SOVEREIGN RISK AND FINANCIAL STABILITY

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The sovereign crisis in the Euro Area (EA) has prompted a debate about how sovereign debt should be treated in banking regulation. Against this background, we review the role of sovereign debt in advanced economies and its current regulatory treatment. We then assess the empirical support for two competing hypotheses explaining the evolution of banks' holdings of domestic sovereign debt during the recent crisis: i) macroeconomic factors; and ii) the commonly known "carry-trade hypothesis". We find that macroeconomic conditions play a more relevant role than "carry-trade" incentives to explain the increase in banks' holdings of domestic sovereign debt in times of stress. Founded on this evidence and considering a set of distinctive characteristics of sovereign risk in the EA we assess different policy options. We argue that correcting fiscal imbalances and ensuring sound inter-temporal fiscal policy both at the country and EA level is a key precondition to financial stability and thus, a route to consider first. Addressing some of the sovereign risk manifestations is a second route. We identify three key building blocks to guide the design of possible regulatory measures on this area. We suggest that a macroprudential Pillar 2 approach would be the best suited to manage this special risk.

1 Introduction

The 2008 financial crisis evolved as a sovereign crisis in the EA in 2010, raising concerns about the fiscal sustainability of the European Union (EU). As financial tensions in the EA heightened, doubts over sovereign debt markets were not only confined to relatively small economies, but quickly spread to other EA long-term sovereign debt, most intensely to Spain and Italy [see *e.g*. Lane (2012)]. All of this was reflected in rapid increases and sudden swings in euro-area sovereign spreads relative to the German bond. The unfolding strains in the EA debt markets, in turn, took a toll on the still fragile financial systems. Access to funding deteriorated even further for banks in countries under stress and the effects of adverse macroeconomic conditions continued eroding the ability by banks to sustain credit. All these factors reinforced the original weaknesses in bank balance sheets which had been revealed in the early stages of the banking crisis. And all this happened in the midst of "safety races" [Haldane (2012)], "bad deleveraging" strategies [Feyen and González del Mazo (2013)] and growing insolvent demand [Ayuso (2013)].

The sovereign crisis in the EA has also prompted a debate about how sovereign debt should generally be treated in prudential regulation, and more specifically on the special features of sovereign risk within a monetary union. Within this debate, three main arguments have been used to motivate a change to the current prudential treatment of sovereign exposures in the EU: a) that the current regulatory treatment of sovereign debt biases the banks' decisions towards sovereign debt; b) that the current treatment was not reflecting risks from banks' sovereign debt; and c) that the current regulatory treatment of sovereign debt generates incentives to pursue "carry trade" strategies. To decide on the more appropriate approach for the prudential treatment of sovereign debt in the EU, it is crucial to assess these arguments. This implies, first, giving detailed attention to the special characteristics of sovereign risk. And second, assessing whether "carry trade" opportunities are indeed generating inaccurate incentives, or whether other alternative explanations are more relevant.

The current literature has failed to appropriately account for the role that macroeconomic factors and fiscal stabilisation policies play during a banking-led sovereign crisis as the ones experienced in many EU countries recently. To fill this gap, we test two competing

hypotheses to explain the changes of banks' sovereign debt holdings: i) the commonly known "carry-trade hypothesis"; and ii) macroeconomic factors, which capture the potential alternative investment opportunities. We find that macroeconomic conditions play a more relevant role than "carry-trade" incentives to increase banks' sovereign debt holdings. We argue that real economy deterioration in a systemic banking crisis leading to a situation of stress in sovereign markets affects the whole balance sheet structure of domestic banks.

Sovereign risk is systemic in nature. Its connections with the financial system are deep and multiple, possibly going above and beyond the effects from direct sovereign debt holdings. The associated deterioration in macroeconomic conditions in times of stress constrains the range of attainable investment options for domestic banks and contributes to a notable increase in their funding costs, at least in the short run. These macroeconomic effects are some of the factors which help to explain why, in some cases, domestic banks would still be investing in domestic sovereign debt – even when foreign investors may be retreating –.

We also highlight the connection between sovereign debt and fiscal policy as a stabilisation instrument in times of stress, and ultimately, as a backstop to mitigate the effects of financial crises – *e.g.* large contractions in output –. The stabilisation role of fiscal policy was particularly relevant in the EU during the recent financial crisis, given the absence of a fully-fledged European resolution mechanism with appropriate funding.

The flip side of the fiscal policy stabilisation role is that, to be effective, individual governments should ensure that their debt is sustainable. This means that stringent conditions need to be met in order to afford policy flexibility in times of stress, *e.g.* maintaining low debt levels in normal times [Cavallo and Izquierdo (2009); Breton, Pinto and Weber (2012)]. Along with this, when navigating through the crisis, governments should make a decided and credible effort to ensure that their public debt dynamics remain on the stable path. Otherwise, the peril is that destabilising dynamics on the fiscal side exacerbate instability in the financial sector and they are mutually reinforced in a "vicious cycle" [see Reinhart and Rogoff (2009a, 2011); Acharya *et al.* (2011); Merler and Pisani-Ferry (2012)].

But sovereign debt is not only intrinsically linked to fiscal policy. Sovereign debt in advanced economies often plays a similar role to that of fiat money, by providing a source of stable collateral for financial markets and the economy. We thus describe a set of distinctive characteristics of sovereign debt in advanced economies – *e.g.* its role as a "risk-free" or "reference" asset – calling for a need to re-establish fiscal equilibrium in individual countries and in the EA as a whole with the final aim of bringing its sovereign debt closer again to the ideal of a risk-free asset.

Given the opportunities and challenges in the use of fiscal policy in times of stress and the distinctive characteristics of sovereign debt in advanced economies, we argue that the first route to effectively solving the problem of sovereign risk in the EA is tackling the root sources of the problem. This means addressing the existent fiscal imbalances and ensuring sound inter-temporal fiscal policy both at the country and EA levels.

A second route is to address some of the sovereign risk manifestations by means of regulatory policy. Drawing on our empirical findings and a set of distinctive characteristics of sovereign risk in advanced economies, we identify three building blocks to guide the design of policy measures in this area. Based on this framework, we suggest that a "macroprudential Pillar 2 approach" would be the best suited to manage sovereign risk in the EA.

The rest of the paper is organised as follows. In Section 2 we review recent literature and explain the main streams of the on-going debate on the treatment of sovereign risk in the EU. We then in Section 3 discuss the key role that sovereign debt plays in advanced economies, we summarise the current prudential treatment of sovereign risk in the EU, and we pose two potential routes for a regulatory reform in this area. In Section 4, we empirically explore the determinants of banks' sovereign debt holdings. In Section 5, founded on the collected empirical evidence and considering the distinctive characteristics of sovereign risk in the EA, we present a framework of three building blocks to guide policy measures on this area. Finally, we conclude in Section 6.

2 Recent literature and on-going debate

Whilst not new, sovereign risk has not been not an issue in many advanced economies which have "graduated" from a history of serial defaults on their sovereign debt [Reinhart and Rogoff (2009b)]. Yet, the chain of events just described re-ignited a debate among academics and policy-makers over the "risk-free status" of sovereign debt, the relationship between sovereign risk and banking crises, and the regulatory treatment of banks' sovereign exposures in the EU. As result of this debate, a range of alternative policies has been proposed.

Hannoun (2011) was one of the first voices to speak about the regulatory treatment of sovereign risk. He argues that whilst highly rated sovereign assets are still low-risk assets, they are no longer perceived as risk-free assets. As a consequence, they are not zero credit risk assets and should no longer receive a zero risk weight in regulation, but should be differentiated according to their different credit qualities. Hannoun also argues that the key problem in the treatment of sovereigns in the EU lies in the EU implementation of the Basel standards *(i.e.* through the Capital Requirements Directive and Regulation, CRD4/CRR) which "generalises" the 0% risk weight option from the Basel standards, rather than in the standards themselves. As a possible way forward, he calls for a more active role of supervision prompting recognition of sovereign risk – giving as an example the European Banking Authority (EBA) initiatives on stress-tests –. As well, he emphasises the need of a consistent implementation of Basel standards across jurisdictions.

The need of differentiating risk among EU sovereign debt was also suggested by Praet (2013) on the grounds that treating banks' holdings of sovereign debt according to the risk they pose to banks' capital will prevent banks from using central bank liquidity to excessively increase their exposures to sovereign debt. Weidmann (2013) also advocates against the "preferential treatment" of sovereign exposures in banking regulation as this would be incompatible with the principle of "individual responsibility" whereby markets interest rates reflect the riskiness of the investment. Weidman argues that besides undermining proper market discipline, the preferential treatment of sovereign debt also crowds out lending to private sector. As a policy recommendation, he proposes introducing – over an adequate transition period – large exposure limits on banks' sovereign debt holdings, since this would be more effective than requiring extra capital to cover sovereign exposures. On the other hand, Nouy (2012), after discussing in detail the prudential treatment of sovereign risk in the EU, considers using a Pillar II approach to extend sovereign risk monitoring and asses its impact on banks' risk profile.

On the incentives created by the preferential treatment of sovereign exposures, Acharya and Steffen (2013) criticise the current approach in EU prudential regulation arguing that it has fostered bank exploitation of "carry trade" opportunities by obtaining cheap funding from the ECB and investing in peripheral sovereign debt without being subject to a regulatory penalty for doing so, for example in terms of higher capital requirements. Similarly, Battistini *et al.* (2013) conclude that the current regulatory approach to sovereign

risk generates distorted incentives for banks to increase their home bias in systemic crises. In contrast, Angeloni and Wolff (2012) find a reduction of sovereign exposure in peripheral countries when measured as a percentage of Core Tier 1 capital. This may be giving some evidence that banks in those jurisdictions were also gradually strengthening their balance sheets in terms of capital, despite the potentially distorted incentives argued above. Similarly, Angelini *et al.* (2014) find that the sovereign-bank link is not stronger than the link between sovereign and domestic non-financial corporations. In this sense, they point out that a sovereign default affects the whole national economy, not just banks. Based on this evidence, they interpret the increases in banks' domestic sovereign debt holdings as part of the re-nationalisation/fragmentation process in EA financial markets which have started with the recent sovereign crisis.

