign exposures.

It should be stressed that, according to the expert group's mandate, any discussion about the appropriate legislation must be concerned with laying the foundations for financial stability in the future when the sovereign debt crisis has been resolved. Against this background, *the analysis in this field is aimed at developing proposals for the steady-state regulatory framework rather than dealing with the euro area debt crisis. This means that the policy options assessed by the expert group are not envisaged as policies to be applied or announced in the current situation*. At the same time, the policy recommendations consider the potential impact of any new rules as well as the transition to a new regime.

As described in Chapter 1, the EU sovereign exposures treatment established in the CRD/CRR is partly based on, and largely consistent with, international standards adopted in the BCBS. Going forward, some expert group members feel that unilateral action by the EU should be avoided in order to ensure the necessary consistency within all relevant jurisdictions worldwide on the implementation of capital requirements for sovereign exposures. Other expert group members are less concerned about this and believe that in the steady state, capital requirements better tailored to risks will improve institutions' resilience and benefit both EU banks and sovereigns. They point to the implications for sovereign default risk of the unique situation in the euro area with a supranational central bank that is independent of national governments. Furthermore, reducing the favourable treatment of sovereigns in regulation will actually encourage a level playing field between private and public sector debt.

Against this background, a certain degree of coordination with other regulators and supervisory bodies regarding sovereign exposure treatment is essential in order to ensure appropriate treatment for the entire banking and insurance sector and also to avoid distorting sovereign and private sector debt market functioning. If any legal change is involved, this has to be carefully debated in the context of the EU decision process. This debate will have to take into account that, as explained in Chapter 2, risks from sovereign exposures come in different forms depending on whether the country in question is a member of the euro area or whether it has its own currency. Since EU legislation applies to all Member States, harmonisation of regulatory rules might be deemed to call for all sovereign exposures to be treated alike. However, such treatment would neglect the specific situation of countries with national currencies other than the euro. Such differences concern not only the risk of sovereign default, but also the scope for diversifying risks by investing in debt issued by different sovereigns; for banks in a country with its own currency, any attempt to diversify risks across sovereigns would involve an exchange rate risk. The preceding views are not shared by some expert group members, who argue that, in the context of risks from sovereign exposures, there are no systematic differences between countries with their own currencies and countries in the euro area.

For a rigorous assessment of the different policy options identified and discussed in this chapter, clear policy objectives and constraints are specified in Section 4.1, against which policy options were assessed by the expert group in a structured and transparent way and on the basis of which the adequate policy options can be recommended.

This chapter is composed of the six following sections: (1) a framework for assessing policy options and a brief discussion on convergence and harmonisation issues, (2) maintaining the current approach in the regulations vs. introducing any changes, (3) potential policy options and their qualitative assessment for banks, (4) potential policy options and their qualitative assessment for insurance companies, (5) a quantitative impact assessment and (6) issues on transition.

Each of the sections dealing with a particular policy option is typically structured in the following way. First, it gives the background and rationale for a policy option. After that, a short description of an option as well as an explanation of how this option would work going forward is provided. Finally, a qualitative assessment of a policy option is conducted in view of the objectives and constraints defined in the framework for assessing policy options (Section 4.1).

One should make clear that, although the policy options are assessed separately in this chapter, the optimal regulatory response might necessitate the application of more than one of them. In practice, it may be more suitable to combine some of these policy measures, e.g. the best option may be a combination of two or more of the proposed policy options.

The report does not give a ranking to the policy options. For some options, the report indicates that implementation problems may be too difficult but, beyond that, it does not give preference to one option or combination of options over another.[1] Such an expression of preference would require a more detailed impact assessment, with more data than the expert group had at its disposal. There is a consensus in the expert group that responsible bodies considering legislative reform for the regulatory treatment of sovereign exposures should engage in such a detailed impact assessment.

Finally, the calibration of the policy options was considered to be outside the expert group's mandate, while calibration obviously has a very significant impact on the assessment of the costs and benefits of policies. Moreover, while giving due consideration to differences between regulated sectors, coherent treatment of like exposures across financial sectors should be ensured in order to avoid any potential regulatory arbitrage between banking and insurance regulations.

4.1 Framework for assessing policy options

The framework presented in this section introduces a set of objectives and constraints to assess a number of policy options for banks and insurance companies.[2]

1 Finally, it is also relevant to mention that not all the policy options discussed by the expert group have been included in this chapter.

2 By using the terms "insurer" or "insurance company", the report means both insurance and reinsurance companies, as Solvency II applies to both.

The qualitative nature of the assessment gives a chance to present different points of view on the most important strengths and weaknesses of each policy option, or express any other concerns, constituting a helpful input to the simplified quantitative impact analysis that is the subject of Section 4.5.

The following box presents the agreed list of policy objectives and constraints to assess each of the policy options and also combinations of policy options. All the policy objectives and constraints are equally weighted.

Box 2

Framework for assessing policy options

Main policy objectives

1) **Increase the resilience of the financial sector to sovereign risk over the economic cycle**
   The measure should increase banks' and insurers' resilience to sovereign risk which includes insolvency risk (credit risk), market risk arising from repricing of risk as well as liquidity risk. To be effective, the increase in resilience should be stable over time, avoiding procyclical effects.

2) **Limit systemic risks at the EU-wide level**
   The net effect of the measure, by addressing some of the manifestations of sovereign risk, should be a reduction of the systemic risk in the EU. Therefore, the measure should not engender unintended consequences with a potential EU-wide impact and/or end up amplifying existing sources of systemic risk.

3) **Ensure appropriate, availability and pricing of funding for the economy as a whole**
   The measure should be consistent with the use of public and private sector debt as a stable source of funding for the economy as a whole across the business cycle.

Main constraints

1) **Be consistent with the rest of prudential regulation**
   The measure should be consistent with the rest of the prudential rules, particularly those affecting the treatment of sovereigns, both at the global and EU levels.

2) **Not hinder or interfere with fiscal, monetary and financial integration policy in the EU**
   The design of prudential regulation in the EU should be coherent with the range of policies that are being implemented to improve the EU in terms of its fiscal, monetary and policy integration.[1]

1 Measures that increase the asymmetries within the EU are likely to interfere with this aim.

3) Not hinder or interfere with free movement of capital in the EU, ensuring a level playing field

Measures that increase the barriers to free movement of capital run counter to a deeper EU common market and may be in breach of the TFEU.

In assessing the different policy options, one must take account of trade-offs. These trade-offs arise not only with respect to different policy objectives and constraints, but also with respect to the effects of any policy option for any one policy objective or constraint. For example, the effects of a given policy may depend on the phase in the cycle one is considering. More generally, a given prudential regime may affect financial institutions differently depending on which phase of a given lending relationship one is considering.[3]

For example, one may suppose that the existing preferential treatment for sovereign exposures has contributed to making banks more willing to lend to sovereigns in other Member States. This effect may be deemed to have promoted financial integration in the EU[4] and to be an instance of free capital movement in the EU. By this analysis, any departure from the current treatment might be deemed to run counter to constraints (2) and (3) above, namely to hinder financial integration and to interfere with the free movement of capital in the EU.[5]

However, at the same time, the large cross-border capital flows before 2008 contributed to excessive borrowing by some sovereigns and therefore contained the seeds of the recent crisis in the euro area. It is worth noting that some sovereign debt problems in EU Member States do not fit this pattern because they have themselves been caused by boom-and-bust developments in lending and real estate, but others have been directly financed by banks.

However, this crisis has been marked by a reversal of financial integration. As explained in Chapter 3, banks in all EU countries included in the sample have increased their holdings of sovereign debt with a clear home bias as many banks have reduced their exposures to sovereigns in the euro area other than their own.[6]

Given that this disintegration is a product of the crisis, it must at least partly be seen as a result of those factors that caused the crisis, including the factors that induced excessive lending to certain sovereigns, real-estate developments and banks before 2008. This experience shows that the possible effects of the current treatment on the different objectives and constraints are thus ambivalent, depending on whether one focuses on the impact on initial lending and investment decisions or on the effects of further developments that may be set in motion by these initial developments. Any assessment of the status quo must take account of this.

3 One should distinguish between the development of risks in different phases of the cycle, namely the build-up of risks (as illustrated by the banks from non-stressed countries – e.g. Dexia, Commerzbank, Hypo Real Estate – raising their exposures to stressed sovereigns), and developments during the crisis (domestic banks stepping in to lend to their own sovereigns). This distinction cannot always be made cleanly, but is nevertheless relevant for policy.

4 Despite the fact that the sovereign debt market is still fragmented along national boundaries in the euro area.

5 It should be noted, however, that financial integration in the EU does not imply identical conditions for all debtors.

6 Possibly with the knowledge and approval of national authorities.

The ambivalence described here is inherent in the very nature of prudential regulation. Prudential regulation imposes restrictions on banks' investment decisions. These restrictions are intended to slow down certain activities. Those who would like to see these activities carried out see the regulation mainly as costly. Presumably, though, the regulation and the slow-down of certain activities that it induces has benefits as well as costs. For example, it might improve the quality of the investment decisions of financial institutions and the ability of financial institutions to bear the risks of their investments. By making such improvements, prudential regulation contributes to financial stability, which includes the ability to provide continued funding to the real economy even when earlier investments and loans run into trouble and financial institutions are stressed.

Any discussion of policy options must take this ambivalence into account, consider the pros and cons of the options analysed at different points in the cycle for each objective/constraint and assess the resulting trade-offs in light of the overall objective of prudential regulation.

4.2 Maintaining current banking and insurance regulations vs. introducing any regulatory changes

Before discussing the different options for regulatory change in any detail, it is appropriate to consider whether anything should be changed at all. Not changing the regulation is obviously one of the available policy options.

However, as discussed in Section 2.2.3, the current prudential regulation of sovereign exposures is inconsistent with the conceptual approach that underlies the existing system of regulation. This approach focuses on the risks that banks take and proposes to limit these risks by suitable restrictions and/or incentives and to ensure the banks' ability to absorb losses from these risks. If sovereign exposures are in fact subject to default risk, consistency with a risk-focused approach to prudential regulation and supervision requires that this default risk is taken into account. Asking that default risks of sovereign exposures be taken into account in prudential regulation and supervision does not mean that attempts at reducing or even eliminating such risks by strengthening economic governance in the EU should be neglected. However, a consideration of strategies for strengthening economic governance in the EU would lie beyond the expert group's mandate. To the extent that such strategies are successful and credit risks of sovereign exposures are reduced or eliminated, any prudential regulation that is truly focused on the risks that exist would of course take this reduction into account.

As mentioned in Section 2.2.3, a small minority of the expert group takes a different view. They consider that effective prudential measures are difficult to design to deal with a risk that is directly linked to fiscal policy and is also intrinsically systemic. These members believe that sovereign risk (particularly domestic) is not suitably addressed at the level of prudential regulation, but should be dealt with by ensuring sound fiscal policies that would eliminate the problem at its root. In simple words, this means that it is too daring to start the analysis with the assumption that absolutely all types of risk can effectively be dealt with using the prudential toolkit at hand. This minority thinks that sovereign risk is one of those very special risks for which the existing prudential toolkit falls short to prevent or even mitigate effectively. In the view of this minority, many of the options being proposed are mere placebos with many potential unintended consequences and the only truly solution should be sought at the source of sovereign risk in the EU. As happens with sovereign risk, there are many other risks which are

hard to tackle by using mechanistic rules, for example strategic risk and concentration risk. Thus, the existing limitations in the regulatory toolkit are not completely new.

Given that the expert group is not in a position to address the problem of sovereign risk at the level of fiscal policy, the question is: what are the pros and cons of maintaining the current regulations versus introducing any changes? The objection that effective prudential measures are difficult to design will be taken up in detail in subsequent sections, considering the different measures that might be taken. Some major concerns, however, relate to all the policy options that might be taken. Therefore, it is appropriate to begin with a general discussion. Going beyond the basic principles considered in Section 2.2.3, it is appropriate to present this discussion with reference to the policy objectives and constraints discussed in Section 4.1.

There are two basic channels through which regulation affects banks' resilience to risks:

- regulation affects the incentives of banks to engage in these risks;
- regulation enhances the ability of banks to absorb losses from these risks.

These channels both provide the motivation for the current regulatory system. Not taking account of sovereign risk when it exists runs counter to the spirit of this system. In addition, a minority in the expert group has raised the following concerns:

- Sovereign exposures are chunky. Capital requirements under the current risk-weighting mechanism would not provide meaningful loss absorption capacity. For a concentrated portfolio, with very low frequency of default and very high impact, capital requirements are less effective or, in the extreme, ineffective in preventing banks from becoming insolvent.[7]
- Sovereign risk is itself a form of systemic risk, which an institution-oriented micro-prudential regulation can hardly tackle. Given the complexity of the issue, there are difficulties in relying on mechanistic regulatory instruments.
- Regulatory rules that make financial institutions refrain from acquiring sovereign debt can contribute to stress in sovereign debt markets and thereby to systemic risk. If the sovereign's problems arise from a downturn of the economy, such rules would be highly procyclical;
- It may not make sense to insure financial institutions against their own backstops.
- Also, a minority of the expert group argues that the change in banking regulations, with the removal of the existing preferential treatment, would not have prevented the crisis and should therefore not be a priority. With regard to incentives, these members suggest that the current high levels of sovereign exposures are a result of the financial crisis rather than a cause. Post-crisis, there is still more uncertainty about the desirable levels of sovereign debt holdings, as certain recent regulations rather promote holding it in order to meet liquidity requirements.

7 For an example illustrating this problem, see Section 2.1.3, footnote 12.

In discussing the issues further, it is useful to distinguish between different phases of the cycle, as discussed in Section 4.1. It is also useful to distinguish between increasing exposures to one's own sovereign and increasing exposures to other sovereigns. In recent years there have been different types of financial sector problems from sovereign exposures:

- With institutions like Dexia, losses from PSI in sovereign debt restructuring were small in relation to their balance sheets, yet because they had very little equity, these losses were sufficient for the banks to require government support.[8]
- As documented in Chapter 3, since 2008, the exposure of banks to their own sovereign in all countries, and particularly in countries under stress in the debt markets has increased substantially; in the case of Greece, this was a major reason why the restructuring of March 2012 had to be accompanied by a recapitalisation of Greek banks with funds from the EFSF/ESM.
- In the course of the crisis, since 2009, Cypriot banks have greatly increased their holdings of Greek sovereign debt. These sovereign exposures have been at the core of the Cyprus crisis.

The argument that sovereign exposures are a result, rather than a cause, of the financial crisis is one that applies to the second type of financial sector problem, but not to the first and third types. For the second type of financial sector problem, the argument applies to countries where the crisis in the financial sector and the macroeconomic fallout from the crisis have impaired the budgetary situation and created additional funding needs for the sovereign while lenders from other countries withdrew their funding. By contrast, the argument does not apply in countries pursuing unsustainable budgetary policies for extended periods of time, even before the crisis.

Also, the argument that sovereign exposures are chunky is relevant for the second and third types of financial sector problem. Chunkiness of sovereign exposures has been a problem, in particular in the experience of domestic banks in countries where sovereigns have been under stress. In Cyprus, chunkiness of sovereign exposures resulted from banks taking large positions in seemingly high-yield Greek debt, with the consequence that when they had to take losses, their own sovereign came under stress. These various chunky exposures have been an important part of the bank-sovereign link, which the project of a banking union is trying to break, or at least reduce in strength.

In the first type of problem, however, as exemplified by the 2011 experience of Dexia, losses on holdings of sovereign debt were fatal not because the positions were so large, but because the bank had very little equity capital, which was possible due to specialised banks exploiting the carve-out for sovereign exposures. With other banks, the acknowledgement of mark-to-market losses on sovereign exposures in the 2011-12 EBA recapitalisation exercise required serious adjustments, which contributed greatly to the financial market turbulence of November 2011, but at least these banks could absorb the losses without insolvencies.

Turning to the role of incentives, there is some question as to how strong these incentive effects actually are. The current system of prudential regulation is based on the assumption that they

8 Reference here is to the 2011 solvency crisis of Dexia and its second bailout, rather than the 2008 liquidity crisis and its first bailout. See Admati and Hellwig (2013b).

are strong and that appropriate capital requirements, as well as appropriate diversification and disclosure measures, are needed to reduce incentives for risk arbitrage.

From an ex ante perspective, at an early stage of the cycle, it is clear that regulation inducing financial institutions to refrain from taking risks from sovereign exposures that they cannot absorb will contribute to their resilience in a crisis.

From an ex post perspective, at a late stage of the cycle, concerns that regulatory restrictions on financial institutions' lending to sovereigns might contribute to stress in sovereign debt markets and increase systemic risk implicitly also assume that regulation affects incentives. But in a time of crisis, government borrowing requirements are typically enhanced, as the government might be acting as a backstop to parts of the financial sector or merely pursue countercyclical fiscal policy. These concerns about procyclicality, although not new,[9] must be taken seriously and addressed at a macro-prudential level.

These observations are particularly pertinent considering that the problems of sovereign risk and of stress in public sector funding are themselves being addressed by institutions such as the ESM and that, in this context, the ESM is also involved in recapitalising banks. The problems of government finance, bank-government relations and bank resolution thus take on an EU dimension which transcends the tradition of domestic banks funding their sovereigns and sovereigns acting as backstops for banks when needed.

In addition, the recently formed banking union could for a large part sever the links between sovereigns and banks. Contagion from banks to sovereigns is reduced through more effective supervision, resolution and financial backstops at the European level. Contagion from sovereigns to banks is also limited by addressing the distorted incentives for banks to hold the debt of the national sovereign and their reliance on national public support.

Effects on systemic risk at the EU-wide level

Here, the same considerations apply as for the resilience of financial institutions. Taking account of sovereign risk in prudential regulation and supervision would contribute to reducing the build-up of systemic risks from sovereign exposures, either through incentive effects or through improved loss absorption.

In this context, it is important to recall the EU-wide turbulence of 2011, which followed the publication of the EBA stress test data and the Eurogroup meeting in July of that year. A key role in these developments was played by the public understanding of the extent of sovereign exposures of banks and by a widespread belief that banks might not have enough equity to withstand write-downs on these exposures in the order that market investors thought would be needed. In particular, US dollar funding was withdrawn because US money managers did not want to be hit by bank insolvencies. If, at that time, sovereign exposures had been smaller and/or bank equity higher, investors' concerns about banks' solvency and the stress in the system would have been much smaller.

9 This argument is similar to the argument that, in a recession, restrictions on lending to non-financial companies would exacerbate the recession and systemic risk, with a chance that, ultimately, even the financial system itself might be harmed.

The subsequent recapitalisation, although initially organised in a way that enhanced fire sales and contributed greatly to market turbulence in November 2011, ended up providing banks with significantly higher capital buffers and thereby also contributed to the reduction of systemic stress in 2012. Because this recapitalisation went beyond the simple application of Pillar 1 rules, some might argue that the experience shows the effectiveness of enhanced Pillar 2 measures and better disclosure requirements. However, the radical changes of rules that were involved, such as the application of mark-to-market accounting rules to sovereign exposures held in the banking book, came as a surprise to the industry and contributed greatly to the sense of instability in the fourth quarter of 2011.

A minority of the expert group warns of procyclicality and enhanced systemic risk from stricter prudential rules for sovereign exposures. However, the experience of August and September 2011 suggests that procyclicality may be more a consequence of insufficient prior provisioning for losses, funding difficulties from market participants' appreciating the problem, and procyclical movements in asset prices as banks reacted to those funding difficulties.

Appropriate and stable availability and pricing of funding for the economy as a whole

Appropriateness of availability and pricing cannot mean that funding is always cheaply available. It also cannot mean that funding for sovereigns is always given preference over funding for the private sector. Appropriateness of availability and pricing must mean that each borrower is able to obtain funding if the risks are acceptable and that the conditions under which they are able to do so are commensurate to the risks involved.

By this standard, privileged and unfounded treatment of sovereign borrowers in the prudential regulation of banks creates a bias which is incompatible with the principle of appropriate availability of funding for the economy as a whole.

As for the stability in the availability of funds, this raises the same concerns as those discussed for resilience: prudential regulation that contributes to banks exerting greater restraint in the upswing of the cycle will contribute to greater stability. This applies to banks' lending to sovereigns as well as to banks' lending to private sector parties. However, empirical evidence shows that, in most developed countries, banks' holdings of domestic sovereign debt have behaved countercyclically rather than procyclically. Once the system gets into a situation of stress, regulation may give rise to concerns about procyclicality, but here again there is no distinction between private and public sector lending.

A minority of the expert group emphasises the need to avoid or reduce cyclicality in the demand for sovereign debt as well as the need to avoid restrictions in banks' lending to the economy in a recession. In particular, they stress the fact that anti-cyclical macroeconomic policy, or sovereign support for parts of the financial sector, might require substantial additional sovereign borrowing in a recession or a financial crisis.

These arguments fall under the general heading of procyclicality and macro-prudential policy, and macro-prudential rules certainly should make room for them. However, they cannot justify maintaining the status quo on micro-prudential regulation.

Concerning the insurance sector, the financial crisis has highlighted the need to frame regulatory tools used to quantify capital requirements in a way to effectively dampen excessive market volatility so as to capture the long-term horizon in which insurers take their investment decisions. The need to complement the Solvency II framework with some kind of smoothing of short-term volatility has been recognised and an essential step has been undertaken with the adoption of the Omnibus II directive.[10]

Consistency with other regulation

Although maintaining the status quo is consistent with the current letter of the existing agreements and legal norms, it would be inconsistent with the conceptual framework underlying the Basel Accord and the EU capital regulation, which focus on risks and risk-taking. If the risks are there, then treating them as non-existent is problematic.

A minority of the expert group thinks that the current approach reflects the limitations of prudential regulatory tools in dealing with sovereign risk, as reflected in previous agreements and discussions in Basel.

The Basel Accord itself does of course have rules for the regulatory treatment of sovereign exposures and merely gives national authorities the right to apply weaker rules if they so wish.

Relationship with fiscal, monetary and financial integration policy

A minority of the expert group warns that departures from the status quo might interfere with ongoing integration in the EU and introduce inconsistencies in the treatment of sovereign exposures from different sovereigns. By treating EU countries as a bloc, the status quo reflects the right of euro area members to issue euro-denominated debt subject to certain conditions. More importantly, they argue that it avoids penalising governments that follow sound intertemporal fiscal behaviour and had low levels of debt and favourable debt dynamics before a banking crisis.

As a matter of principle, the question is whether consistency of treatment of sovereigns in prudential regulation requires that all sovereigns be treated alike or that like sovereigns be treated alike and unlike sovereigns be treated differently. If the regulation is focused on calibrating capital requirements to risks that are taken, then treating unlike sovereigns alike is in fact a case of unequal treatment, which is inconsistent with the professed aims of the regulation. In particular, a principle of equal treatment requires that default risks be taken into account where they are present, and that exemptions be available where such risks are not present. This principle suggests that whatever regulation is developed should take account of differences in default risk between euro area and non-euro area members of the EU. It should also have the flexibility to adapt to further institutional reforms at the euro area level substantially reducing sovereign default risks.

As for the overall effects on integration, it is important to take account of the fact that, in the crisis, we have observed significant fragmentation of financial systems along national boundaries. The existing regulatory approach, which provided the background to the

10 Directive 2014/51/EU of the European Parliament and of the Council amending Directives 2003/71/EC and 2009/138/EC and Regulations (EC) No 1060/2009, (EU) No 1094/2010 and (EU) No 1095/2010 in respect of the powers of the European Supervisory Authority (European Insurance and Occupational Pensions Authority) and the European Supervisory Authority (European Securities and Markets Authority), OJ L 153, 22.5.2014, p. 1.

accumulation of exposures and risks before the crisis, has also provided the background to the fragmentation that we have seen in the crisis and must therefore be deemed to have been harmful to the objectives of integration policy in the EU.

Relationship with the free movement of capital in the EU ensuring a level playing field
A minority of the expert group maintains that the current approach avoids differentiated costs for EU-based investors willing to invest in different euro-denominated sovereigns and that regulatory heterogeneity would increase barriers to the free movement of capital.

Here again, it must be seen that heterogeneity is not bad per se. If the heterogeneity reflects relevant real differences, such heterogeneity is called for by the underlying principles driving the regulation. Regulation that treats different risks equally will result in uneven playing fields, rather than level playing fields.

A minority of the expert group thinks that it is not for prudential policy to deal with this potential "heterogeneity" in euro-denominated debt, but rather that this is an issue to be treated within the fiscal architecture of the euro area.

As for concerns about the free movement of capital, the actual fragmentation of capital markets that we see must be considered a major challenge, despite the current regulation.

4.3 Potential policy options for banks – qualitative assessment

4.3.1 Pillar 1 capital requirements

If the existence of credit risk from sovereign exposures is to be taken into account, the most straightforward way of doing so would be to apply the rules that the Basel Accord stipulates for this purpose within Pillar 1.

In this regard, possible policy options involve eliminating some of the preferential treatment identified for sovereign exposures in Chapter 1 of this report:

- removing the domestic carve-out in the standardised approach;
- introducing a non-zero risk-weight floor for sovereign exposures in the standardised approach;
- developing alternatives to the only use of CRA ratings in the standardised approach;[11]
- setting a minimum (regulatory) floor in the IRB approach.

The recognition of credit risk in sovereign exposures involves dealing with both the standardised and IRB approaches in an integrated and consistent way. Indeed, as explained in Section 1.3.1, these approaches are even more intertwined for sovereigns than in any other exposure class due to the "permanent partial use" rule which allows IRB banks to apply the standardised approach.

This interlinkage is also mostly visible when addressing certain possible policy options, namely introducing a non-zero risk-weight floor for sovereign exposures in the standardised approach, including exposures that are denominated and funded in the currency of the country, which automatically requires setting a minimum (regulatory) floor in the IRB approach as well.

11 This issue is not specific to sovereign exposures and thus has not been identified in Chapter 1 as a preference for sovereigns.

Like the option of maintaining the current approach in Section 4.2, these options will be discussed in terms of how they bear on the different objectives and constraints listed in Section 4.1. For some objectives and constraints, the discussion here is a mirror image of the discussion in Section 4.2. To the extent that this is the case, the discussion here will be kept brief or even omitted. The focus is mainly on those points that are specific to these particular policy options.

4.3.1.1 Removing the domestic carve-out in the standardised approach

Background and rationale

Under the EU regulation, a zero risk weight is applied to the debt of all Member States when it is denominated and funded in the currency of the Member State (see Section 1.3.1). Furthermore, the Basel Accord permits any supervisor to allow its banks to apply the same treatment to all sovereigns that provide the same allowance to their domestic banks, and the EU treatment described has been developed on the basis of this allowance. In theory, a rationale for a domestic carve-out could be that the central bank can ultimately bail out the sovereign by "printing money".

However, as explained in Section 2.2.1, this argument does not apply to the euro area and is also not relevant for non-euro area Member States, as the prohibition of monetary financing stipulated in Article 123 of the TFEU applies to all EU central banks.

Description

A possible policy option is thus the removal of the domestic carve-out in the standardised approach.

A sovereign exposure to a Member State denominated and funded in the currency of that Member State would no longer be granted an automatic zero risk weight, but rather be treated according to the general procedures defined for sovereign exposures.

Assessment of policy option

As discussed in Sections 4.1 and 4.2, the impact of any regulation on banks' resilience over the cycle depends on the regulation's effects on the incentives banks have as risks are building up and on the contribution of the regulation to their susceptibility to losses when risks materialise.

The removal of the domestic carve-out in the standardised approach would imply the application of risk weights as specified in Basel[12] (this section assumes that the change is not accompanied by other changes detailed below such as risk-weight floors or modified risk weights).

The following questions thus arise:

- Does the approach prevent the build-up of excessive risks in the initial phase of the cycle?
- Does the approach provide sufficient loss absorbency if risks materialise?
- Does the approach provide disincentives against outsized investments in domestic sovereign risk?
- Does the approach perhaps even contribute to losses when risks materialise?

12 As described in Section 1.1.1, risk weights for sovereign exposures are applied in accordance with external credit ratings, going from 0% to 150%.

If some EU sovereigns continue to have poorly-rated debt in the future or if EU banks apply zero risk weights to non-EU sovereign debt with poor ratings on account of the clause allowing them to take the lead from foreign supervisors which apply the carve-out, this option should reduce the incentives to purchase risky debt imprudently and provide more loss absorbency. Nevertheless, the rest of this section suggests that removal of the domestic carve-out may not be sufficient on its own.

In dealing with these questions in the EU, the following observations are pertinent:

- In good times, i.e. typically in early phases of the cycle, high sovereign ratings are the rule rather than the exception within the EU. For exposures to these sovereigns, the standardised approach does not have a significant effect on the build-up of risks.
- For exposures to foreign sovereigns with the same currency, loss absorption capacity would not be much of a problem if the build-up of risks was limited.
- For exposures to banks' own sovereigns, loss absorption capacity from capital requirements is likely to be insufficient, considering the main channels of contagion through which sovereign risk may affect the banking sector (see Section 2.3.2).
- Dependence on ratings is problematic if the ratings themselves are flawed and move abruptly, and in a highly procyclical manner. This issue is further analysed in Section 4.3.1.3.

With regard to the effects on systemic risk at the EU level, given the systemic importance of sovereign debt, all the concerns raised with respect to banks' resilience over the cycle must be raised in this context as well. Specifically, if ratings are too optimistic in the upswing, Basel risk weights for sovereigns will make no difference at all. The lack of restraint on the build-up of risks will in fact be reinforced if sovereign exposures play no role in countercyclical provisioning, as is the case now.

Moreover, if ratings move abruptly away from optimism to realism or even pessimism, the resulting effects on the financial system will be greater if, through the ratings change, banks become squeezed for capital. Downward adjustments in markets will then be reinforced by banks' attempts at deleveraging.

To the extent that macroeconomic stabilisation might require anti-cyclical fiscal policy, the problems could be enhanced by the sovereigns finding it more difficult to fund such a policy, particularly in a crisis situation.

On the appropriateness and stability of the availability and pricing of funding in the economy, the assessment depends very much on the appropriateness of risk weights determined by ratings as reflecting risks of sovereign exposures relative to risks of exposures to private debtors. Moving from risk weights that are automatically zero to positive risk weights is likely to be an improvement. However, the history of the rating agencies' performance on sovereign risks suggests that they might be too soft in the upswing and sometimes too harsh in the downturn.

The possible effects in terms of financial integration and the free movement of capital in the EU, and in particular in the euro area, again lead to some considerations of a dynamic nature regarding the moment of the cycle we are in and the claimed impact.

An end to the carve-out would possibly limit such mobility at the time when there are capital flows building up the positions. However, after the crisis has broken out, and if regulation incentives were effective, then the removal of the carve-out would have no limitations on the free movement of capital. Indeed, the previous flows would have been smaller, the crisis would be less severe, and there would be no fragmentation as we are currently seeing.

4.3.1.2 Introducing a non-zero risk-weight floor for sovereign exposures in the standardised approach

Background and rationale

Under the standardised approach, where an assessment from a CRA is available, sovereign exposures are assigned a risk weighting ranging from 0% to 150% (see Section 1.1.1). However, as highlighted by Section 2.2, sovereign debt contains certain non-negligible risks. Moreover, as discussed in Section 4.3.1.1, the CRA ratings often do not properly assess these risks in the upswing.

If sovereign exposures are risky and if the rating agencies underestimate these risks in the upswing, an assignment of a zero risk weight to sovereign exposures is problematic. The stand is that if there is no risk-free asset, then there should be no zero-risk capital requirements.

Description

This option would involve imposing a non-zero risk-weight floor for sovereign exposures under the standardised approach.

The definition of a non-zero risk-weight floor would affect capital requirements for any exposures that would otherwise have lower risk weights, e.g. because of high credit ratings under the standardised approach or exposures that would otherwise benefit from the domestic carve-out.

The order of magnitude for this floor would need to be considered. For that purpose, risk weights have to be calibrated taking into consideration the characteristics of sovereigns, which include the power to collect taxes, as well as the fact that the sovereign risk weighting is in fact a floor to other exposure classes. Consequently, owing to the distinctive nature of sovereigns, such a risk weight would necessarily be below the corporates' risk-weighting floor.[13] Although such detailed calibration is outside the expert group's mandate, a 10% risk weight floor was assumed for the quantitative impact assessment because this percentage facilitates the necessary comparisons, as the capital requirement is linear in the floor – see Section 4.5. This level of the risk weight floor should only be treated as an example, as there are diverging views within the expert group regarding its optimal level. Some expert group members would object to having such a floor at all, while others would consider the appropriate floor to be the same as for exposures to private borrowers.

Assessment of policy option

A non-zero risk-weight floor would ensure that all sovereign lending must be backed by some capital. That is to say, if Basel risk weights for sovereign exposures are not used at all and not

13 Although it should be recognised that a very solidly capitalised, well-earning company can be more credible than a sovereign under stress.

replaced by other risk indicators, the non-zero risk-weight floor would be the only Pillar 1 requirement for sovereign exposures under the standardised approach.

The non-zero floor would avoid some consequences of excessive optimism in the early phases of the cycle, in that it would imply that all sovereign exposures would be affected by the counter cyclical buffer, which would not be the case without the floor. In addition, it would contribute to banks' resilience to sovereign risk over the economic cycle by limiting the build-up of exposures. For cross-border lending to other sovereigns, it would also provide some enhancement of loss absorption capacity. Furthermore, a non-zero floor would align the regulatory treatment of sovereign exposures with other exposure classes (e.g. banks or corporate), as risk weights of *at least* 20% would be applied to them.

As insensitivity to risks is deemed to introduce biases, e.g. in favour of lending to riskier sovereigns, which would harm resilience, this option would also contribute to increasing banks' resilience in that regard. One should note, however, that the non-zero floor is also risk insensitive and it discriminates against exposures with risks that would warrant risk weights below the floor. However, these biases would, if anything, be smaller than they are under the present system with a uniform zero risk weight. In the view of some members of the expert group, though, it is unlikely that a low floor risk weight would have any significant impact on loss absorbency and incentives.

Moreover, as the standardised approach is dependent on ratings, this approach would counteract the effects of the excessive optimism of rating agencies in the upswing.[14] In this regard, as discussed in the next section, it would also be important to think about other indicators of sovereign risk and the evolution of sovereign risk through the cycle that might provide an alternative tool to the ratings-based approach. Additionally, a non-zero floor would smooth the "cliff effect" of higher capital requirements if external ratings for sovereigns are downgraded.

4.3.1.3 Developing alternatives to the sole use of credit rating agency ratings in the standardised approach

Background and rationale

The default approach, implicitly assumed in the previous sections, is that risk weights in the standardised approach would continue to be based on CRA ratings. However, previous works have shown the shortcomings of CRA ratings of sovereign debt as early warning indicators and that CRA ratings tend to introduce procyclicality.

The dependence on ratings can contribute to losses over the cycle if (i) excessively optimistic ratings allow banks to build up large positions without any capital backing them, and (ii) an excessive swing towards more pessimistic ratings exposes banks to sudden and drastic changes on significant parts of their portfolios. This effect may involve changes in the market environment as well as changes in required capital.

14 To counteract the systemic impact of excessive agency pessimism in a crisis, it would also have to be accompanied by a suitable macro-prudential regime that leaves room for countercyclical fiscal policy (see Section 4.3.3).

The last observation raises the following issue: should external ratings be automatically relied upon?

Reducing the (over)reliance on ratings in the Basel and EU regulation is not a novel issue. It is in fact a more general concern, not specific only to sovereign exposures, and is being dealt with in several fora.

In October 2010 the Financial Stability Board (FSB) endorsed principles to reduce authorities' and financial institutions' reliance on CRA ratings[15] and these principles were approved by the G20. Later, the FSB also adopted a roadmap to accelerate the implementation of the principles which aim to achieve:

- removal or replacement of references to CRA ratings in laws and regulations, wherever possible, with suitable alternative standards of creditworthiness assessment;
- banks, market participants and institutional investors making their own credit assessments and not relying solely or mechanically on CRA ratings.

The BCBS has also proposed to reduce over-reliance on CRA ratings in the regulatory capital framework.[16] As for the EU, the regulatory framework for CRAs has been revised,[17] requiring them to be registered and supervised at a European level. The new rules also reduce the reliance of fund managers and supervisors on external ratings and control the frequency and timing of sovereign rating announcements, recognising that "measures are needed to reduce references to external ratings in legislation and to ensure investors carry out their own additional due diligence on a well-informed basis". Moreover, Article 39b(1) of the CRA III Regulation states that the Commission shall, by end-2015, report on alternative tools to enable investors to make their own credit assessment.