These measures proposed – *e.g.* higher capital requirements or limits to large exposures –, however, aim to tackle some sovereign risk manifestations. As such they do no not address the underlying factors explaining these manifestations observed in the EU. From this perspective, Blundell-Wignall (2012) examines a series of fiscal and structural policy measures being followed in the EU and aimed to tackle the underlying problems that triggered the financial and sovereign debt crisis in first instance, and which have also contributed to their mutually reinforcing effects. Examples of these measures include governments' efforts on fiscal consolidation, the ECB role as liquidity provider of last resort, the role of the European Financial Stability Facility (EFSF) and the European Financial Stabilisation Mechanism (EFSM) to address asymmetric shocks in the EU, structural policies targeting the real economy – *e.g.* growth measures on labour and product markets – and finally, measures to address structural weaknesses in the financial sector – *e.g.* separation of retail and investment activities –. In the same vein, Bi (2012) finds in a theoretical model that short term austerity measures fail to contain the default risk premium, whereas a credible long term plan for fiscal reform does alleviate the cost of sovereign funding.

3 Addressing sovereign risk

3.1. THE ROLE OF SOVEREIGN DEBT IN ADVANCED ECONOMIES

Financial markets cannot work well both in normal times and under stress without risk free sovereigns [Nakaso (2013)]. Sovereign bonds are commonly used as a benchmark for pricing other assets, performing a "price discovery" function [see for example Dunne *et al.* (2007)] and serve as a reference rate for the economy [Nakaso (2013)]. More generally, risk-free sovereign debt helps to economise financial transactions costs [Giovannini (2013)] as they serve as a safe and stable source of collateral in financial transactions, attracting lower haircuts and margin requirements – *e.g.* in standardised contracts such as plain vanilla repo transactions [IMF (2012)] –.

As a result, sovereign debt plays a similar role to that of fiat money in economies – *i.e.* it is "cash equivalent" [Singh (2013)]. Indeed, the re-use of sovereign debt collateral in other collateralised transactions creates an effect which is similar to the monetary multiplier effect [Singh (2011); and Claessens *et al.* (2012)]. The transmission mechanism of monetary policy can therefore be affected by the workings of sovereign debt repo markets. This role of sovereign debt as money substantiate central banks' efforts to prevent that excessive fluctuations in the stock of sovereign debt collateral grow into distortions to the aggregate economy.

But sovereign debt is also intrinsically linked to fiscal policy. Since the seminal work of Barro (1979) on the "tax-smoothing" hypothesis, it is generally agreed that tax rates should remain stable over the business cycle. There is less agreement though on the net benefits of more aggressive stabilisation policies. The "tax-smoothing" hypothesis implies that

deficits are expected to accumulate during recessions, when tax revenues fall, to be compensated by higher revenues during expansions [Alesina and Giavazzi (2013)]. These dynamics tend to create a countercyclical pattern in fiscal deficits. The current crisis has not been an exception, albeit with differing paths across countries. Stimulus measures in the G-20 countries averaged about 2% of GDP both in 2009 and in 2010 [Banca d'Italia (2010)]. But, while the US swiftly approved massive increases in government expenditures, European governments adopted comparatively more prudent measures that relied on automatic stabilisers.

On this connection between sovereign debt and the implementation of inter-temporal – and stabilising – fiscal policies, some lessons can be drawn from experiences in emerging markets [see for example Cavallo and Izquierdo (2009)]. If good preconditions are met – *e.g.* low levels of public debt over GDP – governments can afford fiscal flexibility to smooth economic cycles and to mitigate the negative effects of economic crises. Of course, the extent and duration of these stabilising policies have their own limits. But this is a key resource that governments with sound inter-temporal fiscal behaviour can use when needed.

Finally, and as expected given its key role in the work of financial markets, safe assets are also integral to prudential regulation [IMF (2012)]. Prudential requirements use safe assets in order to limit or prevent excessive risk taking in normal times *(e.g.* to limit maturity mismatches) and safe assets also provide a means of protection in bad times *(e.g.* safe assets can be exchanged for riskier assets thus raising capital ratios).[1] Safe assets are also used as back-stops, benchmarks and as a first line of defence to shocks. These multiple functions of safe assets in prudential regulation provide some background to the distinctive treatment sovereign bonds receive in comparison to other assets.

Yet, despite the pivotal role of safe assets in advanced economies, it can be argued that no asset is absolutely risk free in practice. And as a consequence, no sovereign bond is absolutely risk free either. Even the safest assets – or the safest sovereign bonds in the world – are subject to risks under certain states of the nature. And while governments have taxation powers to raise resources to repay its debt, there are limits to this policy instrument. No economy can produce infinite resources and therefore governments are subject to an inter-temporal budget constraint. When the fiscal limits are met, central banks are still able to provide funding to the government, issuing new money and monetising debt. But this action also has its own limits. High inflation creates adverse effects on the real value of tax revenues *(i.e.* the Olivera-Tanzi effect) and can prompt destabilising spirals between fiscal deficit and money growth.

Taking all of the above into account, the term "risk free" may be better seen as a relative concept [Fisher (2013); and Giovannini (2013)] rather than as an absolute one. Sovereign bonds from advanced economies tend to show lower credit risk in comparison with other assets in a given economy or currency. This does not imply, however, that under certain realisations of nature, sovereign bonds cannot eventually be defaulted. Unfortunately, when these bad realisations of nature occur, financial markets cannot work well, monetary and fiscal policies are seriously impaired and the entire real economy is damaged.

In sum, both the financial system and the economy cannot work without risk-free assets, even when they may not exist in strict sense. As a corollary, the closer sovereign debt gets

1 The April 2012 IMF *Global Financial Stability Report* examines the various roles of safe assets also including their use in prudential regulations.

to the ideal of a risk free asset, the better the financial system and the economy will work. In this sense, sovereign bonds in the EA have consistently remained among the least risky assets in a long period of time, with only one default episode since the Second World War, and were thus close to the concept of risk-free assets. There is a need to re-establish fiscal equilibrium in individual countries and in the EA as a whole with the intention of getting sovereign debt closer again to the ideal of a risk-free asset.

3.2 THE PRUDENTIAL TREATMENT OF SOVEREIGN DEBT

Microprudential standards are principally focused on preventing and mitigating risks in individual banks' balance sheets. In this section we summarise the microprudential treatment of sovereign exposures in Basel and EU regulation in the following areas: solvency (credit and market risks), liquidity and concentration (i.e. large exposures).[2]

The current approach for calculating capital requirements for credit risk to sovereign exposures maintains the overall structure of Pillar 1 requirements in Basel regulation. That is, banks are offered a choice between a simple Standardised approach (SA) which is heavily reliant on Credit Rating Agencies (CRA) ratings, and a more advanced approach which is based on banks' internal credit ratings, the Internal Ratings Based approach (IRB). Both approaches have their advantages and disadvantages.[3] Pillar 1 requirements are then complemented with supervisory review (Pillar 2) and banks' disclosures requirements (Pillar 3).

Under the SA sovereign debt exposures are risk weighted according to their external rating following a "look-up" table of five buckets for rated exposures.[4] The current approach, however, introduces an option *(i.e.* the "domestic sovereign carve-out") under which supervisors, subject to national discretion, may apply a lower risk weight to banks' exposures to their own sovereign (or central bank) of incorporation denominated in domestic currency and funded in that currency. Where this discretion is exercised, other national supervisory authorities may also permit their banks to apply the same risk weight to domestic currency exposures to this sovereign (or central bank) funded in that currency.[5] In the EU a uniform 0% risk weight is assigned under the SA to "exposures to member states" central governments, and central banks denominated and funded in the domestic currency of that central government and central bank'.[6]

Additionally, a "partial use" of the standardised approach is allowed in the EU for exposures to central governments and member states central banks subject to certain conditions and prior permission of the competent authority.[7] This means that a bank using the IRB approach *(i.e.* an "IRB bank") can use instead the SA for the calculation of risk-weights for its sovereign portfolio, applying then a 0% RW for exposures within the EU, and internal estimates for the rest of exposures. As Nouy (2012) points out, the rationale behind the "partial use" is that internal credit risk inputs *(e.g.* PDs and LGDs) are difficult to calculate for sovereign portfolios from advanced economies. Sovereign defaults in advanced economies are very rare events, with a high and widespread impact. This and the small number of high-quality sovereign bonds seriously limit the size and quality of the sample for statistical inference purposes.

2 Nouy (2012) provides some further details than here on the treatment of sovereign exposures in current and upcoming banking regulation, also considering regulatory changes in the insurance sector (Solvency II).
3 See for example, Kupiec (2006), Jarrow (2007) and Tarullo (2008).
4 The corresponding risk weights when a CRA rating is available are 0% (AAA to AA–), 20% (A+ to A–), 50% (BBB+ to BBB–), 100% (BB+ to B–) and 150% (below B-). Unrated exposures receives a 100% risk weight.
5 Art. 54, Basel Committee (2006).
6 Art. 114 of CRR.
7 Art. 150 of CRR.

In fact, whilst IRB models can produce some risk differentiation by assessing individual sovereign exposures and getting more granular estimates *(e.g.* more granular PDs), internal estimations tend to produce very low capital charges for advanced economies sovereign portfolios, which render such a differentiation quite immaterial in practice. This being the consequence of the very low default frequency observed in advanced economies and limitations in the risk-weighting mechanism.[8] As a result, IRB estimates are not so different from the SA approach in practice. IRB estimates for sovereign debt from advanced economies tend to attract capital charges not materially different than zero and tend to rely heavily on external ratings as a reference point. The statistical issues in sovereign risk portfolios not only affect the accuracy in banks' internal estimates, but also make their back-testing and validation challenging. Given this and other special characteristics of sovereign risk qualitative analysis is generally needed.