Also, according to the conclusions presented by the House of Lords European Union Committee (2011), "investors should not rely solely on sovereign ratings as an authoritative indicator of creditworthiness, but view them as opinions that need to be balanced and confirmed by other market indicators".

The question that it raises is then, if external ratings are to be continued to be accepted, what are the (complementary) measures of creditworthiness for sovereigns? The expert group noted a desire for possible alternatives.

Description

An alternative (or complementary) approach to CRA ratings would be for regulators to rely on slow-moving indicators of sovereign risk.

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15 Financial Stability Board (2010), *Principles for reducing reliance on CRA ratings,* 27 October.

16 Basel Committee on Banking Supervision (2014), *Revisions to the standardised approach for credit risk – Consultative document*, 22 December.

17 Regulation (EU) No 462/2013 of the European Parliament and of the Council amending Regulation (EC) No 1060/2009 on credit rating agencies (CRA III), OJ L 146, 31.5.2013, p. 1; Directive 2013/14/EU of the European Parliament and of the Council amending Directive 2003/41/EC, Directive 2009/65/EC and Directive 2011/61/EU in respect of over-reliance on credit ratings, OJ L 145, 31.5.2013, p. 1.

Under an indicators-based approach, through-the-cycle sovereign risk weights would be set by regulators using slow-moving indicators of sovereign risk. Such indicators might include: (i) moving averages of public and external debt to GDP ratios; (ii) moving averages of the long-term real interest rate; (iii) moving averages of volatility of GDP denominated in the numeraire of the sovereign debt (weighted where necessary); and (iv) prior default history.[18] One could also consider combining these lagging indicators with some more recent (market) indicators, balancing out the need for timely changes in the assessment of creditworthiness and the high volatility (and potentially procyclical nature) of market indicators.

Assessment of policy option

Such an approach would encourage regulators to think more carefully about the determinants and measurement of sovereign risk and it is possible that this indicators-based approach could be seen as complementary to CRA ratings.

Furthermore, by using slow-moving indicators (e.g. 20-year averages), this approach is less likely to lead to procyclical risk weights. However, slow-moving indicators could lead to the wrong risk weights, e.g. in the case of sudden structural changes.

A more thorough analysis would be necessary to carry forward this policy option, in that some members consider that, although the problems with external ratings are recognised, the merits of alternative approaches are unclear at this point and have not been thoroughly evaluated by the expert group.

Another alternative approach to CRA ratings that was suggested but not thoroughly discussed in the expert group was to make use of risk assessments reflected in market prices. An indirect way of doing so would be to subject sovereign exposures to mark-to-market rules. Such an approach could potentially reduce the procyclicality of risk weights driven by ratings through instead taking account of market information and market risks. Changes in interest rates for a particular sovereign debtor may reflect changes in the risk premia that the market applies to this debtor as well as general movements in interest rates. Such reassessments of risks in sovereign exposures might happen more gradually than changes in credit ratings. It should be acknowledged, however, that this approach would not address the problem of credit risk inherent in sovereign exposures directly. Moreover, it would at best smooth procyclicality but not eliminate it, because market pricing can also be procyclical.

4.3.1.4 Setting a minimum (regulatory) floor in the internal ratings-based approach

Background and rationale

Although, as described in Chapter 1, the IRB approach does not automatically result in a zero risk weight for highly rated sovereigns, the arguments for such a floor in the IRB approach are the same as for the standardised approach: if there is no risk-free asset, then there should be no zero risk capital requirements.

18 The precise variables chosen and the calibration would need further analysis, bearing in mind that the current early warning literature on sovereign debt crises is not large and early warning indicators models tend to give little forewarning of crises.

Description

A possible policy option would involve setting a minimum (regulatory) floor for sovereign exposures in the IRB approach.

For consistency reasons, the IRB floor should match the non-zero risk-weight floor to be applied in the standardised approach (see Section 4.3.1.2).

One simple approach would be to impose a hard floor rule for the risk weight as proposed for sovereign exposures in the standardised approach. An alternative approach would consider the definition of (regulatory) floors for PDs and LGDs.[19] In this later approach, one should consider that lower boundaries for PDs and LGDs are already applied to other IRB exposure classes: these lower boundaries encompass a floor of 0.03% for PD estimates for exposures to corporates, institutions and retail exposures and floors of 10% and 15%[20] for LGD estimates for collateralised retail exposures.[21] These PD and LGD floors would lead to a risk-weight floor around 5% to 15%, depending on the IRB approach and the relevant maturity of the exposures.

It should be highlighted that banks would continue to be allowed to apply the standardised approach – through the permanent partial use rule – which would be particularly relevant for smaller banks.

Assessment of policy option

The setting of a minimum (regulatory) floor for sovereign exposures in the IRB approach would present similar pros and cons as introducing a non-zero risk weight for sovereign exposures in the standardised approach.

Imposing a floor would also contribute to reducing the observed variations or uncertainties of estimations among credit institutions for the same sovereign (see Box 3 below). In the view of some members of the expert group, however, it is unlikely that a low-floor risk weight would have any significant impact on loss absorbency and incentives.

Some additional considerations

In the analysis of the IRB approach for sovereign exposures, the expert group debated a possible banning of the IRB approach for sovereign exposures.

Indeed, there are inherent difficulties in estimating robust credit risk parameters for sovereign exposures, given the poorness of data and low defaults in that exposure class. Moreover, as sovereign defaults inherently represent extreme tail events, the distributional assumptions behind IRB models (which ordinarily assume a normal distribution of asset returns) may be inappropriate for capturing such tail probabilities.

Observed variations or uncertainties of estimations were detected among credit institutions for the same sovereign – see Box 3 below.

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19 Under the IRB approach, the risk weights are calculated according to a bank's internal rating systems, which must take into account a number of risk parameters (e.g. PD, LGD) – see Chapter 1.

20 10% is for retail exposures secured by residential property and 15% for retail exposures secured by commercial property.

21 One should bear in mind that, with very few exceptions, sovereign debt is not collateralised, so these numbers are not fair comparators, as LGDs will typically be higher on sovereign exposures than collateralised exposures – see Box 3 below for details.

Box 3

The IRB approach to sovereign credit risk[1]

This box presents some of the findings with the estimation of PDs and LGDs for sovereigns by four Belgian banks[2] as well as some of the main conclusions drawn by the UK Financial Services Authority (FSA) in a "hypothetical portfolio exercise" conducted in 2009, in which ten British banks were asked to assign PDs and LGDs to a homogeneous portfolio of 17 sovereigns (some quantitative results are presented in Annex 7).

(i) PD

The main conclusion was that increased uncertainty leads to more variability in PD estimation across banks (see Annex 7 with the graphs reporting the evolution of some sovereign PDs estimated by Belgian banks). Also, the UK FSA found significant variation among PDs assigned by the different banks, with a five-fold increase between the lowest and highest PD – and this was even before the onset of the current sovereign crisis. Moreover, the data also indicate that the PD estimates tend to be somewhat procyclical. Before the sovereign crisis, the PDs assigned to Italy and Spain were very low, and then increased sharply just as these sovereigns got into trouble. This is a general feature of IRB models which tend to rely on past data, and can become overly optimistic owing to good runs of data. It may be particularly relevant for sovereigns because the sudden nature of the change in perception – from no default to likely default, affecting all of the exposures at once – can have a large effect on risk and capital estimates, and because of the generally large amount of uncertainty and of judgement involved in the risk assessment.

(ii) LGD

The results for the LGD estimated by four Belgian banks on some sovereigns by December 2011 (see the table in Annex 7) indicate a wide dispersion in the LGD estimates, but also raise the question of the LGD level as such. Indeed, banks were using LGD estimates as low as 5% for some countries and even the "maximum" LGD is (still) as low as 20% for many countries, which might be questionable considering, for example, the losses banks had to book as a result of the restructuring of the Greek debt, or a study by Moody's[3] pointing to an average loss ranging from 33% to 69%.[4]

The variation in the risk factors manifests itself in a variation of risk weights (see the table in Annex 7 for Belgian banks).

To summarise, based on the examples presented and although with caveats,[5] one can conclude that there is a substantial variation across banks in their PD and LGD estimates for the same sovereign.

1 References to Belgian and British banks are only for the purpose of illustration. Note as well that the non-zero PDs reported do not de facto mean the banks report positive risk-weighted assets, as these might have been overruled by the application of the permanent partial use rule and, consequently, the EU carve-out.

2 Three banks under Advanced IRB and one under Foundation IRB.

3 Moody's Investor Services (2011).

4 Depending on the metric.

5 The non-zero PDs reported do not de facto mean the banks report positive risk-weighted assets, as these might have been overruled by the application of the permanent partial use rule and, consequently, the EU carve-out.

Although some members of the expert group would tend to favour such a policy option to the detriment of setting a minimum (regulatory) floor for the IRB approach, it was acknowledged that the banks' use of the IRB approach for sovereign exposures is subject to the prior permission of, and supervision by, the competent authorities, requiring banks to comply with high standards on resources, expertise and data quality before applying the IRB approach for regulatory own funds purposes.

The expert group also considered that the IRB approach results in a more granular assessment of risk than the standardised approach, encouraging banks to develop internal credit risk evaluations, inter alia reducing the reliance on external ratings. Indeed, the IRB approach, if robust, would ensure that, apart from the few CRAs, a wider range of (bank) market participants systematically analyses information about sovereign credit risk and forms independent judgement about the parameters of risk.

4.3.2 Diversification

4.3.2.1 Fully or partially removing the exemption of sovereign exposures from the large exposures regime

Background and rationale

In the EU, the main regulatory tool to ensure that credit institutions limit their exposure to a single client or a group of connected clients[22] is the large exposure regime, which limits any such exposure to 25% of own funds. The rationale for this regime is that excessive concentration of exposures may result in an unacceptable risk of loss. Such a situation can, in turn, be considered prejudicial to the solvency of a credit institution.

As described in Chapter 1, the main argument for the current exemption of some sovereign exposures from the large exposures limit is that the creditworthiness of some counterparties is considered to be of such a quality that their likelihood of default should be considered sufficiently low not to give rise to a need for restriction.

Revising this exemption could be a consequence of considering the default risk of sovereigns too high for continuing it, based on the discussion in the previous sections. Given the wording of the current regulation,[23] sovereign exposures would in fact be automatically capped by the limit to large exposures if they were assigned a non-zero risk weight for the purposes of minimum capital requirements for credit risk.

It would also be possible to make the removal of the exemption only partial. In fact, the large exposures regime currently allows, for some specific counterparties, the application of a partial exemption at the discretion of Member State competent authorities. It may be that such partial

22 This concept is based on the existence of relationships of control and economic interdependence between counterparties, but for sovereigns there are certain exemptions, namely on control. For the quantitative impact assessment, the EBA's sovereign exposures definition for the stress tests and the recapitalisation exercise has been used (see Section 4.5).

23 The EU regulation makes reference to the standardised risk weight on sovereign exposures: as long as sovereign exposures are assigned a 0% standardised risk weight for the purposes of minimum capital requirements for credit risk, they are exempt from the large exposure limit.

exemptions have been granted in order to give recognition in the setting of limits, to a greater or lesser extent, to the credit quality of counterparties with very distinctive features.

However, it could be argued that the large exposures regime is not entirely one of credit risk measurement. In extremis, it is clearly imprudent to extend a very large part of an institution's capital to a single counterparty, no matter how accurately the risk associated with this exposure may be measured. In this regard, it is worth recalling that the large exposures regime deals with the risk of traumatic losses due to "unforeseen events".

Description

The removal of the exemption of sovereign exposures from the current EU large exposures limit, then, could be seen as a possible policy option. One can consider either a full or a partial removal of the exemption in this respect. For that purpose, limits to sovereign exposures have to be calibrated, taking into consideration the trade-offs between the prudential objectives of setting a limit on the one hand, and other concerns, such as the liquidity regulation and currency area issues on the other hand. Different scenarios were considered for the quantitative impact assessment, ranging from a full removal of the exemption to a partial exemption – 50% or 20% (in this case, exposures are considered only for 20% of their face value, meaning an 80% exemption) – see Section 4.5. One should make clear that those figures should be treated as examples and that this issue requires further analysis.

Assessment of policy option

As explained in Section 2.3.2, the holding of government debt is one of the main direct channels through which sovereign risk may affect the banking sector and have systemic implications. Inducing banks to limit the exposures to sovereigns would contribute to minimising the negative feedback loop effects between sovereigns and banks, thus increasing banks' resilience to sovereign risk.

The implementation of a diversification requirement also presents the advantage that it is not a procyclical measure.[24] In effect, limiting investments in sovereign exposures would minimise the risks of recapitalisation demands and procyclicality of deleveraging that may result from write-downs in the holdings of sovereign debt in a crisis scenario.

In terms of the effects on systemic risk at the EU-wide level, limiting banks' sovereign exposures will increase banks' resilience to sovereign risk and thus increase the stability of the EU financial system at an EU-wide level. It should be noted that the positive effects on the banks' resilience to sovereign risk and on systemic risk at the EU-wide level would be the highest in the case of a full removal of the large exposures exemption. For a partial removal, the effect depends on the percentage chosen.

As for the appropriate and stable availability and pricing of capital for the economy as a whole, two factors are to be carefully considered.

24 However, it might prove procyclical in a downturn as the supply of (and demand for) government debt rises. Therefore, large exposures limits could be varied over the cycle if necessary, in line with what is discussed in Section 4.3.3.

On the one hand, any measure that prevents privileged and unfounded access of sovereigns to bank financing contributes to a more efficient allocation of resources and the appropriate and stable availability and pricing of capital for the economy as a whole, minimising possible crowding-out effects. In particular, compared with a Pillar II (discretionary) approach, a large exposures limit is less exposed to the risk of supervisory/regulatory capture when the public sector needs to expand its fundraising possibilities.

On the other hand, as a full removal of the exemption would require banks to reduce their exposure to the sovereigns significantly, it is pivotal to assess the impact (and potential disruption) on the EU sovereign bonds market. In fact, credit institutions are important holders of government liabilities. Most often, the major part of the funding provided is concentrated towards the country in which credit institutions are incorporated or in which they have their subsidiaries (a common home bias phenomenon illustrated in Chapter 3). Even abstracting from transition problems, the ability of domestic banks to hold their own sovereign's debt would be significantly reduced. Unless this effect is offset by banks from other EU or other euro area countries, or by other financial institutions, the sovereigns' funding costs may increase. A key question will therefore be to what extent a diversification mandate, in particular in the euro area, would give rise to financial institutions from other euro area countries substituting for domestic banks in funding sovereigns. The question is most critical for the ability of sovereigns to engage in anti-cyclical policies at times when the downturn of the economy itself puts a strain on their finances.

Credit institutions traditionally also have an important role as arrangers in sovereign bond issues, also acting as market-makers. Here, too, the question is to what extent a Europeanisation of activities through the recently established banking union will provide substitutes for domestic banks engaging in these activities.

As is the case for the positive effect on financial stability, the scale of portfolio adjustments necessary would be the highest in the case of a full removal of the large exposures exemption, and for a partial removal, the effect depends on the percentage chosen.

The importance of these issues clearly suggests that the option of removing sovereign exposures from the possible exemption in the EU large exposures regime would need to be phased in gradually and over a long period. Moreover, some form of (partial or total) grandfathering of sovereign exposures already outstanding would need to be considered in order to avoid a potentially disruptive sell-off (with fire sales) of government bonds – see Section 4.6 on issues of transition.

Regarding consistency with other regulation, no inconsistencies would emerge, with one possible exception. Removing the exemption might be seen as conflicting with the incentives embedded in the liquidity regulation introduced by the CRR as the new liquidity regulation will consider sovereign debt as a highly liquid asset, to be included in a bank's liquidity buffer without any limits, banks could thus be incentivised to hold sovereign debt in their liquidity buffers.[25] However, one should note that banks could still do so by holding more sovereign debt

25 This issue is further analysed in Section 4.3.6.

issued by foreign countries, and thus, by diversifying sovereign exposures, banks face no trade-off with liquidity requirements. It should be noted here that, while euro area banks can diversify their sovereign portfolios without exposing themselves to additional FX risk, investments of non-euro area banks in their own sovereign have no real alternative, as corporate bonds often do not provide a higher level of security and government bonds from other countries generate FX risk.

However, one should consider that the possible (future) increase in bank holdings of foreign sovereign debt might have a mixed impact on the resilience of the financial system when this involves currency mismatches.[26] Arguments in favour of it increasing resilience include the extra cushion against sudden stops in foreign funding and the more favourable balance sheet effects of depreciation (as long as the foreign government bond is in FX and its purchase is not associated with the issuance of an FX liability). Arguments against include the possibility that small banks may find it difficult to assess the creditworthiness of foreign sovereigns and hedge any exchange rate risk, and the potential downsides of further increasing debt linkages across countries. Therefore, it is not obvious that the system would be more stable if banks held more cross-border debt denominated in foreign currencies. In this connection, FX position limits could be taken into account.

There are some further implications of imposing a large exposures limit which also bear consideration. In many EU countries, banks need to hold sovereign debt for monetary policy purposes, as discussed in Section 4.3.6.3. Banks can use highly rated foreign government debt in repo operations with the central bank, but the possibility that a large exposures limit may impair the operation of monetary policy could merit further analysis and consideration.

Alternative approaches

Two other variants of this policy option were also discussed, though not explored in detail.

The first variant is based on the premise that the rationale for removing the exemption of sovereign exposures from the large exposure regime is to encourage diversification of sovereign credit risk, not to limit the overall size of a bank's sovereign debt holdings as such. If a euro area bank were to hold a well-diversified sovereign debt portfolio of euro area governments, this diversification objective would already be met. Hence, it would logically follow that such a bank should not be subject to any limit to its holding of such a portfolio of sovereign debt. This would be feasible at the regulatory level, considering that regulation allows for a partial removal of the exemption: in the limit, one can envisage no removal of the exemption for a well-diversified portfolio of sovereign debt. A possible definition of such a well-diversified portfolio might be one where each sovereign debt is weighted by the corresponding country's GDP in the euro area GDP. It could be argued that, by logical extension, no limit should then apply to a synthetic security that were to generate the same cash flows as such a well-diversified portfolio of sovereign debt, being backed by an underlying pool of sovereign debt in the required proportions.

One example of such a security would be the so-called European safe bonds (ESBies) proposed by some economists.[27] They would be the senior tranche of the securitisation of sovereign debt issued by euro area sovereigns. The plan is to entrust the securitisation to a newly created European Debt Agency (EDA), which would buy a GDP-weighted portfolio of bonds from euro area sovereigns,

26 Not relevant insofar as diversification is amongst EMU countries.

27 Brunnermeier et al. (2011).

which back two securities that the EDA issues. The first security, ESBies, would be a senior claim on the payments from the sovereign bonds held in the portfolio. The second security, European Junior Bonds (EJBies), would be a junior claim on these payments – that is, it would be first in line to absorb whatever loss is realised in the pool of sovereign bonds that serve as collateral for these issues. It could possibly be purchased either by non-bank financial institutions or by households. Therefore, any failure by a sovereign state to honour its debts in full would be absorbed by the holders of the junior tranche security, not by the EDA, any euro area entity or the European Union. The main argument behind this proposal is that ESBies, owing to the "double protection" of diversification and of seniority, would have limited exposure to sovereign risk.

It should be stressed, though, that ESBies would require a political agreement at EU level to create a governance structure for developing such a product, i.e. the EDA. Another unknown is the viability of the markets for these securities, in particular for EJBies, if these products were developed. This proposal should therefore be treated as a theoretical example at this stage. The diversification of sovereign credit risk could also be achieved if banks were to hold other types of securities of similar nature like the European Bonds suggested by the EC,[28] but on which there is no political consensus.

The second variant of the policy option under consideration starts from the recognition that using a uniform limit of 25% of own funds to the exposure towards any single sovereign does not take into account the fact that the credit risk of sovereign debt may vary across sovereign issuers and over time. In order to address this problem, the large exposure limits to sovereign exposures could be made risk-sensitive, i.e. tighter for debt issued by riskier sovereigns and looser for debt issued by safer ones. The limit could vary from 25% of a bank's own funds to zero as an inverse function of the risk of the exposure.

It could be argued that risk-sensitive limits would not only prevent excessive concentration of banks' sovereign portfolios on individual sovereign issuers, but also induce their diversification along the same lines that would be chosen by risk-averse investors: banks would be constrained to holding a smaller amount of riskier debt, while they would be allowed to hold a larger amount of the safer one. At the same time, it should be acknowledged that this proposal introduces a very substantial change to the large exposures regime (which – by construction – does not risk scale counterparties), could increase procyclicality and would pose numerous practical implementation issues (e.g. measurement of sovereign risk, calibration issues).

4.3.2.2 Introducing a capital requirement for concentration risk

Background and rationale

The large exposures regime addressed in the previous section deals with the risk of traumatic losses with a single counterparty, or a group of connected counterparties, due to "unforeseen events", a concept which fits with the more general notion of concentration risk.[29]

28 European Commission (2011).

29 This later notion also involves undiversified idiosyncratic risk and sectoral and geographic risks which are concentration risks addressed in Pillar 2 at national (discretionary) level. For these "residual" risks, no harmonised minimum capital requirements are envisaged.

In order to take account of the greater sensitivity of a highly concentrated portfolio to the effects of the default of a single counterparty (or group of connected counterparties), supervisors could ask credit institutions to set aside a sufficient amount of capital (in addition to Pillar 1 minimum capital requirements) for concentration risk.[30] Asking banks to set aside capital for concentration risk would implicitly be equivalent to setting a limit to exposures towards a single sovereign.

Description

One possible option to take concentration risk into account explicitly and consistently would simply be to include it among the Pillar 1 risks (for which a minimum capital requirement would be defined).

Assessment of policy option

In terms of its assessment, this policy option would also present some of the pros and cons described for the removal of the full exemption for sovereign exposures under the large exposures regime.

However, there are a number of additional caveats related to this option. Two of them seem particularly important.

First, at the moment there is no single methodology to compute a capital requirement for concentration risk that seems to be sufficiently reliable. Analyses conducted by the BCBS (through its Research Task Force) in the past have showed that this issue is difficult to overcome.

Second, even if a reliable methodology for measuring capital requirements for concentration risk could actually be devised, this methodology would most probably rest on the implicit assumption that banks' borrowers are private (rather than public) by nature. It is under this assumption, in fact, that one can compute (historical) default correlations among (private) borrowers and, consequently, capital requirements against concentration risk in the banking book. One could counter-argue, however, that even if few episodes of sovereign defaults are observed, there are time series of returns on sovereign debt whose changes mainly reflect revisions of credit risk by investors, and thus estimates of the correlations of different sovereign risks can easily be computed and updated.

The methodology would also rest on the assumption that private borrowers' credit risk could be (easily) diversified away by credit institutions. It may well be the case that this assumption does not necessarily hold for sovereign borrowers. Indeed, diversifying away sovereign credit risk could be particularly difficult for credit institutions (not least because of their large size).

30 The Pillar 1 capital requirement for credit risk is based on the assumption that the loan portfolio consists of a very large number of exposures, each with negligible individual value. Where, however, the number of positions is small, or if certain individual positions account for a significant percentage of the total exposure, the principle on which the calculation of the capital requirement is based no longer holds, and the capital allocated to support credit risk may no longer represent a sufficient guarantee.

4.3.3 Coverage of sovereign exposures in macro-prudential regulation

Background and rationale

Whereas micro-prudential regulation is mainly concerned with the safety and soundness of individual banks, macro-prudential regulation is concerned with the interaction between banks and the macroeconomic environment, and the impact of regulation on this interaction. Countercyclical capital buffers are intended to slow banks' building up of risks in the upswing, or at least to provide additional capacity to absorb losses from such risks. The dissolution of countercyclical buffers in a downturn provides scope for reducing the credit crunch that might otherwise come as banks take losses on their past loans and other investments. Such a regime serves not only to improve the protection of banks from excessive exuberance in the upswing, it also reduces the economy's exposure to cyclical fluctuations from the banking sector.

Whereas the overall concept of macro-prudential regulation is by now well established, the macro-prudential treatment of sovereign exposures has so far not been considered much, perhaps because these exposures are exempt from most regulatory requirements altogether. Yet macroeconomic concerns are particularly important with sovereign debt. In principle, sovereign borrowing should be reduced in the upswing as tax revenues are high and rising. In the downturn, however, there may be a need for additional sovereign borrowing as the government tries to use anti-cyclical fiscal policy to reduce the impact of the downturn. It is important that banking regulation takes account of this macroeconomic role of sovereign debt management over the cycle.

The box below gives two examples of sovereign debt crises in which financial institutions played an important role and suffered as a consequence, and discusses how a countercyclical sovereign capital requirement could have operated as a useful tool for reducing the build-up of systemic risk.

Box 4

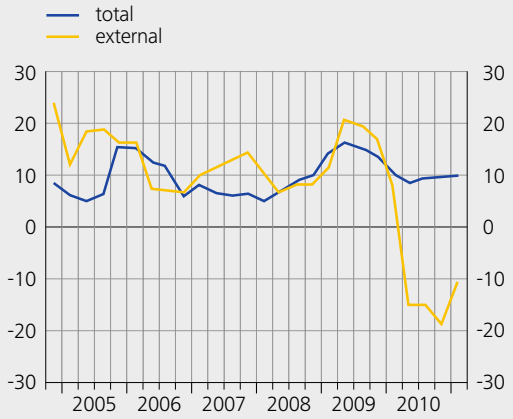
When might a time-varying sovereign capital requirement have been useful in the past?

While, in many countries, the recent crisis started in the private sector, in some countries, the crisis started with the sovereign itself. Greece is the most obvious. In the third quarter of 2008, on the eve of the crisis, Greek government debt was over €250 billion (110% of GDP), of which over €190 billion (about 75%) was owed to non-residents. It is highly likely that foreign financial institutions accounted for a very large proportion of these holdings. In the preceding five years, non-residents' claims on the Greek government rose by over €90 billion, higher than the increase in Greek government debt itself, at an average rate of around 20% per year (see the left chart below). As is well documented, this funding was provided on extremely generous terms until the crisis struck. But ex post, Greece's vulnerabilities are very clear. In particular, the sovereign was exposed to considerable real exchange rate risk as adjustments to regain competitiveness would probably require a fall in the domestic price level which in turn would increase the debt-to-GDP ratio.

Chart 15

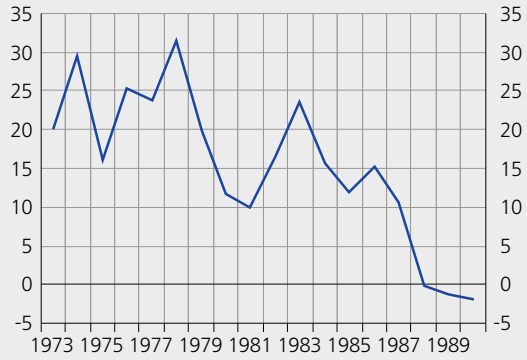
Greek government debt

(growth; percentage oya)



Latin American external public debt

(growth; percentage oya)



Just as in Greece, foreign claims on the public sector in South American countries[1] grew extremely rapidly before the 1980s crisis (about 20% per year on average in the ten years leading up to the crisis; see right chart above). By 1981, total public debt to GDP was about 30%, of which around three fifths was owed to non-residents. Just as in Greece, it is highly likely that the majority of this funding was provided by foreign financial institutions (by 1982, commercial bank exposures accounted for three fifths of South American total external debt, and around half of total external debt was public debt). As in Greece, funding costs stayed low until the crisis started. And just like Greece, South American sovereigns were exposed to real exchange rate risk, as their debt was issued primarily in foreign currency. Unlike Greece, their debt-to-GDP ratios did not look startlingly high before the crisis. But, as demonstrated by Catao and Kapur (2004), their capacity to bear debt was probably much lower because of higher (exogenous) economic volatility.

Ahead of both the Latin American debt crisis and the Greek crisis, government (especially external government) debt grew rapidly. Financial institutions probably accounted for a high share of government funding. Both crises ended very badly, causing significant financial stress in domestic and foreign banking systems (see Cline, 1995).

It is in exactly these circumstances that a macro-prudential sovereign capital requirement would be useful to policy-makers. It would be used when risk was underpriced and built up both to increase resilience against sovereign stress and to dampen the supply of funding to such sovereigns. It would then be relaxed when risk crystallised (or the risks were mitigated through fiscal actions).

1 The sample in this and the following calculations consists of Argentina, Bolivia, Brazil, Chile, Columbia, Ecuador, Peru, Paraguay, Uruguay and Venezuela.

Although fragilities in public finances can be hard to spot, there is some evidence that regulators have spotted them in the past. For instance, the Federal Deposit Insurance Corporation (1997) account of the Latin American debt crisis makes it very clear that the Federal Reserve Board was concerned about US commercial bank lending to Latin America well ahead of the start of the crisis.[2]

2 For example, the FDIC notes that Volcker pointed to the risk of a debt rescheduling in 1981.

Description

In the upswing, this tool could be implemented via a tightening of capital and large-exposure regulations. A capital add-on could be calibrated as a proportion of banks' exposures to sovereigns considered to be at risk. It would function in the same way as, for example, EU legislation on commercial real estate lending. Furthermore, the same safeguards would be applied to prevent the tool being used for purposes unrelated to financial stability. It could be applied to all sovereigns, a group of sovereigns (such as a regional grouping) or an individual sovereign, depending on the circumstances.

Implementation of such a requirement must deal with the difficulty, already discussed for general Pillar 1 requirements, that standard approaches to assessing may not be sufficient to tackle the build-up of sovereign risk for several reasons. First, ratings as well as market-based risk indicators tend to be over-optimistic in good times; any instrument based on such indicators might therefore be too blunt. Second, because sovereign defaults are relatively rare events, the database is too small to provide reliable estimates of default risks. This might improve as more data becomes available over time, but then one must deal with non-stationarity in the data. Third, financial innovation and other changes to the economic and financial environment may yield new sources of sovereign risk, or indeed ways to limit it.[31]

In principle, a countercyclical surcharge on the general capital buffer may be used to mitigate sovereign risk if the domestic carve-out is removed or a risk-weight floor for sovereign exposures is introduced. However, because macro-prudential concerns are even more important for sovereign exposures than for other exposures, a more targeted tool may be superior. For instance, in a country with high sovereign borrowing and a high current account deficit, on the upswing, regulation should not discourage the expansion of the export sector. Indeed, a healthy export sector will be necessary for a rebalancing to occur and debt to be repaid. Even from a micro-prudential standpoint, exposures to the export sector are likely to fare much better during periods of adjustment than other exposures to the country in question. By contrast, in the downturn, there would be reasons for treating sovereign exposures less rigidly than private exposures in order to facilitate anti-cyclical fiscal policy. Given the associated risks, such treatment would have to be monitored very closely by micro-prudential and macro-prudential authorities, in particular in the banking union.

31 For example, output price-indexed bonds would have reduced credit risk on euro area sovereign bonds by hedging against real exchange rate risk. In the future, nominal GDP-indexed bonds may be used to hedge against unexpected movements in both real exchange rate and potential supply. Regulation should encourage such risk-mitigating behaviour.

How the option would work going forward

The additional capital requirement for sovereign exposures would be activated when the macro-prudential authorities judged that the following conditions hold: (i) the sustainability of a sovereign's finances comes into question; (ii) lending to that sovereign is deemed underpriced; and, potentially, (iii) financial institutions are building up significant exposures to the sovereign. Capital requirements on intra-financial sector exposures to the country may need to be raised in tandem to prevent funds being channelled through the local financial system. The Instruments Working Group of the ESRB would be asked to give guidance on the operation of the tool, including the indicators used to activate and deactivate it.[32]

In designing the tool, authorities must be careful to be precise about the relationship between the use of an additional macro-prudential capital requirement for sovereign exposures and the use of general countercyclical capital buffers. They must also be careful about the use of such requirements in situations of macroeconomic stress.

Situations of macroeconomic stress tend to be situations in which government budgets are most stressed and the sustainability of government finances is most in doubt. Yet these are also the situations in which the need for anti-cyclical policy measures of the sovereign are most needed. Such measures are likely to require substantial debt issues. Macro-prudential arrangements for such situations must pay attention to the trade-off between enhanced risks of sovereign debts and enhanced needs for sovereign funding. This is not only a challenge for the design of rules, but also a challenge for their implementation. A proper system of governance, particularly in the context of the banking union, will be crucial.

As Chapter 3 documents, banks in stressed euro area countries increased their holdings of domestic sovereign debt during the crisis. Although the econometric analysis cannot isolate any one explanation for this behaviour, it finds that the data is consistent with a carry trade/gambling for resurrection hypothesis. Relaxation of regulation for macro-prudential reasons should not take a form that would allow or even encourage such excessive risk-taking by weak banks.

Within the expert group, three arguments have been made to suggest that these micro-prudential concerns should not be given too much weight. All amount to an argument that, absent other factors, well-capitalised banks should not need any regulatory incentives to prevent them from loading up on sovereign risk during a sovereign debt crisis.

First, to the extent that the purchases of domestic sovereign debt in the crisis were strongly encouraged by national governments, the problems that this might cause would not be resolved by micro-prudential regulatory measures such as the ones considered in this report, but by changes in governance of supervision such as the recent establishment of the SSM. In any case, such behaviour by governments and banks might be a proper use of sovereign power, unless the associated risks affect supranational institutions in the euro area or the EU. The complication here is that credit risk may migrate to other taxpayers in the EU if the Eurosystem makes losses in the event of a sovereign default.

32 One idea the group might consider is whether to use the same indicators as in the fiscal compact and the Macroeconomic Imbalances Procedure.

This leads to the second argument: if the motivation for domestic purchases of sovereign debt stems partly from the ECB's collateral policy, then again it may be better to change this incentive directly.

Third, absent regulatory pressure to do so, it is far from clear why a well-capitalised bank would want to engage in gambling for resurrection or risky carry trades in the way some EU banks have done.[33] If the problem is a chronic lack of capital, then proper measurement of capital ratios and, where necessary, recapitalisation or resolution, are the appropriate policies.

Assessment of policy option

A macro-prudential sovereign capital requirement would give sharper incentives to both banks and sovereigns to curtail risk-taking during the build-up of risk. Its primary benefit would be to limit systemic risk by reducing the supply of funds to sovereigns when the risk of future sovereign stress is judged to be underpriced. Of course, this aim may not be achieved, particularly if there are leakages. Even so, the tool should still allow policy-makers to increase the resilience of the financial sector to sovereign risk by incentivising lower exposures and by increasing the proportion of loss-absorbing liabilities required to fund the remaining exposures.

It would be a very useful complement to recent EU governance reforms. Furthermore, its more targeted nature compared with a countercyclical buffer would allow policy-makers to avoid hampering other economic sectors where there may not be an excessive build-up of risk. A minority of the group disagrees with this view. It should be noted, however, that this might seem at odds with the fact that, in the run-up to the recent financial crisis, i.e. during the period 2000-07, banks were reducing their sovereign exposures as a proportion of their total assets, as presented in Charts 1-4 of Chapter 3. On the other hand, it is evident that euro area banks increased their foreign government holdings in this period in nominal terms, as presented in Chart 6.

This tool would be best suited to reducing "Dexia-style" risks: exposures to risky sovereigns built up in benign financial environments which are not very large, but are sufficient to lead to stress in the financial system. These tend to be cross-border in nature.

Just as is the case with the countercyclical capital buffer and other sectoral capital requirements, the sovereign capital requirement's time-varying nature means that it can be raised to build resilience and temper the supply of credit to sovereigns in boom times and that it can be switched off if stress materialises to prevent fire sales. This would smooth the supply of credit to sovereigns over the credit cycle, helping to achieve the third policy objective (ensuring appropriate and stable availability and pricing of funding for the economy as a whole).

A minority of the expert group is concerned that this instrument may interfere with the already defined processes at EU level for dealing with fiscal imbalances. They consider it very unlikely that this instrument could add any value to those processes, and it might be abused to second-guess legitimate EU-level decisions. It is unclear to them why capital requirements, which very

33 One might argue, however, that sovereign risk presents a potentially massive shock beyond the control of bank management and that is why even a well-capitalised bank may still gamble for resurrection with respect to its sovereign risk.

indirectly and in a very difficult-to-predict manner influence sovereign borrowing, could be desirable alongside direct fiscal control. They also do not find it plausible that macro authorities would have any informational advantage over the institutions involved in those processes. Finally, they see a risk that national macro authorities could abuse this instrument to direct capital flows away from other Member States towards their own economy.

4.3.4 Enhanced Pillar 2 requirements

Background and rationale

An enhanced Pillar 2 approach would provide a flexible and comprehensive policy option for dealing with sovereign exposures. Pillar 2 requirements are particularly helpful to address risks: (i) that are not covered by Pillar 1 requirements; (ii) for which the risk-weighting methodology for the determination of capital requirements could be inadequate; and/or (iii) which are hard to capture by a single (and relatively simple) formula or model. For these reasons, an enhanced Pillar 2 approach might help to overcome some of the problems and limitations identified in Pillar 1 options when applied to the particular case of sovereign exposures.

Description

The current Pillar 2 approach could be straightforwardly expanded in two main directions in order to enhance the prudential treatment of sovereign exposures:

First, the Pillar 2 EU-wide supervisory guidelines could include explicit and direct recommendations to perform stress tests with the aim of assessing the risks and effects resulting from distress in sovereign exposures. In addition, either bank-specific or standardised scenarios could be included as options for the stress tests. Moreover, the risk assessment in the stress tests could emphasise the risk for the banking system stemming from important exposures on sovereign bonds, taking into account specific market characteristics. Furthermore, the assessment could incorporate a broad range of elements from a wide perspective, such as structural factors driving movements in banks' holdings of sovereign debt, consequences of rating migrations, effects of market illiquidity and price developments, exchange rate risk for bonds denominated in foreign currencies, changes of other market risk factors and higher granularity in credit risk assignation of ratings. The outcome of the stress tests will help to guide supervisory actions when monitoring banks' balance sheets and the effects that stress in the sovereign could have on them. In addition, proper and timely disclosures of the stress tests can also be helpful for improving market discipline.

Second, further EU-wide guidance to the diversification of sovereign exposures could be added to the rules text. This qualitative guidance to diversification could take into account, among other things, the particular case of countries under a monetary union and countries/jurisdictions with insufficient eligible liquid assets for the liquidity regulation.

How the option would work going forward

Supervisory measures via Pillar 2 should be discussed within the supervisory colleges, bringing together all the relevant competent authorities under the leadership of the respective consolidating

supervisor, operating under the auspices of a framework agreed and monitored by, for example, the EBA in order to assure appropriate coordination in the implementation of a concrete measure.

All the accumulated experience using stress tests within the EU can be helpful to guide the design and implementation of enhanced Pillar 2 requirements for sovereign exposures, namely the explicit recommendations to perform stress tests and the consideration of potential latent losses. Regarding qualitative guidance on diversification, it could be useful to see recent experience in liquidity regulation dealing with diversification within liquidity buckets, among other issues. Implementation should be smooth, as some of these tools have already been used in practice.

The work can progress further to fit the enhancements proposed into the current set of Pillar 2 requirements in the Basel regulation and to ensure a common EU position in international fora.

Assessment of policy option

The enhanced Pillar 2 approach should increase banks' resilience to sovereign risk, as it is a flexible and adaptable approach to (i) overcome limitations in the mechanical Pillar 1 measures as a way to increase loss absorbency; and (ii) address a fundamentally complex issue such as sovereign risk. This is a bespoke approach which allows supervisory authorities to take into account both the structure of the financial system (e.g. diversification in terms of the number and type of institutional investors) and the specificities of the national economies (e.g. fiscal expansions and contractions in the operation of intertemporal fiscal policy). However, one should be aware that the enhanced supervisory approach requires good coordination for the implementation of any measure. Otherwise, this option may contribute to an uneven playing field if implementation is not harmonised.

The enhanced supervisory review can also adjust the timing and pace of the measures to different economic contexts and unexpected events, avoiding disruptions to sources of funding for the economy.

One of the main disadvantages of the enhanced supervisory approach is the risk of "supervisory capture", including arbitrary stress tests and political pressure, if well-defined procedures, scenarios, triggers and ranges of actions are not established well in advance. In this context, supervisory actions could also be procyclical like some of the Pillar 1 tools analysed. One should also have in mind that Pillar 2 is a mainly micro-prudential tool originally developed to target a singular institution. In practice, in the past, Pillar 2 requirements have only rarely been successful in preventing the build-up of general risks not taken into account in Pillar 1, such as funding risks for long-term loans or risks from correlations in loan performance (concentration risk).

The enhanced Pillar 2 approach should also contribute to limiting the systemic risk at the EU-wide level, since it allows broad and narrow effects resulting from distress of the sovereign to be considered, including negative unintended consequences. This is a useful feature, given the broad macroeconomic implications of sovereign risk and its numerous interlinkages with financial stability. The measures proposed promote the identification of a clear framework for assessing

sovereign risk through stress tests, consideration of latent losses and guidance on diversification. Stress tests have been used in practice during the recent crisis and have shown they could be a useful and effective tool if properly calibrated and implemented in a timely manner. However, given the intrinsically systemic nature of sovereign risk, it might also be hard for authorities to disentangle the effects from other systemic events not strictly related to sovereign risk in the stress tests and when monitoring the implementation of the supervisory guidance in practice.

The measures proposed promote the coordination among EU supervisors within the supervisory colleges, which is consistent with the process of consolidation of supervisory authority in the EU. The measures are also consistent with EU and Basel liquidity regulations, the large exposures regime and with the upper-bound limit to banks' total assets that would be introduced by the adoption of the leverage ratio as a binding requirement.

4.3.5 Enhanced disclosure requirements on banks' sovereign exposures

Background and rationale

The enhancement of Pillar 3 disclosures for sovereign exposures could be an important tool for reinforcing market discipline and therefore constrain banks' behaviour and prevent excessive risk-taking. The basic rationale behind the demand for adequate disclosures is the existing information asymmetry and agency conflicts between (bank) management and outside investors as well as other stakeholders. The aim of the enhanced disclosure requirements would thus be for banks to provide more and better disclosures about their exposures to sovereign debt and the related risks. Sufficient, consistent and comparable information are preconditions for effective market discipline.

Description

The main objective of the transparency approach would be to boost market discipline on banks by requiring them to provide more and better qualitative and quantitative disclosures about their exposures to sovereign debt and the related risks.

As a starting point, the enhanced disclosures could draw on existing Pillar 3 disclosure requirements, be aligned to the prevailing international accounting conventions (i.e. US GAAP and IFRS) and leverage observed banks' and supervisory best practices. It would be important to ensure that these disclosures encompass, with sufficient granularity, the composition of sovereign portfolios, as well as the outcome of sensitivity shocks (e.g. related to market price fluctuations).

A specific mandatory template on sovereign risk disclosures could also be designed for its application in the EU. For instance, this template could include mandatory disclosures on other specific risks. As a result of an agreement at EU level to ensure a necessary and continuous harmonisation of disclosures, authorities could adjust the template periodically according to different developments to ensure that vital information is available when needed. Generally, the main advantages of the mandatory template are consistency, comparability and, when generally agreed at EU level for the sake of harmonisation, potential flexibility to adjust the required disclosures on an ongoing basis.

In addition, the current ongoing initiatives on disclosure may also provide some reference points from which to leverage the enhanced disclosures:

- **Pillar 3 disclosure requirements**: The Basel II disclosure framework (Pillar 3) includes additional requirements which, inter alia, relate to portfolios subject to the IRB approach;
- **Potential alignment of Pillar 3 and accounting**: Further alignment of Pillar 3 and accounting disclosures could be considered and enhanced qualitative and quantitative disclosures would be particularly important;
- **EBA disclosure of sovereign exposures**: The EBA released information on a bank-by-bank basis regarding the sovereign exposures held as of December 2010 in the 2011 stress test. In particular, the EBA provided granular data on sovereign holdings (loans, debt securities and derivatives) broken down by country, maturity and IFRS portfolio (held to maturity, available for sale, fair value option, held for trading). The EBA also published very similar disclosures with the issuance of the 2011 Recommendation. On this occasion, the disclosure has been enhanced by the provision of further details, including prudential filters and available-for-sale reserves;
- **Initiative launched by the Financial Stability Board (FSB)**: The FSB established a private sector Enhanced Disclosure Task Force (EDTF) to develop principles for enhanced disclosures by financial institutions, based on current market conditions and risks, including ways to enhance the comparability of disclosures. In addition to developing principles for enhanced disclosure by financial institutions, the EDTF was also tasked with identifying leading practice risk disclosures presented in annual reports based on broad risk areas. At the December 2011 FSB roundtable, both investors and analysts stressed that enhancing the transparency of risks and risk management practices would help to build market confidence. In particular, they identified exposures to sovereign debt exposures as an area for further improvement.

How the option would work going forward

In light of the current sovereign crisis, the need for enhanced risk disclosures has been widely acknowledged. Several international authorities and organisations have already launched initiatives aiming to accommodate the increased demand for adequate disclosures about the risks banks are facing, including their exposure to sovereign risk.

The EBA, in a wider effort for enhancing transparency about the capital positions and balance sheet holdings of EU banks, provided unprecedented granular data of sovereign exposures. This initiative allowed investors, analysts and other market participants to develop an informed view on the resilience of the EU banking sector. A specific mandatory template on sovereign risk disclosures could be designed for its application in the EU.

An additional advantage of enhanced disclosures on sovereign risk is that they would not require any changes to other elements of accounting and prudential frameworks. However, it is important to be aware of, and accept, the limits of even the most adequate disclosures. While enhanced disclosures may contribute to further reducing the information asymmetry, their ability to overcome deficiencies in accounting and prudential frameworks would depend on investors' ability to constrain and exert influence on banks' behaviour.

Assessment of policy option

Disclosure requirements are different from other policy options presented in this chapter in that they typically complement other regulatory requirements (e.g. capital requirements under Pillar 1 and Pillar 2). The recent crisis showed there was an under-provision of information on sovereign holdings. The enhancement of disclosures ("market discipline") may help to restore confidence in the viability of the financial sector without introducing further procyclicality in the capital requirements, thereby helping to increase the bank's resilience to sovereign risk. In particular, a mandatory template could ensure that a minimum amount of information is available in an adaptable, consistent and comparable format. However, the net effect on banks' resilience relies on investors' ability to constrain and influence banks' behaviour. As a result, it is not fully certain that enhanced disclosures can always compensate for other deficiencies in accounting and prudential standards. At the same time, market failures (e.g. moral hazard) may disincentivise market participants from disciplining banks. For example, insured depositors may not have enough incentives to monitor banks' asset allocation choices. This is in fact true even for uninsured debt holders, who may prefer to free ride on the information contained in stock prices. Because returns to shareholders are always dependent on how the bank fares, shareholders always have strong incentives to invest in information. By contrast, returns to debt holders depend on how the bank fares only if there is a risk of default. As long as stock prices are going up, debt holders are unlikely to be worried, imposing discipline only when a decline in stock prices indicates that the bank is in trouble. As shown by the experience of the build-up of risks from US real-estate finance in 2002-07 and the crisis in 2008, this intervention of debt holders may be too late to prevent the build-up of risks, especially if the build-up begins with a boom for shareholders.[34] Investor sentiment may also vary procyclically, resulting in a lack of discipline in good times and excessive risk aversion in bad times.

A minority of the expert group is of the view that providing comparable and consistent mandatory disclosures would solve the issue, at least for risks from sovereign exposures, because the information would be freely available without costs in a clear, concise and comparable format for debt holders, i.e. they do not need to invest in information or the information cost would be low. This view neglects the costs of putting the information into context and analysing the implications of current economic developments for default risks.

Enhanced disclosure requirements can help limit systemic risks at the EU-wide level, especially if they are in place from the beginning, even before the risks are built up. A lack of consistent and comparable information could be seen as a source of systemic risk by itself and early enhancement of disclosures would help to reduce information asymmetry further. Once a crisis is at hand, concealment is a source of mistrust, which burdens the functioning of markets; a belated disclosure in a situation of stress may actually enhance the stress. For example, the July 2011 disclosure of sovereign holdings, bank by bank, did contribute to the funding difficulties of banks whose exposure seemed to overtask their capacity to take losses.

Enhanced transparency can contribute to ensuring appropriate and stable availability and pricing of funding for the economy as a whole. As information is a prerequisite for adequate pricing, uncertainty around sovereign risk could trigger unfounded price changes and excess volatility in markets.

34 See Admati and Hellwig (2013b).

This option is entirely consistent with other prudential regulation, in particular both the Pillar 3 approach in the Basel framework and EU prudential regulation introduced by the CRD IV/CRR. Moreover, the disclosure of granular information (marked to market, prudential filters) on sovereign holdings would avoid the introduction of any change in the accounting and prudential regulations. However, there might be some overlap between accounting and prudential disclosure requirements, such as disclosures on risk characteristics, VAR analysis (market risk) and impairment analysis (credit risk).

Finally, the measure does not hinder or interfere with fiscal, monetary and financial integration policy in the EU. On the contrary, it will promote further alignment of Pillar 3 and accounting disclosures, as well as disclosures on exposures to sovereign debt.

4.3.6 Regulation of liquidity risk

4.3.6.1 Alternative approaches to treating central government debt in liquidity regulation

Background and rationale

The Basel III framework, and within this framework the LCR, requires that internationally active banks hold a buffer of unencumbered liquid assets (see also Section 1.2.2.). Given the experiences of liquidity breakdowns in 2007 and 2008, this regulation aims to ensure that banks always have sufficient liquid assets to cover their payment needs over a significant period ahead.

As discussed in Chapter 1, the LCR regulation gives a privileged position to the debt of domestic sovereigns:

- At least 60% of the buffer HQLAs must be in cash, central bank reserves, 0% risk-weighted public sector debt, domestic central government debt, or securities issued by the sovereign or central bank in the country where the liquidity risk is being taken. As banks are unlikely to hold a great part of the 60% in cash, which yields no interest, or central bank reserves, the bulk of these asset holdings are likely to be in sovereign debt.
- The Basel standards recommend diversification of the buffer *within* asset classes (i.e. diversification of sovereign bonds, covered bonds and corporate bonds), but domestic government debt is explicitly exempted from this recommendation. Moreover, regarding the diversification *between* asset classes (i.e. distinction between Level 1 and Level 2 liquid assets), there is no recommendation to hold the remaining 40% of the buffer in the form of private sector debt, i.e. to diversify out of the government debt.
- Finally, the haircuts for buffer assets described in Chapter 1 favour Level 1 assets (including central government debt), which are not subject to the 15% (or higher) haircut applied to Level 2 assets (which include eligible private sector assets).

To the extent that sovereign exposures are themselves subject to a risk of becoming illiquid, not acknowledging this risk in the regulation is problematic. There also is a question of consistency between liquidity regulation and capital or large exposure regulations, which aim at safeguarding the banks' solvency. On the other hand, the recent start of the implementation of the LCR is likely to reduce the size of the net cash outflows, which will reduce the amount

of HQLAs banks will need to hold. Implementation of the NSFR is likely to reduce the required HQLAs buffer even further. This should moderate some of the potential conflicts flagged above.

Description

One possible policy option would be to take account of market indicators of liquidity in defining liquid assets. This approach could either replace or complement the current approach involving a list of eligible assets chosen by discretion. The CRD IV/CRR empowers the European Commission to implement a liquidity buffer requirement for all European credit institutions in 2015. The legislation also tasks the EBA with developing indicators of market liquidity, based on which assets should be qualified as either of high or extremely high liquidity and credit quality, independent of whether they are public or private sector debt. These indicators could be used to adjust the definition of categories of high-quality liquid assets in a way that is more market-oriented than the current one. At the same time, the current haircuts (broadly distinguishing between cash and central government debt, on the one hand, and private sector debt, on the other hand) could be replaced by haircuts differentiated according to actual market liquidity.[35] It would also be an option to introduce haircuts that do not only cater for liquidity risk, but also for credit risk, which could be considered as an alternative to the use of credit ratings.[36] Under this option, eligibility for the liquidity buffer would be based on this categorisation, where 60% of the buffer would have to be of extremely high liquidity and credit quality. Market liquidity would have to be assessed regularly and the liquidity categories updated accordingly, while at the same time avoiding excessive fluctuations and procyclicality. It should be stressed that illiquidity of the government bond market should be analysed further before influencing the rules on including government bonds in the liquidity buffer. In particular, it should be examined whether the market illiquidity is caused by a general market situation, or rather by fundamental characteristics of the respective sovereign.

Assessment of policy option

This policy option should increase banks' resilience to sovereign risk, as it does not rely on the implicit assumption that government debt always entails less liquidity risk than any private sector debt. It would also address the fact that the home bias in government debt holdings (discussed in Chapter 3) might be reinforced by the new liquidity regulation, as domestic government debt is eligible by default. Furthermore, this policy option allows for more diversification in the liquidity buffers, both in terms of liquidity risk (possibly not all assets become illiquid at the same time) and credit risk. In addition, the difference compared with the Basel III approach would avoid, or at least mitigate, the need for EU banks to hold additional government debt following the introduction of a liquidity buffer requirement, provided that enough other liquid assets are available.

35 For example, these haircuts could be chosen to be the same as the central bank haircuts for assets eligible in monetary policy operations, since the derivation of these haircuts is based on similar considerations. This would also ensure consistency in the treatment of assets and central bank liquidity that is obtained by using these assets as collateral and could thus reduce the scope for arbitrage using central bank liquidity-providing operations.

36 For example, while the haircuts applied by the ECB are mainly based on the classification of the assets into liquidity categories, a differentiation according to credit quality steps is also made – see Table 7 in the Guideline of the ECB on monetary policy instruments and procedures of the Eurosystem (ECB/2011/14), OJ L 331, 14.12.2011, p. 1.

According to those who advocate this approach, this policy option should also contribute to limiting the systemic risk at the EU-wide level, since the definition of liquid assets under this option can be adjusted to changes in actual market liquidity. Whereas the Basel approach tries to specify a list of "liquid" assets once and for all, in practice, we do not have a set of measures that is able to capture all the different dimensions of (market) liquidity and that works for different kinds of assets. In addition, most measures of liquidity require (high-frequency) data that are not available for most assets.

At a deeper level, it may not be possible to identify "liquid" assets, other than central bank money, in a robust way at all. "Liquidity" is a property which depends on the attitudes of market participants (for tradable long-term assets) or on the issuer's ability to fulfil their obligations (for short-term debt). Market participants' attitudes and issuers' payment capacities can change over time. Sometimes these changes occur very abruptly, as happened with mortgage-backed securities in August 2007.

An approach to liquidity regulation that is based on market measures would take account of the changing nature and the endogeneity of the "liquidity" of different assets. In most cases, the difference in market liquidity between normal times and periods of stress is smaller for government debt than for most other assets. The departure from the current treatment of sovereign exposures might therefore not be very drastic.

It needs to be considered that it is also expected that the currency denomination of buffer assets roughly matches the currency denomination of banks' liquidity needs under stress. However, it is not clear that assets of (extremely) high liquidity and credit quality can be identified at all in every currency. At times, domestic government debt may be the most liquid asset in a currency, but be relatively illiquid in absolute terms.

In such a situation, central bank liquidity provision through lending to banks using the debt securities in question as collateral may be a mitigating factor, even though aggregate liquidity provision is decided by the central bank in view of the liquidity needs of the economy as a whole and cannot be adjusted simply in view of the LCR. More generally, for the purposes of liquidity regulation, it seems appropriate to take account of the central bank's policies in accepting different securities as collateral – please see Section 4.3.6.3.

Furthermore, if domestic government debt is not eligible by default and insufficient domestic private sector debt is available, banks might face either opportunity costs from holding cash or non-interest-bearing central bank reserves instead of bonds or exchange rate risk from holding government bonds issued in a different currency.

It should be noted, however, that this policy option is not consistent with international regulations, as it is not in line with what is decided within the Basel III framework which relies on the distinction between Level 1 and Level 2 assets. In addition, it may be the case that market pressures hold internationally active EU banks to the Basel III formulation, even if another approach was to be considered within the EU.

4.3.6.2 Interaction between liquidity requirements and other policy options

In the context of the impact assessment, the interaction between the new liquidity requirements and any "hard" prudential measures such as risk-weight floors or large exposure limits for sovereign exposures needs to be assessed. Given the possibility that a number of EU banks that participate in the quantitative impact studies still exhibit shortfalls in their liquidity buffers[37] and given the large number of banks that have not participated in the studies, for which no precise information was available at the time when the expert group made its assessment, it is well possible that some banks will still have to increase their holdings of government debt because of the new liquidity requirements. In addition, there is the issue that, in a given currency, there can be insufficient non-central government liquid assets available. On the other hand, some – especially non-euro area – countries can be classified as a jurisdiction with alternative liquidity approaches (ALA) treatment by the BCBS, i.e. jurisdictions with an insufficient supply of Level 1 assets. There are some potential options for ALA treatment, including contractual committed liquidity facilities from the relevant central bank, banks to hold assets in a currency that does not match the currency of the associated liquidity risk, and additional use of Level 2 assets with a higher haircut, i.e. above 40%.

The impact of introducing risk weights and/or large exposure requirements for sovereign exposures has to be assessed in principle on a "what if" basis, assuming full implementation of the buffer requirements in the LCR. The capital requirements would have to be assessed against the current plus any additional necessary government debt holding and the large exposure limits would have to be assessed against any additional concentrated holding that would result from the eligibility criteria of the buffer. Owing to a lack of data for EU banks to be able to calculate the LCR at the time when the expert group conducted its impact assessment, the interaction between the different policy options and the LCR could not be assessed completely. However, such an impact assessment should be carried out, especially if introducing large exposure limits, as this will work as a hard limit on the banks' exposures to specific sovereigns.

In the impact assessment of the interaction, it is important to distinguish between how the impact varies between banks that are only domestic and banks that are internationally active, as well as between euro area and non-euro area banks. For some banks, the holdings of government bonds/bills can exceed 100% of own funds to match the banks' liquidity needs for the LCR in a specific currency. Thus, a large exposure limit may force banks, especially domestic banks in non-euro area countries, to hold sovereign bonds from other jurisdictions and in other currencies in order to fulfil the LCR requirement, in many cases from countries as well as in currencies where they do not have any exposure.[38] It can be argued that it is not prudential regulation to force a bank to expose itself to a risk, especially foreign exchange risk, to which it would not otherwise have exposure. Note that in the Basel LCR framework as of January 2013 (paragraph 42), it is stated that: "While the LCR is expected to be met and reported in a single currency, banks are expected to be able to meet their liquidity needs in each currency and maintain HQLA consistent with the distribution of their liquidity needs by currency", and:

37 The impact study was done before the decision regarding the final version of the LCR at the BCBS meeting in January 2013. As the final version of the LCR is less strict than that used when conducting the impact study, it is somewhat unclear if there is still a shortfall for a number of banks, or whether this only holds for a few individual cases.

38 Thus, a large exposure limit for sovereign exposures would make it nearly impossible for non-euro area countries in particular that were contemplating introducing an LCR separately in the (domestic) currency.

"As such, the LCR by currency is expected to be monitored and reported to allow the bank and its supervisor to track any potential currency mismatch issues that could arise."[39]

As discussed in Chapter 1, under the Basel formulation of the LCR and its implementation in the EU, government debt by default qualifies as highly liquid if assigned a 0% risk weight under the Basel II standardised approach for credit risk because of a credit rating quality step of "1". Regarding the potential introduction of a non-zero risk-weighting floor for sovereign exposures (or a time-varying macro-prudential risk weight for sovereign exposures), consideration needs to be given to how this will affect how respective assets would be treated under the LCR. The decision not to allow for a 0% risk weight anymore would be based on the assertion that government debt is actually not credit risk-free and should not benefit from a preference over private sector debt. This assertion would also extend to the liquidity rules, implying there as well that government debt should not enjoy a preference over private sector debt – particularly as the fundamental characteristics of these assets require both high credit and liquidity quality. It is noted that the impact of not accepting highly rated government bonds as highly liquid assets could be sizeable, unless sufficient alternative assets can be identified as highly liquid. The policy option discussed for the LCR may provide a possible way out: under this option, either the government bonds could be qualified as eligible liquid assets based on their liquidity characteristics or possibly other assets could be identified as eligible to compensate for those government bonds no longer being eligible.

Even though, for the reasons stated above, a complete impact assessment could not be carried out with respect to the interaction between LCR and the proposed policy options, certain trade-offs between different prudential objectives have to be considered. For instance, the following suggestions may be used to accommodate the proposed policy options and the LCR requirements at the same time:

- Consider exemptions from, or relaxation of, the capital/large exposure limits for assets held to meet the buffer requirements.
- Allow less liquid assets (against appropriate haircuts) into the buffer in order to allow compliance with large exposure limits.
- Accept some foreign exchange risk because of foreign currency liquid assets in the buffer by relaxing the requirement to match buffer and liquidity needs broadly by currency (although, during crises, currency swap markets may dry up and the exchange cannot take place at all, making the bank unable to fulfil its obligations which are denominated in a foreign currency).
- Central banks could help banks meet their LCR requirements by holding central bank reserves (e.g. by setting higher reserve requirements, but allowing these additional reserves to be drawn down in times of stress, in agreement with local supervisors) to the extent that this could be accommodated in the central bank operational framework without undesirable side effects.

39 The currency risk may not arise when banks can diversify across EMU countries.

4.3.6.3 Considerations on central banks' collateral policy

In the discussion of sovereign exposures and liquidity risk, it is worth taking a closer look at central banks' collateral policy. First, central banks have certain degrees of freedom on how to treat sovereign debt in monetary policy implementation, including the treatment of sovereign bonds as collateral for credit operations. Second, liquidity obtained from the central bank may be used to satisfy liquidity regulation requirements, so inconsistency between the regulatory and central bank approach may lead to regulatory arbitrage opportunities.

As regards the first point, although central banks have very different approaches regarding sovereign debt, the treatment of sovereign debt is usually favourable. This is based on the important role that sovereign debt instruments play in financial markets in general and on the generally high liquidity and low credit risk of these instruments. At the same time, what matters for assessing the degree of positive discrimination of sovereign debt is the treatment of private debt relative to sovereign debt. Within a consistent collateral framework that encompasses both private and sovereign debt, risk mitigation measures such as haircuts have to be applied, and these can differ depending on the asset.

When the aim is to ensure risk equivalence between different asset classes, it can happen that the final treatment of sovereign debt is more favourable than that of private debt, but this would be based on objective criteria such as the liquidity of the underlying assets. For example, this is the case for the ECB, where the range of eligible collateral is very broad, encompassing both marketable and non-marketable assets. A detailed haircut schedule is applied.[40] The haircut schedule for marketable assets depends on the classification of assets into liquidity classes, credit quality steps and maturity categories. While central government debt instruments are included in liquidity category I (based on their high liquidity relative to other assets), this only gives them a marginal advantage over relatively liquid private debt instruments such as jumbo covered bank bonds, which are classified under liquidity category II. Local and regional government debt instruments are also classified under liquidity category II.

As regards the second point, as mentioned above,[41] it could be considered whether the regulatory haircuts applied in liquidity regulation should be chosen to be the same as the central bank haircuts for assets eligible in monetary policy operations, since the derivation of these haircuts is based on similar considerations. This would ensure consistency in the treatment of assets and central bank liquidity that is obtained by using these assets as collateral and could thus reduce the scope for arbitrage using central bank liquidity-providing operations to satisfy regulatory requirements. Of course, central bank collateral policy should be a matter for central banks and not agreed in international regulatory fora.

40 See the Guideline of the ECB.

41 See Section 4.3.6.1.

4.4 Potential policy options for insurance companies – qualitative assessment

4.4.1 Maintaining the Solvency II approach vs. introducing any changes

As was the case for banks above, before assessing policy options which would expand on Solvency II, it is appropriate to consider the arguments for maintaining the soon-to-be implemented treatment in Solvency II.

The currently applicable insurance regulation, Solvency I, refers to a range of EU directives regulating the insurance sector. These rules are outdated and have been superseded by industry, international and cross-sectoral developments. Importantly, they are not risk-sensitive. Under basic Solvency I rules, capital requirements depend on the volume of premiums, technical provisions or incurred claims, unrelated to investment exposure. As pointed out earlier in this report, the management of investment risk is also dealt with in a relatively simplistic and non-risk-sensitive way.

Solvency II will ensure the harmonisation of valuation methods, capital requirements and supervisory practices, and help rectify these shortfalls. Insurance companies will have to comply with capital requirements which will take into account both asset and liability-side risks, thereby providing a more complete picture of the risk taken by any individual insurer. Solvency II also brings robust and complete rules on governance, risk management and internal control and audit, as well as provisions developing comprehensive and harmonised reporting, which will include a detailed list of assets (including government bonds).

All assets, including government bonds held by insurers, will also be treated differently under Solvency II. First, since all assets will be valued at market prices (i.e. mark-to-market valuation), there will be no difference between a trading and a hold-to-maturity portfolio. Alterations in government bond risk assessment by financial market participants, similarly to all other tradable assets, will be reflected by market price shifts, thus in asset values and, as a consequence, in the insurer's capital position.

Second, the interest rate module in the standard formula stresses capital for the impact of changing interest rates when interest rate-sensitive assets (including government bonds) and liabilities are not duration-matched. The stress is based on scenarios of both rising and falling interest rates, with the resultant change in capital depending on the capital adequacy requirements resulting from the more adverse scenario.

Third, Solvency II will also enhance the risk management of insurance companies. In addition to capital requirements, Solvency II includes comprehensive requirements on governance and risk management, including the ORSA. The ORSA will be carried out independently from the SCR standard formula and will be an essential element of the undertaking's risk management. In the ORSA, the undertaking must take into consideration all the risks they face, regardless of whether these risks are covered by the standard formula. Therefore, potential risks related to sovereign holdings will be assessed in the ORSA and should be managed either by quantitative or qualitative measures. Moreover, insurers will have to explain their (large) investments as part of the supervisory review process.

Fourth, insurers will have to comply with the prudent person principle, which requires them to ensure the security, quality, liquidity and profitability of the investment portfolio. In the investment risk management policy, undertakings must state the company's own assessment of the credit risk of counterparties, including instances where the counterparties are central governments. For larger exposures (sovereign exposures included), undertakings are required to develop their own internal credit assessment, which will be considered unless it leads to lower capital requirements than the ones generated by CRAs. This avoids over-reliance on these agencies and should ensure proper assessment of sovereign exposure risks.

Fifth, if a supervisory authority concludes that the risk profile of the insurance or reinsurance undertaking deviates significantly from the assumptions underlying the SCR calculated using the standard formula, the authority may require the undertaking to use an internal model to calculate the SCR or the relevant risk modules in the SCR. Furthermore, where the requirement to use an internal model is inappropriate or has been ineffective and while an internal model is being developed, the supervisory authorities may set capital add-ons.

Solvency II brings substantial improvements to supervision and risk management in the insurance sector, and many of these changes also cover government bonds (see Chapter 1). Therefore, making the step from Solvency I to Solvency II should be the key priority at this stage in order to move to a consistent, risk-based solvency and supervisory regime. The expert group therefore notes that the policy options that are discussed below should not be envisaged as policies to be applied or announced at this moment in time. Rather, it believes that, given the improvements Solvency II will bring to supervision and risk management in the insurance sector (many of which are extensively discussed in the report), the focus should be on the smooth transition to the new regime in 2016.

Assessment of policy option

Although Solvency II will bring important improvements to supervision and risk management in the insurance sector, government bonds issued or guaranteed by EEA central governments/central banks denominated and funded in their domestic currency have a zero capital charge in two of the risk modules (the concentration risk module and the spread risk module) in the standard formula.[42] It is also possible that insurers will use this zero capital charge to argue for similar treatment of sovereign exposures when using internal models, even though the Solvency II regulation on internal models does not allow for a biased or unjustified selection of the risks to be captured under the scope of the internal model. An overall assessment could therefore consider that government bonds issued or guaranteed by EEA countries do receive preferential regulatory treatment, which may affect incentives. Therefore, some of the same considerations apply as for the resilience of banks, and several of the arguments presented in the discussion on the banking sector would also apply in the insurance sector.

Although the core business of insurers may not contribute to systemic risks (see also Section 2.2.2), insurers are large investors in government bonds. The large holdings together with a certain home bias and similar behaviour on the markets may expose insurers to a de facto concentration risk. However, it is important to bear in mind that the home bias observed may be appropriate in the case that assets are held to cover liabilities in the same currency. In contrast

42 However, they are included in the interest rate module in the standard formula.

to banks, insurance is mainly a liability-driven business model, where assets should preferably only be held to the extent that they match the liability side of the balance sheet.

The sustainability of the financial system, and in particular the soundness of insurance companies, depends heavily on a robust assessment of the risks of the underwriting and investment activities. The regulatory framework should incentivise market participants to develop active management of all risks, sovereign risks included, considering the specific features of the insurance business and the improvements the Solvency II framework will bring to supervision in the insurance sector.

4.4.2 Including sovereign exposures in the concentration and spread risk modules of the solvency capital requirement standard formula

Description

Solvency II envisages a regular review of the calibration of the standard formula set out in the implementing measures, and hence the capital charge can be changed, for instance following market developments. This means that, in the long run, including sovereign exposures in the concentration and spread risk modules could be considered in order to keep the treatment of sovereign exposures consistent with that of other exposures. The impact assessment of any recalibration should consider whether the qualitative and quantitative measures of Solvency II that already take account of sovereign debt risk have performed satisfactorily or have turned out to be insufficient. For this purpose, it will be necessary to assess whether the resulting valuation rules and capital requirements are applied coherently across the financial sector. This work would naturally need to ensure full internal consistency, taking into consideration the treatment of sovereign bonds issued by EEA countries in foreign currencies, but also whether differences between sovereign bonds, covered bonds and corporate bonds warrant separate treatment (i.e. consistency means treating equally exposures with the same features, and differently where the features are different).

An appropriate calibration of sovereign bonds in the spread and concentration risk module would involve a detailed recalibration of several parts of the standard formula in order to arrive at appropriate levels of the actual capital requirements both in isolation and when compared with the treatment of other exposures. The Delegated Act contains lower capital requirements for certain categories of sovereign bonds than for corporate bonds, such as reduced capital charges on government bonds issued in a different currency or by non-EEA governments. Solvency II and the Delegated Act also contain lower capital charges for certain types of covered bonds and bank deposits. These differences in the treatment of corporate bonds, covered bonds and sovereign bonds issued by non-EEA countries stem from the calibration of these risk modules and the empirical investigation of how changes in the prices of these affect the variability in insurers' own funds. A detailed calibration of capital requirements for government bonds issued by EEA countries in their own currency will have to be carried out in a similar manner.

For simplicity, however, it has been assumed in the impact assessment presented in the report that government bonds will be subject to the same capital requirement as corporate bonds with the same rating. This would constitute a relatively harsh treatment of sovereign exposures, and is likely to involve higher capital requirements than if fully calibrated. In other words, this approach presents the more workable option for the impact assessment within the tight

deadlines available, but does not encompass a detailed calibration of the appropriate levels of risk weights. Therefore, the results presented should be seen as indicative and likely to reflect an upper bound of the effects.

Assessment of policy option

An inclusion of sovereign debt in both the spread risk sub-module and the concentration risk sub-module would provide benefits from the perspective of micro and macro-prudential supervision. It would make the capital requirement reflect the observation that, in principle, sovereign debt is not entirely risk-free. It could thereby reduce any possible remaining incentives to invest in a few sovereign states instead of a large diversified portfolio of assets. Insurers that invest in sovereign debt would be required to hold more capital. This would make the insurance sector more resilient to sovereign crisis events and thereby reduce systemic risks.

However, the expert group notes some drawbacks to this approach.

This policy option would increase incentives for insurance companies to invest in sovereign debt with higher ratings, increasing the potential for price differences among sovereign assets issued by different Member States. If, during a crisis, there is already a scarcity of relatively safer government bonds (i.e. AAA-rated) and government bond spreads widen, this option, by differentiating between government bond spreads, may exacerbate the spread differences between countries. It would be important to analyse how any introduction of new regulatory requirements would affect the investment opportunities for insurers in the current environment. This is also pointed out in the April 2012 edition of the IMF Global Financial Stability Report:

"The shrinking set of assets perceived as safe, now limited to mostly high quality sovereign debt, coupled with growing demand, can have negative implications for global financial stability. It will increase price of safety and compel investors to move down the safety scale as they scramble to obtain scarce assets. Safe asset scarcity could lead to more short-term volatility jumps, herding behaviour, and runs on sovereign debt. To mitigate the risk to financial stability from a potentially bumpy, uneven path to a new price for safety, policy responses should allow for flexibility and be implemented gradually enough to avert sudden changes in what are defined as safe and less-safe assets. In general, policy-makers need to strike a balance between the desire to ensure the soundness of financial institutions and the costs associated with a potentially too-rapid acquisition of safe assets to meet this goal."