As a backstop to the risk-weighted minimum capital requirements, the Basel Committee has introduced a non-risk sensitive measure: the leverage ratio. Banks under the leverage ratio regime should hold a minimum of eligible capital of their stock of non-risk-weighted assets.[9] Since sovereign debt is fully included in that measure, the leverage ratio has the potential to act as a quantity-based constraint to the amount of sovereign debt banks hold. The CRD4/CRR in the EU follows the same provisions than in Basel. It introduces a reporting requirement to supervisory authorities for the leverage ratio starting in 2014 with the idea of migrating to a binding harmonised requirement in 2018.

Similarly to the credit risk treatment, the Basel market risk framework also comprises two choices for measuring market risks in trading book exposures: a standardised calculation (the "Standardised measurement method") and a model-based option (the "Internal Models approach"). The standardised method includes the option for national supervisors to apply a lower specific risk charge to sovereign debt denominated in the domestic currency and funded by the bank in the same currency [Basel Committee (2006)]. In contrast, the model-based option does not include this possibility. As result of the weaknesses revealed by the recent financial crisis, the Basel market risk framework was subject to substantial changes. Some of these changes were already introduced in the revised requirements also known as Basel II.5 [Basel Committee (2009)]. And a deeper redefinition of the entire framework is being envisaged in the "Fundamental review" of the trading book framework [Basel Committee (2014)].

Basel II.5 includes sovereigns in the VaR and Stressed-VaR calculations under the Internal Models Approach. Additionally, Basel II.5 introduces an incremental risk capital charge (IRC) for unsecuritised credit products which now is capturing not only default risk but also migration risk. This was done in response to the increasing amount of exposure in banks' trading books to credit-risk related and often illiquid products whose risk was not well reflected in value-at-risk measures [Basel Committee (2009)]. Sovereign exposures are included in the IRC.

The fundamental review to the trading book, in turn, moves from VaR to Expected Shortfall (ES) calculations and applies a separate Incremental Default Risk (IDR) charge. The separate IDR recognises the practical challenges to achieving a joint modelling of the discrete (default risk) and continuous (spread risk) components of credit risk.[10] This means

8 We discuss further on this in Section 5.

9 As an indicative starting point, a 3% minimum requirement is being assessed during a "parallel run" period from 2013 and 2017 with a view to implementing the final rules in 2018. In the meantime, public disclosure requirements will start in 2015.

10 Where spread risk is also covering migration risk.

that default risk – captured by the IDR – is detached from general interest and spread risks – captured by the ES calculations –. Further to the inclusion of sovereign debt in the ES calculations, the BCBS 2014 Consultative Document indicates that sovereign risk will also be included in the scope of the IDR in the models-based framework, and that general partial use of the standardised approach for sovereign debt will not be granted.

On the liquidity side, the recently introduced Liquidity Coverage Ratio (LCR) requires banks to maintain a minimum buffer of unencumbered high-quality liquidity assets (HQLA, the numerator) against their stress net cash outflows (denominator) over a 30 days' time window.[11] The aim of the standard is to ensure that banks can withstand in the short-term a scenario of severe liquidity stress. The composition of the liquidity buffer is divided in two Levels (ie: tiers or buckets). The Level 1 comprises those assets of highest quality in the pool of eligible assets, basically cash, central bank reserves, and highly rated sovereign debt (AAA-AA).[12] Level 1 assets can be included without limits in the total stock of HQLA *(i.e.* no cap applies), are held at market value and – depending on supervisory discretion – are not subject to a haircut.

The LCR also includes a "carve-out" for domestic sovereigns whereby sovereign bonds that are rated below the AA- threshold are still eligible as Level 1 for domestic banks or foreign banks taking liquidity risk in the country of issuance of the sovereign debt. This may be reflecting the observation that high quality sovereign bonds – even in times of stress – tend to remain as the most liquid asset class when compared with the rest of possible asset classes within a given economy *(e.g.* corporates and securitisations).[13] Subject to approval from the EU Commission, the EU is planning to introduce in 2015 a "liquidity coverage requirement" following the same structure than the LCR. Some of the details of the calibration of the new liquidity requirements are still pending – including the exact definition of highly liquid assets; yet sovereign bonds are allocated at the top tier of liquidity –.

Basel III also introduces a second liquidity requirement, the Net Stable Funding Ratio (NSFR). Although the NSFR is not fully completed yet, sovereign debt is also categorised at the top of the liquidity scale. The NSFR is a medium-term (1 year) structural liquidity measure aimed to ensure that there is a minimum amount of stable funding (numerator) available in relation to the liquidity characteristics of banks' assets (denominator). The NSFR is not a binding requirement in the EU yet. But the CRD4/CRR provides for a reporting obligation to national supervisory authorities. And national authorities are also given discretion to apply provisions in the area of stable funding requirements before a binding NSFR is specified.

Regarding diversification requirements *(i.e.* concentration risks), the BCBS is working on setting a regime of limits to large exposures. Under the envisaged regime banks' exposures exceeding 10% of their eligible capital base will be subject to a mandatory reporting requirement to national supervisors. And a large exposure limit is defined for exposures exceeding 25% of their eligible capital. Sovereign exposures have been excluded from the scope of the proposed framework as the view of the BCBS is that the appropriate treatment

11 See Basel (2013).

12 Level 2 assets includes highly rated corporate and covered bonds, and national supervisors can also choose to include a sub-level of assets (Level 2B) comprising lower rated corporate bonds, RMBS and common equity, both under certain conditions. There is a cap of 40% of total HQLA on Level 2 assets, and 15% on Level 2B assets.

13 Even when some other particular securities within other asset classes *(e.g.* corporates) may remain as liquid as sovereign bonds (or perhaps even more) in time of stress, it is very difficult to anticipate ex ante which specific security within the pool will do so.

of concentrated sovereign exposures will need to be addressed as part of a broader review of the treatment of sovereign risk within the regulatory Basel framework. In the EU, the CRD4/CRR set a 25% limit to large exposures. Members' sovereign debt subject to a 0% RW are exempted from the regime.

3.3 ALTERNATIVES FOR A POTENTIAL REGULATORY REFORM

Broadly speaking, there are two main routes to prevent and mitigate risks on financial stability stemming from sovereign risk in the EA. The first route is going straight into the source of the problem, fixing the underlying weaknesses and vulnerabilities in the EA. The second route is addressing some of the sovereign risk manifestations.

Tackling the root sources of the sovereign risk in the EA implies solving the existent fiscal imbalances and ensuring sound inter-temporal fiscal policy both at the country and EA level. Individual governments should commit to create enough fiscal space in normal times to allow them room to manoeuvre in stress times. And when using fiscal policy to mitigate some of the unintended consequences of financial crises they should do a decided and credible effort to maintain their public finances within adequate tolerance levels. In addition, tackling the root problems also implies fixing the faulty lines in the fiscal architecture of the EA and boosting coordination among countries in crises management.

At the end of the road, going in this direction should converge towards a consolidation of a fully-fledged fiscal and banking union [see Van Rompuy (2012) and Coeuré (2012)].

To solve the underlying weaknesses and vulnerabilities in individual countries and in the EA as a whole is also a necessary condition to get its sovereign debt closer to the risk-free status it had in the past. As risk-free assets are necessary for the proper work of financial systems, this is also a necessary condition to ensure financial stability, and to break the vicious cycle between banks and sovereigns at its source. For sovereigns in the EA this means adopting fundamental policies to ensure that sustainable fiscal policies are applied, and profound coordination among member states to prevent and mitigate the effects of asymmetric shocks. The EU is making progress to address these issues.

On the fiscal side, EU leaders have agreed on a series of reforms to improve fiscal governance in the EU and to strengthen its budgetary framework. These include two reform packages known as the Six Pack and the Two Pack, in 2011 and 2013 respectively. These reforms are concrete steps towards the consolidation of a fiscal union along the lines expressed in the EU Commission Blueprint's Roadmap towards a deep and genuine EMU.[14]

In addition, two temporary financial assistance facilities were established in 2010: The European Financial Stability Facility (EFSF) and the European Financial Stabilisation Mechanism (EFSM). The measures look to address the effects of asymmetric shocks in the EA and promptly correct growing fiscal imbalances, thereby ensuring the implementation of sound inter-temporal fiscal policies in the EU.

On the banking side, the creation of the Single Supervisory Mechanism (SSM) under the responsibility of the European Central Bank (ECB) constitutes a milestone towards the consolidation of a banking union in the EU. If successfully implemented, the SSM will be helpful to avoid the perceived sluggishness when working on coordinated solutions at the onset of the recent banking crisis. These issues may have contributed at least partially to the increasing fragmentation observed in the EA in the near past.

14 See European Commission (2012, 2013).

The second route aims to address some of the sovereign risk manifestations, such as credit or interest rate risk stemming from sovereign debt holdings [*e.g.* Weidmann (2013)]. On this, three main arguments have been used to propose a change to the current prudential treatment of sovereign exposures in the EU: a) that the current regulatory treatment of sovereign debt biases the banks' decisions towards sovereign debt; b) that the current treatment was not reflecting risks from banks' sovereign debt; and c) that the current regulatory treatment of sovereign debt generates incentives to pursue "carry trade" strategies.

We assess the third of the arguments above in the following section. The key messages from the empirical analysis will then be useful to develop on the other two arguments and to derive policy recommendations in Section 5.

4 Empirical analysis: the determinants of banks' sovereign debt holdings

In this section, we exploit the empirical evidence on the determinants of banks' sovereign debt holdings that has accumulated during the recent crisis. The third of the three arguments used to motivate a change to the current treatment of sovereign risk in the EU was that the current treatment creates incentives in banks to engage in "carry-trade" investment strategies. In other words, this means that the current treatment would be incentivising banks to invest in high yield sovereign debt with the liquidity they borrow from the ECB, instead of lending to the real economy. However, the incentives for "carry trade" will only be effective if this strategy becomes relatively more attractive than the range of alternative investments available for banks. In this sense, the alternative hypothesis that we consider is that banks may in fact be facing a period of lack of lending opportunities that are able to match their higher funding costs in stress times. Unfortunately, it is not possible to directly test the two hypotheses, because we do not have information of the alternative investment opportunities, if any, which banks rejected. Our identification strategy assumes that, if carry trade is taking place, it should be stronger when the returns it yields are larger, conditioning on alternative investment opportunities. We capture the alternative opportunities with macroeconomic variables that reflect the situation of the economy. Specifically, we analyse which of the following related effects is more important:

1 If the "carry trade" hypothesis prevails, then banks would increase their holdings of sovereign debt when sovereign yields rise.