Where the credit risk classification of sovereign debt is based on the assessments of CRAs, it would additionally give rise to concerns about the over-reliance of financial regulation on ratings.

Furthermore, the inclusion of government bonds in the spread module may amplify the volatility of insurers' SCR, given the large exposures to them and the dynamics of their valuation over the economic cycle (see the box below). Therefore, any changes to the treatment of government bonds in the standard formula would need to be complemented with an assessment of this drawback and possibly by the introduction of mechanisms that address the volatility of balance sheets effectively.

Moreover, the complexity of undergoing a complete calibration exercise should be noted. Importantly, the data required for a complete calibration of the capital requirement is not readily

available. It is unlikely that historical data covers a time period with a sufficiently consistent policy framework.

Finally, it should be noted that this policy option will not be applicable on a cross-sector consistent basis owing to the fundamental differences among prudential frameworks in the banking and the insurance sector. Solvency II marks sovereign bonds to market. When comparing the regulatory treatment of sovereign risk in banking and insurance regulation, the treatment both in the denominator and in the numerator of the solvency ratio should be considered.

Box 5

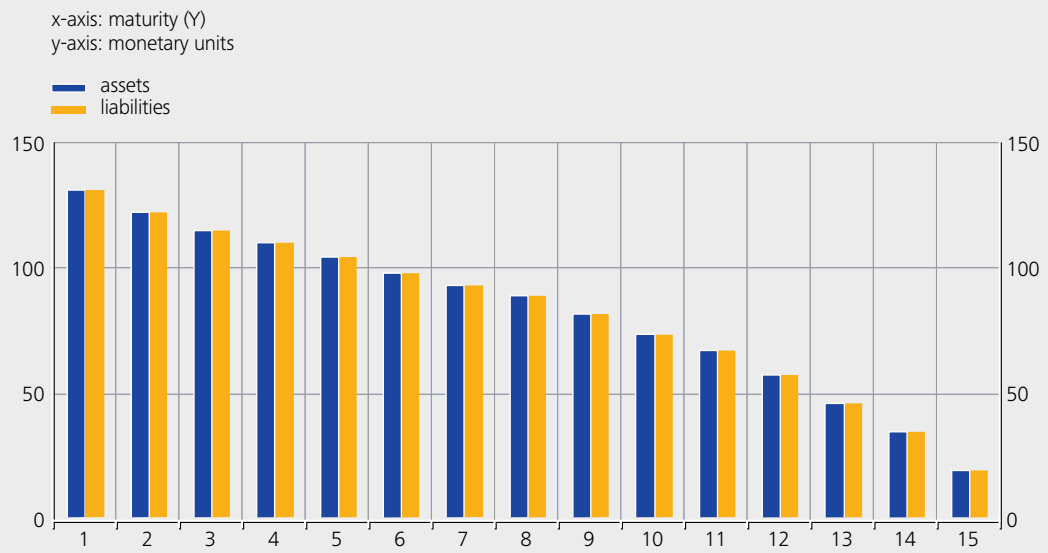
Potential volatility in balance sheets and capital requirements – systemic implications

Consider a life insurer facing a term structure of liability cash flows as presented in Chart A. Since interest rate risk is usually one of the two major risks run by life companies, the insurer's strategy is to mitigate it. In the current example, a perfect interest rate hedge is possible with the use of a portfolio of (possibly zero-coupon) bonds. Suppose further that the term structure of liabilities' cash flows is stable over time. This simplification is close to what is often encountered in practice.

Consider two cases: a Swedish and a German insurer that run their business locally and invest only in domestic government bonds. Both assets and liabilities are valued at market prices. Liabilities' cash flows are discounted with a risk-free rate curve by the use of relevant swap rates corrected for credit risk, in line with the Solvency II requirements. The present value of each asset portfolio is approximately 1,000 monetary units.

Chart A

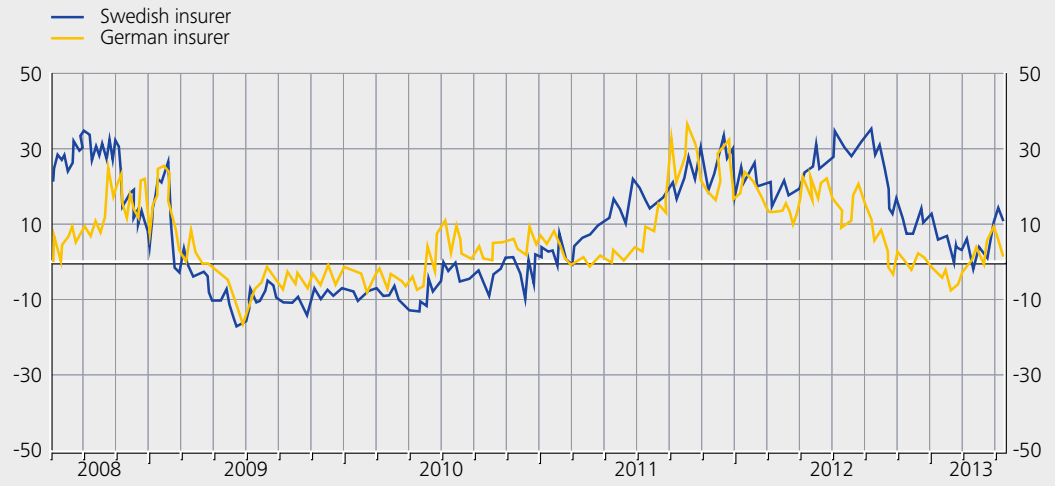
Nominal Cash-flows



Source: Calculations based on Bloomberg data.

Chart B

Net asset value



Source: Calculations based on Bloomberg data.

Chart B illustrates the variability of the net asset value, i.e. the difference between the market value of assets and that of liabilities for the historical data. In reality, there is no interest rate risk (except for default risk), as the cash flows of assets and liabilities are perfectly matched. The changes in the net asset value in Chart B can therefore be understood to relate to changes in the spread of government bonds over risk-free rates, which introduces variability of the net asset value and, consequently, the own funds. Naturally, the difference between the maximum and minimum net asset value in this example would be problematic from the point of view of the insurer, as, in the last five-year period, the difference was of the magnitude of 4%-5% of the value of the asset portfolio. Such an amount might be as high as half of own funds for many EU insurers. Furthermore, the Swedish and German cases shall be seen as conservative in a sense that the difference between the government rate and the swap rate is rather stable when compared with most other EU countries, meaning that the variability issue pointed out here is expected to be much less problematic for Sweden and Germany than for the other EU Member States.

As mentioned in Chapter 2, the SCR in Solvency II is based on the high quantile of the one-year forecast distribution of change of own funds. This means that the more variable the change in basic own funds, the higher the SCR as an insurer's SCR would increase when its sovereign holdings were downgraded. Since government bonds are a large asset class in insurers' investments, the inclusion of them in the spread and concentration risk sub-modules in the standard formula would amplify the volatility of the SCR. Combined with the sensitivity of own funds to the movement of market prices, the SCR ratio, i.e. own funds divided by the SCR, is expected to be more volatile if the additional capital requirement on government bond exposures were to be imposed.

4.4.3 Enhancing Pillar 2 requirements

Description

As in the case of bank regulation, Pillar 2 is a crucial component of insurance supervision, complementary with Pillar 1, dealing with risk management and governance of the insurer.

Policy options involving Pillars 2 and 3 should aim at ensuring that sovereign exposures are treated consistently with other exposures, while allowing for their specific features (and hence guaranteeing an economic approach). The best way to efficiently achieve this goal seems to be to strengthen the EIOPA actions fostering a common, uniform and consistent application of the treatment of sovereign bonds in Pillars 2 and 3 (i.e. guidelines as set out in Article 16 of the EIOPA Regulation).

In Pillar 2, the Solvency II framework deals with sovereign exposures in two ways. First, insurers are required to take into consideration in the ORSA all the risk they face, regardless of whether these risks are in the standard formula. Therefore, potential risks related to sovereign holdings will be assessed in the ORSA and should be managed either by quantitative or qualitative measures. This means that the ORSA is not only a monitoring device, but it also includes the managing of risks identified in the assessment. Moreover, insurers will have to explain their (large) investments in any type of exposure (including sovereign exposures) as part of the supervisory dialogue. Second, insurers will have to comply with the prudent person principle, which requires them to ensure the security, quality, liquidity and profitability of the investment portfolio. In the investment risk management policy, undertakings must state the company's own assessment of the credit risk of counterparties, including instances where the counterparties are central governments. It should be noted that Pillar 2 requirements clearly discourage mechanistic approaches by both the insurer and the supervisor, focusing more on the substance and the targets to achieve than simple formal fulfilment.

In Pillar 2, a policy option would imply that the EIOPA guidelines on the ORSA could take special care of ensuring that the following items are covered and applied consistently to all exposures:

- An appropriate risk analysis of sovereign exposures;
- Appropriate management actions specifically focused on the nature of sovereign exposures, including sufficient consideration of the relationship between assets and liabilities.

These policy options are not completely new requirements; they are merely a strict interpretation and an explicit elaboration of principles already in the framework. They would make sure that insurers implement these principles in a harmonised and detailed fashion, with a focus on sovereign risk.

Assessment of policy option

This policy option gives supervisory authorities tools to address sovereign risks. This has the potential to increase insurers' resilience and thereby decrease systemic risks. Since it is less mechanical than the options which address sovereign risk in Pillar 1, it makes it possible for insurers and supervisors to address sovereign risk proportionally, depending, for instance, on the exposure at stake or on the state of the economic cycle. Such flexibility and reliance on supervisory judgement may become a disadvantage when political pressure during crises would make the sensitivity analysis not stressful enough and insurers would be allowed to deviate from

the guidelines on sovereign exposure. This disadvantage calls for strict coordination and peer review by EIOPA and factual independence of national supervisory authorities.

4.4.4 Enhancing Pillar 3 requirements

Description

For the banking sector, the report considers enhanced disclosure requirements on banks' sovereign exposures. The basic rationale, which relates to existing information asymmetry and agency conflicts between management and other stakeholders, is also valid for insurers. If such disclosures are required from banks, it could be advisable to also require similar disclosures from insurance companies, in part in order to avoid regulatory arbitrage, for instance in conglomerates. Any such public disclosure should be linked to the Pillar 3 reporting requirements in Solvency II, which envisages an annual public disclosure of key items, such as the SCR calculation and a breakdown of the balance sheet. These disclosure requirements apply both on a solo and a group level. The balance sheet reporting templates published by EIOPA envisage that investments are broken down with a split, among others, between government and corporate bonds. For the sake of full transparency, more detailed splits could be required.

The Solvency II framework will require insurers to report a list of their holdings, including sovereign bonds, to supervisory authorities. Solvency II also requires the public disclosure of aggregate information, including on sovereign debt holdings.

The added Pillar 3 requirements could be that sovereign exposures are publicly disclosed in more detail – not in an aggregated format, but counterparty by counterparty, when they exceed certain thresholds in respect of total assets and own funds, for example. Ideally, and for the sake of neutrality, these thresholds should be consistent with the thresholds applied to any other type of investment.

Assessment of policy option

This policy option is in line with one of the principles of Solvency II: transparency. The aim is to decrease information asymmetry and thereby increase pressure from financial markets to treat sovereign exposures in an appropriate manner, increasing insurers' resilience and decreasing systemic risks. Their effectiveness depends on the extent that this market pressure functions well, both in times of economic upturns and downturns. On the one hand, the recent crisis has shown that market participants pay close attention to large exposures of risky assets in insurers' portfolios. They would be helped with more granular data. On the other hand, it is doubtful whether market participants can fully take into account the benefits of asset and liability matching, which insurers aim for when investing long-term sovereign debt.

A drawback of this option is that the disclosure requirement for sovereign debt would be stricter and more burdensome than for other asset classes, whereas, in principle, there is no rationale for this difference.

Another drawback of the public disclosure of detailed asset data on sovereign exposure comes from potential pressure to sell in a market when prices are low. The business model of insurers allows them to be long-term investors and therefore avoid fire sales. Market pressure may lead to premature sell-offs and, if done on a large scale, would not only harm insurers, but also reduce asset prices further.

4.5 Quantitative impact assessment

The expert group decided to carry out a simplified impact assessment for a number of Pillar 1 policy options discussed in Chapter 4 (not all were considered). The policy options included for banks are: (i) removal of the carve-out; (ii) setting of a risk-weight floor; (iii) full or partial elimination of the large exposures exemption. For insurance companies, only the option that envisages changes to the concentration and spread risk modules of Solvency II is considered. This section illustrates the results of such an assessment for four basic policy options. The impact of combinations of policy options can generally be derived by appropriately combining the impact of the basic options reviewed in this note.

This section is arranged as follows: Section 4.5.1 analyses options related to banks, while Section 4.5.2 is devoted to insurance companies. Section 4.5.1 starts with a description of the data sources. It then deals with the cost of compliance of the three options considered, gives a qualitative assessment of their impact on incentives, interaction with liquidity regulation and effect on the market for government bonds and it concludes with the impact of capital-related measures on financial stability and on growth. A final section draws some general conclusions.

4.5.1 Banks

Data

The impact assessment is performed on simple versions of the policy options. Estimates are calculated at two points in time – during the sovereign crisis (December 2011) and before (December 2007) – to provide upper and lower bounds on the impact of policy proposals.

Subject to the lack of more up-to-date data at the time when the impact assessment was conducted, exposures and ratings recorded at the time of the EBA data collection for the recapitalisation exercise (started in autumn 2011 and ended by mid-2012) provide an upper bound for capital requirements, as exposures are high and ratings low. The banks in the EBA sample are only a subset of all EU banks, skewed towards larger banks. However, since it is derived from the stress test sample of 2011, it covers more than 50% of bank assets in each EU country. The sample includes both banks that use the standardised approach and the IRB approach, and treats them all as if they use the standardised approach (i.e. the IRB banks are assumed to have issued no capital for their sovereign exposures if that is what they would have done with the standardised approach).

To have a lower bound, the same calculations are performed with the exposures and ratings recorded in December 2007. Since the EBA database does not contain information about individual banks' holdings at that time, the following assumptions are made (which might affect the results, especially in terms of distributional effects):

- The size of total sovereign portfolios in 2007 is calculated by comparing the 2007 and 2011 data for the aggregate sovereign-exposures-to-total-assets ratio at the country level and then adjusting for each bank with a comparison of its own sovereign exposures-to-total-assets ratio to the aggregate one in 2011. In other words, if in 2011 a bank in the EBA sample has a sovereign exposures-to-total-assets ratio twice as large as its country average, in 2007 its sovereign exposures-to-total-assets ratio is also twice as large as its country average in 2007.

- The ratio of domestic to foreign sovereign exposures is the same for all banks of the same country and is derived from aggregate data (also in December 2007).
- The composition of the foreign sovereign exposures portfolio is the same as in the EBA data for each bank at the earliest possible date in order to reduce the impact of home bias.

Data sources are the EBA for the breakdown of sovereign portfolios in December 2011, the ECB for aggregate data on domestic and euro area sovereign-exposures-to-total-assets ratios and sovereign ratings and SNL (a commercial provider) for balance sheet data such as individual bank equity and total assets in 2007.

One other limitation of the dataset is that it does not distinguish between bonds and loans, or between central and local entities. Because of these limitations, we cannot estimate whether the impact of policy options is different for bonds and loans, or whether an application of the regulation on related parties for large exposures would have a material impact.

Direct impact on banks ceteris paribus

Removing the domestic carve-out – standardised approach (RSA)
Policy option examined: removal of the carve-out and application of the standard ratings scale for sovereigns (see Annex 8).

Methodology: application of the risk weights of the sovereign ratings scale to the exposures of the EBA sample (all banks, including banks that use the IRB approach) calculated in two dates as described above to obtain the capital requirement.

Results: the share of sovereign debt that would be affected by the removal of the carve-out and the consequent implementation of the Basel risk weights would amount to approximately 15% and 20% of the sovereign holdings as of 2007 and 2011 respectively (see Annex 8 for countries' ratings – most of the largest countries' ratings imply a zero risk weight in both years). The total additional capital requirements for 2007 would amount to €2.8 billion for €984 billion worth of sovereign exposures (0.3% of total equity, an average implicit risk weight of 2.8%), whereas for the 2011 positions, the respective amount would be €9.0 billion for €1.661 billion worth of exposures (0.7% of total equity, an average implicit risk weight of 5.4%).

These figures can be compared with the projected equity shortfalls due to a 7% CET1 targeted ratio in Basel III. In such a case, the total shortfall would be approximately €250 billion for a similar sample of banks (see European Banking Authority, 2012). Applying the RSA to sovereign exposures would add, ceteris paribus, less than 4% to the total to be raised. Obviously the distribution of the burden is uneven across banks for both requirements, and this comparison ignores the fact that any change in regulation is foreseen for a time in which sovereigns would be in normal conditions and therefore presumably with very low risk weights.

The countries for which the capital requirement would be highest as a share of equity are as follows:

- In 2007: Malta (3.62%), Austria (1.38%), Italy (1.32%).
- In 2011: Cyprus (21.70%), Portugal (6.00%), Malta (5.45%).

In absolute amounts: in 2007 – Italy (€1.917 billion), France (€518 million); in 2011 – Italy (€2.608 billion), France (€1.533 billion), Germany (€1.349 billion), Portugal (€916 million), Cyprus (€682 million), UK (€680 million).

Non-zero risk-weight floor

Policy option examined: introduction of a non-zero risk-weight floor for all sovereign exposures (including domestic).

Methodology: the floor is set at a risk weight of 10% (the figure is arbitrary but broadly consistent with the average values found in the section above). Then the same methodology as for the RSA is applied to derive the capital requirement. Capital requirements are also computed for risk-weight floors of 5% and 20%, but since the results are linear in exposures, they are not reported. They can be provided upon request.

Results: a risk-weight floor of 10% would imply a capital requirement of €6.6 billion (0.68% of equity) in 2007 and €10.8 billion (0.80% of equity) in 2011. By definition, the capital requirement is 8% of RWA, or given a 10% risk weight, 0.8% of sovereign exposures. Also, in this case, the additional requirement would be less than 4% of the shortfall with respect to a target of 7% CET1 ratio.

The capital requirements in this case are strictly proportional to sovereign exposures for each bank, independent of their portfolio composition. The mean requirement for the EBA sample would be €110 million (maximum requirement: €957 million) in 2007, €177 million (maximum requirement: €707 million) in 2011.

Diversification approach

Policy option examined: removal of the exemption from the large exposures regime of sovereign exposures. Sovereign exposures would then be subject to the limit of their nominal value being below 25% of a bank's own funds, which implicitly means that, for the purposes of the large exposures regime, sovereign exposures are not subjected to any partial exemption (other assets benefit from exemptions that use a fraction of their nominal value for the computation of the large exposures requirement).

Methodology: application of the large exposures rule to EBA data to obtain how many bonds would have to be sold, aggregated by country of issuance.

Results: application of the large exposures rule to sovereign exposures would lead to the following excess holdings, by country of issuance:

- In 2007: a total of €455 billion, 46% of total sovereign exposures, of which €247 billion for Germany, €82 billion for Italy and €37 billion for France.

- In 2011: a total of €716 billion, 43% of total sovereign exposures, of which €303 billion for Germany, €120 billion for Italy and €99 billion for Spain.

Most of the excess exposures are concentrated among domestic banks (German banks for German sovereign debt, Italian banks for Italian debt, etc.).

For individual banks, excess holdings are, in many cases, between 50% and 90% of their exposure to a given sovereign, so applying the requirement would imply a significant portfolio adjustment for these banks.

If 50% of the exposures were exempted from the limit – or, in other words, if a partial exemption ("weight") is applied to sovereign exposures' face value – the excess holdings are determined as follows:

Excess holdings (bank i, country j) = sovereign exposure (i, j) * weight – 0.25 * equity (i)

In other words, they are linear in the weight with a deductible equal to 25% of the bank's equity.

If we consider sovereign exposures at 50% of their nominal value, excess holdings would be the following:

- In 2007: a total of €134 billion, of which €98 billion for Germany and €22 billion for Italy.
- In 2011: a total of €218 billion, of which €120 billion for Germany, €39 billion for Italy and €28 billion for Spain.

If we consider sovereign exposures at 20% of their nominal value, excess holdings would be the following:

- In 2007: a total of €19 billion, all for Germany.
- In 2011: a total of €36 billion, of which €32 billion for Germany.

Impact on incentives

Since regulation has not changed over the period of observation, we cannot estimate the sensitivity of banks' sovereign exposures to changes in capital requirements or large exposure regulation. Therefore, this section provides a qualitative analysis of the possible impact of policy options on sovereign exposures.

From the analysis performed in Chapter 3, we can infer that banks' holdings are at least somewhat sensitive to changes in yields, but this effect is difficult to quantify.

In general, we would need to know whether banks' sovereign exposures are a portfolio investment, or are held for other reasons (as a result of a deterioration in the macroeconomic stance, residual buyers of domestic issuances, liquidity regulation, moral suasion, etc.). If they are a portfolio investment, we would need to know the risk-return-covariance characteristics of all other assets in the portfolio. In this case, it is possible that even relatively modest changes in net yields could cause significant reallocations away from sovereigns. In turn, changes in

net yields themselves could be explained by a variety of factors, particularly during a stress situation. If, on the other hand, sovereign exposures are held for reasons largely independent of their return, then it is likely that a larger change in net yields would be needed to cause a reallocation.

Changes in the large exposure regulation would provide a hard limit to sovereign holdings and are therefore less likely to impact on banks' incentives; capital requirements are focused on below.

A simple back-of-the-envelope calculation allows us to at least understand what risk weight would make a risk-neutral bank indifferent between holding and not holding a sovereign bond in absolute terms, depending on some basic parameters. This is an extreme case, simply to illustrate the orders of magnitude that would matter for a bank.

In the most favourable scenario, let us assume that a government bond does not have any credit risk (therefore, no provisioning is needed) and that a bank finances the purchase with recourse to LTRO-like funds (and just enough equity to cover the requirement – no extra buffers, whether regulatory or as part of a bank's risk management practice). In this case, the break-even point is when the return of the bond equals the cost of funding, which in turn is a weighted average of the cost of funding and the cost of equity:

$$R * B - r * (B - K) - RoE * K = 0 \text{ and } K = B * W * C$$

With: B – the face value of the bond, R is the return/yield on the bond, r the cost of funding, K the regulatory equity, RoE the required return on equity, C is the level of bank capital (assumed for simplicity to be equal to the regulatory requirement), and W the break-even risk weight. Solving for W gives:

$$W = 1/C * (R - r) / (RoE - r)$$

Assuming a required return of equity of 10% (15%), the level of bank capital is 0.08 and a cost of funding r = 0.5%, we can make two cases:

- A higher-rated, lower-yielding bond, with R = 1.5%. In this case, W = 132% (86%). Conversely, if regulation were to set W at 100%, banks would be extracting an RoE of 12.5% from this trade. This is relatively in line with their targets and would therefore not change their incentives much.
- A lower-rated, higher-yielding bond, with R = 4.5%. In this case, W = 526% (345%). Conversely, if regulation were to set W at 100%, banks would be extracting an RoE of 50% from this trade. This would still leave a big incentive for banks to engage in this trade, compared with the current risk weight of zero.

In other words, if sovereign holdings were a pure carry trade on high-yielding bonds with no relation to other holdings, and banks were risk-neutral, risk weights should be well above 100% to entirely discourage such transactions. Higher funding costs for banks, e.g. r = 2%, would still imply W = 312% for an RoE of 10% for the higher-yielding bond.

Plugging in different values for the parameters allows the reader to derive a complete schedule for equilibrium risk weights for any combination of funding cost, sovereign yield, bank capital and required RoE.

Interaction with liquidity regulation

The current regulation of liquidity risk hinges on banks holding safe and liquid assets. It is assumed that government securities are the most relevant asset within this class. Applying large exposure rules or capital requirements would create an interaction between credit and liquidity risk regulations.

In order to perform a quantitative impact assessment, we would need estimates of banks' required sovereign holdings under the new liquidity regulations established by the CRR. However, such data was not available at the time of analysis, so this section provides some back-of-the-envelope calculations and a mostly qualitative analysis of such interaction. The issue of currency composition for liquidity regulation purposes is also ignored, other than to say that banks in countries with a small amount of sovereign debt compared with the size of their liquidity requirements might face additional hurdles in order to comply with the new liquidity regulation if credit risk requirements imply a further tightening/additional costs for holding domestic sovereign debt.

Estimates of the impact of the new liquidity regulation show that EU banks would need to significantly increase their holdings of safe, liquid assets to sustain their current balance sheets (European Banking Authority , 2012 – all subsequent estimations are based on the old LCR agreement, before the revision of January 2013). In particular, in 2011 the shortfall for the LCR – for which holdings of safe liquid assets is key – was of €1.15 trillion (for reference, the sample had total assets of €31 trillion). In any event, it is safe to assume that current sovereign holdings are likely to increase to meet the new liquidity regulation.

Capital requirements

Capital requirements such as applying the RSA or a risk-weight floor would make banks bear a regulatory cost to hold sovereign debt. In a ceteris paribus world, banks might at least have to double their current sovereign holdings.

Banks' average LCR is 70%, around 40% of banks in the sample are above 85% and the shortfall of €1.15 trillion refers only to banks with a shortfall, without considering excess holdings by other banks. Making the heroic assumption that banks with a shortfall have an average LCR of 50%, a shortfall of €1.15 trillion implies eligible assets of €1.15 trillion. Sovereign holdings constitute about half of eligible liquid assets; therefore, they would have to increase by 100% to 200% to cover the gap.

Let us make a further heroic assumption that banks with a shortfall are in the sovereign exposures sample (this is likely, since it is larger banks that are more likely to have LCR shortfalls) and that the approximately €600 billion of sovereign holdings of banks with liquidity shortfalls are distributed as in the EBA sample for sovereign exposures. Their sovereign exposures would then represent 35% of that sample.

Based on the results of the section "Direct impact on banks ceteris paribus" for 2011 and doing a simple back-of-the-envelope calculation that does not take into account ratings or other characteristics of sovereign exposures, this would imply an extra equity requirement for the banks of the EBA sample with LCR shortfalls of between €6.3 billion and €9.45 billion (€3.15 billion for current exposures – 35% of €9 billion, another €3.15 billion to 6.3 billion for new exposures) for the RSA, and of €7.6 billion to €11.4 billion for a risk-weight floor of 10%. This is likely to be less than 3% of the total equity of banks with a shortfall of eligible liquid assets. Banks with no LCR shortfall would have a capital requirement of €5.85 billion and €7.0 billion respectively with the RSA and with a risk-weight floor of 10%.

In reality, the distribution of such a burden depends on the distribution of the shortfalls with respect to the new liquidity regulation. One should also consider that the current deleveraging process and push towards more stable sources of funding would reduce the need for both safe and liquid assets, perhaps significantly, depending on the starting point of each bank.

Diversification approach

The removal of the large exposures carve-out will surely interfere with the new liquidity regulations, depending on whether there are partial exemptions for sovereigns. If sovereign exposures are considered at their full nominal value, as shown in the previous section, there are already excess holdings for some countries.

If, on the other hand, we assume that banks and regulators do not care much about the composition or potential foreign exchange risk (see also Section 4.3.6 on the issue of currency composition for liquidity requirements) of their sovereign portfolios, total equity of the EBA sample of €1.35 trillion means that they can hold approximately €440 billion worth of sovereign exposures per country of issuance. Using the figures in the paragraph above, assuming current holdings of €600 billion and total extra needs between another €600 billion and €1.8 trillion, a portfolio of four large countries would be enough to cover banks' needs for eligible liquid assets without incurring the large exposures limit.

However, this analysis is static and does not consider that, if portfolio adjustments imply a sell-off of bonds of countries with problems in market access to comply with a large exposures requirement for sovereigns, this could lead to significant disruptions in bond markets and heavy losses for banks and bondholders. Additionally, such a requirement might interfere with the new liquidity standards established by the CRR, which set no limits on sovereign bonds in liquidity buffers. As a result, the broad policy implication of this qualitative impact assessment should be carefully considered and, eventually, any rule with these potential effects should be implemented only very gradually and when markets in sovereign bonds are sufficiently resilient.

Obviously the figures estimated above are based aggregates, so we would need to have bank-by-bank liquidity requirements and to compare them with current sovereign holdings to understand how binding the large exposures rule would be. What is not binding at the aggregate level might well be very binding for a subset of banks.

With a partial exemption of 50%, banks would need only two countries, with debt issuance of €880 billion each. Considering only 20% of sovereign exposures' nominal values, it is likely that the large exposures rule would have little or no intersection with liquidity requirements.

So, in the end, the diversification approach limits concentrated exposures, but banks have sufficient equity to hold a diversified sovereign portfolio to meet the new liquidity requirements.

Impact on the market for government bonds

Capital requirements – a bank-level cost-of-capital approach

Capital requirements on sovereign exposures increase the cost of such holdings. Banks are likely to pass on at least part of this cost to issuers. However, the degree of pass-through depends on whether banks are the marginal buyers, which would then heavily influence prices, or whether they are infra-marginal. It also depends on whether banks have market power as buyers. Depending on the degree of oligopsony, the increase in cost is shared between issuer and buyer in different ways. Because of the lack of firm evidence about all these aspects, this section is also based on back-of-the-envelope calculations and a qualitative assessment.

The increase in costs to the bank is proportional to the risk weight and to the bank's required return on equity relative to its cost of funding; using the variables defined before:

$$\text{Increase in cost} = C * W * (RoE - r)$$

If W = 100%, C = 8 %, RoE = 10% and r = 0.5%, this means an increase of 76 basis points. If W = 50%, the increase would be of 38 basis points. As the cost of funding increases relative to RoE, the impact on the cost for sovereigns decreases: if r = 2%, the increase would be of 64 basis points when W = 100%, and 32 basis points when W = 50%. As before, the reader can plug other values into the formula to obtain a full schedule.

The question is how much of this increase banks are likely to pass on to issuers. Table 5 in Chapter 3 shows that euro area banks hold a significant share of domestic debt; if one excludes the outlier Slovakia, their share is between 20% and 30% for many countries. Again, a key variable is the role of incentives: if banks are sensitive to risk-return considerations for their sovereign holdings and are marginal buyers, they are more likely to pass through a larger share of the increase in cost. If, on the other hand, they hold sovereign exposures for other reasons (to comply with liquidity regulations, as residual buyers, because of moral suasion, etc.) they might pass on a lower share of the increase in cost. If banks form an oligopsony, pass-through should be incomplete, as part of the increase would be absorbed by banks.

A second question is, does the price effect at some point translate into rationing the sovereign? The increase in required yield could be such that, in fact, the sovereign might effectively be shut out of the market, especially if the regulation effect is compounded by market gyrations. As the recent financial crisis shows, yields of 7% represent a sort of psychological threshold beyond which there is an assumption that debt servicing could spiral out of control and trigger a default. By backward induction, when financing costs approach such a threshold, governments find it very difficult to access markets. Banks could still be buying on the primary market, but such a situation would have a material impact on the market for sovereign securities.

Since risk weights are correlated with ratings, which deteriorate as the financial situation of sovereign deteriorates and yields increase, risk weights would have a procyclical effect on sovereign bond markets and, in some situations, could significantly accelerate the process that leads to

rationing. A floor would just increase one-off financing costs for governments, probably by a small amount, and would be unlikely to generate rationing mechanisms if introduced in non-crisis times.

Capital requirements – a macro-modelling approach

An alternative way to assess the impact of an increase in the cost of holding sovereign exposures is to use the results of the Macroeconomic Assessment Group (MAG; see Basel Committee on Banking Supervision, 2010a).

The MAG estimates via a variety of macro-models the impact of a general increase in equity on the general cost of credit during the transition. Keeping in mind all the necessary caveats linked to the application of such a general framework to a very special case such as sovereign risk, and ignoring the effects on fiscal policy and its feedback effects on the economy and therefore on banks, the main findings can be summarised as follows:

- A 1 percentage point increase in the targeted capital ratio (TCE/RWA), implemented over eight years, would increase lending spreads by between 15 and 20 basis points (median values).
- It would decrease lending volumes relative to baseline projections by between 1% and 2% (median values).

The long-term economic impact study (LEI; see Basel Committee on Banking Supervision, 2010b) provides similar estimates for lending spreads in steady state (long-term effects), also measured against increases in capital ratios. If liquidity requirements are added, spreads would increase in total by between 15 and 50 basis points. The report considers these values as likely to be upper bounds.

A CET1 ratio of 5% implies that, to bring it to 6%, equity has to increase by 20%; from 10% to 11%, equity would have to increase by 10%; the largest average impact in this impact assessment is around 3%, if banks had to cover LCR shortfalls with sovereign bonds. Considering, therefore, that even the most conservative approaches used in this impact assessment yield increases far below 1 percentage point of capital ratios, subject to the important limitations mentioned before, the macro-modelling approach suggests that, in normal times, the direct impact of capital requirements may be relatively small.

Diversification approach – a general perspective

The end of the large exposures carve-out for sovereign holdings would set a hard limit, especially for banks' holdings of domestic debt. As seen before, if sovereign exposures are considered at full nominal value, the direct effect would be quite significant for a few countries; with a partial exemption of 50%, the problem already seems to disappear.

If we assume that banks are relatively indifferent to the composition of their sovereign portfolios and that they keep holding between 20% and 30% of total euro area debt, then the banking system as a whole has enough equity to absorb its share of even the largest sovereign debts. However, if preferences are such that, for certain countries which are perceived as being riskier, there is little demand from abroad, then the choice of the weight for sovereigns in the large exposures regulation becomes crucial in this respect.

In terms of the share of total debt that would need to be reallocated, the highest figure is for Germany; in 2007, €250 billion represented 16% of total debt; in 2011, €300 billion

represented almost 15% of total debt. In 2012, admittedly a busy year for German sovereigns in all likelihood owing to a generalised flight to quality, turnover in standard German government securities was 5.5%.[43] The impact of a large exposures requirement would depend on the size of the adjustment relative to total outstanding debt, market turnover and the length of the phase-in. In the case of Germany, if banks had to adjust within a year, they would be increasing market transactions by 3%; if they were able to do it over three years, they would be adding 1% per year. The effect on liquidity and yields would depend on their sensitivity to such changes in transactions patterns.

Diversification approach – a partial equilibrium exercise on banks' holdings

In order to understand how banks in the EBA sample might behave in the case of a removal of the large exposures carve-out, a thought experiment is performed. Limits to large exposures are assumed to be calculated at the full nominal value.

The constraint is imposed that the banks in the sample as a whole should absorb the sample's total holdings of sovereigns. It is assumed that each bank is willing to buy as much sovereign debt of each country as is necessary to compensate for other banks' excess holdings (this should be considered a very strong behavioural assumption). The results are as follows:

- In 2007 the banks in the sample could not absorb all the German sovereign holdings; in order to do so, sovereign exposures should be considered at 69% of their face value via the use of a partial exemption.
- In 2011 only German exposures cannot be fully absorbed; the break-even rate at which sovereigns should be considered at is 74%.

Interaction between credit risk and liquidity risk regulations

While the credit risk regulation tends to limit banks' financing of sovereigns, the liquidity risk regulation tends to increase it. The net effect of the two regulations is difficult to gauge, considering that both will create incentives for banks to alter the composition of their assets and liabilities. In a ceteris paribus situation, since the liquidity regulation introduces a quantity floor, it is likely that banks would increase their sovereign holdings and bear much of the extra cost, since they would be more price takers than price setters in such a situation. Rationing of sovereign issuers would be likely if the large exposures rule becomes binding for banks in countries under stress with respect to domestic debt.

Impact on financial stability and output

Results from the LEI report

The results of the LEI report are used to obtain an estimate of the macroeconomic implications of introducing risk weights on sovereign bonds within the EU.[44] The same caveats apply as before. Both the MAG and the LEI frameworks have significant limitations when applied to the case of sovereign debt.

43 Source: Finanzagentur GmbH, available at http://www.deutsche-finanzagentur.de/en/institutional/secondary-market/

44 In addition, the MAG report estimates the macroeconomic impact of higher capital levels. However, it considers the macroeconomic costs of the transition to higher capital levels, but not its benefits. For this reason, the focus here is on the LEI report.