2 Under the alternative macroeconomic explanation, banks' sovereign debt holdings would respond counter-cyclically to macroeconomic cycles. Banks would increase their holdings of sovereign debt during recessions, when lending opportunities to the private sector are scarcer, as a way to preserve value and liquidity. And, by contrast, they would reduce these exposures during expansions, when lending to the private sector is safer and more profitable in risk-adjusted terms.

Acharya and Steffen (2013) and Battistini *et al.* (2013) empirically study the first effect and conclude that "carry trade" strategies are prevalent. In contrast, we argue that it is crucial to control for the macroeconomic situation, which captures the presence or absence of attractive alternative investment opportunities.

4.1 DATABASE, RECENT DEVELOPMENTS AND THE CRISIS

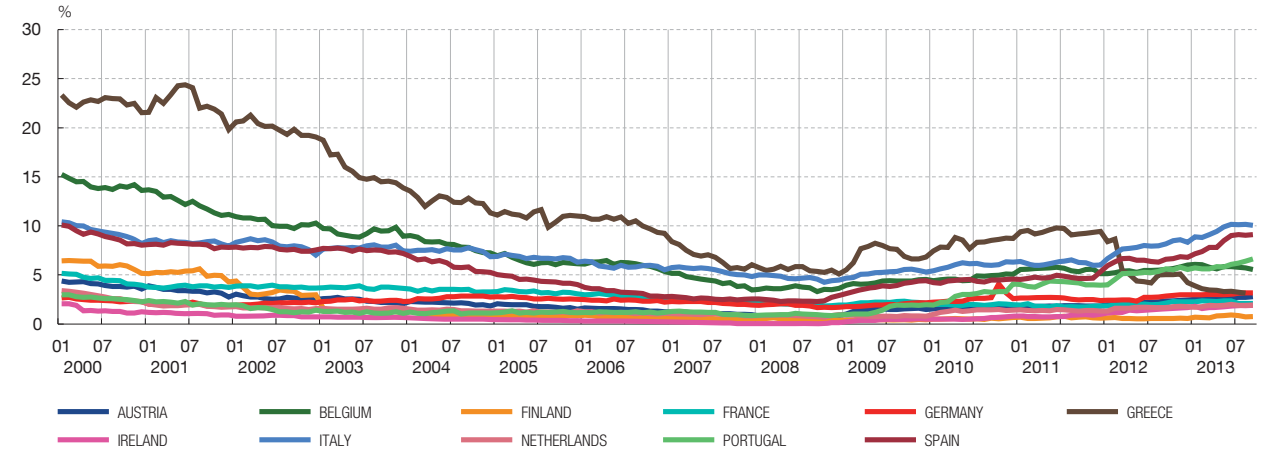
We use monthly data from January 2000 until September 2013 of the banks' sovereign domestic debt holdings to total assets ratio aggregated by country.[15] We focus on domestic exposures to explicitly address the link between banks and the sovereign risk of the

15 We obtained this data from the ECB Statistical Data Warehouse (SDW), which is publicly available at http://sdw.ecb.europa.eu/.

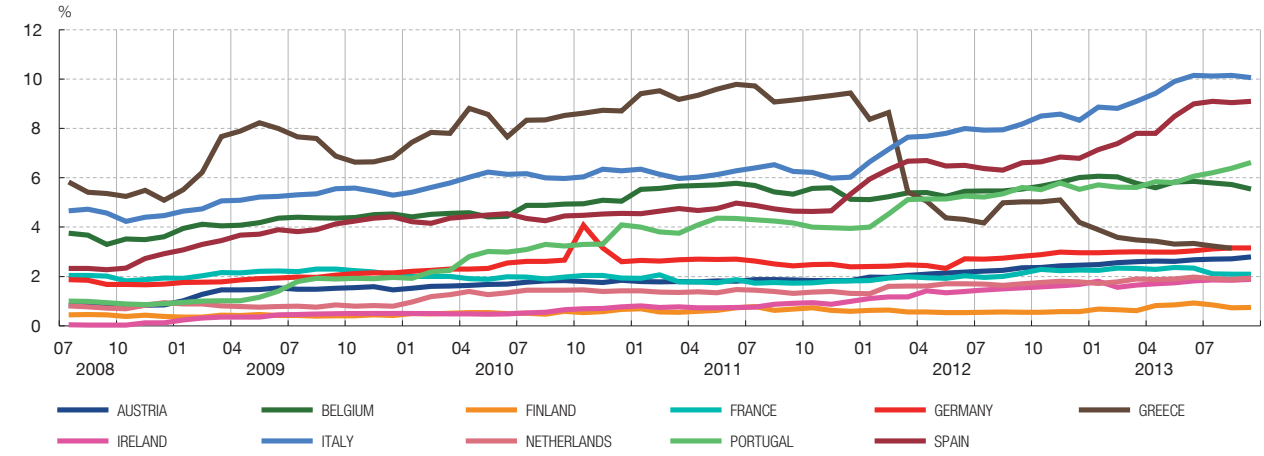
HISTORICAL EVOLUTION OF DOMESTIC SOVEREIGN DEBT HOLDINGS IN EURO AREA COUNTRIES, AS A PROPORTION OF BANKS' TOTAL ASSETS

CHART 1

A. JANUARY 2000 – SEPTEMBER 2013



B. JULY 2008 – SEPTEMBER 2013



FUENTE: ECB Statistical Data Warehouse.

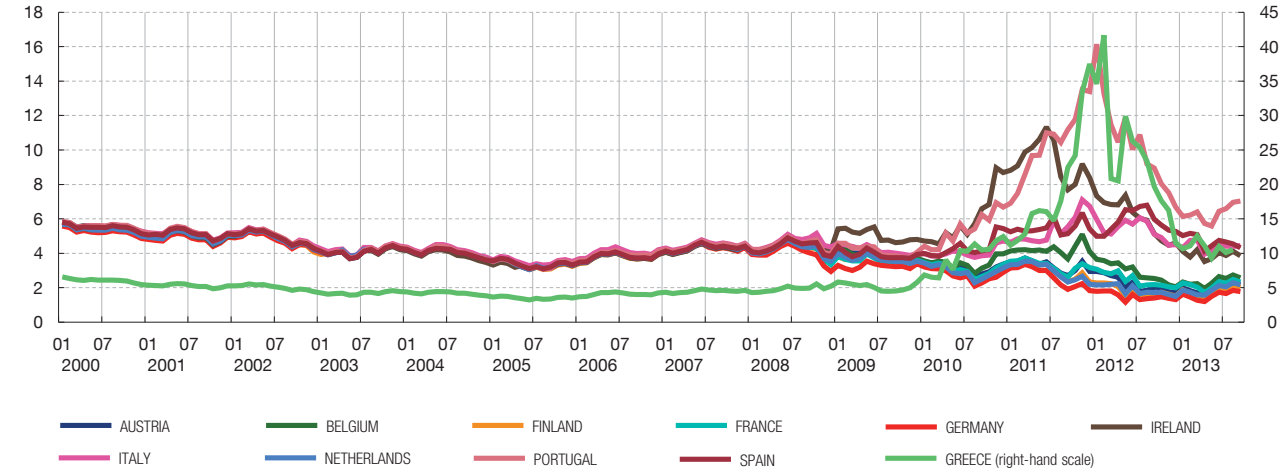
country in which they are headquartered. We study the "carry trade" hypothesis by considering end-of-month yields on 10-year sovereign bonds. Analogously, we capture the macroeconomic situation with industrial production, as a proxy of GDP available at the monthly frequency, and the unemployment rate.[16] In addition, changes in industrial production can also be capturing effects on governments' revenues due to a slowdown in the economy, while increases in the unemployment rate can also be reflecting rises in Government expenditures due to the real economy deterioration.

Chart 1.A shows the historical evolution of sovereign exposures in EA countries as a proportion of banks' total assets. We observe that sovereign exposures were relatively high at the beginning of the sample in early 2000s. They steadily decreased over the following boom years until the beginning of the 2008 financial crisis. Chart 1.B, in turn, shows in more detail that sovereign exposures in core EA countries have remained

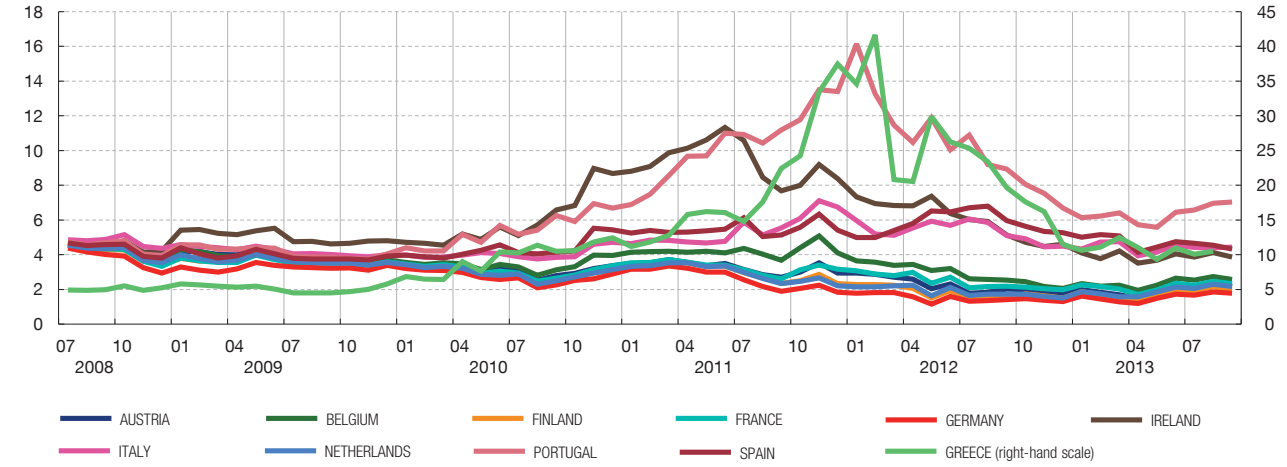
16 We use industrial production as a proxy of GDP growth, which is not available at the monthly frequency. We have obtained the data on industrial production and unemployment from Eurostat, and the sovereign yield data from Datastream.