In the LEI report, the long-term economic impact in steady state of an increase in bank capital is analysed with respect to the economic costs and benefits. The costs are mainly related to the possibility that higher lending rates lead to a downward adjustment in the level of output, while leaving its trend rate of growth unaffected. The main benefits of higher capital levels are a lower probability of banking crises and their associated output losses.

In the LEI report, the increase in capital is expressed as tangible common equity/risk-weighted assets (TCE/RWA); in this impact assessment, data is available to calculate common equity/total assets. Therefore, capital levels are recalculated using Table A5.1 in the LEI report for euro area banks.[45]

Table 16
Loss in output (GDP) as a percentage when capital is increased by 1 percentage point

	Euro area: DSGE with bank capital	Euro area: DSGE without bank capital	Average in LEI
TCE/RWA	0.14	0.12	0.13
Common equity/TA	0.30	0.26	0.28

Source: Basel Committee on Banking Supervision (2010b).

The long-run costs of higher capital on output are assessed using a variety of macroeconomic models. The list includes dynamic structural general equilibrium models, semi-structural models and reduced-form models. In these models, it is assumed that higher capital increases the cost of bank credit without additional non-price restrictions (e.g. credit rationing). Therefore, the higher cost of bank credit lowers investment and consumption, in turn influencing the steady-state level of output. Table 7 of the LEI report shows estimates of the long-run costs for different regions as well as an average for all regions. For the euro area, two separate estimations are conducted, dynamic stochastic general equilibrium (DSGE) models with and without bank capital.[46] Both estimates are included, together with the average for all models and regions. Note that, in order to get estimates for common equity/TA, linear interpolation is conducted as in Basel Committee on Banking Supervision (2011).

The loss in output is linear in capital levels, i.e. independent of the starting level of the capital ratio. An increase of 1 percentage point of the CE/TA ratio decreases output relative to trend by anywhere between 0.26% and 0.30%.

The long-term net benefits of increased capital levels are estimated by calculating the expected yearly output gain associated with the reduction in the frequency and severity of banking crises. This is equivalent to the reduction in the probability of banking crises multiplied by the discounted output costs of their multi-year effects – the "expected costs" of crises.[47]

45 In Table A5.1 for euro area banks, 1% of tangible common equity/RWA (Basel II) is equal to 0.47% common equity/total assets.

46 The methodology to calculate the cost depends on specific features of the macroeconomic models. In those that already include measures for capital, changes can be imposed directly. In those that do not, it is first necessary to map regulatory requirements into lending spreads, or the cost of borrowing more generally, as this is always included in the models.

47 Thus, the calculation involves two steps: estimating the expected discounted cost of crises and estimating the impact of stronger capital and liquidity requirements on those expected costs – on the probability and severity of crises.

By observing historical episodes of banking crises and relevant academic studies of these crises, the LEI report concludes that a 1 percentage point reduction in the annual probability of a crisis yields an expected benefit per year equal to 0.63% of output.[48] This relationship is assumed to be linear, i.e. it does not depend on the starting probability of a crisis.

The LEI report relies mainly on two types of methodology to map higher levels of capital (requirements) into reductions in the probability of crises. The first involves reduced-form econometric studies. These estimate the historical link between the capital ratios of banking systems and subsequent banking crises, controlling for the influence of other factors. The second involves treating the banking system as a portfolio of securities. Based on estimates of the volatility in the value of bank assets, of the probabilities and of correlations of default and on assumptions about the link between capital and default, it is then possible to derive the probability of a banking crisis for different levels of capital ratios. Combinations of these methodologies are also used. As none of these methods focus on the specific conditions for EU countries (or other regions for that matter), only the average estimates for all models and regions is included. Note that, in the LEI report, the calculations are performed with and without liquidity requirements (somewhat similar to the NSFR), while the focus is only on the results without liquidity requirements. Note that linear interpolation is used, as in Basel Committee on Banking Supervision (2011), to obtain some of the figures (in italics below).

Table 17
The impact of capital on the probability of systemic banking crises
(in percentages)

TCE/RWA	Common equity/TA	Probability of systemic banking crises
6	2.8	7.2
	3.0	*6.1*
7	3.3	4.6
8	3.7	3.0
	4.0	*2.4*
9	4.2	1.9
10	4.7	1.4
	5.0	*1.1*
11	5.1	1.0
12	5.6	0.7
	6.0	*0.5*
13	6.1	0.5
14	6.5	0.4
15	7.0	0.3

Source: Basel Committee on Banking Supervision (2010b).

48 In Basel Committee on Banking Supervision (2010b), some other estimates are also used. But the estimate of 0.6% includes all academic studies, and is therefore included here. In Basel Committee on Banking Supervision (2010b), barely any of the academic studies include the financial and sovereign crisis of 2007 until today.

For example, if, in a given country, banks have an initial average capital level of 4% CE/TA and capital levels increase by 1 percentage point, then the probability of banking crises decreases by 1.3 percentage points (from Table 16). Thus, the benefit of increasing the capital levels is 1.3% * 0.63% = 0.693%. The cost of the increase in capital levels by 1 percentage point is generally between 0.26% and 0.30%. Therefore, there is a net gain after such an increase in capital of around 0.4% of higher GDP. Given that the benefits in terms of a decrease in the probability of banking crises diminish as capital ratios increase, net gains become likely output losses for a CE/TA ratio of 6%. Currently most countries' leverage ratios are between 10% and 20%, implying CE/TA ratios between 5% and 10%, so further increases would entail losses in output. However, given that even the most conservative estimates of the impact of capital requirements on capital ratios produce values well below 1 percentage point, and subject to the limitations commented on in the analysis, the impact of such measures may be low in terms of output.

Caveats in using the LEI report for sovereign exposures

In interpreting the results, some points are worth highlighting.

First, the LEI does not endogenise some key variables, which makes the results subject to criticism not only for the empirical methodology, as is the case for most empirical work anyway, but also in terms of its theoretical foundations. In particular, it does not consider the endogenous effects on two variables that are key for this impact assessment: the weighted average cost of capital (WACC) for banks and fiscal policy. By assuming that ROE remains fixed for banks, the LEI ignores the fact that more capital increases the resilience of banks. This should decrease the required return on equity and, if it makes the system less risky overall, it should reduce the WACC and therefore actually lead to a decrease in lending rates (assuming some degree of pass-through of the lower cost of funding), not an increase. Therefore, the LEI is likely to underestimate the net benefits of regulatory increases of bank capital for the economy. Effects on fiscal policy are not considered in the LEI, and this has important financial stability dimensions. Any increase in bank capital that affects it (and a specific measure on sovereign exposure is likely to have such an effect) should consider that constraints on fiscal policy (such as increasing the procyclicality of its financing cost) reduce its ability to act countercyclically, to stabilise output or to recapitalise the banking system should there be a crisis. Therefore, estimates based on the LEI study are likely to overestimate the net benefits in terms of the financial stability of measures that would interact with fiscal policy.

Second, the LEI report focuses on the long-run economic impact. The analysis assumes that banks have completed the transition to the new levels of capital. To do this, it compares two steady states, one with and one without the proposed regulatory enhancements. Therefore, the benefits and costs associated with the transition phase cannot be assessed.

Third, the LEI report considers an overall increase in capital. This case considers an increase in capital due to the introduction of risk weights for a specific portfolio, sovereign debt. It can be argued that banks can avoid increasing their capital levels if they have some slack, which is the case for most banks, given the small amounts that would be required. In addition, the increase

in lending spreads that drives the decline in output in the estimation is supposed to apply to all sectors, i.e. households, non-financial corporations and government. The exact distribution of the effects is hard to anticipate in practice.

Fourth, if banks increase the costs of lending to other sectors of the real economy (e.g. lending to small and medium-sized enterprises) to compensate for the increase in risk weights to sovereigns, the effects on the economy could be greater than previously anticipated. By the same token, the net effect on resilience could be lower than what was estimated as a result of these actions.

Fifth, intuitively, a more resilient banking system should also be expected to reduce the severity of banking crises. Higher aggregate levels of capital should help insulate stronger banks from the strains faced by weaker ones. There is, however, no extant research on this issue. In the spirit of providing conservative estimates, the calculation of net benefits in the LEI report effectively assumes that tougher capital standards have no impact on the severity of crises.

Sixth, the estimates in the LEI report are based on the conservative assumption that the whole adjustment is absorbed by lending rates, i.e. any increases in funding costs or reductions in returns on investments are fully passed through. It also assumes that the cost of capital does not fall as banks become less risky. It thus represents something close to an upper bound in estimating costs and a lower bound in estimating benefits.

All in all, the LEI study provides some estimates to think in general terms about the impact of increased bank capital on financial stability and the economy, but the subject is so complex that these estimates should be accompanied by very large confidence intervals.

4.5.2 Insurance companies

In the Solvency II implementing measures, the concentration risk module does not require capital for exposures to central governments and central banks in the EEA, which are denominated and funded in the currency of that central government/central bank. These exposures are therefore assigned a risk weight equal to zero. The same applies in the spread risk module.

The set of computations presented in this note aims at providing an estimate – with strong caveats, however – of the change in the SCR if the exemptions for sovereign debt were removed from the standard formula and sovereign debt were treated as corporate debt. It is important to note that this is not a proposed policy measure, but rather an expository device to give an indication of what the introduction of a charge could mean.

Methodology and caveats

The results are expressed at country level, as the additional capital (in relative terms) that a representative undertaking would be required to hold.[49] As stated above, the results are only

49 See also information about the sample size given in Chapter 3.1. Overall coverage per market was at least 50%.

intended to give a first indication of what the introduction of a charge could mean, and are subject to the following important caveats.

- Capital requirements for spread risk and concentration risk have been calculated using the tables calibrated for corporate bonds provided in Article 176 for the spread risk on bonds and loans and Articles 185 and 186 for the excess exposure threshold and risk factor for market risk concentrations in the Delegated Act.[50] This means that this exercise is not based on any calibration of risk charges specifically for sovereign bonds, according to the risk characteristics of such assets. The use of the treatment and factors designed and calibrated for corporate bonds when deriving theoretical charges for sovereign exposures should not be seen as an approach supported in this note as technically or prudentially sound, but rather as a mere proxy used to quantify the implications of a hypothetical capital charge on sovereign bonds. In particular, it should be noted that the Delegated Act also envisages a distinct treatment for certain categories of sovereign bonds, which means that capital charges on government bonds issued in a different currency or by non-EEA governments are different to those calibrated for corporate bonds.[51] This was not taken into consideration in the main calculations.
- Moreover, the Delegated Act set out lower capital charges for certain types of covered bonds and bank deposits.[52] As with the point above, these benefits could either be reflected in the capital charges for sovereign bonds as well, or be removed altogether. In the case of the latter, the impact would be material for some markets where (re)insurance undertakings have material exposures in those assets. This would also lead to different capital requirements than those presented here.
- The Delegated Act envisages reduced capital charges for the spread risk for bonds under the matching adjustment mechanism. The effect of the matching adjustment has been estimated by applying a flat 30% reduction in the capital charge (before diversification) on that part of the portfolio that is likely to be held under the matching adjustment. The 30% flat-rate reduction of the capital charge is based on Article 181, which foresees factors of reduction between 0% and 55% depending on credit quality. As data on the actual holdings that could be covered by the matching adjustment are not available, an overall factor of 30% was assumed (which implies a credit quality of between 3 and 4). The relevant portfolio share was estimated by assuming that the share of technical provisions reported under the matching adjustment would translate into a similar share of bond holdings under the matching adjustment and by keeping the relative holdings of bond categories constant.
- The calculations are only relevant for the standard SCR. They do not consider the possibility that undertakings will use internal models to compute their SCR. It is not clear to what extent internal models would cover sovereign risks and there is no way of estimating the sign of the difference between the SCR calculated with the standard formula, or with an internal model, without conducting additional and much more extensive research.
- The true split of the total effect into the spread and concentration risk components would depend on individual diversification effects and cannot be accurately calculated in this

50 See Section 1.4.1.

51 Article 180(3) (for the spread risk) and Article 187(4) (for the concentration risk).

52 Article 180(1) and Article 187(1).

tool. The split provided in this impact assessment is therefore estimated by holding the relative share between the two components (pre-diversification) constant.

- The mapping of country ratings into credit quality steps follows the table employed[53] in the fifth Quantitative Impact Study (QIS5) and subsequent stress tests. It is noted that this mapping table is not officially final. Where available, ratings from end-2013 have been employed.

Results

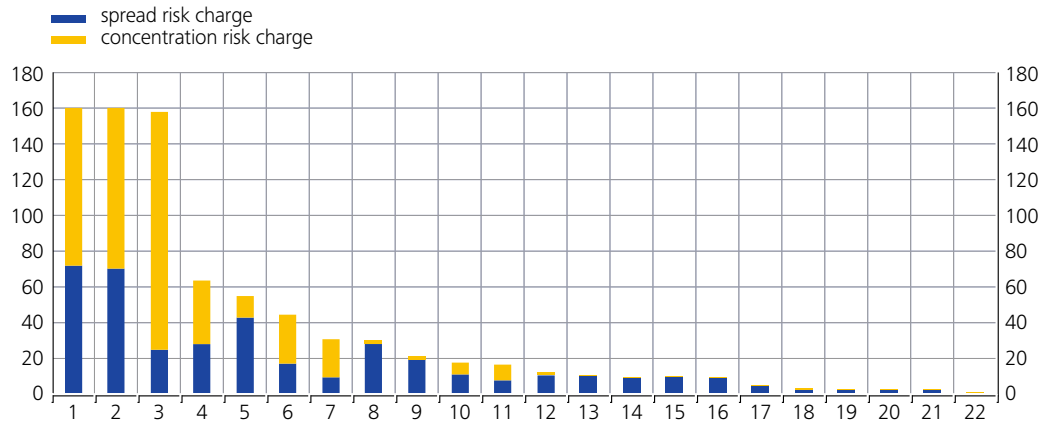
Under the assumptions provided, and given the important caveats, the following findings emerge: Given the sample and the countries for which sufficient data was available,[54] the total increase in own funds required to meet an SCR where capital charges for sovereign bonds are derived as if they had the same risk characteristics as corporate bonds, would amount to around €80 billion.

The results are highly sensitive to the assumptions employed, described above. Overall, the results would change substantially if other assumptions were employed as to the relevant tables for the spread and concentration risk charges. If the tables given in Article 180 point 3 for the spread risk and Article 187 point 4 for the concentration risk were applied (following the distinct treatment for certain categories of sovereign bonds such as those issued in a different currency or by non-EEA governments referred to above), the overall amount of own-funds required would be reduced to €35 billion.

Individual country-level effects are found to be quite sensitive to the credit rating (and the subsequent assignment of credit quality steps). This is due to the non-linear increase in risk factors (and thresholds) for the risk modules. For instance, a move from credit quality step 2 to 3 not only lowers the excess exposure threshold from 3% to 1.5%, it also increases the risk factor from 21% to 27%. The impact of these combined changes would be substantial in some cases.

Chart 16

Adjustments in final SCR – percentage changes



Source: EIOPA stress test 2014.

53 See European Insurance and Occupational Pensions Authority (2011).

54 The following countries have been included in this analysis: Austria, Belgium, Bulgaria, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Lithuania, Malta, the Netherlands, Poland, Portugal, Slovenia, Spain, Sweden, the United Kingdom and Norway.

4.5.3 Conclusions

The impact assessment conducted on three policy options for banks and on one combined policy option for insurance companies leads to some general conclusions in terms of the direct impact and the broader effect on the economy.

Banks

In order to compare policy options across all fields, the main results are summarised by options, grouping the RSA and risk-weight floor into the broader category of capital requirements.

Capital requirements

The main results are the following – everything is ceteris paribus:

- *Impact on bank capital*: between €3 billion (the figure for 2007, assumed as a minimum) and €9 billion (the figure for 2011, assumed as a maximum) for the RSA, between €6 billion and €11 billion for a risk-weight floor of 10% (the capital requirement is linear in the floor).
- *Impact on incentives*: risk weights should be well above 100% to make a risk-neutral bank not want to hold a government bond, especially if it has a relatively high yield.
- *Interaction with liquidity regulation*: for banks that have an LCR shortfall, plugging it with sovereign holdings would entail an increase in equity of between €6 billion and €10 billion with the RSA, between €7 billion and €11 billion with a risk-weight floor of 10%. Note that these figures are from before the final version of the LCR was decided upon.
- *Impact on the market for government bonds*: a risk weight of 10% would imply an increase in required yields below 10 basis points if there is complete pass-through from banks to issuers. A higher risk weight would imply higher required yields, which might push countries with problematic fiscal situations out of the markets.
- *Impact on financial stability and on output*: measuring both effects in terms of output gains/losses, given current levels of capital, an increase due to a capital requirement for sovereign exposures would probably have a small impact, potentially negative. However, estimation methodologies might overestimate costs and underestimate benefits, and should be interpreted with large confidence intervals.

Diversification approach

The main results are the following – everything is ceteris paribus:

- *Excess holdings*: if sovereign exposures are considered at full nominal value, excess holdings in 2011 (the upper bound case) are around €720 billion, more than 40% of total sovereign exposures; if they are weighted at 50%, excess holdings are around €220 billion; if they are weighted at 20%, excess holdings are around €40 billion.
- *Interaction with liquidity regulation*: if banks and regulators/supervisors are indifferent to the composition of their sovereign portfolio, on average, banks with LCR shortfalls can satisfy their liquidity requirements and at the same time observe the large exposures rule with holdings from four countries. This result might vary considerably based on individual circumstances; the limit might push banks in countries with relatively small sovereign debt markets into holding sovereign debt in foreign currencies.

- *Impact on the market for government bonds*: considering that banks hold between 20% and 30% of their domestic sovereign debt, limits to such holdings might be absorbed by other market participants. This probably depends among other factors on what share of bond trading is done by banks (whether they are marginal traders – if the share is relatively low, they might be able to collectively offload their excess holdings, while if their share is high and concentrated, it might be difficult to find new buyers). In terms of the sample considered for this impact assessment, as a whole, it could absorb most excess holdings. With a partial exemption that would apply the requirement to around 70% of nominal value, it could absorb all holdings. In terms of excess holdings relative to domestic markets, taking into account turnover and phase-in, the impact on market transactions should be in the low single digits per year.

Preliminary implications of policy options for banks

The three policy proposals have different impacts on banks and sovereigns in terms of cost of compliance and general impact:

- *The simple removal of the carve-out is sensitive to ratings*: it is most expensive for banks with large exposures to sovereigns with low ratings. To the extent that ratings are procyclical, it has a procyclical component (that might be reinforced by the behaviour of exposures that might be anti-cyclical, as documented in Chapter 3 of the report, and are in the denominator, and therefore have a procyclical impact on possible capital requirements). Its procyclicality might impact on the market for government bonds where banks are relevant players. The effect on incentives, interaction with liquidity regulation and overall impact on output are likely to be small.
- *The risk-weight floor* is sensitive only to the size of exposures. Therefore, it implies a higher capital requirement than the removal of the carve-out when ratings are high (less procyclical). The requirement rises when exposures rise, usually during crises, but the gap with pre-crisis times is smaller than with the carve-out removal. Its impact on all other dimensions (market for government bonds, incentives, interaction with liquidity regulation, overall impact on output) is likely to be small. Given the small effect ex ante and the little capital available to absorb losses as a result ex post, the impact of such a measure on banks' resilience is likely to be small.
- *The removal of the large exposures exemption* is independent of ratings, sensitive to low levels of capitalisation (the binding constraint) and would require large portfolio adjustments for safe haven strategies, or situations of moral suasion to buy domestic bonds. Its interaction with the new liquidity regulation depends on assumptions about banks' (and maybe also regulators'/supervisors') preferences about their sovereign holdings. Its overall impact on the market for government bonds is likely to be small, but also depends on assumptions about banks' preferences about their sovereign holdings.

Insurance companies

The distribution of the additional capital requirement due to changes in the spread risk and the concentration risk modules is very uneven across countries. In three countries, the average SCR would increase by more than 150%. For more than half of the countries, the increase in SCR would be less than 20%. The aggregate additional capital needs would be between €35 and €80 billion, depending on the assumptions. However, these results have to be read very carefully and can only be seen as a first assessment of the order of magnitude associated with including sovereign bonds in the concentration and spread sub-modules. In particular, the results are

subject to the important caveats mentioned in Section 4.5.2. Furthermore, given the limitations of the exercise, no impact assessment on government bond markets and output was performed.

4.6 Issues concerning transition

General considerations

The report presents a range of policy options that the expert group has considered and that should be taken into consideration in order to reform the regulatory system so as to take account of potential risks from sovereign exposures of financial institutions. As mentioned in the introduction to this chapter, the report does not give a ranking, nor does it provide any detailed discussion of possible combinations of measures. As was also repeatedly mentioned, a small minority of the expert group would prefer not to have any explicit change in rules and instead rely on an enhanced use of Pillar 2 and Pillar 3.

Any reform of regulatory rules will have to be addressed by the appropriate decision-making bodies, internationally at the level of the BCBS and other bodies, and, for legislation and actual supervision, at the level of EU authorities, starting with a legislative proposal from the EC, and at the level of national authorities. As they decide on such reforms, it would be important for the decision-making bodies to obtain more detailed data and more detailed impact assessments than the expert group was able to carry out. In particular, impact assessments should also consider the long-run impact of different (and/or combinations of) policy measures, rather than taking current structures as given, as was done here.

Given the sensitivity and the potential impact of any change in regulation, the timing of such deliberations, as well as the timing of the introduction of new measures, and the rules for transition need to be carefully considered. At a time of crisis, any consideration of new measures imposing burdens on banks and/or making sovereign funding more difficult can have a negative impact on markets, which might exacerbate the crisis. Even if transition is allowed to take a long time, announcement effects might occur immediately.

As stated at the beginning of this chapter, the policy measures considered here are aimed at providing ideas for appropriate legislation to achieve financial stability in the future when the recent crisis has been resolved.

When legislative institutions turn to the subject of regulatory reform for the treatment of sovereign exposures, they should take account of recent developments in banking and insurance regulations and fiscal policy. Of particular importance are the introduction of the SSM, the Banking Resolution and Recovery Directive, the ESM capacity to recapitalise banks directly and further developments on the fiscal union.

Given its forward-looking nature and given the lack of a ranking of proposals, this report does not provide a basis for a recommendation, let alone a warning of the ESRB. The ESRB should, however, as part of its work on identifying systemic risk, communicate to the appropriate decision-making and legislative bodies the risks for financial stability stemming from sovereign exposures and their potential systemic impact.

Transitional arrangements for policy options

Any changes in regulation, in particular any changes in capital requirements, should allow for appropriate transition regimes. Such a regime should give the regulated institutions the time they need to adapt to the new regulation. It should also ensure that the impact of the change on markets and, in this case, on the sovereigns that rely on financial institutions and markets for funding, should be properly smoothed.

In designing transition arrangements, it will be important to take account of potential market reactions forcing financial institutions to adapt their strategies right away, regardless of what the regulation might say about transition. As an example of such front-running, markets have exerted pressure for the immediate application of the new rules for capital requirements relative to risk-weighted assets and liquidity regulation under Basel III. By contrast, there has been no front-running with respect to the leverage ratio regulation.

The various policy options considered by the expert group entail different transitional problems:

- *Removal of the carve-out and application of the standardised approach or non-zero risk floor (10% floor):* Countries such as Cyprus, France, Germany, Italy and Portugal seem to be particularly exposed to the application of the standardised approach. The results of the impact assessment suggest that the impact in terms of new capital requirements can be afforded by credit institutions through a possible phase-in period. Nevertheless, from a global point of view, the situation of sovereigns in some of these countries should be carefully assessed in order to introduce this type of measure, even with a smooth phase-in.
- *Diversification approach:* Sovereign exposures are not currently subject to a large exposures limit. The impact assessment shows that if the removal of the large exposure exemption and a 25% limit is suddenly introduced, the impact on the banking system would be huge. Countries like Germany would have more than €300 billion of sovereign exposures excess. Italian and Spanish banks would also be affected. The introduction of this type of measure would probably require a more prolonged phase-in period, along with a gradual introduction of the limit from the complete exemption to the current limit for non-sovereign exposures (25%). Interactions with liquidity standards should also be carefully considered (see Section 4.3.6.1).On a general note, this type of measure will immediately force banks to disinvest from the domestic sovereign market. At the current juncture, this would destabilise sovereign markets and lead to unintended consequences.
- *Enhanced Pillar 2 and disclosure requirements:* By their very nature, Pillar 2 requirements and disclosure rules can be more easily adapted to different circumstances and events. Transition may therefore pose fewer difficulties than for Pillar 1 requirements. The experience of autumn 2011 shows that, with Pillar 2 requirements as well as other rules, it is important to avoid sudden changes that increase fear and uncertainty in the system. The experience of the EBA stress tests shows both the benefits of adapting requirements to current developments in the financial system and the difficulties of doing so without an abruptness that market participants find difficult to deal with. Supervisors could work close to the regulated institutions to facilitate the transition and adoption of any supervisory measure. Instead of applying a rigid and one-size-fits-all approach for the transition, supervisors could discuss different plans with the institutions, taking into account their initial conditions and the particular characteristics of their financial markets. These actions are of central importance and should be discussed within the supervisory

colleges. One of the fundamental tasks for supervisory authorities as members of colleges is reaching joint decisions on the risk-based capital adequacy of cross-border groups and their EEA subsidiaries.

Potential options for managing the transition period

Depending on the policy options decided by the relevant bodies, all the above-mentioned considerations should be taken into account.

For Pillar 1 measures, a phase-in period would necessarily have to be foreseen. Depending on the type of measure, the gradual implementation (including possible preferential treatments for legacy exposures) should be done more or less smoothly. This period could be subject to calm market conditions for a prolonged period of time. There should also be a clear understanding about the extent to which banks individually and collectively would have to reduce their holdings of sovereign debt. In particular, it is important to understand to what extent, for banks collectively, reductions of sovereign holdings at the level of individual banks might be offset by increases elsewhere, as institutions increase the degree of cross-sovereign diversification in their holdings of sovereign debt. To the extent that banks would collectively reduce their holdings of sovereign debt, the question would be what market reactions will be needed to accommodate the "excess" government debt once the adjustment takes place. Specific commitments to tighter supervisory measures via enhanced Pillar 2 supervisory review and disclosure requirements should be designed and announced sufficiently in advance so as to ensure a smooth adjustment without any disruption to financial institutions and markets.

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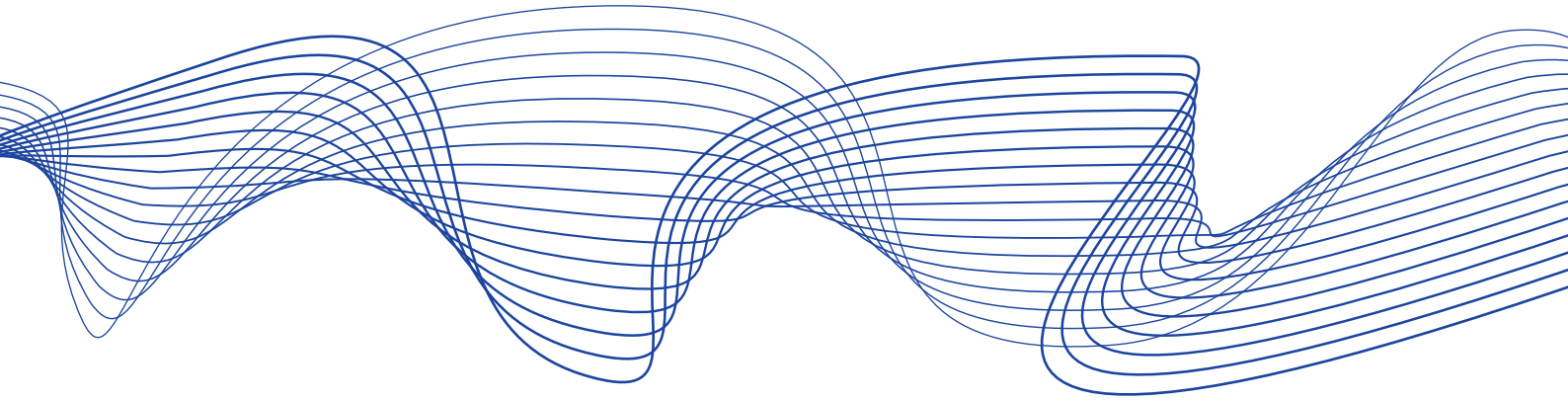
Technical appendix



Technical appendix

Annex 1 Preliminary data analysis and specification search for the estimation model

This annex presents the preliminary steps that lead to the specification of the VEC model estimated in the report and in Annex 2.

The first preliminary step is to control for the presence of unit roots in the data-generating process (DGP). Taking a conservative approach, augmented Dickey-Fuller (ADF) tests are carried out for all the time series and for all the sampled countries within regressions with two lags and a constant drift. The results, reported in Table A1, hint at a strong problem of unit roots in the German Bund yields (*bund_yield*), but weaker unit root concerns in time series for other domestic debt yields (*own_yield*) and, in particular, domestic sovereign exposures as a fraction of banks' total assets (*d_debt*): for Greece and Portugal, the null hypothesis of unit roots in both *d_debt* and *own_yield* may not be rejected at the 1% significance level and, for Italy and Spain, at the 5%; Ireland's domestic sovereign yields are also significantly affected by unit roots at the 1%, but its domestic debt does not display unit roots at any conventional significance level. As a side note, disregarding statistical evidence, on "a priori" grounds, it is not hard to see that sovereign exposures could hardly be non-stationary, being constrained to lie between zero and one.

The second preliminary step more specifically addresses lead-lag relationships in the data. A Granger causality test is carried out on the time series sampled (in levels). As a caveat, note that such a test only verifies the presence of pairwise causality between two variables, hence disregarding potential effects due to other factors. As shown in Table A2, the estimates reveal that for stressed euro area countries, the variables are deeply interconnected: the null hypothesis of no Granger causality is mostly rejected (at 1% significance level), in particular regarding the direction of causation from both *own_yield* and *bund_yield* to *d_debt*, as well as from *d_debt* to *own_yield*.

Table A1
Unit root tests

	***p*-values (H_0: Unit root)**	
	d_debt	***own_yield***
Greece	0.1323	1 .0000
Ireland	0.0007	0.1171
Italy	0.0103	0.0101
Spain	0.0507	0.0179
Portugal	0.9235	0.9928
Germany	X	0.1332

Red cells: may not reject H_0.
Yellow cells: reject H_0 at 5-10% level.
Green cells: reject H_0 at 1% level.

These two preliminary results indicate the presence of non-stationarity issues in the data and underscore the need to take into account the joint dynamics of domestic sovereign exposures, domestic sovereign yields and German sovereign yields. A VEC model appears to have the necessary flexibility to deal with

Table A2

Granger causality tests

		p-values (H_0: No Granger causality)				
Dependent	**Independent**	**Greece**	**Ireland**	**Italy**	**Spain**	**Portugal**
d_debt	*own_yield*	0.017	0.000	0.002	0.000	0.636
	bund_yield	0.101	0.006	0.000	0.000	0.000
	All	0.056	0.000	0.000	0.000	0.000
own_yield	*d_debt*	0.211	0.245	0.200	0.218	0.001
	bund_yield	0.001	0.003	0.124	0.081	0.000
	All	0.001	0.008	0.265	0.195	0.000
bund_yield	*d_debt*	0.008	0.021	0.031	0.048	0.205
	own_yield	0.001	0.000	0.001	0.001	0.002
	All	0.001	0.000	0.002	0.002	0.002

Note: Green cells support Granger causality from the independent to the dependent variable at the 1% significance level, yellow cells at the 5% and 10%, red cells do not support Granger causality at any standard significance level.

both of these issues. In order to determine its specifications, the focus is first on the evidence for stressed countries, which are the main targets of the empirical assessment because the domestic interest rate diverged from the German rate in these countries, thus opening up the potential for carry trades. The analysis is then extended to the other countries.

In searching for the correct specification of the VEC model, an analysis based on information criteria and likelihood ratios indicates that the VAR model should include between one and four lags: as reported in Table A3, for different countries, Hannan-Quinn (HQIC) and Bayesian information criteria (BIC), usually the most parsimonious criteria, oscillate between one and two lags, whereas Akaike information criterion (AIC) and likelihood ratio (LR) indicate four (and sometimes three) lags. In light of an ex-post Lagrange multiplier (LM) test for autocorrelation of residuals of a VECM (not reported), an error-correction version of a VAR(2) is opted for in order to achieve the best combination of simplicity and accuracy for the model.

Table A3

Model specification (IC and LR test)

	Optimal specification of VAR (number of lags)				
	Greece	**Ireland**	**Italy**	**Spain**	**Portugal**
LR	4	2	4	4	4
AIC	4	2	4	4	3
HQIC	1	1	1	1	2
BIC	1	1	1	1	2

Annex 2 Properties of a vector error-correction model estimated with sovereign exposures and bond yields

The specification search (see Annex 1) leads us to the following two-lag vector autoregression (VAR(2)) representation of a baseline model:

$$\begin{bmatrix} d\_debt_t \\ own\_yield_t \\ bund\_yield_t \end{bmatrix} = \mu + A_1 \begin{bmatrix} d\_debt_{t-1} \\ own\_yield_{t-1} \\ bund\_yield_{t-1} \end{bmatrix} + A_2 \begin{bmatrix} d\_debt_{t-2} \\ own\_yield_{t-2} \\ bund\_yield_{t-2} \end{bmatrix} + u_t \quad (1)$$

where d_debt_t is the sovereign exposure of country i's banks as a fraction of their total assets in month t, own_yield_t is country i's sovereign debt yield in month t, $bund\_yield_t$ is the German Bund yield in month t, $\mu = [\mu 1\ \mu 2\ \mu 3]$ are deterministic terms, $A1$ and $A2$ are the 3×3 matrices of the coefficients associated with the one-period and two-period lagged variables respectively, and $u_t = [u1_t\ u2_t\ u3t]$ are unobservable error terms (white noise processes with time-invariant, positive definite covariance matrix) associated with the ith equation of the system, for $i = 1, 2, 3$ respectively.

On the basis of the preliminary analysis of the data described in Annex 1, the three time series in the model are non-stationary and cointegrated. A VEC model is hence the preferred solution, when compared to a VAR approach (whether in levels or in differences).[1] The VEC representation of the baseline model (and equivalent to the VAR(2) model (1)) is given by

$$\begin{bmatrix} \Delta\, d\_debt_t \\ \Delta\, own\_yield_t \\ \Delta\, bund\_yield_t \end{bmatrix} = \mu + \Pi \begin{bmatrix} d\_debt_{t-1} \\ own\_yield_{t-1} \\ bund\_yield_{t-1} \end{bmatrix} + \Gamma \begin{bmatrix} \Delta\, d\_debt_{t-1} \\ \Delta\, own\_yield_{t-1} \\ \Delta\, bund\_yield_{t-1} \end{bmatrix} + u_t \quad (2)$$

where $\Delta x_t = x_t - x_{t-1}$, for $x_t = [d\_debt_t\ own\_yield_t\ bund\_yield_t]'$, the 3×3 matrix π contains the *long-run parameters*, and Γ is a 3×3 matrix with the *short-run parameters*. As usual, the analysis in this report focuses on the parameters describing the long-run relationships among the variables (i.e. the coefficients in the π matrix), which indicate how the dependent variables are related to the levels of the explanatory variables in the long-run equilibrium. The rank of π is referred to as the *cointegrating rank r* (i.e. the number of cointegrating relationships) of the model, and the matrix $\pi = \alpha\beta'$, where α is the $3 \times r$ matrix of the adjustment parameters and β is the $3 \times r$ *cointegration matrix*.

The cointegrating rank of the model, r, is identified through the Johansen test for cointegration. This step is crucial to impose the most suitable restrictions and identify the parameters of the error-correction term, which captures the adjustment of the dependent variables (i.e. current first-differences of *d_debt*, *own_yield* and *bund_yield*) towards their long-run equilibrium levels in response to changes in the lagged levels of the same variables. The Johansen test for cointegration reveals that $r = 1$ in the baseline model for all the stressed countries except Italy (where $r = 0$). The

1 See Annex 1 for details.

model is estimated using Johansen's (1995) maximum likelihood method. In order to produce consistent estimates of the cointegrating vector β, identifying restrictions must be imposed on its coefficients: in particular, if the cointegrating rank is r, then r^2 restrictions are needed to produce a just-identified cointegrating vector. The guiding principles for imposing restrictions on the cointegrating vector β are informed by econometric soundness as well as economic theory. First, from an econometric perspective, the standard restriction strategy suggested by Johansen (1995) assumes that the first part of β is an identity matrix, i.e. $\beta' = [I_r : \beta_1]$, where β_1 is a $(K\text{-}r)$ x r matrix, with K denoting the number of endogenous variables in the model. Johansen's strategy is deemed to be a conservative approach, notably when the model is small and the cointegrating rank is equal to 1. Second, from an economic perspective, identifying restrictions on β should be imposed so that the cointegration equation is economically meaningful. In this regard, normalising the coefficient on the dependent variable to 1 and estimating the remaining parameters seems to be the most sensible solution to the identification problem. Since the relationship of interest in the present study is the long-run effect of movements in domestic and German sovereign debt yields on banks' domestic sovereign exposures, a choice informed by economic sense is to constrain the cointegrating coefficient on *d_debt* to equal 1, and estimate the cointegrating parameters in β on *own_yield* and *bund_yield*.

The model is estimated for each country (except Germany) separately. The results of the estimation of the fully specified VEC model are reported in Table B1 for the stressed countries. The numbers reported in parenthesis below the coefficient estimates are *p*-values. Coefficients that are significantly different from zero at the 1%, 5% and 10% level feature three, two and one asterisks, respectively**. The estimates of the baseline model help to understand how this estimation framework lends itself to economic interpretation, although, for the purposes of the report, the full model provides the relevant evidence**.

The estimated long-run parameters in π indicate a significant effect of domestic and German yields on domestic sovereign debt exposures (at the 1%) for each stressed country. Moreover, the sign of every coefficient is consistent with the carry trade hypothesis: the *own_yield* variable carries a positive coefficient and the *bund_yield* variable a negative one, implying that either an increase in domestic yields or a decrease in German bund is associated with a higher long-run equilibrium level of the domestic sovereign exposure. For Portugal, there also appears to be a long-run positive effect running in the opposite direction: domestic sovereign yields are themselves significantly affected by lagged sovereign exposures, confirming that there are also feedback effects in the data from banks' sovereign exposures onto yields (as suggested by the Granger causality tests reported in Table A1 of Annex 1).

The baseline model also allows investigation of whether the evidence for carry trades extends beyond stressed countries, where differentials between domestic and foreign yields should have offered the greatest inducement to such trades. The report addresses this issue by extending to non-stressed countries the analysis carried out for stressed countries. Table B2 reports the estimates of the long-run parameters and of the cointegrating coefficients. The long-run parameters indicate that *own_yield* and *bund_yield* are significant determinants of *d_debt*, whereas the opposite relationship is not true. These are the same conclusions reached for stressed countries (except Portugal). However, the coefficients estimated are consistent with the carry trade hypothesis only for Austria, Belgium and Finland. In other non-stressed countries, most coefficients have the opposite sign. Second, the coefficients of the cointegrating equation

are not significantly different from zero, suggesting a lack of inner reciprocal causation among variables in the non-stressed countries, except for Austria and Belgium, where the estimates are consistent with the carry trade hypothesis.

To conclude, the estimates obtained from the baseline model are consistent with the carry trade hypothesis for stressed countries, and, to a lesser extent, for some non-stressed ones. In particular, the evidence for France and the Netherlands is not consistent with this hypothesis. However, this accords with expectations because the differentials between these countries' sovereign yields and the Bund yield provided little or no opportunity for carry trades.

The estimation of the baseline model is concluded by performing three important robustness checks. First, to test the stability of the estimates, the estimation is repeated separately for the period of the sovereign debt crisis and the pre-crisis period. Second, the statistical significance of *d_debt* in the long-run relationship is assessed and its robustness to different estimation samples is analysed. Third, since banks in stressed countries may not have been able to sell or short Bund positions to fund their investment in domestic sovereign debt, the previous specifications are re-estimated, replacing the Bund yield with the average cost of funding of the banking sector.

To perform the *first robustness check*, a preliminary step is to identify potential structural breaks in the dynamics of banks' sovereign exposures, domestic sovereign yields and German sovereign yield. Based on a simple visual check of Charts 3 and 11 of the report, a common pattern emerges for all stressed countries: between late 2008 and early 2009, both their government bond spreads and banks' domestic sovereign exposures started soaring. Therefore, a new regression is estimated separately for (i) the period from January 2000 to October 2008 (pre-crisis) and (ii) the period from November 2008 to March 2012 (crisis), to explore whether the estimates differ across them.

Tables B3 and B4 report the estimates of adjustment parameters, coefficients of cointegrating equations and long-run parameters in stressed countries for the crisis and pre-crisis periods respectively. The evidence of carry trades for Italy and Spain is significant in both sub-periods, whereas it is significant for Ireland and (to a lesser extent) for Greece only for the most recent period. Surprisingly, the evidence for Portugal accords with the carry trade hypothesis only in the pre-crisis period, while domestic sovereign exposures (as well as German sovereign yields) seem to drive domestic sovereign yields in Portugal during the crisis: increases in the former put upward pressure on the latter, hinting at a contagion effect from the banking sector's investment decisions to the government's funding costs.

To implement the *second robustness check*, the cointegration rank is computed for different countries as a function of the period considered (Table B5). For Austria, Belgium, Italy and Spain, the existence of cointegration depends on the inclusion of data from the crisis. In this sense, the long-run relationship reported in Table B1 is sensitive to the inclusion of this period.

Besides the question of whether there is a long-run relationship, there is the issue of whether *d_debt* has a significant coefficient on this relationship. Upon re-estimating the VEC imposing a unit coefficient on the *own_yield* variable, Table B6 finds that the coefficient on the *bund_yield* remains highly robust across countries and samples. Further, the sign and significance of the coefficient of *d_debt* depends on the sample. These findings are not surprising, considering the basic features of the time series under consideration. As illustrated in Figure 3 in the report, sovereign yields

are stable throughout the mid-2000s, while domestic exposures decrease in the first part of the decade and rise during the sovereign debt crisis. Hence, it is likely that the lack of significance for the cointegrating coefficient on *d_debt* in the first part of the sample is due to the exclusion of the period with the most significant dynamic patterns. In conclusion, sovereign holdings have definitely been in a long-run relationship with domestic and bund yields, at least since the beginning of the crisis. For the previous years, the evidence is weaker, but this could be due to statistical issues.

To perform the *third robustness check*, the obvious requirement is the availability of a sufficiently long monthly time series for the cost of funding of banks. Since such data were available only for Italy and Spain, the specification of the VEC model where the Bund yield is replaced by the banks' average cost of funding could be re-estimated only for these two countries. The results, which are reported and discussed below are, if anything, even more supportive of the carry trade hypothesis than those shown for Italy and Spain in Table B1: the long-run response of banks' sovereign exposures to the domestic sovereign yield is not only positive and significant, but stronger; the response to the cost of funding is negative and significant, and stronger for Italy, though weaker for Spain. The fact that the evidence is at least as supportive of the carry trade hypothesis as that of Table B1 is due to the fact that the average cost of funding for stressed-country and Belgian banks is almost always below the Bund yield (especially in 2009-10), so carry trades were in fact even more attractive than if funded at the German rate.

As already mentioned above, the data can reveal carry trades only in countries where domestic sovereign yields diverged appreciably from German yields, such as stressed countries and, to a lesser extent, non-stressed countries such as Belgium and Austria. This most likely explains why no response of domestic exposures for France and the Netherlands can be found in Table B2: French and Dutch yields barely differed from German ones for most of the sample period, as shown by Table B1.

However, we know from Figure 6 in the report that banks in non-stressed countries tended to *decrease* their exposure to stressed-country sovereign debt in 2011 and early 2012, while stressed-country banks greatly increased their domestic exposure. This points to an inherent difference between banks in the stressed countries and those in the non-stressed countries in managing their sovereign debt portfolios. The behaviour of banks in non-stressed countries suggests that banks might have perceived a large part of the increase in the yield of stressed-country sovereigns as arising from the risk of redenomination in the event of a collapse of the euro rather than pure country-level credit risk. Faced with such risk, banks that invest in domestic sovereign debt benefit from a natural hedge, since most of their liabilities are towards domestic residents. This may explain why, in the aggregate, non-stressed countries' banks divested from stressed-country debt and went for their own sovereign debt rather than engaging in carry trades: for them, redenomination risk was too high for comfort, so they reduced their exposure.

Battistini, Pagano and Simonelli (2014), indeed, provide evidence that is consistent with this account. They decompose sovereign yield differentials in one arising from common (or systemic) risk and another reflecting country-level credit risk, and then estimate on 2008-2012 data a VEC model that relates the dynamics of domestic sovereign exposures to that of these two factors. They find that (i) in stressed countries, banks respond to increases in country risk by increasing their domestic exposure, while in non-stressed countries they do not; and (ii) in contrast, in most euro

area countries, banks respond to an increase in the common risk factor by raising their domestic exposures. Finding (i) is consistent with the idea that the carry trade hypothesis applies essentially to banks in stressed countries, while finding (ii) indicates that, when systemic risk increases, all euro area banks tend to increase the home bias of their portfolios, making the euro area sovereign market more segmented. For non-stressed countries, however, the effect of systemic risk was the prevalent one.

The baseline model estimated so far does not allow domestic sovereign exposures to also respond to other macroeconomic factors, such as industrial production and unemployment rates. The empirical analysis cannot be considered reliable and complete without including these variables.

Table B1

VECM estimates for stressed euro area countries (full sample)

			Greece	Ireland	Italy	Spain	Portugal
B	*d_debt*		1.000	1.000	1.000	1.000	1.000
	own_yield		37.743***	-0.121**	-2.828**	-5.086***	0.546***
			0.001	*0.029*	*0.011*	*0.000*	*0.000*
	bund_yield		-39.224***	0.319***	3.245***	4.746***	-1.802***
			0.004	*0.005*	*0.001*	*0.000*	*0.000*
	Constant		-4,285.323	-110.173*	-599.269	-65.873	375.918**
			0.305	*0.060*	*0.229*	*0.899*	*0.018*
A	Δ *d_debt*		0.007***	-0.056***	-0.023***	-0.017***	0.017***
			0.000	*0.000*	*0.000*	*0.000*	*0.001*
	Δ *own_yield*		-0.001	-0.086	-0.002	-0.003	0.101***
			0.235	*0.157*	*0.716*	*0.579*	*0.000*
	Δ *bund_yield*		0.000	-0.033	0.001	0.003	-0.001
			0.724	*0.324*	*0.816*	*0.460*	*0.889*
π	Δ *d_debt*	lag 1 *d_debt*	0.007***	-0.056***	-0.023***	-0.017***	0.017***
			0.000	*0.000*	*0.000*	*0.000*	*0.001*
		lag 1 *own_yield*	0.275***	0.007***	0.066***	0.085***	0.009***
			0.000	*0.000*	*0.000*	*0.000*	*0.001*
		lag 1 *bund_yield*	-0.285***	-0.018***	-0.076***	-0.079***	-0.031***
			0.000	*0.000*	*0.000*	*0.000*	*0.001*
		Constant	-31.190***	6.118***	14.006***	1.097***	6.503***
			0.000	*0.000*	*0.000*	*0.000*	*0.001*
	Δ *own_yield*	lag 1 *d_debt*	-0.001	-0.086	-0.002	-0.003	0.101***
			0.235	*0.157*	*0.716*	*0.579*	*0.000*
		lag 1 *own_yield*	-0.036	0.010	0.007	0.013	0.055***
			0.235	*0.157*	*0.716*	*0.579*	*0.000*
		lag 1 *bund_yield*	0.037	-0.027	-0.008	-0.013	-0.182***
			0.235	*0.157*	*0.716*	*0.579*	*0.000*
		Constant	4.041	9.486	1.414	0.174	38.053***
			0.235	*0.157*	*0.716*	*0.579*	*0.000*
	Δ *bund_yield*	lag 1 *d_debt*	0.000	-0.033	0.001	0.003	-0.001
			0.724	*0.324*	*0.816*	*0.460*	*0.889*
		lag 1 *own_yield*	-0.010	0.004	-0.003	-0.015	-0.001
			0.724	*0.324*	*0.816*	*0.460*	*0.889*
		lag 1 *bund_yield*	0.010	-0.011	0.004	0.014	0.002
			0.724	*0.324*	*0.816*	*0.460*	*0.889*
		Constant	1.099	3.625	-0.738	-0.191	-0.374
			0.724	*0.324*	*0.816*	*0.460*	*0.889*
	Obs.		118	145	145	145	145

Table B2

VECM estimates for non-stressed euro area countries (full sample)

			Austria	Belgium	Finland	France	Netherlands
B	*d_debt*		1.000	1.000	1.000	1.000	1.000
	own_yield		-3.594***	-3.396	-1.158	0.098	0.650
			0.000	*0.297*	*0.766*	*0.986*	*0.501*
	bund_yield		3.748***	6.042**	1.786	3.231	-0.196
			0.000	*0.022*	*0.632*	*0.494*	*0.829*
	Constant		-96.523	-1110.240	-207.295	-1321.242**	-296.260***
			0.496	*0.186*	*0.555*	*0.037*	*0.000*
A	*Δd_debt*		-0.029***	-0.014***	-0.021***	-0.008***	-0.045***
			0.000	*0.000*	*0.000*	*0.000*	*0.000*
	Δown_yield		-0.016	0.001	-0.011*	-0.007*	-0.030
			0.134	*0.595*	*0.068*	*0.090*	*0.191*
	Δbund_yield		-0.016	0.001	-0.010	-0.005	-0.031
			0.148	*0.797*	*0.110*	*0.231*	*0.170*
Π	*Δd_debt*	lag 1 *d_debt*	-0.029***	-0.014***	-0.021***	-0.008***	-0.045***
			0.000	*0.000*	*0.000*	*0.000*	*0.000*
		lag 1 *own_yield*	0.104***	0.049***	0.025***	-0.001***	-0.030***
			0.000	*0.000*	*0.000*	*0.000*	*0.000*
		lag 1 *bund_yield*	-0.109***	-0.087***	-0.038***	-0.024***	0.009***
			0.000	*0.000*	*0.000*	*0.000*	*0.000*
		Constant	2.800***	16.036***	4.443***	9.969***	13.459***
			0.000	*0.000*	*0.000*	*0.000*	*0.000*
	Δown_yield	lag 1 *d_debt*	-0.016	0.001	-0.011*	-0.007	-0.030
			0.134	*0.595*	*0.068*	*0.090*	*0.191*
		lag 1 *own_yield*	0.059	-0.004	0.013*	-0.001	-0.019
			0.134	*0.595*	*0.068*	*0.090*	*0.191*
		lag 1 *bund_yield*	-0.061	0.008	-0.019*	-0.021	0.006
			0.134	*0.595*	*0.068*	*0.090*	*0.191*
		Constant	1.573	-1.437	2.247*	8.727	8.776
			0.134	*0.595*	*0.068*	*0.090*	*0.191*

Table B2 (continued)

VECM estimates for non-stressed euro area countries (full sample)

			Austria	Belgium	Finland	France	Netherlands
	Δbund_yield	lag 1 *d_debt*	-0.016	0.001	-0.010	-0.005	-0.031
			0.148	*0.797*	*0.110*	*0.231*	*0.170*
		lag 1 *own_yield*	0.057	-0.002	0.011	0.000	-0.020
			0.148	*0.797*	*0.110*	*0.231*	*0.170*
		lag 1 *bund_yield*	-0.059	0.003	-0.017	-0.015	0.006
			0.148	*0.797*	*0.110*	*0.231*	*0.170*
		Constant	1.531	-0.638	1.975	6.296	9.111
			0.148	*0.797*	*0.110*	*0.231*	*0.170*
Obs.			145	145	145	145	145

Table B3

VECM estimates for stressed euro area countries (crisis)

			Greece	Ireland	Italy	Spain	Portugal
B	*d_debt*		1.000	1.000	1.000	1.000	1.000
	own_yield		-0.088	-0.047***	-0.324	-0.472*	0.450*
			0.741	*0.000*	*0.272*	*0.081*	*0.056*
	bund_yield		1.070***	0.403***	1.370***	1.207***	1.218
			0.000	*0.000*	*0.000*	*0.000*	*0.282*
	Constant		-1,011.820***	-157.618***	-876.679***	-633.556***	-619.306
			0.000	*0.000*	*0.000*	*0.001*	*0.162*
A	*Δd_debt*		-0.636***	-0.227***	-0.126***	-0.124***	0.021
			0.001	*0.000*	*0.000*	*0.000*	*0.101*
	Δown_yield		-0.425***	-2.001***	-0.039	-0.073	0.163***
			0.008	*0.004*	*0.592*	*0.334*	*0.000*
	Δbund_yield		-0.035	-0.227	-0.018	0.017	-0.016
			0.810	*0.450*	*0.738*	*0.750*	*0.264*
Π	*Δd_debt*	lag 1 *d_debt*	-0.636***	-0.227***	-0.126***	-0.124***	0.021
			0.001	*0.000*	*0.000*	*0.000*	*0.101*
		lag 1 *own_yield*	0.056***	0.011***	0.041***	0.059***	0.009
			0.001	*0.000*	*0.000*	*0.000*	*0.101*
		lag 1 *bund_yield*	-0.680***	-0.092***	-0.172***	-0.150***	0.025
			0.001	*0.000*	*0.000*	*0.000*	*0.101*
		Constant	643.388***	35.819***	110.299***	78.759***	-12.918
			0.001	*0.000*	*0.000*	*0.000*	*0.101*

Table B3 (continued)

VECM estimates for stressed euro area countries (crisis)

		Greece	Ireland	Italy	Spain	Portugal
Δ*own_yield*	lag 1 *d_debt*	-0.425***	-2.001***	-0.039	-0.073	0.163***
		0.008	*0.004*	*0.592*	*0.334*	*0.000*
	lag 1 *own_yield*	0.037***	0.095***	0.012	0.034	0.073***
		0.008	*0.004*	*0.592*	*0.334*	*0.000*
	lag 1 *bund_yield*	-0.454***	-0.807***	-0.053	-0.088	0.198***
		0.008	*0.004*	*0.592*	*0.334*	*0.000*
	Constant	429.785***	315.398***	33.823	46.138	-100.745***
		0.008	*4,9*	*0.592*	*0.334*	*0.000*
Δ*bund_yield*	lag 1 *d_debt*	-0.035	-0.227	-0.018	0.017	-0.016
		0.810	*0.450*	*0.738*	*0.750*	*0.264*
	lag 1 *own_yield*	0.003	0.011	0.006	-0.008	-0.007
		0.810	*0.450*	*0.738*	*0.750*	*0.264*
	lag 1 *bund_yield*	-0.038	-0.092	-0.024	0.020	-0.020
		0.810	*0.450*	*0.738*	*0.750*	*0.264*
	Constant	35.607	35.839	15.475	-10.663	10.144
		0.810	*0.450*	*0.738*	*0.750*	*0.264*
Obs.		15	42	42	42	42

Table B4

VECM estimates for stressed euro area countries (pre-crisis)

			Greece	Ireland	Italy	Spain	Portugal
B	*d_debt*		1.000	1.000	1.000	1.000	1.000
	own_yield		8.610	-0.124	12.892	-31.574**	-64.270**
			0.233	*0.867*	*0.109*	*0.045*	*0.017*
	bund_yield		12.312	-0.047	-17.624**	35.028*	91.916***
			0.186	*0.955*	*0.045*	*0.056*	*0.004*
	Constant		64.755	36.982	829.273*	-1,069.393	-10,077.380***
			0.947	*0.560*	*0.063*	*0.372*	*0.000*
A	Δ *d_debt*		-0.004	-0.083***	0.020**	-0.013***	-0.004***
			0.729	*0.000*	*0.034*	*0.000*	*0.000*
	Δ *own_yield*		-0.005	-0.052	0.018**	-0.001	-0.003**
			0.160	*0.257*	*0.030*	*0.632*	*0.048*
	Δ *bund_yield*		0.000	-0.038	0.021**	-0.001	-0.003**
			0.960	*0.411*	*0.011*	*0.669*	*0.030*
π	Δ *d_debt*	lag 1 *d_debt*	-0.004	-0.083***	0.020**	-0.013***	-0.004***
			0.729	*0.000*	*0.034*	*0.000*	*0.000*
		lag 1 *own_yield*	-0.033	0.010***	0.262**	0.410***	0.238***
			0.729	*0.000*	*0.034*	*0.000*	*0.000*
		lag 1 *bund_yield*	0.047	0.004***	-0.358**	-0.455***	-0.340
			0.729	*0.000*	*0.034*	*0.000*	*0.000*
		Constant	0.246	-3.054***	16.860**	13.887***	37.251
			0.729	*0.000*	*0.034*	*0.000*	*0.000*
	Δ *own_yield*	lag 1 *d_debt*	-0.005	-0.052	0.018**	-0.001	-0.003**
			0.160	*0.257*	*0.030*	*0.632*	*0.048*
		lag 1 *own_yield*	-0.040	0.006	0.228**	0.044	0.164**
			0.160	*0.257*	*0.030*	*0.632*	*0.048*
		lag 1 *bund_yield*	0.057	0.002	-0.311**	-0.049	-0.235**
			0.160	*0.257*	*0.030*	*0.632*	*0.048*
		Constant	0.298	-1.922	14.653**	1.503	25.787**
			0.160	*0.257*	*0.030*	*0.632*	*0.048*
	Δ *bund_yield*	lag 1 *d_debt*	0.000	-0.038	0.021**	-0.001	-0.003**
			0.960	*0.411*	*0.011*	*0.669*	*0.030*
		lag 1 *own_yield*	-0.001	0.005	0.267**	0.040	0.180**
			0.960	*0.411*	*0.011*	*0.669*	*0.030*
		lag 1 *bund_yield*	0.002	0.002	-0.365**	-0.044	-0.258**
			0.960	*0.411*	*0.011*	*0.669*	*0.030*
		Constant	0.011	-1.420	17.195**	1.352	28.267**
			0.960	*0.411*	*0.011*	*0.669*	*0.030*
	Obs.		103	103	103	103	103

Table B5

Cointegration rank of the vector error correction model for different samples

	200512	200612	200712	200812	200912	201012	201112	201203
Austria	0	0	0	0	1	1	1	1
Belgium	0	0	0	0	1	1	1	1
Spain	1	1	1	2	1	1	1	1
France	2	1	1	0	0	0	0	0
Finland	0	1	0	0	0	0	0	0
Greece	0	1	1	1	0	1		
Ireland	1	1	1	1	1	2	2	1
Italy	0	0	0	0	0	0	1	0
Netherlands	1	2	1	1	1	1	1	1
Portugal	0	1	1	1	1	1	2	1

Note: The initial date of the samples is January 2000 in all cases. The final date is reported in the headings of the columns.

Table B6

Parameter estimates of the long-run relationship in a VEC model

a) Bund yield

	2005	2006	2007	2008	2009	2010	2011	2012
Austria	-1.21***	-1.07***	-1.22***	-1.21***	-0.62*	-1.25***	-1.16***	-1.06***
Belgium	-1.15***	-1.04***	-1.19***	-1.28***	-0.71***	-1.47***	-1.27***	-1.29***
Spain	-1.36***	-1.46***	-1.32***	-1.27***	-1.01***	-1.09***	-0.94***	-1.10***
France	-1.14***	-1.14***	-1.09***	-1.09***	-0.48	-1.24***	-0.90***	-1.67***
Finland	-1.27***	-1.05***	-1.05***	-1.15***	-2.76***	0.45	-2.85*	3.49
Greece	-1.57***	-1.05***	-0.91***	-1.12***	-1.13***	-0.76**		
Ireland	-0.79***	-0.60***	-0.57***	-0.91***	-0.79***	-0.57	-0.98***	-1.96**
Italy	-1.95***	-2.17***	-1.34***	-1.22***	-0.98***	-2.07***	-1.81***	-1.31***
Netherlands	-1.07***	-1.02***	-1.04***	-1.10***	-1.13***	-0.96***	-0.32	-0.58**
Portugal	-1.39***	-1.19***	-1.25***	-1.38***	-1.46***	-1.51***	-2.25***	-1.31***
b) Domestic debt								
Austria	-0.05	-0.12***	0.01	0.00	-0.65***	-0.09	-0.15*	-0.28***
Belgium	-0.03*	-0.04**	0.00	0.01	-0.10***	0.02	-0.06	-0.08
Spain	0.03	0.12***	0.04*	0.02	-0.05***	-0.03	-0.13***	-0.19**
France	0.07**	0.15***	0.04	0.03*	-1.60***	0.32***	0.45**	-0.47
Finland	0.00	-0.05***	-0.05***	-0.02	0.27	-0.33**	-0.68	1.54
Greece	0.03	0.00	0.00	0.02	-0.05***	0.02		
Ireland	-0.97***	-1.39***	-1.38***	-0.94***	-1.41***	-3.39***	-1.56***	-8.20***
Italy	0.67***	0.88***	0.15***	0.05	-0.07**	0.50***	-0.40	-0.01
Netherlands	-0.17***	-0.38***	-0.20***	-0.08**	-0.37***	1.27***	1.62***	1.50***
Portugal	0.01	-0.14**	-0.12	-0.01	-0.11	-0.30	0.46**	0.37

Note: An error correction model has been estimated for own_yield, bund_yield and domestic_debt, whose cointegration relationship is own _yield bund + α bund_yield + β domestic _debt.
The model in levels allows for two lags. Panel (a) reports the estimates of a as a function of the sample size, while Panel (b) reports the values for b. The initial date of the samples is January 2000 in all cases. The final date is reported in the headings of the columns.

A further robustness check: an alternative specification of the VEC model, replacing the German Bund yield with measures of banks' funding costs

This section reports the results of an alternative specification of the VEC model described above for stressed countries and Belgium.

This specification aims to ascertain whether banks perceive domestic sovereign debt as a profitable investment when their funding market conditions worsen, with the result that their levels of sovereign exposures increase. In particular, the analysis focuses on the interconnections among domestic sovereign exposures, domestic sovereign yields and a weighted average of funding costs for domestic banks,[2] which replaces German bund yields. For the sake of comparability, the estimated model with funding costs has the same specification as that with German yields, i.e. a VECM representation of a VAR(2).

Owing to data availability, the VECM regressions are carried out for the period January 2006 to March 2012 and only for selected countries, namely the Banca d'Italia and the Banco de España, which provided monthly data on the funding costs of their banking sectors. Table B7 shows the estimated adjustment parameters, cointegration coefficients and long-run parameters.

For both countries, the cointegrating parameters are significant, indicating significant interconnections among the variables; the adjustment parameters indicate that sovereign exposures react significantly to movements in the independent variables in both countries, but Italy and Spain feature different feedback effects, indicating significant responses by bank funding costs and domestic sovereign yields to changes in independent variables. The long-run parameters (in the P matrix) that capture the response of banks' sovereign exposures to the independent variables show a positive response to sovereign yields and a negative one to the average funding cost, again in line with the carry trade hypothesis. The feedback effects instead differ. In Italy, higher sovereign exposures appear to exert upward pressure on long-run equilibrium funding costs, possibly reflecting the fact that larger sovereign exposures increase the perceived riskiness of banks and thus raise the interest rate at which they can raise funds. This effect appears absent in Spain, where higher sovereign exposures seem to be associated with upward pressure on long-run equilibrium yields. One possible interpretation of this finding is that greater bank exposures increase the perceived riskiness of banks and thus raise the likelihood of future bank recapitalisations by the government, which in turn induces investors to require a higher yield on sovereign debt.

2 Source of data. In Table B1, the weighted average of funding costs is represented by fund_cost.

Table B7

VECM estimates for Italy and Spain

			Italy	Spain
β	*d_debt*		1.000	1.000
	own_yield		-0.838***	-1.516***
			0.000	*0.000*
	fund_cost		0.59592***	0.85314**
			0.000	*0.011*
	Constant		-317.917***	52.823
			0.000	*0.564*
α	Δ*d_debt*		-0.158***	-0.071**
			0.000	*0.022*
	Δ*own_yield*		0.084	0.1552**
			0.250	*0.012*
	Δ*fund_cost*		0.05***	0.0135
			0.009	*0.744*
π	Δ*d_debt*	lag 1 *d_debt*	-0.158***	-0.031**
			0.000	*0.022*
		lag 1 *own_yield*	0.132***	0.104**
			0.000	*0.022*
		lag 1 *fund_cost*	-0.094***	-0.040**
			0.000	*0.022*
		Constant	50.255***	-20.758**
			0.000	*0.022*
	Δ*own_yield*	lag 1 *d_debt*	0.084	0.019**
			0.250	*0.012*
		lag 1 *own_yield*	-0.070	-0.064**
			0.250	*0.012*
		lag 1 *fund_cost*	0.050	0.025**
			0.250	*0.012*
		Constant	-26.595	12.863**
			0.250	*0.012*
	Δ*fund_cost*	lag 1 *d_debt*	0.05	-0.002
			0.009	*0.744*
		lag 1 *own_yield*	-0.04	0.007
			0.009	*0.744*
		lag 1 *fund_cost*	0.029***	-0.003
			0.009	*0.744*
		Constant	-15.3***	-1.393
			0.009	*0.744*
Observations			73	73

Annex 3 Impulse response functions of the country-by-country vector error-correction estimations

To visually assess the response of sovereign exposures to unexpected changes in yields and in macroeconomic variables, it is worth looking at the (orthogonalised) impulse response functions (IRFs) in levels of *d_debt* with respect to the explanatory variables of the system. Charts C1-C4 show the long-run effects on *d_debt* of shocks originating in *spread*, *ip* and *unemp* in the macro-augmented model for the stressed countries and Belgium.

As illustrated by Chart C1, the net effect of shocks in yields, as represented by shocks in *spread*, is consistent with the presence of carry trades: an increase in the yield spread is associated with a rise in banks' investments in domestic sovereign debt. In all stressed countries, *d_debt* is positively affected by disturbances originating in *spread*. The IRFs also help to assess whether the signs of the short-run parameters of *own_yield* and *bund_yield* contradict the carry trade hypothesis. The IRFs show that the short-run effects are indeed consistent with Italian and Greek banks increasing their domestic exposures in response to a positive shock to the yield differential, except for a small blip in the opposite direction for the first two to four months depending on the specification. This evidence is arguably consistent with the aforementioned interpretation on the delayed implementation of portfolio decisions of banks reacting to sudden changes in market conditions. The brief negative response of domestic exposures to a positive shock in yield differentials most likely reflects the mechanical negative effect that a higher domestic yield has on the market value of the banks' sovereign debt holdings, an effect which is then gradually overcome by the adjustment in the banks' nominal holdings.

The deficit absorption hypothesis appears consistent with the dynamic response of domestic sovereign exposures only for some of the countries being considered. The response of sovereign exposures (*d_debt*) to an increase in industrial production (*ip*) is consistent with this hypothesis for Belgium, Ireland and Spain, but not for Greece and Italy. Also, a shock in *unemp* elicits no response in domestic sovereign exposures in Belgium and Italy.

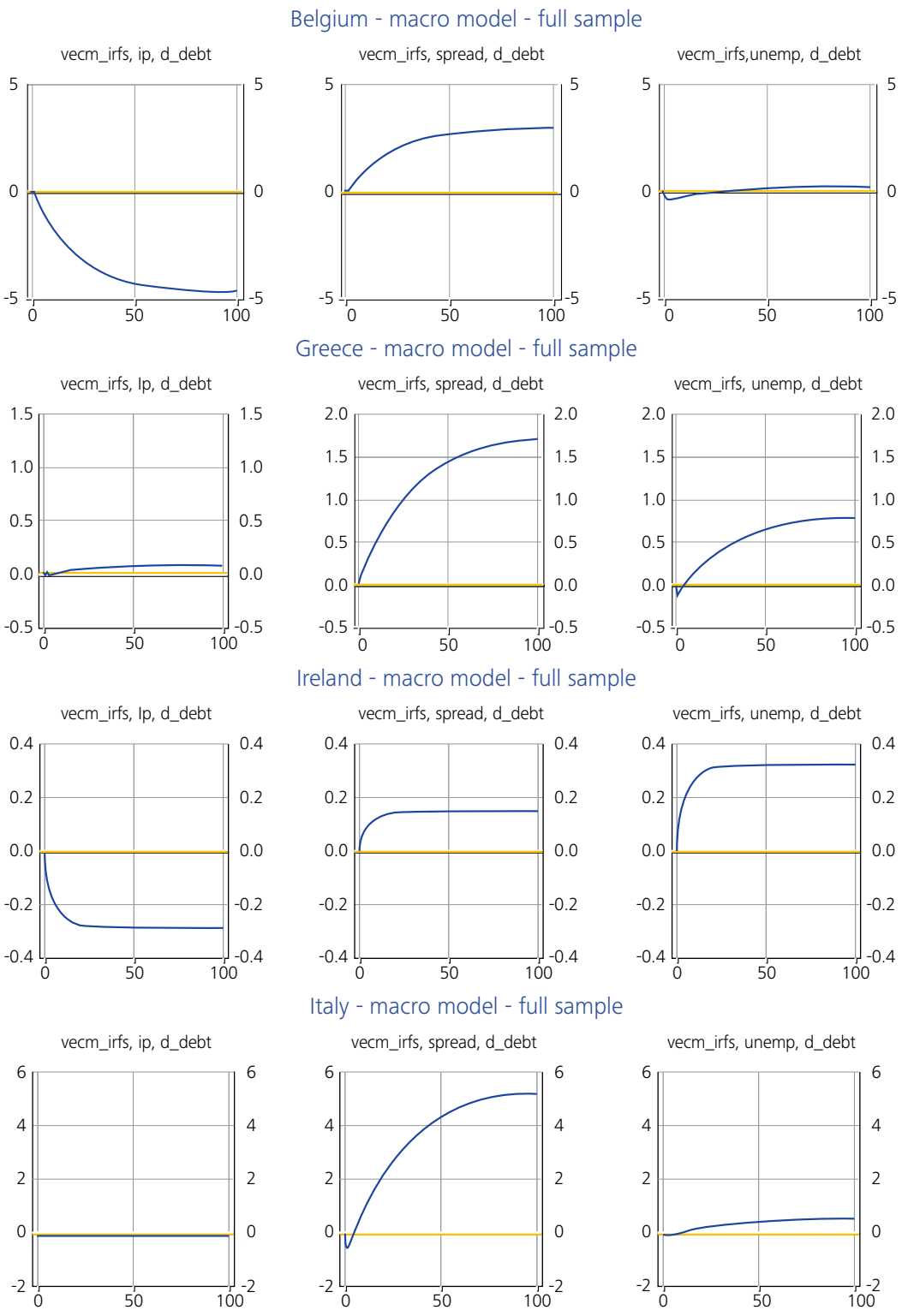
The feedbacks among the different system variables are shown in Charts C1-C4. A shock to banks' sovereign exposures appears to have little impact on yield differentials, except for Italy, where it triggers a considerable reduction in the spread, as one would expect; a similar but weaker response is observed in Spain. The effect of an increase in banks' sovereign debt holdings on macroeconomic variables is more surprising: in Belgium, Ireland, Portugal and Spain, an increase in banks' sovereign exposures is associated with a subsequent drop in industrial production and an increase in the unemployment rate, with Italy being the exception. This recessionary effect of an increase in banks' sovereign exposures may reflect the crowding-out of bank loans to the private sector resulting from greater lending to the domestic government. Hence, even accepting the deficit absorption view that banks tend to expand their domestic sovereign exposures in recessions, in most countries this behaviour appears to aggravate the recession rather than relieving it.

On the basis of the evidence presented in this subsection, the positive response of sovereign exposures to the differential between domestic and German yields by the banks of stressed countries gains a solid theoretical and empirical validation, while the deficit absorption hypothesis does not seem to be equally consistent with the data, at least not for all the stressed euro area countries.

Chart C1

Orthogonalised IRFs in the macro-augmented model (d_debt)

(Graphs by irfname, impulse variable, and response variable)



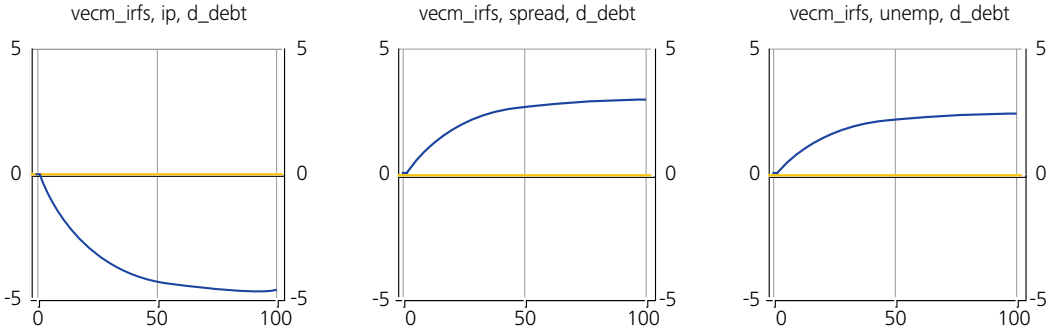
Note: The response variable is d_debt. The impulses are due to ip, spread and unemp (in that order).