HISTORICAL EVOLUTION OF THE YIELDS OF 10-YEAR SOVEREIGN BONDS CHART 2

A. JANUARY 2000 – SEPTEMBER 2013



B. JULY 2008– SEPTEMBER 2013



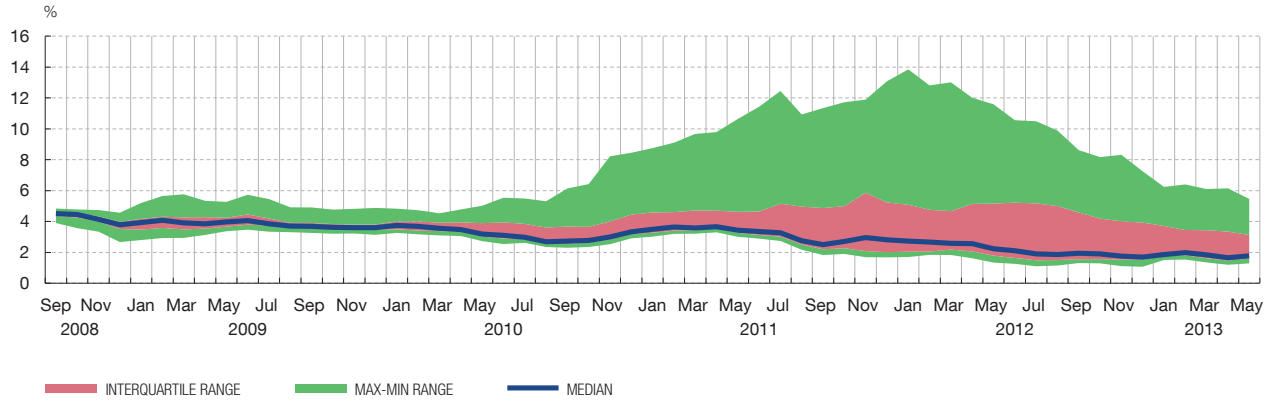
SOURCE: Datastream.

relatively flat or with moderate growth since the onset of the crisis, whereas the exposures of the so-called peripheral countries *(i.e.* Greece, Ireland, Italy, Portugal and Spain) have grown at a much faster rate. It is worth noting that domestic sovereign debt holdings in Greece plunged after the Greek debt restructuring. To avoid that this event affects our conclusions, we will only consider Greek data until 2010.

Chart 2 shows that EA sovereign yields moved almost in unison until the end of 2008. Hence, during the years where most EA banks were reducing their domestic sovereign debt holdings, sovereign bonds from different EA countries were perceived as having a similar risk. Yet, already in 2009 Greece and Ireland began to pay higher prices for their sovereign debt. These countries were followed by Portugal, Spain and Italy in 2010, and to a minor extent by Belgium. Meanwhile, core EA countries even benefited from lower sovereign yields albeit with a higher dispersion than during the boom years. Since mid 2012, nonetheless, spreads in countries under stress have fallen. Whilst the timing and magnitude of rises in spreads were not the same for all countries, the sharp decline and re-convergence of spreads since mid 2012 is being evidenced all across the board. This can be seen in the contraction of inter-quartile spreads, particularly in the upper quartiles (see Chart 3).

DISTRIBUTION OF LONG-RUN INTEREST RATES ON SOVEREIGN DEBT (a)

CHART 3



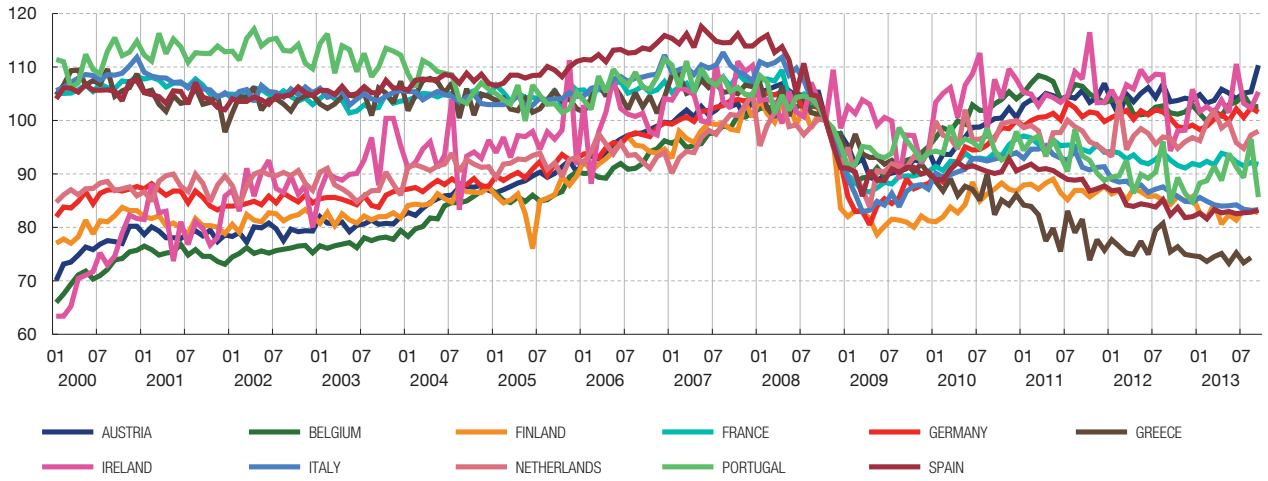
SOURCE: Banco de España - *Boletín Estadístico*.

a Greece is excluded from the sample.

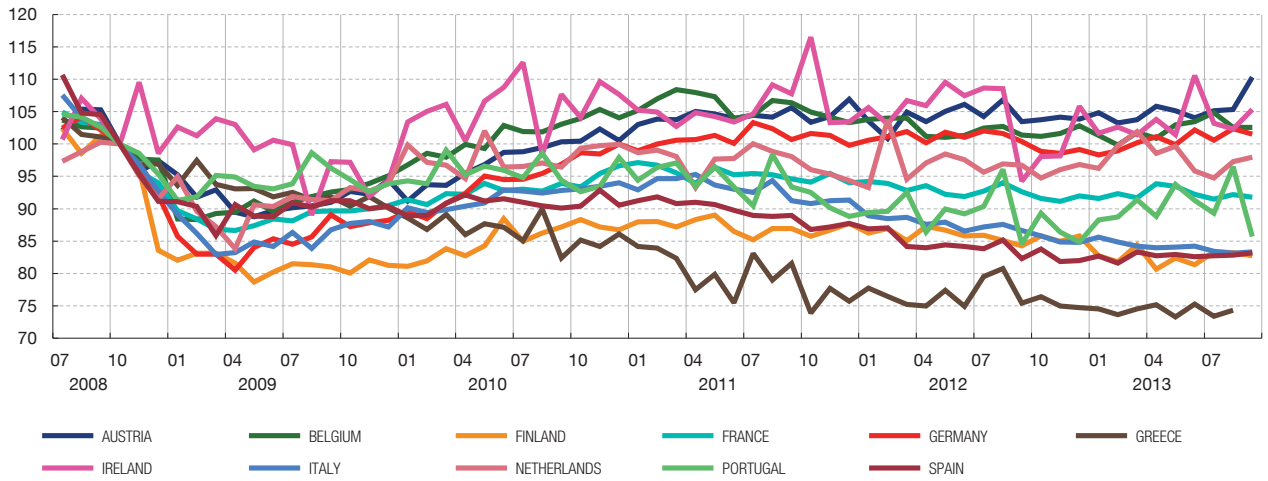
HISTORICAL EVOLUTION OF INDUSTRIAL PRODUCTION IN EURO AREA COUNTRIES (Normalised to 100 in October 2008)

CHART 4

A. JANUARY 2000 – SEPTEMBER 2013



B. JULY 2008 = SEPTEMBER 2013

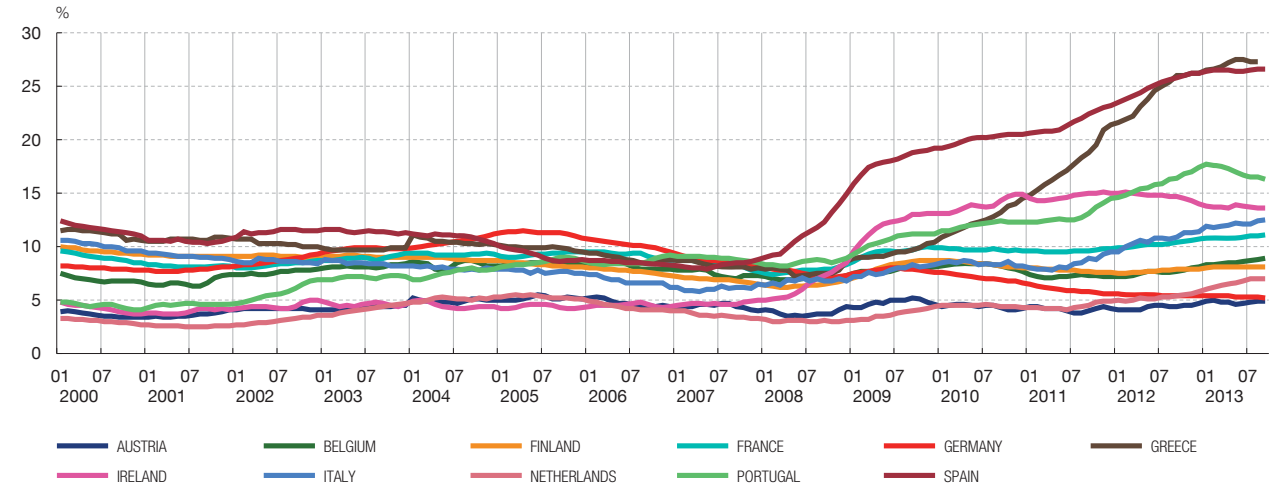


SOURCE: Eurostat.