Chart C1 (continued)

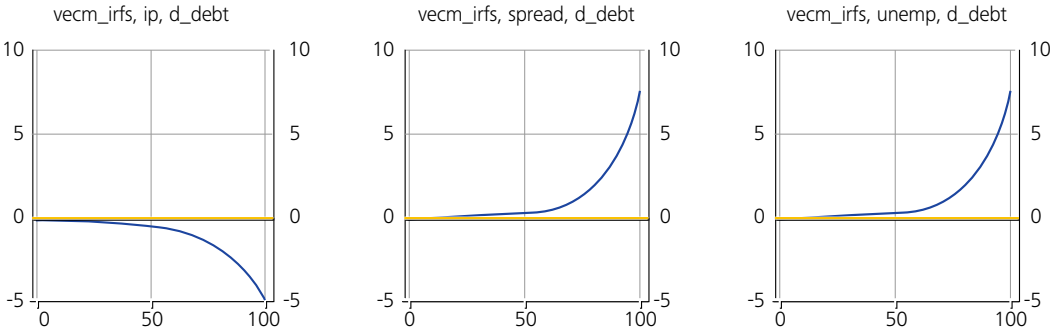
Orthogonalised IRFs in the macro-augmented model (d_debt)

(Graphs by irfname, impulse variable, and response variable)

Spain - macro model - full sample



Portugal - macro model - full sample

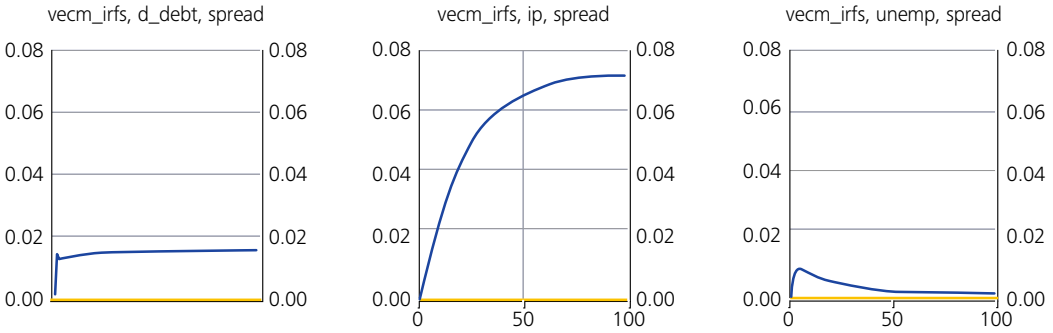


Note: The response variable is d_debt. The impulses are due to ip, spread and unemp (in that order).

Chart C2

Orthogonalised IRFs in the macro-augmented model (spread)

Belgium - macro model - full sample



Greece - macro model - full sample

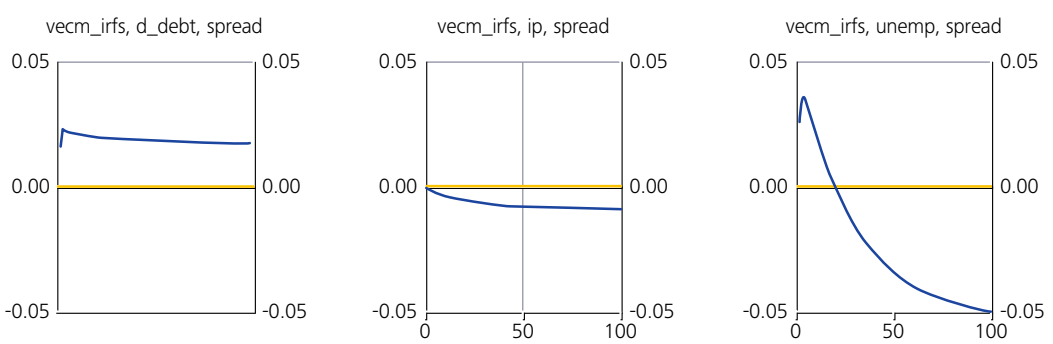
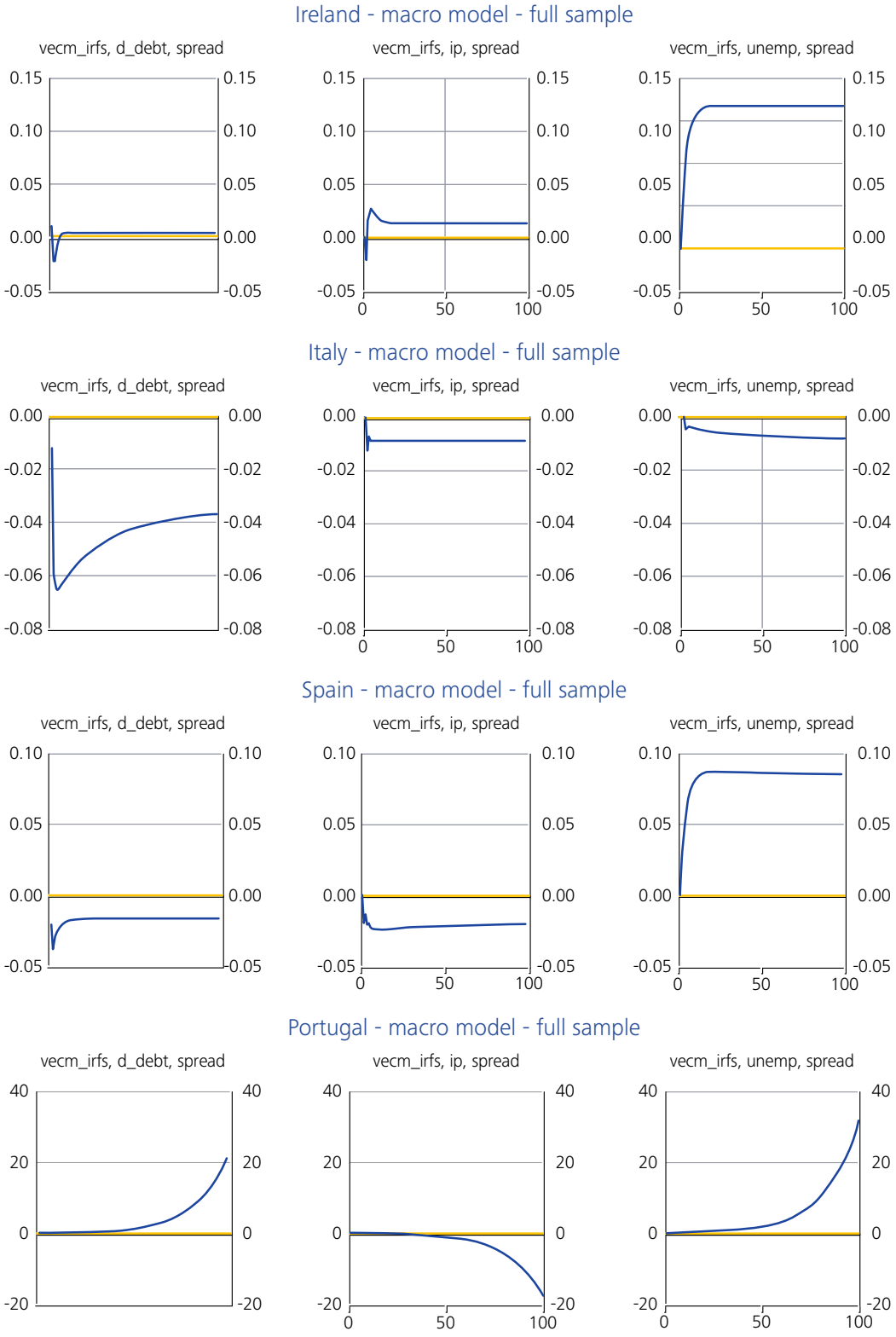


Chart C2 (continued)

Orthogonalised IRFs in the macro-augmented model (spread)



Note: The response variable is spread. The impulses are due to d_debt, ip and unemp (in that order).

Chart C3

Orthogonalised IRFs in the macro-augmented model (ip)

(Graphs by irfname, impulse variable, and response variable)

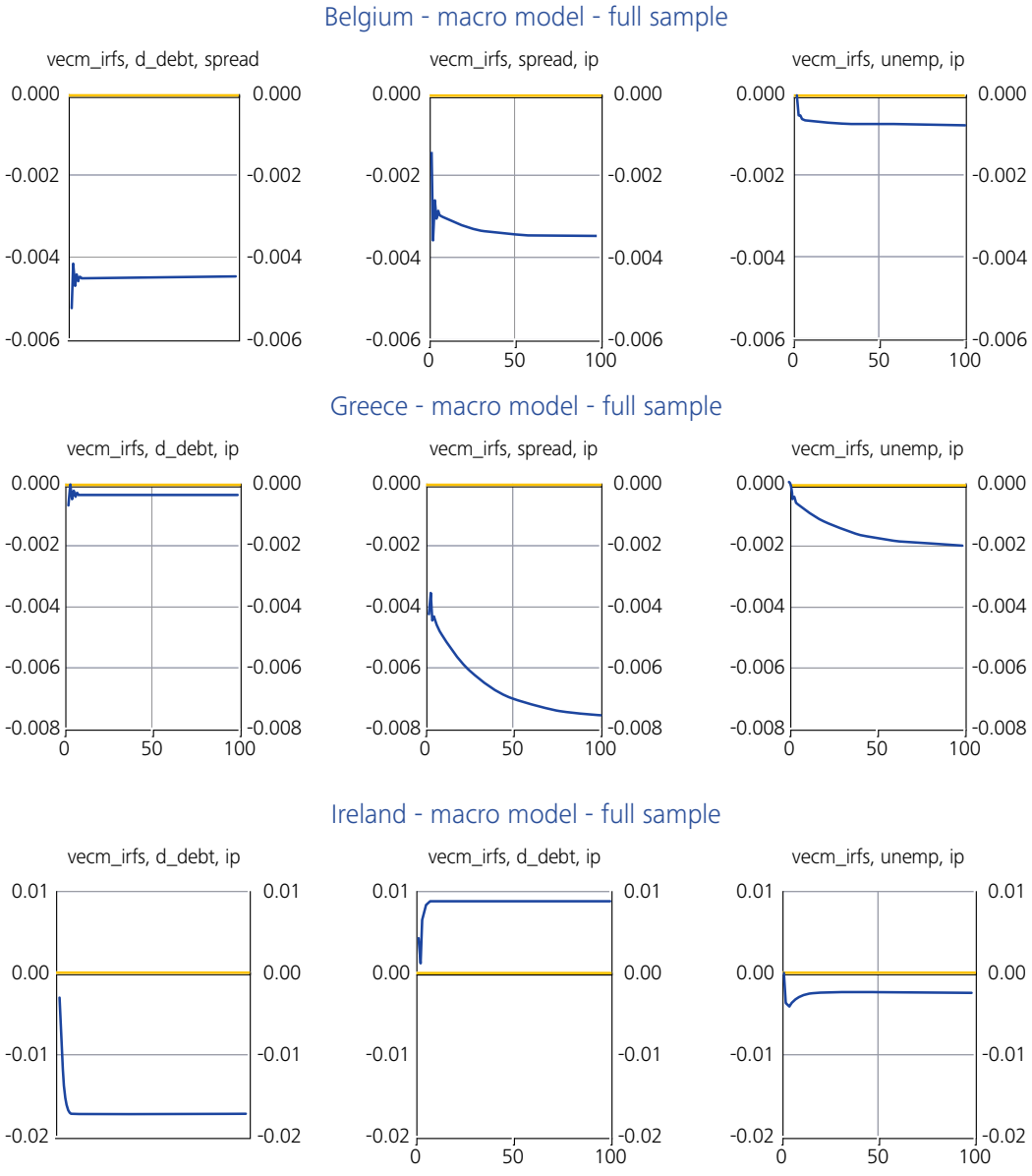
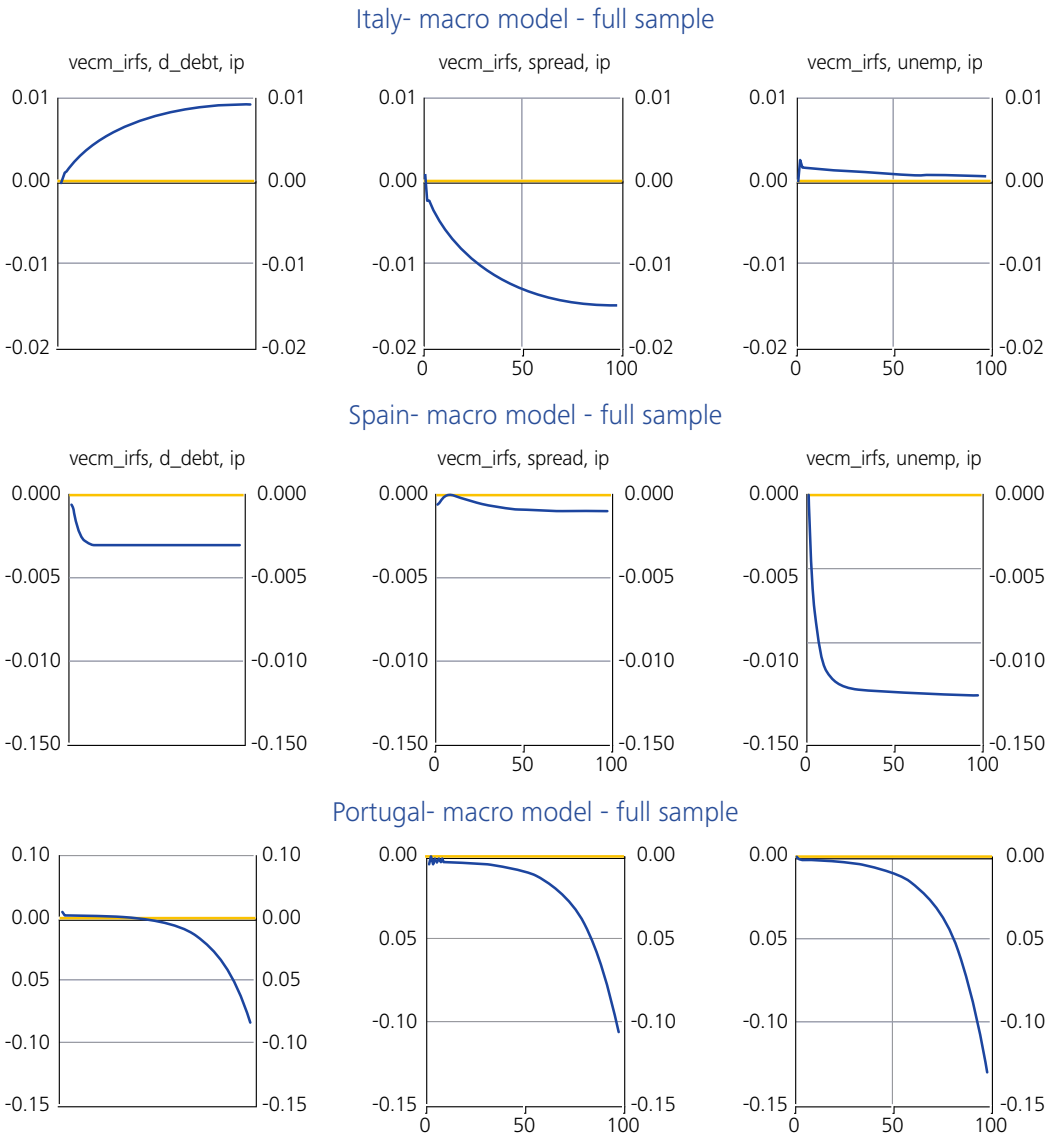


Chart C3 (continued)

Orthogonalised IRFs in the macro-augmented model (ip)

(Graphs by irfname, impulse variable, and response variable)



Note: The response variable is ip. The impulses are due to d_debt, spread and unemp (in that order).

Chart C4

Orthogonalised IRFs in the macro-augmented model (unemp)

(Graphs by irfname, impulse variable, and response variable)

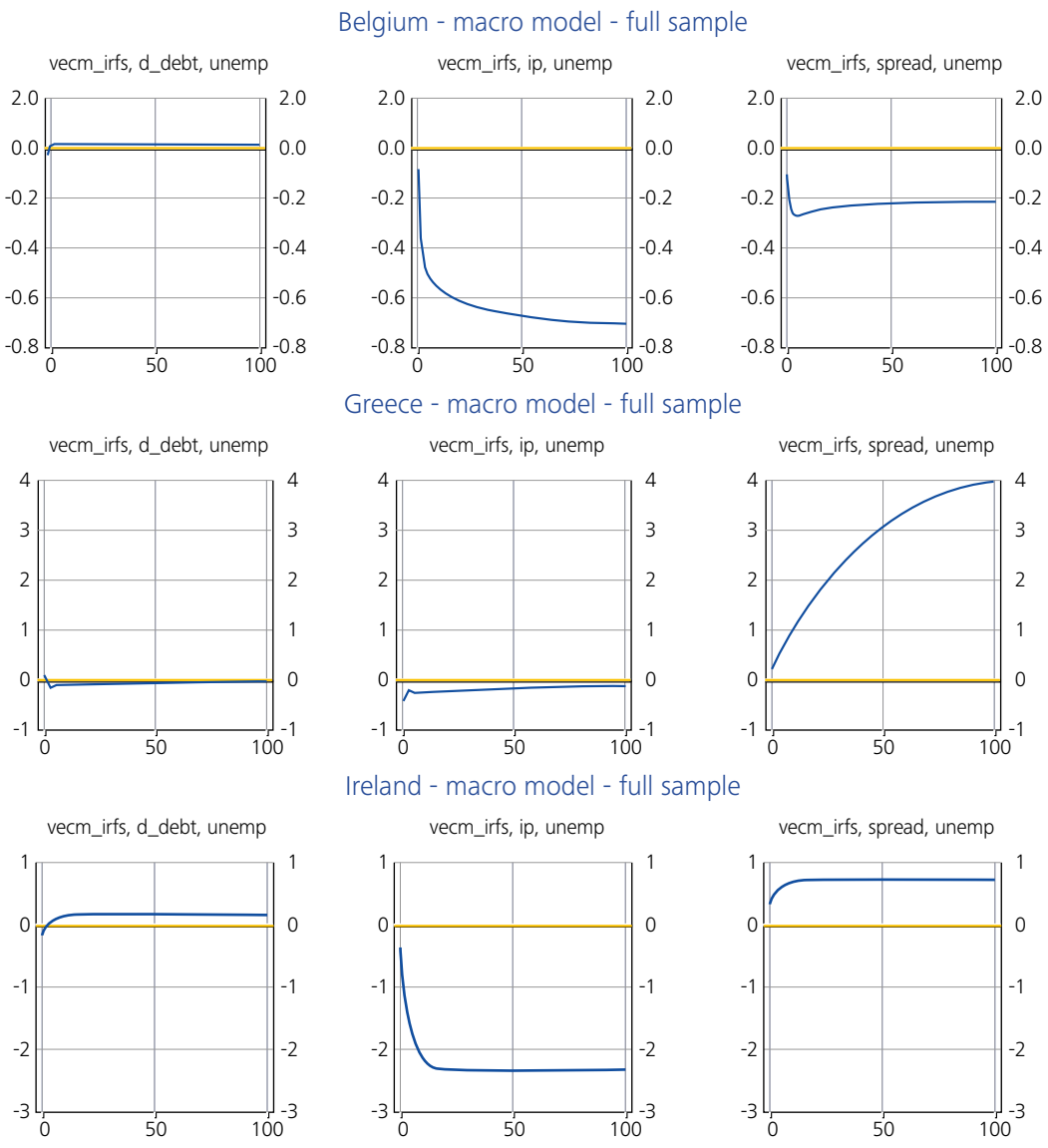
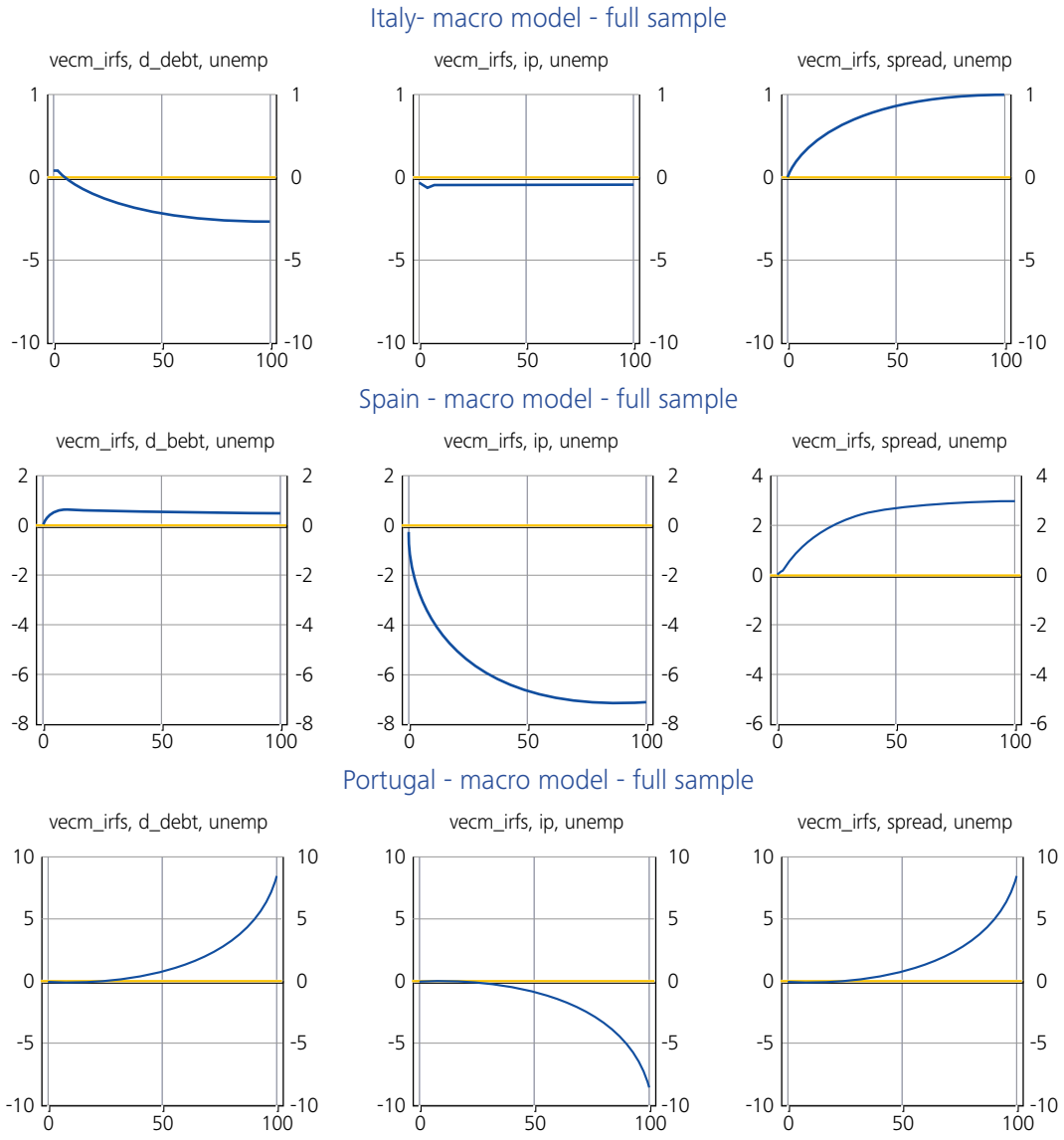


Chart C4 (continued)

Orthogonalised IRFs in the macro-augmented model (unemp)

(Graphs by irfname, impulse variable, and response variable)



Note: The response variable is unemp. The impulses are due to d_debt, ip and spread (in that order).

Annex 4 A global value-at risk model and its impulse response functions

A GVAR is estimated where each country *i*'s model contains (i) an unobserved common factor explaining co-movements in yield spreads, and (ii) observed measures of risk aversion and systemic stress (namely a global indicator of risk aversion and the CISS, a measure of systemic stress developed by the ECB).[3] The GVAR framework allows for country-specific unobserved common factors, proxied by cross-section weighted averages of the non-domestic counterparts of the endogenous variables included in each country's model.

This report controls for unobserved common factors affecting the cross-country co-movements of the endogenous variable *spread* by constructing a variable $spread^*_{i,t}$ denoting country *i*'s unobserved common factor (or foreign variable):

$$spread^*_{it} = \sum_{j \neq i} w_{jt} spread_{jt},$$

for every $t = 1, \ldots, T$, where w_{jt} is the time-varying weight assigned to foreign country *j*. Regarding the choice of the variable that should measure the weights, there is no strict indication in the literature. Since the present analysis is aimed at estimating the response of euro area banks' aggregate sovereign exposures to movements of government bond yields, foreign variables are aggregated by assigning to each counterpart country *j* a weight proportional to its banking sector's net flow of consolidated claims towards the banking sector of the reference country *i*.[4] In this setting, net cross-border bilateral claims of each country's banking sectors appear to provide a better measure for banks' portfolio decisions than real variables, such as bilateral net trade flows.

Based on the specification search conducted at the country level (for domestic endogenous variables) and the multi-country level (for foreign variables) using the information criterion method, GVAR is selected with two lags for the domestic endogenous variables and one lag for the country-specific foreign variable (and, when indicated, the observed common factors).[5] The GVAR (2,1) representation is given by the following "marginal model" for country i:

$$\begin{bmatrix} \Delta\, d\_debt_{it} \\ \Delta\, spread_{it} \\ \Delta\, ip_{it} \\ \Delta\, unemp_{it} \end{bmatrix} = V_i + \Theta_i \begin{bmatrix} d\_debt_{it-1} \\ spread_{it-1} \\ ip_{it-1} \\ unemp_{it-1} \\ X^*_{it-1} \end{bmatrix} + \Psi_{0i}\, \Delta X^*_{it} + \Psi_{1i} \begin{bmatrix} \Delta\, d\_debt_{it} \\ \Delta\, spread_{it} \\ \Delta\, ip_{it} \\ \Delta\, unemp_{it} \end{bmatrix} + e_{it} \qquad (1)$$

where $x^*_{it} = [spread^*_{it}\ d_t]'$, and d_t denotes the *k* x 1 vector of observed common factors, with *k* the number of such factors. As mentioned above, the common factors d_t considered here are (i) the global indicator of risk aversion (*riskav*), and (ii) the CISS (*ciss*). Note that, following the standard methodology for GVAR models, foreign variables and common factors are allowed to enter (in differences) the equation of each endogenous variable with their contemporaneous

3 The results presented in this subsection are robust to the inclusion of further common variables, such as the VIX index, the VStoxx index, the dollar-euro exchange rate and the euro effective exchange rate against the euro area's 20 most relevant trading partners.

4 The data is drawn from BIS consolidated banking sector statistics. As argued by Dees, Di Mauro, Pesaran and Smith (2007), flows, rather than stocks, should be used in order to compute bilateral country-specific weights. Flows are computed as year-on-year changes (i.e. differences between consecutive four-quarter stock values).

5 The results presented below are robust to different specifications of the lag structure, even when the optimal specification for domestic endogenous variables is obtained through the information criterion method at the multi-country level.

values. The specification (1) was selected so as to yield the most reliable estimation and inference results in terms of the structural stability of each country's model, using the stability test described by Dees et al. (2007) on the dynamics of the eigenvalues of the system.

Since the GVAR model requires observable common factors to enter the marginal model of at least one country as endogenous variables, the non-stressed countries (i.e. Austria, Belgium, France, Finland and the Netherlands) are aggregated into a single non-stressed region and the common factors included as endogenous variables of this non-stressed economy's model. This assumption appears justified in light of the considerable weight that the aggregate non-stressed region retains inside the euro area economy: feedback effects from all non-stressed countries' economies on common factors, such as the euro-dollar exchange rate, are likely to occur.

Therefore, the cross-sectional dimension shrinks from ten to six units: the non-stressed-country region, Greece, Ireland, Italy, Portugal and Spain. In order to gather the non-stressed countries into a single region, an aggregation method different from the one used to compute the foreign variable *spread** is employed: in this case, the magnitude of each country's economy is taken, as measured by its nominal GDP,[6] as a suitable gauge of its importance relative to the other countries of the region.

Before performing the estimation, the weak exogeneity of the foreign variables is tested for because the main assumption underlying the estimation strategy is the weak exogeneity of *spread** with respect to the long-run parameters of the conditional model (1). For this purpose, a joint significance test is carried out of the estimated error correction terms in auxiliary equations for the country-specific foreign variables.[7] In Table D1, results for two sets of experiments are reported, where column a (or b) refers to the model excluding (or including) the observed common factors, *riskav* and *ciss*. In both cases, the null hypothesis of weak exogeneity may not be rejected (at the 5% significance level) for most of the countries being considered.

Table D1

Weak exogeneity test for observed and unobserved common factors

	Test for weak exogeneity at the 5 percent significance level					
Country	**F test**	**F cv (0.05)**	**a**		**B**	
			spreads	**spreads**	**riskav**	**ciss**
Non-stressed	F(1,127)	3.916	0.105	1.307		
Greece	F(1,127)	3.916	8.130*	0.554	0.003	0.003
Ireland	F(1,127)	3.916	1.285	0.820	0.712	0.002
Italy	F(1,127)	3.916	1.229	0.633	0.190	0.201
Portugal	F(1,127)	3.916	0.321	6.570*	0.036	4.993*
Spain	F(1,127)	3.916	1.132	3.951*	0.621	0.207

Note: An asterisk (*) denotes rejection of the null hypothesis of weak exogeneity at the 5% significance level.

6 More precisely, long-run (across the whole sample, January 2000 through to March 2012) averages of nominal GDP evaluated at current prices are used to compute countries' relative weights.

7 For a detailed explanation, see Dees, Di Mauro, Pesaran and Smith (2007).

The GVAR model estimated here is given by specification (1), where the domestic endogenous variables are *d_debt*, *spread*, *ip* and *unemp*, and the common factor *x** includes three variables: *spread**, *riskav* and *ciss*. Moreover, the marginal models for Greece, Ireland, Italy, Portugal and Spain include a domestic dummy variable *d_prog* that captures the inception of the bailout programmes (or special liquidity-enhancing measures). The specific programmes considered are the IMF/ECB bailout programmes for Greece, Ireland and Portugal started in May 2010, December 2010 and May 2011 respectively, as well as the LTROs executed by ECB as of December 2011. The rationale for including these dummy variables is the alteration of the working of financial markets and banks induced by these programmes in the corresponding countries. The results of the GVAR estimation are best understood by looking at the orthogonalised IRFs of banks' domestic sovereign exposures in stressed countries to a one-standard-deviation shock to the domestic spread, which are shown in Chart D1.

Chart D1

Orhogonalised IRFs of d_debt to a shock in spread in the GVAR model

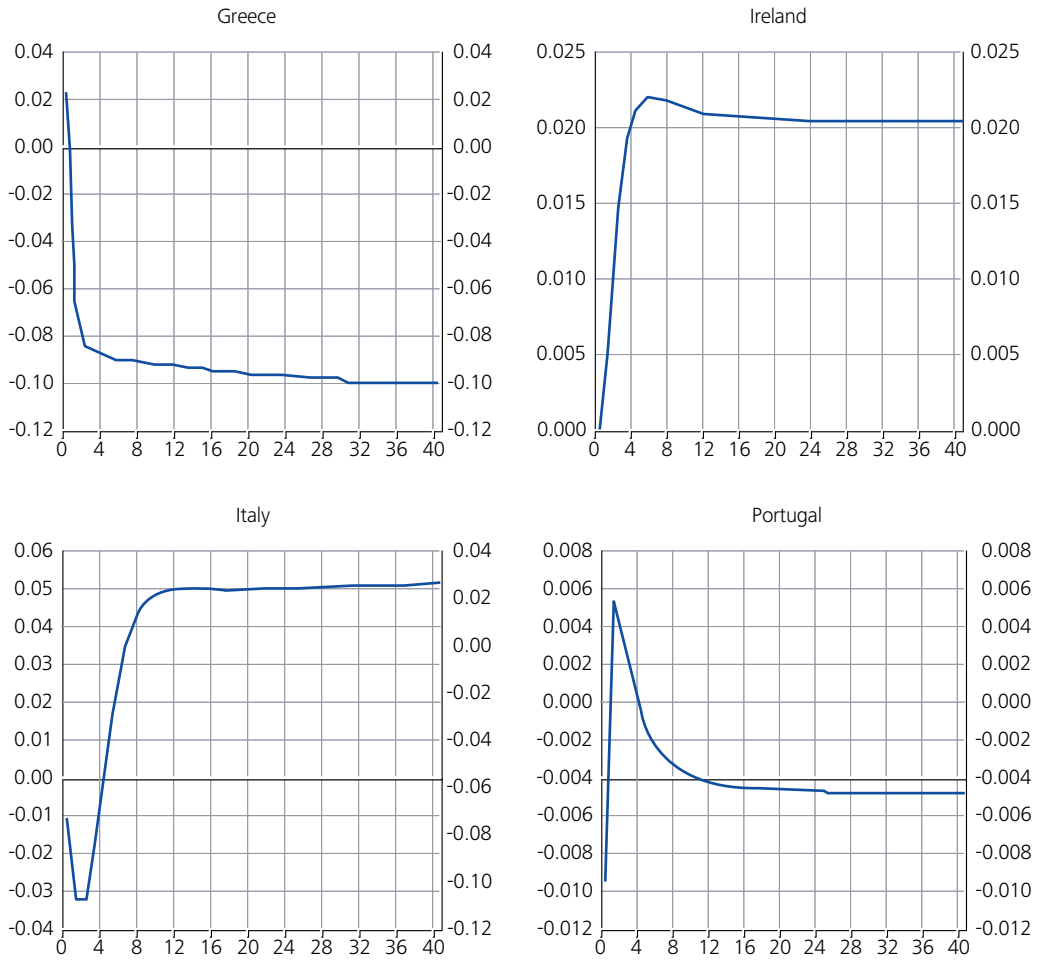
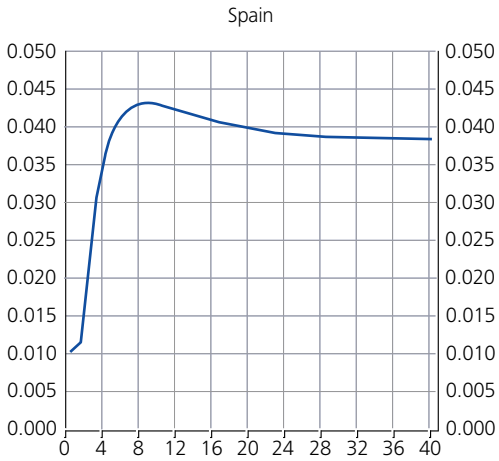


Chart D1

Orhogonalised IRFs of d_debt to a shock in spread in the GVAR model



The IRFs shown in Chart D1 indicate that, in the multi-country framework, the evidence in favour of the carry trade hypothesis is weaker than in the country-by-country models. Banks' sovereign exposures react positively to a shock to yield differentials in Ireland, Italy and Spain, while the response for Greece is negative, and that for Portugal is positive only in the short run. As in the IRFs for the single-country VEC models discussed above, Italy presents a short-lived negative response of banks' domestic sovereign exposures to a positive shock in the yield spread.

Annex 5 Co-integrating parameters and impulse response functions of the country-by-country vector error-correction models with recent data

This annex presents the results for the estimation of the country-by-country VEC models with the most recent available data.

The sample covers the period from January 2000 to August 2014 for all countries except Greece (which is analysed for the period from January 2000 to February 2012, as there is no available data for Greek five-year government bond yields after the Greek default). Data for five-year government bond yields and the Euro Over Night Index Average (EONIA) five-year swap interest rate are drawn from Bloomberg; data for sovereign exposures, unemployment and industrial production index (the last two are seasonally adjusted) are obtained from the SDW.