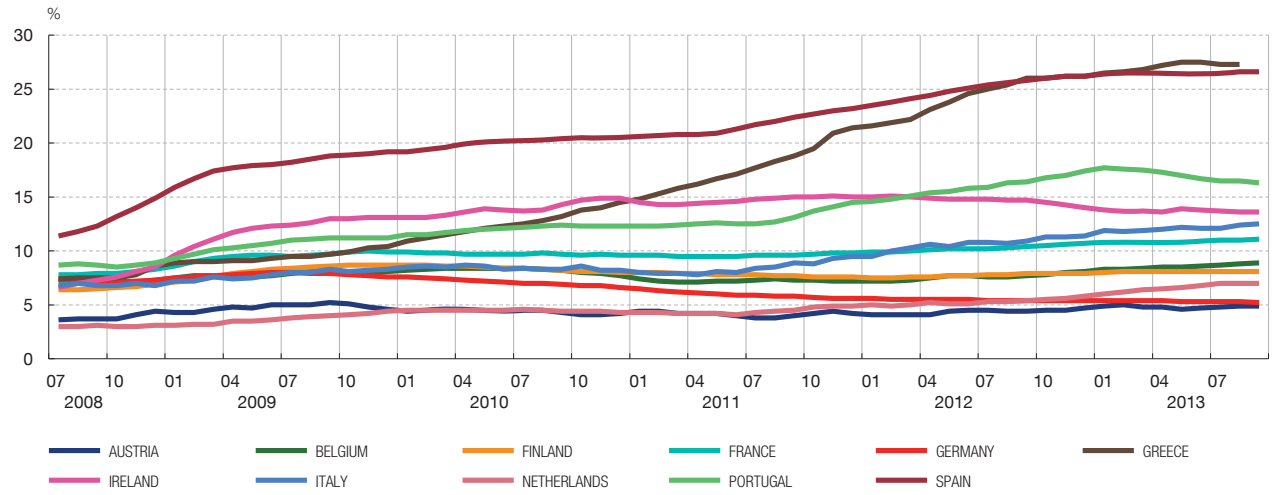
HISTORICAL EVOLUTION OF THE UNEMPLOYMENT RATE IN EURO AREA COUNTRIES

CHART 5

A. JANUARY 2000 – SEPTEMBER 2013



B. JULY 2008 – SEPTEMBER 2013



SOURCE: Eurostat.

In terms of industrial production, we observe in Chart 4 that core EA countries experienced large growth levels during the first half of the previous decade. In contrast, Spain experienced a milder growth in industrial production until 2008, while the other peripheral countries had roughly constant industrial production levels. In contrast, all EA countries suffered substantial falls in industrial production at the beginning of the crisis. But core EA countries quickly recovered their pre-crisis levels, while peripheral countries suffered a double dip shock. On this, Chart 5 shows consistently higher unemployment levels in peripheral countries than in core countries all across the sample. This situation has worsened during the crisis. At the end of the sample, more than one quarter of the active population in Spain and Greece was unemployed.

4.2 ANALYSIS OF STATIONARITY AND COINTEGRATION

The previous charts showed the high heterogeneity in the macroeconomic evolution and financial shocks that different EA countries experienced during the recent crisis. We believe, in this sense, that it is crucial to incorporate this information to explain the determinants of domestic sovereign debt holdings by EA banks. More specifically, we seek to study the link between sovereign yields and banks' sovereign debt holdings controlling for the macroeconomic situation in each country. As there might be feedback effects between

sovereign yields, debt holdings and the macroeconomic factors, we consider a vector autoregressive (VAR) model to incorporate these features.

Given the high persistence in the time series observed in Charts 1 to 5, and as it is common practice in the literature, we need to study their stationarity in order to apply an adequate statistical treatment. In addition to the variables already discussed, we define the sovereign spread as the difference between the sovereign yields of EA countries and the German yield. Using the whole sample, we cannot reject the presence of unit roots in the sovereign yields, the spread, industrial production and unemployment. We present detailed results of the unit roots analysis performed in the Appendix.

Further to the stationarity analysis, the possible presence of cointegration between series is also an issue to consider. Related to our work, Battistini *et al.* (2013) argue in favour of considering the presence of cointegration between the home country sovereign yield, the German yield and domestic sovereign holdings. This assumption is not innocuous, since cointegration turns out to be a key element to support the carry trade hypothesis under a vector correction model (VEC). However, we find that the evidence in favour of cointegration is fairly weak (detailed results can be found in the Appendix). Cointegration is a long term phenomenon, but unfortunately the sample length in the data is too short to determine its presence or absence in sufficiently precise statistical terms. Yet, it is still possible to make a well founded modelling decision by turning to the model's economic features. We will now discuss the economic implications of cointegration to justify why we do not think it is a reasonable assumption in this setting.

A cointegration relationship between the domestic yield, the German yield and domestic sovereign holdings would imply a long term equilibrium relationship between their levels. Hence, a different level of domestic debt holdings would be related in equilibrium to different levels of sovereign yields, although the variables may temporarily deviate from the long term relationship due to short term shocks. Alternatively, the absence of cointegration would imply that there is not a long term equilibrium relationship between sovereign yields and banks' sovereign debt holdings. This does not mean, however, that – under absence of cointegration – these variables are not related. That is, a shock to sovereign yields might actually induce a change in the holdings of sovereign debt – and the other way round – but there would not be an intertemporal relationship between the levels to which they revert. For instance, cointegration between these variables would imply that if sovereign yields doubled then banks' debt holdings should double as well in the long run, whereas absence of cointegration does not introduce such kind of restrictions. In addition, a cointegration relationship between sovereign yields and debt holdings would pose a technical problem in the long run, since this latter variable only has support between 0 and 1 – being expressed as a proportion of total assets – whereas yields can take values in [0, ∞). For all these reasons, we think that a VAR framework is more suitable than an error correction model (a VEC model).

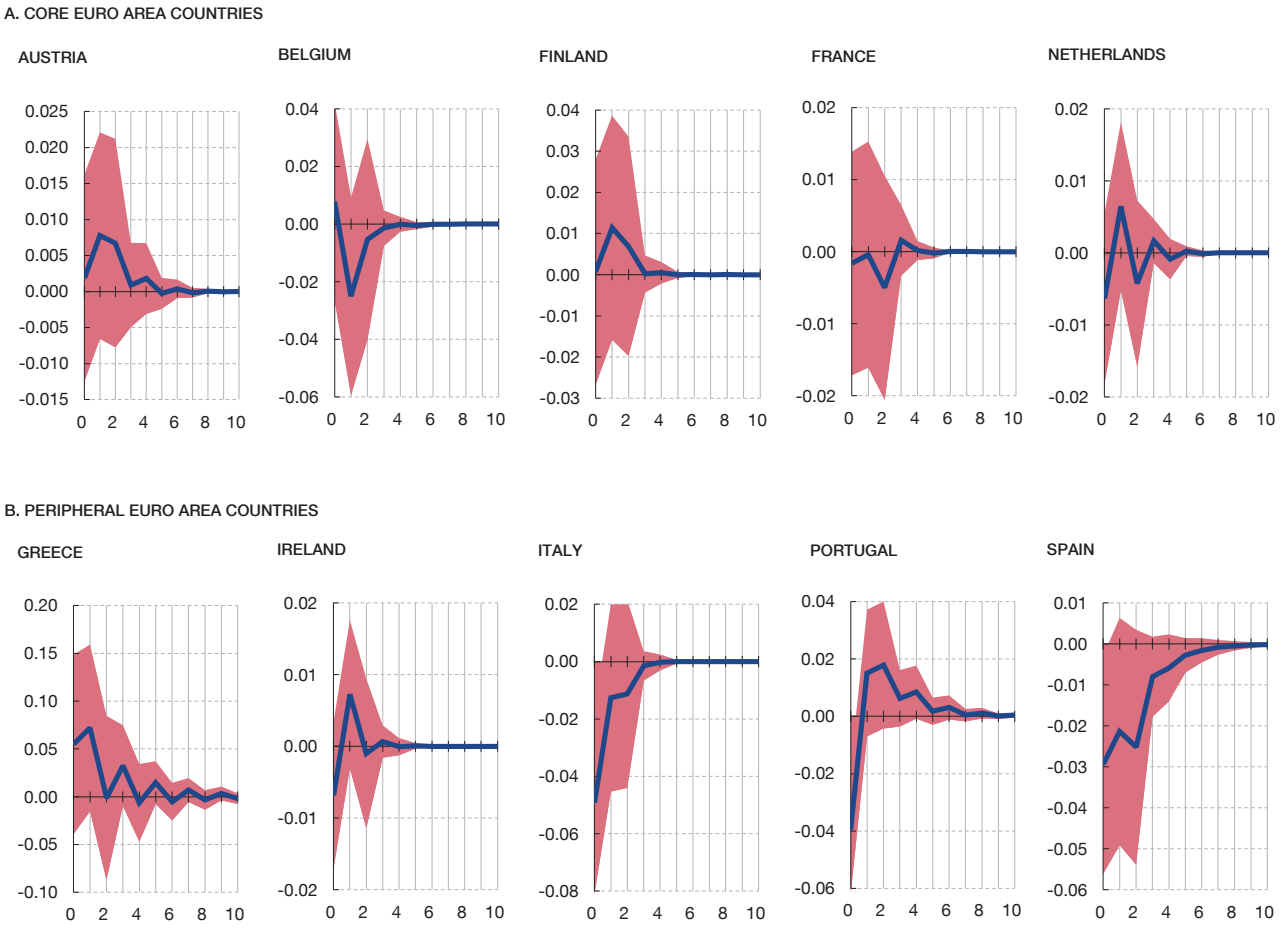
4.3 REGRESSION ANALYSIS

We first consider a VAR(2) model with only two endogenous variables: the monthly change of the ratio of domestic debt holdings over total assets ($\Delta ddebt_t$ for short) and the monthly change of the sovereign spread ($\Delta spread_t$), computed as the difference between the domestic sovereign yield and the German bond yield. Both variables are computed for each EA country. Specifically, our model can formally be expressed as

$$\begin{bmatrix} \Delta ddebt_t \\ \Delta spread_t \end{bmatrix} = A_0 + A_1 \begin{bmatrix} \Delta ddebt_{t-1} \\ \Delta spread_{t-1} \end{bmatrix} + A_2 \begin{bmatrix} \Delta ddebt_{t-2} \\ \Delta spread_{t-2} \end{bmatrix} + \varepsilon_t, \qquad [1]$$

ORTHOGONALISED IMPULSE RESPONSE FUNCTION OF DOMESTIC DEBT TO A SHOCK OF THE SPREAD. VAR(2) BIVARIATE MODEL OF SPREADS AND DOMESTIC DEBT

CHART 6



SOURCE: Authors´elaboration.
NOTE: Variables in first differences. The orthogonalisation is based on the Choleski factorisation, where the variables are ordered as follows: (i) spread, (ii) domestic debt.

where A_0 is a 2x1 vector of coefficients, $A_1$and A_2 are 2x2 matrices of free parameters, and the vector of residuals ε_t is iid bivariate normal with zero means.