Following Battistini, Pagano and Simonelli (2014), the spread is constructed as the difference between the domestic yield and the EONIA five-year swap interest rate; the latter represents the risk-free rate for an investment with a five-year maturity and, unlike the Bund yield, does not contain country-specific information.

The specification of the model also follows Battistini, Pagano and Simonelli (2014) as regards the ordering of the variable: in both models, d_debt is placed in last position, whereas ip is the first variable in the macro-augmented model. This choice implies that the response of d_debt is not restricted to be zero on impact. Then, in particular as regards the response to shocks in spread, this choice is conservative and does not help the carry trade hypothesis. In fact, an increase in spread, through valuation effects, tends to reduce the sovereign exposure in the short term. Also, this choice implies that the economic cycle (the variable ip) is exogenous (in the short term) and can only be affected by sovereign debt variables (prices and quantities) with a lag.

Unemployment is excluded from the macro-augmented model, since the corresponding coefficient in the co-integrating vector is not significantly different from zero in any country, except France (where it is negative and significant, as expected according to the deficit absorption hypothesis), and Portugal and Spain (where it is positive and significant, in contrast to the deficit absorption hypothesis).

The table below reports the estimated cointegration parameters β and adjustment parameters α for the baseline model and the macro-augmented model. According to the estimates of the baseline model, there is evidence of a positive response of domestic sovereign debt exposures to a positive shock in the spread of domestic government bond yields and the risk-free interest rate in every country except Germany (where the adjustment parameter is not significantly different from zero and the long-run equilibrium relationship between d_debt and spread exists nonetheless). According to the estimates of the macro-augmented model, the positive response of domestic sovereign exposures to movements in domestic spreads holds in every country in which it holds in the baseline model, except Portugal and Spain (where it has the correct sign); a significantly negative response of exposures to the economic cycle (represented by the industrial production index) emerges in most countries, notably Belgium, Greece, Italy, Portugal and Spain. This is further evidence that the carry trade and the deficit absorption hypotheses may coexist, especially in stressed countries.

The following figures show the IRFs with the response of domestic sovereign exposures to the other endogenous variables of the baseline and the macro-augmented model. They substantially confirm the results from the parameter estimates (note: unlike the parameter estimates, the carry trade hypothesis seems to work for Portugal as well).

	Baseline model		Macro-augmented model		
Parameter	***α***	***β***	***α***	***β***	
Variable		***spread***		***ip***	***spread***
Country	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Spain	-0.011***	-4.634***	-0.019***	0.315***	-0.282
	(0.000)	(0.000)	(0.000)	(0.000)	(0.62)
Greece	-0.002	-7.707***	0**	17.685***	-36.02**
	(0.259)	(0.000)	(0.033)	(0.000)	(0.033)
Ireland	-0.016***	-0.656***	-0.01***	-0.23***	-0.417*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.053)
Italy	-0.021***	-3.324***	-0.025***	0.081***	-2.287***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Portugal	-0.006***	-1.749***	-0.029***	0.286***	-0.17
	(0.002)	(0.000)	(0.000)	(0.000)	(0.241)
Austria	-0.019***	-9.676***	-0.011***	-0.114***	-14.858***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Belgium	-0.019***	-3.341***	-0.025***	0.141***	-4.775***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Germany	-0.03	-2.115***	-0.034	-0.04***	-0.202
	(0.207)	(0.000)	(0.241)	(0.000)	(0.681)
France	-0.018***	-4.531***	-0.012***	-0.015***	-8.188***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)
Netherlands	-0.049***	-2.324***	-0.034***	-0.106***	-3.314***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Chart E1

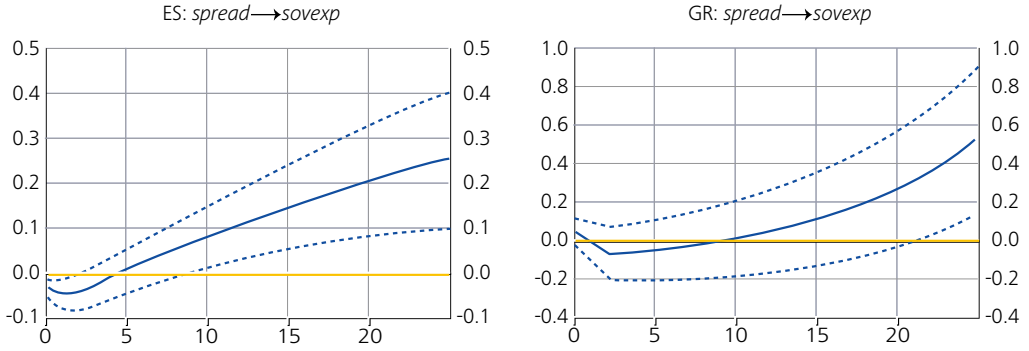


Chart E1 (continued)

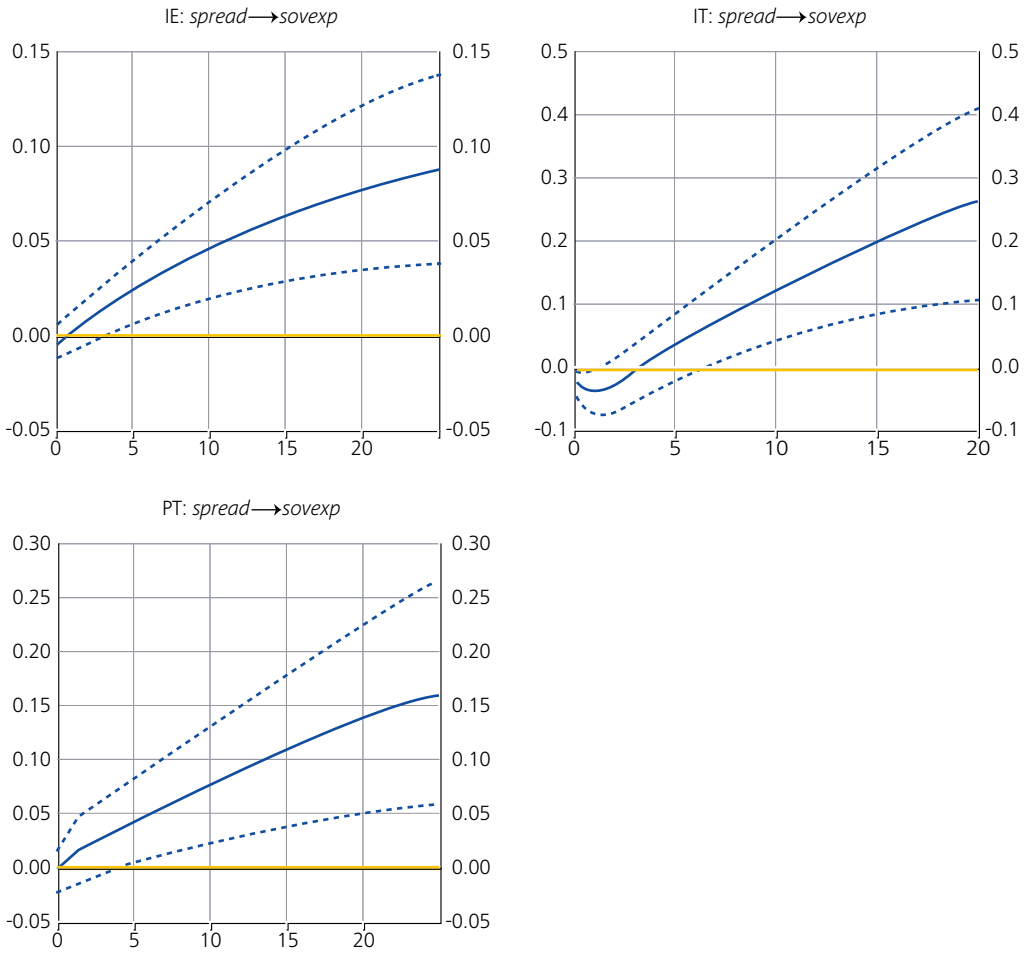


Chart E2

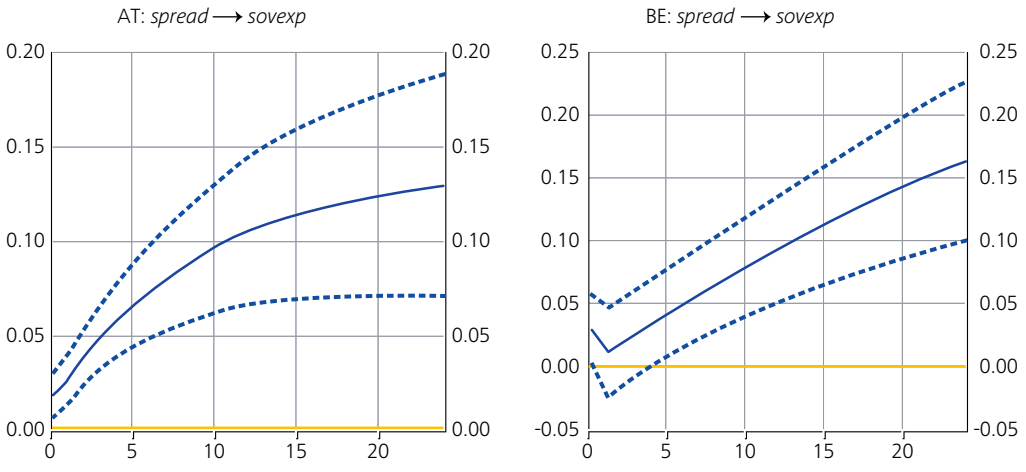
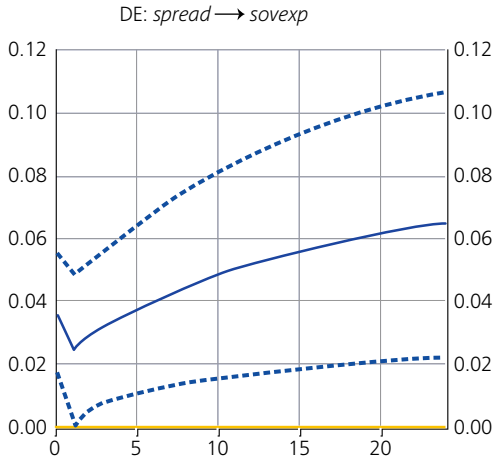
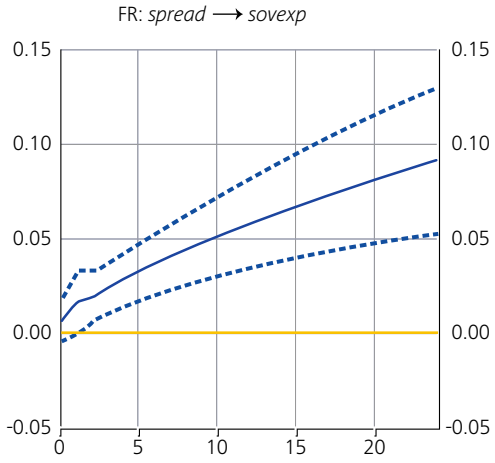


Chart E2 (continued)





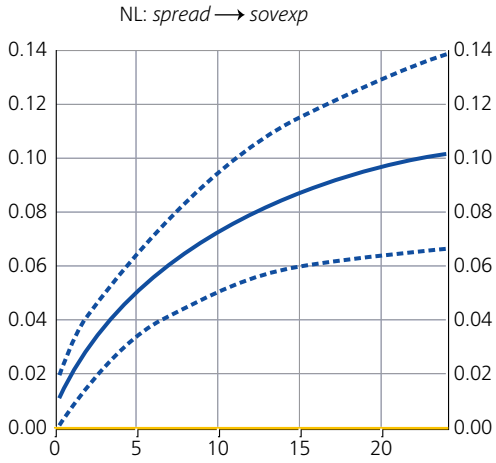
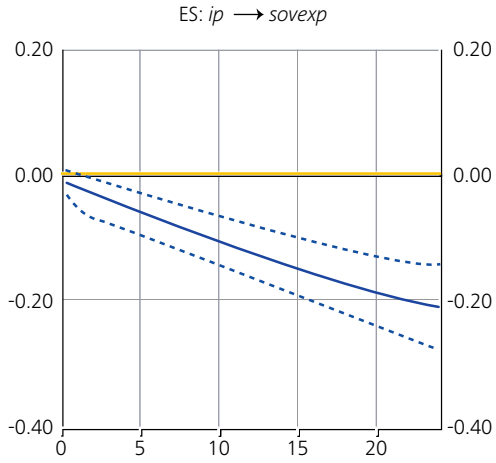


Chart E3



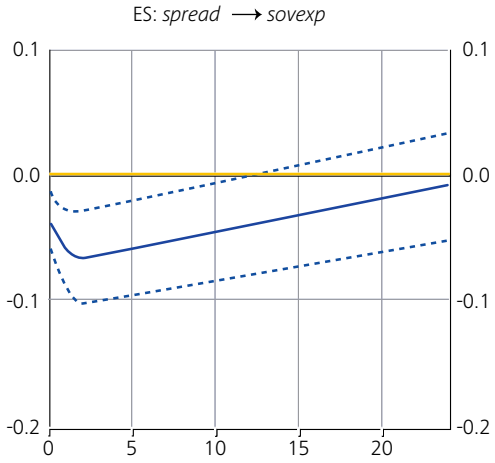


Chart E3 (continued)

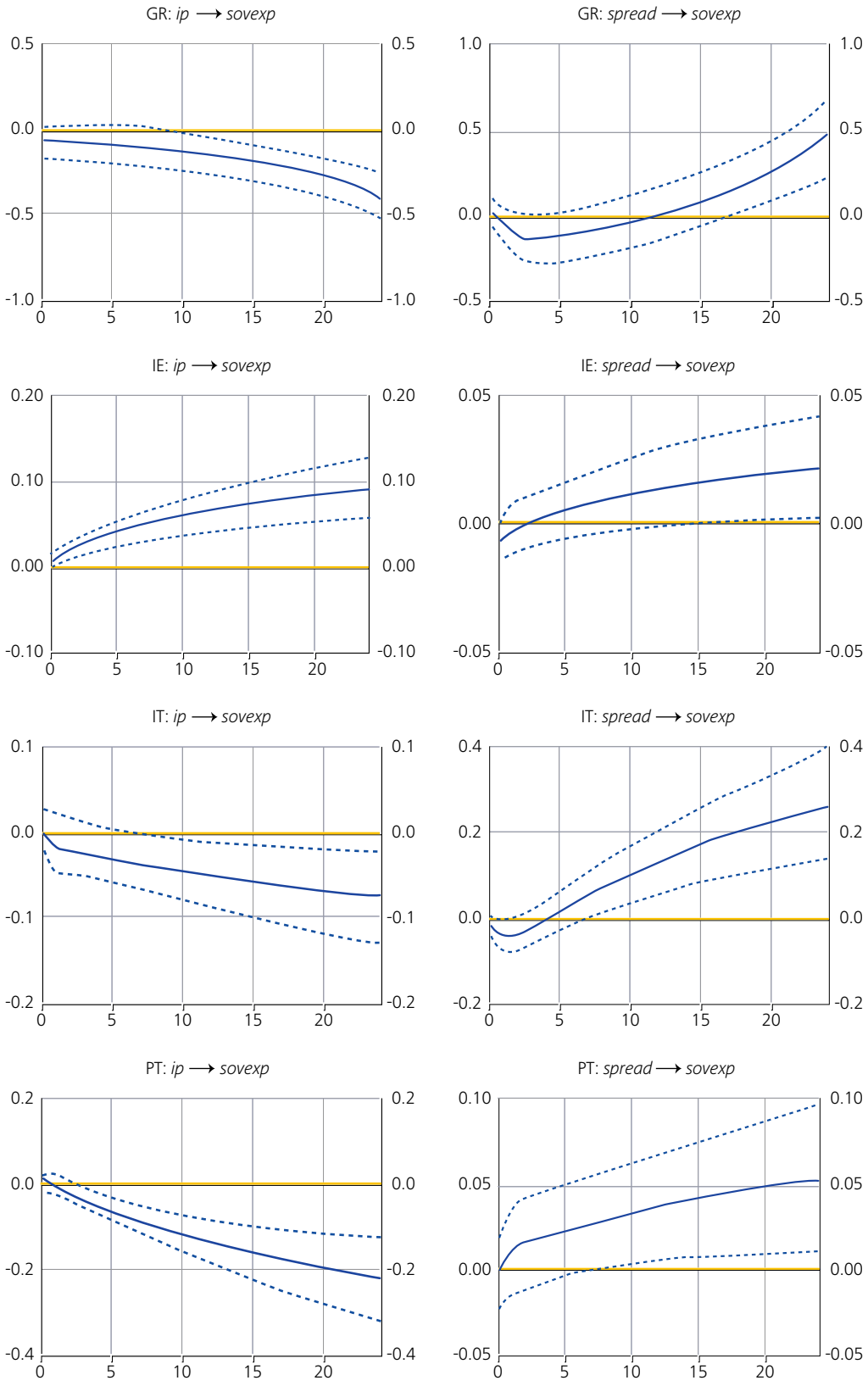
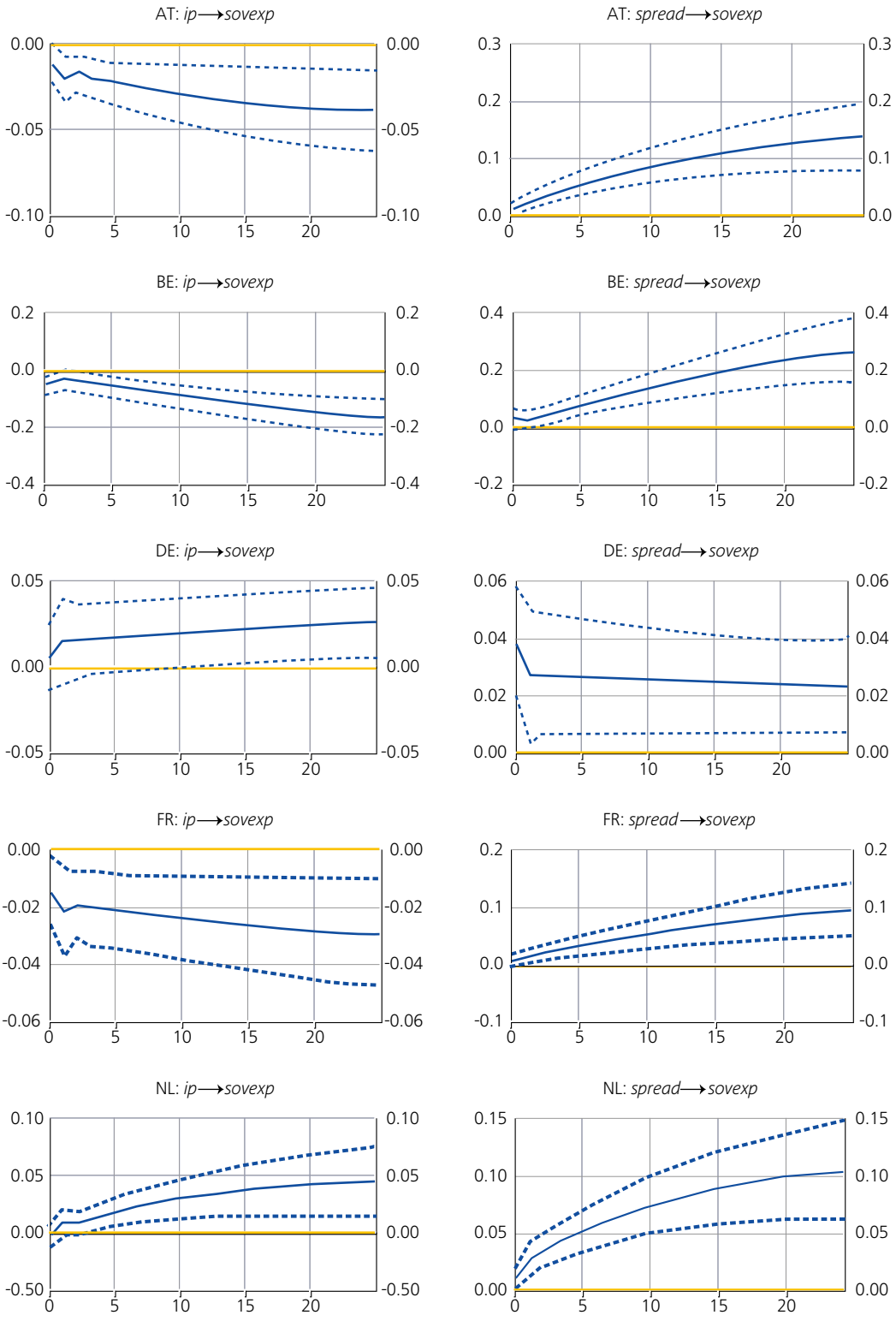


Chart E4


AT: ip⟶sovexp
AT: spread⟶sovexp
BE: ip⟶sovexp
BE: spread⟶sovexp
DE: ip⟶sovexp
DE: spread⟶sovexp
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FR: spread⟶sovexp
NL: ip⟶sovexp
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Annex 6 Comparison of the econometric methods used

Model		Key findings	Main strengths	Main limitations
Country by country	VAR	Macroeconomic variables have a significant impact on banks' sovereign debt holdings. Sovereign spreads do not have a significant role once macroeconomic variables have been considered. Indirectly, the macroeconomic factors would capture the effects on alternative investment opportunities for banks.	Accounts for feedback effects – particularly between yields and debt holdings and macroeconomic factors. Considers the presence of several endogenous variables. Simple and tractable model with transparent assumptions.	Does not allow for a long-run co-integration relationship, leading to biased estimates (due to an omitted variable) if that relationship actually exists. The model does not consider cross-country shocks.
	VEC	There is a significant impact of sovereign spreads on banks' sovereign debt holdings. Evidence of a long-run relationship between domestic sovereign exposures with spreads. Macro variables also play a role, but to a lesser extent.	Accounts for feedback effects and several endogenous variables. Allows the long-run behaviour of the endogenous variables to converge to their long-run equilibrium relationships.	The observed long-run co-integration relationship on which the VEC is built has weaker evidence for some countries and for sample periods not including the recent crisis. Does not consider cross-country shocks.

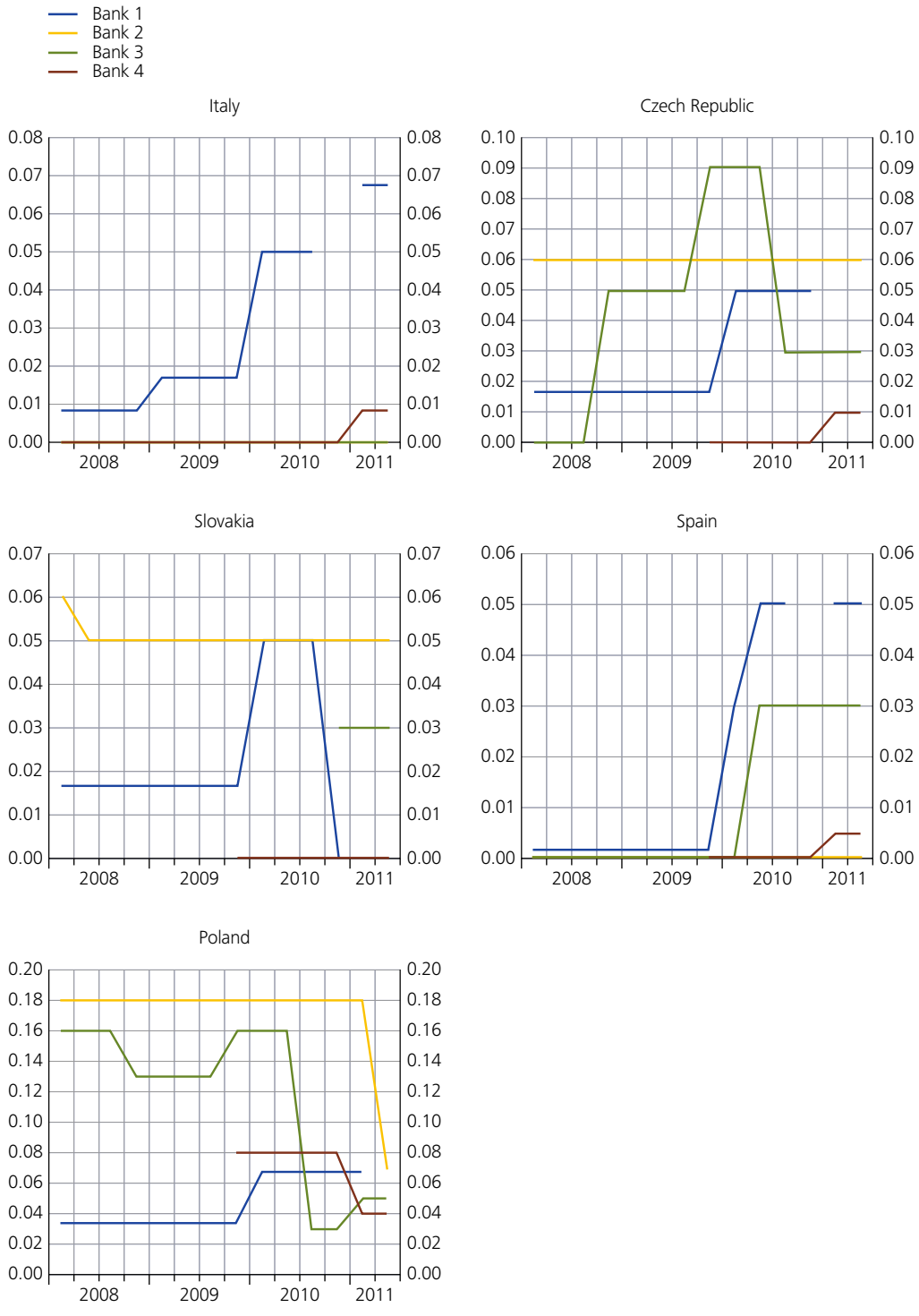
Model		Key findings	Main strengths	Main limitations
Multi-country	GVAR	Weaker evidence in favour of sovereign spreads having a significant effect on banks' sovereign debt holdings. The impact of macro variables is not reported.	Considers cross-country shocks. Accounts for cross-country correlation. Accounts for common factors.	The model is actually a GVEC. The long-run co-integration relationship assumed is subject to the same limitations as the VEC. The model is quite opaque and results rely heavily on some ad-hoc modelling choices, such as the weighting matrix. There is redundancy in some of the variables, e.g. the CISS uses sovereign yields as an input, but sovereign yields are also entered in the GVAR as dependent variables. However, results are robust to the exclusion of these observed common factors.
	Extended VAR	Macro variables have a significant impact on banks' sovereign debt holdings. Sovereign spreads do not have a significant role once macroeconomic variables have been considered. Indirectly, the macroeconomic factors would capture the effects on alternative investment opportunities for banks.	Considers cross-country shocks. Accounts for cross-country correlation. Simple and tractable model with transparent assumptions.	Does not allow for a long-run co-integration relationship, leading to biased estimates (due to an omitted variable) if that relationship actually exists. The model does not consider other common EU factors, although they can be easily incorporated.

Annex 7 Internal ratings-based approach applied to sovereign credit risk: quantitative results

(i) PD

The following graphs report the evolution of some sovereign PDs estimated by four Belgian banks.

Chart F1
(percentages)



(ii) LGD

The next table reports the LGDs estimated by four Belgian banks on some sovereigns in December 2011.

(percentages)

LGD estimates; four Belgian banks; Q3 2011

LGD	Minimum	Maximum	Maximum/Minimum ratio
AT	5.00	20.00	4.00
BE	5.00	20.00	4.00
CA	5.00	18.54	3.71
CY	5.00	20.00	4.00
CZ	5.00	19.06	3.81
DE	5.00	20.00	4.00
DK	5.00	18.54	3.71
ES	10.00	20.00	2.00
FI	5.00	20.00	4.00
FR	5.00	20.00	4.00
GB	5.00	18.54	3.71
GR	20.00	60.00	3.00
HK	5.00	5.00	1.00
HU	20.00	29.77	1.49
IE	10.00	24.10	2.41
IT	10.00	20.00	2.00
JP	5.00	18.54	3.71
LUX	5.00	20.00	4.00
NL	5.00	20.00	4.00
PL	19.58	20.00	1.02
PT	10.00	32.88	3.29
SK	5.00	19.06	3.81
TR	48.52	55.00	1.13
US	10.00	18.54	1.85

(iii) Risk weights

The table below provides an example[8] of the evolution of risk weights for sovereigns for Belgian banks:

(percentages)

Risk weight	Q1 2009					Q4 2011[1)]				
	GR	IT	PT	SP	IE	GR	IT	PT	SP	GR
Minimum	0	0	0	0	0	78	0	10	0	10
Maximum	27.6	4.80	3.20	1.60	0	default	23	71	23	44
Median	7.1	0	0	0	0	164	6	46	5	13

1) Third quarter of 2011 for one of the four banks.

8 Based on PDs and LGDs provided by banks on their sovereign exposures, a common assumption of an effective maturity of 2.5 years is applied. Note that these PDs and LGDs do not mean that these banks did not make use (fully or not) of the EU carve-out on those exposures.

Annex 8 Ratings for EU sovereign debt

Country	December 2007			December 2011		
	S&P	Moody's	Fitch	S&P	Moody's	Fitch
AT	AAA	Aaa	AAA	AAA	Aaa	AAA
BE	AA+	Aa1	AA+	AA	Aa3	AA+
BG	BBB+	Baa3	BBB+	BBB	Baa2	BBB
CY	A	A1	AA-	BBB	Baa3	A-
CZ	A+	A1	A+	AA	A1	AA-
DE	AAA	Aaa	AAA	AAA	Aaa	AAA
DK	AAA	Aaa	AAA	AAA	Aaa	AAA
EE	A	A1	A+	AA-	A1	A+
ES	AAA	Aaa	AAA	AA-	A1	AA-
FI	AAA	Aaa	AAA	AAA	Aaa	AAA
FR	AAA	Aaa	AAA	AAA	Aaa	AAA
GB	AAA	Aaa	AAA	AAA	Aaa	AAA
GR	A	A1	A	CC	Ca	CCC
HU	BBB+	A2	A-	BB+	Ba1	BBB
IE	AAA	Aaa	AAA	BBB+	Ba1	BBB+
IT	A+	Aa2	AA-	A	A2	A+
LT	A	A2	A+	BBB	Baa1	BBB+
LU	AAA	Aaa	AAA	AAA	Aaa	AAA
LV	BBB+	A2	A-	BB+	Baa3	BBB
MT	A	A2	A+	A	A2	A+
NL	AAA	Aaa	AAA	AAA	Aaa	AAA
PL	A	A2	A	A	A2	A
PT	AA-	Aa2	AA	BBB-	Ba2	BB+
RO	BBB	Baa3	BBB+	BB+	Baa3	BBB
SE	AAA	Aaa	AAA	AAA	Aaa	AAA
SI	AA	Aa2	AA	AA-	A1	AA-
SK	A	A1	A+	A+	A1	A+

Source: ECB.

Annex 9 Capital requirements if the ratings scale of the RSA is applied

Country	December 2007					December 2011				
	Tot. sov. exp.	Δ RWA	Δ Cap. req.	Δ Cap. req./ tot. eq. (%)	Δ Cap. req./ tot. sov. exp. (%)	Tot. sov. exp.	Δ RWA	Δ Cap. req.	Δ Cap. req./ tot. eq. (%)	Δ Cap. req./ tot. sov. exp. (%)
AT	20,732	1,155	92	1.38	0.45	37,912	1,491	119	0.43	0.31
BE	35,726	34	3	0.02	0.01	42,515	1,029	82	0.61	0.19
CY	4,367	721	58	1.08	1.32	7,810	8,529	682	21.70	8.74
DE	266,053	1,043	83	0.07	0.03	421,683	16,864	1,349	0.86	0.32
DK	16,814	1	0	0.00	0.00	25,594	271	22	0.10	0.08
ES	59,861	436	35	0.03	0.06	154,919	2,963	237	0.15	0.15
FI	686	0	0	0.00	0.00	1,238	1	0	0.00	0.00
FR	200,604	6,471	518	0.34	0.26	234,574	19,159	1,533	0.57	0.65
GB	80,215	41	3	0.00	0.00	252,647	8,499	680	0.21	0.27
HU	2,077	1	0	NA	0.00	3,061	26	2	NA	0.07
IE	2,881	33	3	0.01	0.09	16,161	6,182	495	1.58	3.06
IT	187,730	23,960	1,917	1.32	1.02	208,988	32,598	2,608	1.79	1.25
LU	4,244	329	26	1.25	0.62	4,383	498	40	1.51	0.91
MT	938	173	14	3.62	1.47	1,559	311	25	5.45	1.60
NL	66,413	386	31	0.05	0.05	131,551	2,242	179	0.19	0.14
NO	4,348	0	0	0.00	0.00	9,380	0	0	0.00	0.00
PL	NA	NA	NA	NA	NA	5,281	0	0	0.00	0.00
PT	4,279	47	4	0.03	0.09	22,727	11,452	916	6.00	4.03
SE	23,625	44	4	0.01	0.02	75,999	110	9	0.01	0.01
SI	2,267	7	1	0.04	0.02	2,815	13	1	0.07	0.04
Total	***983,858***	***34,882***	***2,791***	***0.29***	***0.28***	***1,660,797***	***112,238***	***8,979***	***0.67***	***0.54***

Sources: ECB, EBA, SNL and own calculations.
Note: In EUR millions, by home country of banks. Exposures for 2007 are calculated according to the methodology illustrated in the impact assessment section of the report. Capital requirements are calculated by applying the ratings of the table in Annex 8 to exposures.

Annex 10 Capital requirements if a 10% floor is introduced

(by home country of banks)

Country	Δ Capital requirement December 2007	December 2011
AT	93	155
BE	138	225
CY	34	61
DE	2,096	3,171
DK	52	68
ES	461	1,194
FI	5	10
FR	1,581	1,765
GB	9	972
HU	0	1
IE	17	116
IT	1,451	1,563
LU	33	34
MT	7	12
LN	507	991
NO	0	0
PL	NA	0
PT	33	176
SE	73	290
SI	18	22
Total	**6,610**	**10,826**

Sources: ECB, EBA, SNL and own calculations.
Note: In EUR millions. Exposures for 2007 are calculated according to the methodology illustrated in the impact assessment section of the report. The floor is calculated by multiplying exposures by 10%.

Annex 11 Exposures exceeding a large exposures requirement

(nominal value, partial exceptions – 50% and 20% – by country of issuance of sovereign debt)

Country	December 2007			December 2011		
	100%	50%	20%	100%	50%	20%
Austria	0	0	0	7	1	0
Belgium	22	5	0	21	6	0
Bulgaria	0	0	0	0	0	0
Cyprus	0	0	0	0	0	0
Czech Republic	7	2	0	9	1	0
Denmark	1	0	0	9	1	0
Estonia	0	0	0	0	0	0
Finland	0	0	0	0	0	0
France	37	3	0	32	5	0
Germany	247	98	19	303	120	32
Greece	2	0	0	4	2	0
Hungary	1	0	0	0	0	0
Iceland	0	0	0	0	0	0
Ireland	0	0	0	4	0	0
Italy	82	22	0	120	39	2
Latvia	0	0	0	0	0	0
Liechtenstein	0	0	0	0	0	0
Lithuania	0	0	0	0	0	0
Luxembourg	1	0	0	2	0	0
Malta	1	0	0	1	1	0
Netherlands	12	2	0	33	7	1
Norway	1	0	0	5	1	0
Poland	2	0	0	4	1	0
Portugal	0	0	0	8	2	0
Romania	0	0	0	0	0	0
Slovakia	0	0	0	0	0	0
Slovenia	1	0	0	2	1	0
Spain	24	1	0	99	28	0
Sweden	0	0	0	7	0	0
United Kingdom	13	0	0	46	2	0
Total	**455**	**134**	**19**	**716**	**218**	**36**

Sources: ECB, EBA, SNL and own calculations.
Note: In EUR millions. Exposures for 2007 are calculated according to the methodology illustrated in the impact assessment section of the report. Capital requirements are calculated by applying the ratings of the table in Annex 8 to exposures.

Annex 12 Members of the ESRB's expert group on the regulatory treatment of sovereign exposures

Co-Chairs:

Adelaide Cavaleiro	Banco de Portugal
Martin Hellwig	Advisory Scientific Committee (ASC), Max Planck Institute for Research on Collective Goods

Secretary:

Adam Pawlikowski	European Systemic Risk Board (ESRB) Secretariat

Members:

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Jürgen Kirchhof	European Central Bank
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