We estimate equation [1] separately for each country in our sample.[17] Chart 6 shows the orthogonalised impulse response function of domestic debt to a shock to the spread.[18] We obtain no significant change in any of the core EA countries. In contrast, we find a significant impact on three peripheral EA countries, but this effect goes in the opposite direction to the carry trade hypothesis. In particular, Italy, Portugal and Spain, which are three of the countries for which it has been extensively argued that their banks were engaging in carry trades, the impact of an increase in the sovereign spread generates a reduction of the domestic debt held by their national banks.

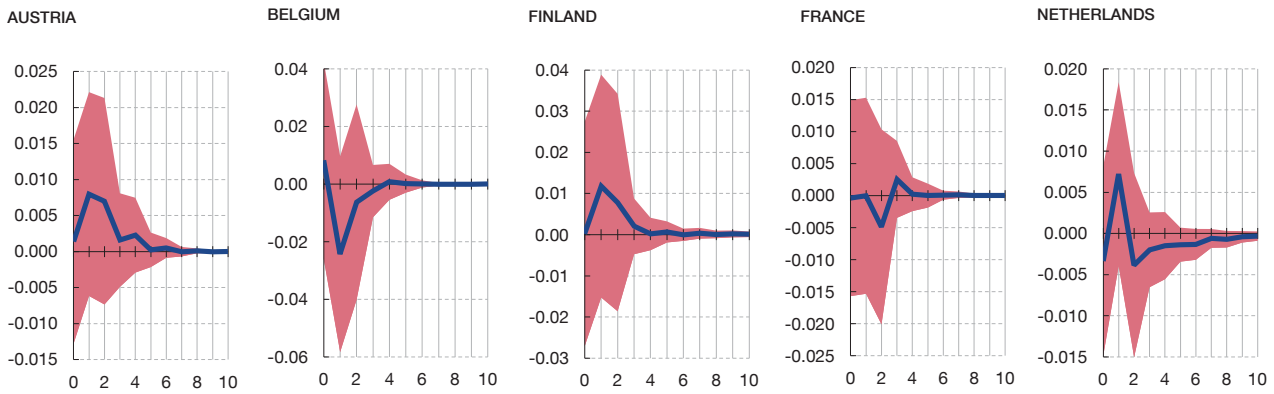
The results from the bivariate model may be affected by the fact that we do not control for alternative investment opportunities. We investigate this issue by proxying the alternative opportunities with industrial production and the unemployment rate. Thus, we now consider the extended VAR(2) model:

17 We consider the same VAR(2) structure for all countries for the sake of consistency.
18 We consider the usual Cholesky factorization. We place the stressed variable in the first place, so that the shock at the initial period only enters through the stressed variable.

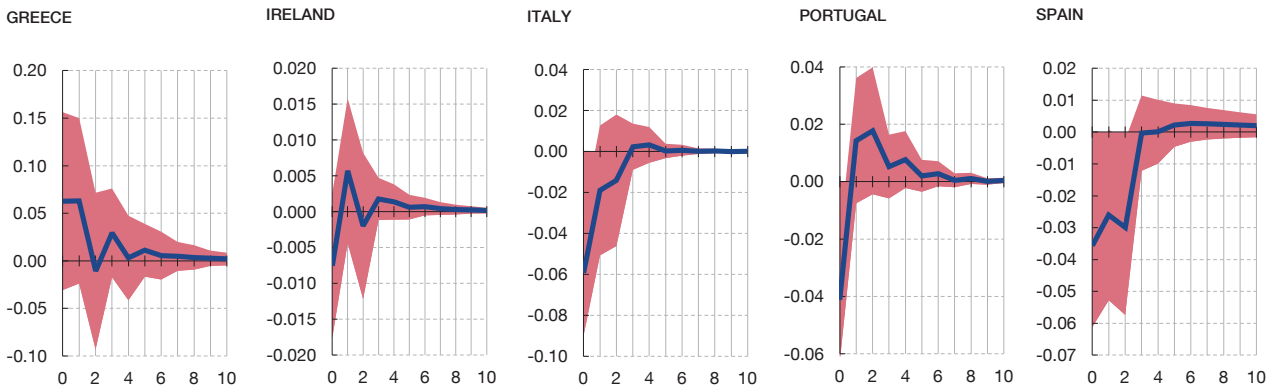
ORTHOGONALISED IMPULSE RESPONSE FUNCTION OF DOMESTIC DEBT TO A SHOCK OF THE SPREAD. VAR(2) MODEL OF SPREADS, DOMESTIC DEBT, INDUSTRIAL PRODUCTION AND UNEMPLOYMENT

CHART 7

A. CORE EURO AREA COUNTRIES



B. PERIPHERAL EURO AREA COUNTRIES



SOURCE: Authors´ elaboration.
NOTE: Variables in first differences. The orthogonalisation is based on the Choleski factorisation, where the variables are ordered as follows: (i) spread, (ii) domestic debt, (iii) industrial production, (iv) unemployment.

$$\begin{bmatrix} \Delta ddebt_t \\ \Delta spread_t \\ \Delta IP_t \\ \Delta UP_t \end{bmatrix} = B_0 + B_1 \begin{bmatrix} \Delta ddebt_{t-1} \\ \Delta spread_{t-1} \\ \Delta IP_{t-1} \\ \Delta UP_{t-1} \end{bmatrix} + B_2 \begin{bmatrix} \Delta ddebt_{t-2} \\ \Delta spread_{t-2} \\ \Delta IP_{t-2} \\ \Delta UP_{t-2} \end{bmatrix} + \varepsilon_t,$$

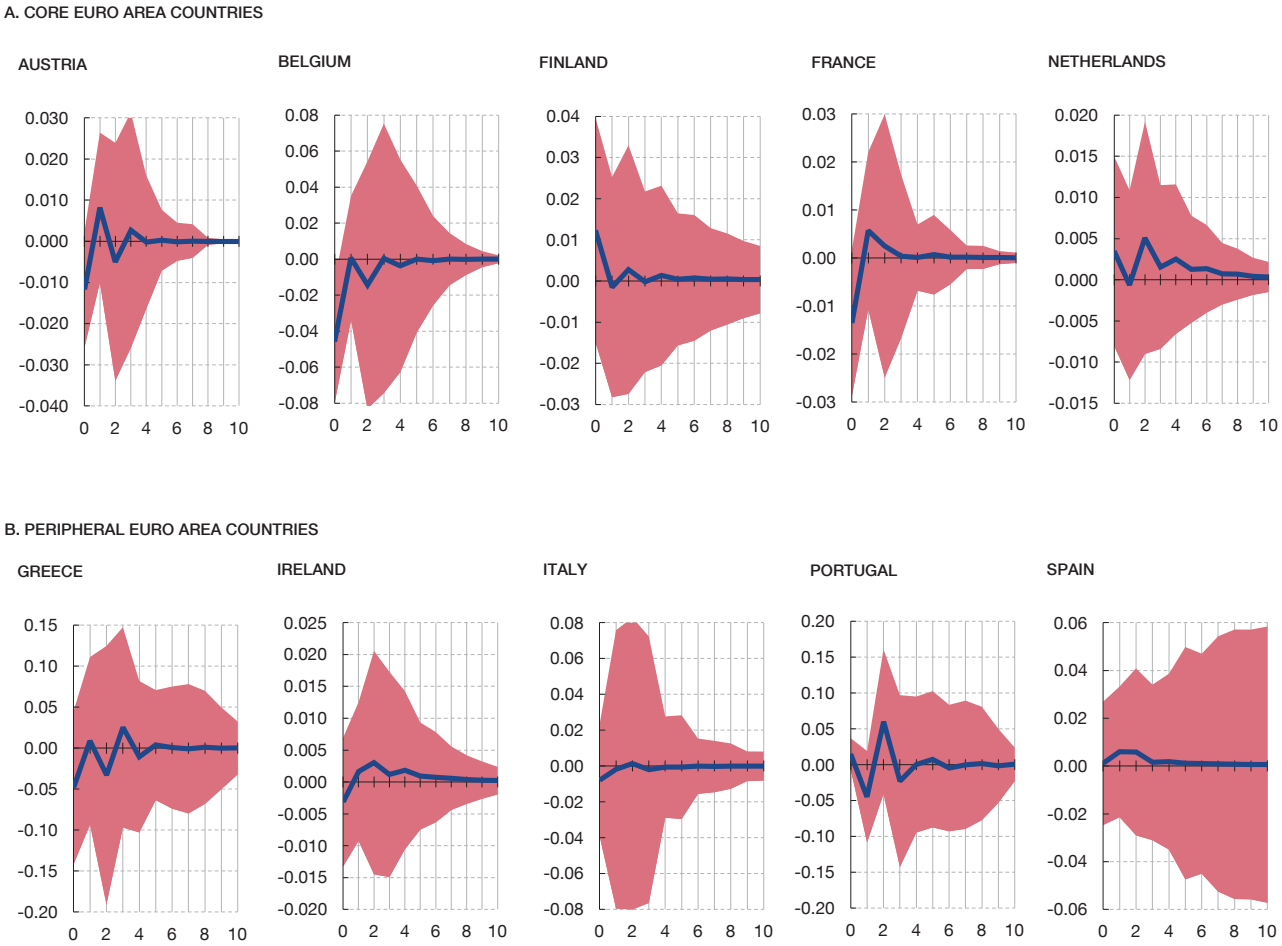
where ΔIP_t and ΔUP_t denote the monthly rate of change of industrial production and the monthly change of the unemployment rate, respectively. Now B_0 is a 4x1 vector of coefficients, B_1 and B_2 are 4x4 matrices of free parameters, and the residual ε_t is an iid normal 4x1 random vector with zero means.

We plot the orthogonalised impulse response functions of domestic debt to shocks of all the other variables in Charts 7 to 9.[19] Chart 7 shows that the shock to the spread essentially has the same effect as in the bivariate model. In turn, the only significant impact of the

19 We consider the usual Cholesky factorization. We place the stressed variable in the first place, so that the shock at the initial period only enters through the stressed variable. Domestic debt is always in the second position. We have checked the impact of placing domestic debt in the third or fourth position. When domestic debt is placed in the third position, the results are quite similar. When it is placed in the fourth position the impulse responses to a spread shock are qualitatively similar, but the impulse responses to the macroeconomic variables follow different patterns.

ORTHOGONALISED IMPULSE RESPONSE FUNCTION OF DOMESTIC DEBT TO A SHOCK OF THE INDUSTRIAL PRODUCTION. VAR(2) MODEL OF SPREADS, DOMESTIC DEBT, INDUSTRIAL PRODUCTION AND UNEMPLOYMENT

CHART 8



SOURCE: Authors´ elaboration.
NOTE: Variables in first differences. The orthogonalisation is based on the Choleski factorisation, where the variables are ordered as follows: (i) industrial production, (ii) domestic debt, (iii) unemployment, (iv) spread.

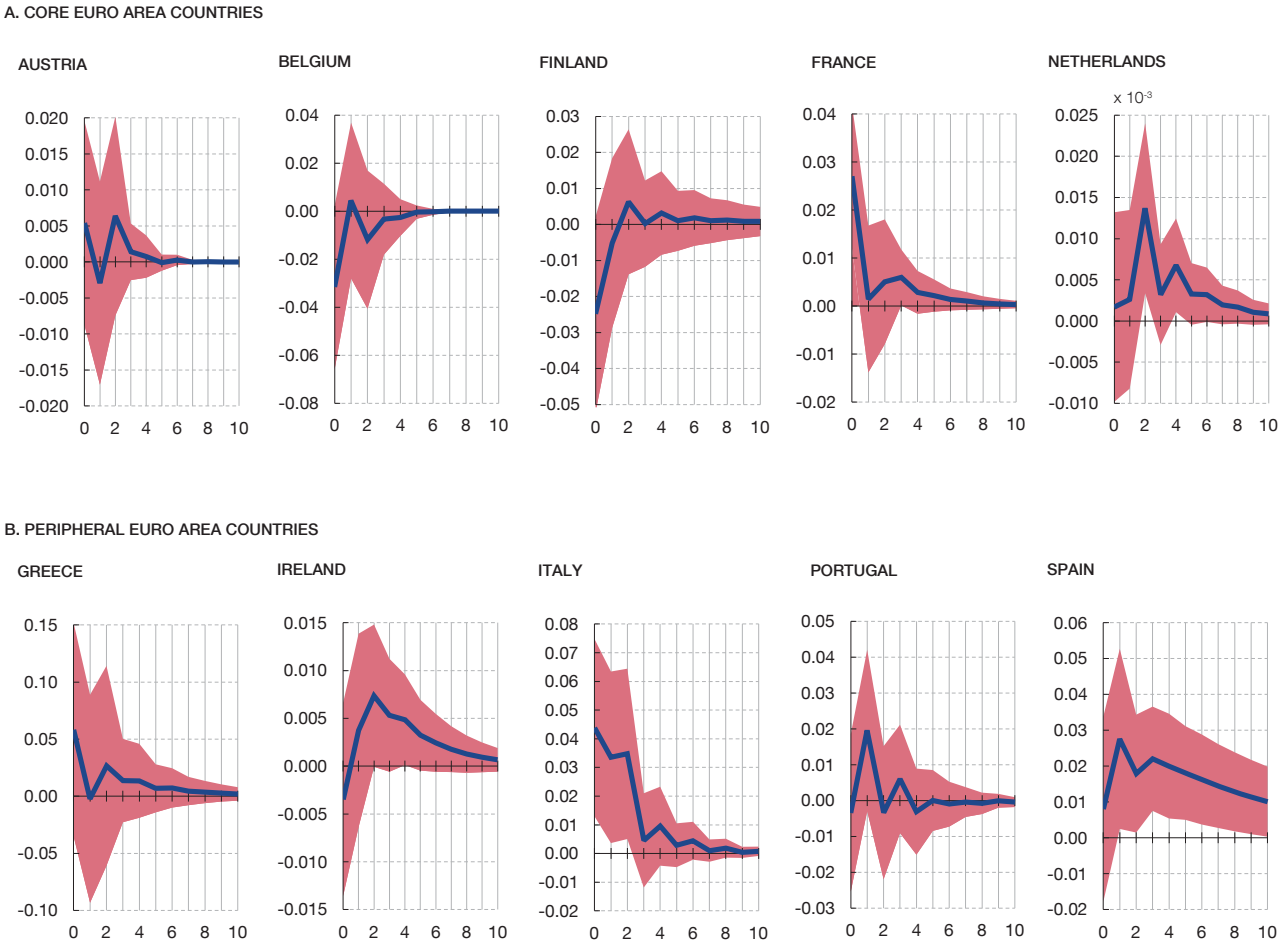
shock to industrial production is a fall in domestic sovereign debt holdings in Belgium (Chart 8). Lastly, the shock to the unemployment rate has a much wider impact, producing significant rises in holdings of sovereign debt in France, Italy, Spain, and to a smaller extent Ireland. This result shows that the real economy situation is a key explanatory factor to understand the evolution of sovereign debt holdings. It is worth noting that, since the variables are modelled in first differences, the transitory changes observed translate into permanent shifts in levels for the same variables.[20]

On the robustness of these results, it might be argued that the crisis involved a structural break changing banks' behaviour. If this were the case, the data prior to the crisis might not be informative of banks' behaviour towards carry trade opportunities. This does not seem to be the case however. The evolution of banks' sovereign debt holdings does not seem to be affected by a shift during the crisis that can be regarded as a structural break. We have re-estimated our bivariate VAR(2) model with data from 2007 to the end of the sample. The resulting orthogonalised impulse response functions of sovereign debt holdings to a

20 This can be illustrated with the following example. Consider the following path for a variable in first differences: $\Delta x(t+1)=c$, $\Delta x(t+2)=0$, $\Delta x(t+3)=0$, … Then, the path followed by the variable in levels will be $x(t+1)=x(t)+c$, $x(t+2)=x(t)+c$, … That is, a transitory shift of c units for the variable in first differences becomes a permanent shift in levels.

ORTHOGONALISED IMPULSE RESPONSE FUNCTION OF DOMESTIC DEBT TO A SHOCK OF THE UNEMPLOYMENT RATE. VAR(2) MODEL OF SPREADS, DOMESTIC DEBT, INDUSTRIAL PRODUCTION AND UNEMPLOYMENT

CHART 9



SOURCE: Authors´ elaboration.
NOTE: Variables in first differences. The orthogonalisation is based on the Choleski factorisation, where the variables are ordered as follows: (i) unemployment, (ii) domestic debt, (iii) industrial production, (iv) spread.

shock of the spreads turns out to be quite similar to the values displayed in Chart 6, both qualitatively as well as in terms of statistical significance.[21] In view of this, our results appear to be adequately capturing banks' behaviour to the incentives posed by sovereign spreads.

4.4 SUMMARY OF MAIN RESULTS

The first relevant result is that we do not find empirical evidence that higher sovereign yields have induced banks to increase domestic sovereign debt holdings in our sample. In this sense, our results do not support the "carry trade" hypothesis for domestic exposures. In contrast, we find that macroeconomic conditions turn out to be a key determinant of sovereign debt holdings as banks tend to increase their exposure to sovereign debt when macroeconomic conditions deteriorate.[22] Our results go in the same direction than Angeloni and Wolff (2012) suggesting a central role for economic factors in explaining the link between sovereign debt and banks, particularly in times of stress.

21 These results are available upon request to the authors.

22 Unfortunately, information on non-domestic high yield banks' sovereign exposures was not available to us. Thus we are not able to test the effects of yields and macroeconomic variables in this case. Yet, "carry-trade" incentives may be stronger in this case, since some of the factors we have described may not apply. In addition, the incentives to engage in "carry-trades" strategies, might become stronger after the sovereign crisis has stabilised, since some sovereign spreads may remain relatively high but the perception of underlying risks may have receded to some extent.

Changes in macroeconomic conditions affect banks' balance sheets through a number of channels. On the assets side, the deterioration of the economic conditions reduces the number of profitable lending opportunities in traditional banking sectors. On the funding side, the sharp increases in funding costs for banks in countries under stress narrowed down the range of feasible investment options in the short-run. The virtually negative real interest rates offered by some European bonds did not offer a return able to match their now much higher funding costs. This made high-yield sovereign bonds one of the few attainable options when the crisis was acutely severe and uncertainty widespread. As a result, there was a natural tendency to observe an increase in banks' holdings of sovereign debt coinciding with the period of fragile private funding markets and shocks to the real economy.

Also relevant, and as reflected in the hierarchy of liquid assets in the Basel III liquidity standards, sovereign debt – even if impaired – tends to remain among the most liquid assets when compared to other assets in the economy in times of stress. Sovereign debt holdings thus allow domestic banks to maintain a buffer of liquid assets at their disposal. This, and a common tendency in the market to front-run the agreed time-lines for the implementation of new regulatory standards, can also form part of the explanation for the observed gradual accumulation of sovereign debt holdings in the last few years.

As a possible side-effect, banks' holdings of domestic debt may also be contributing to preserve value in the context of persistent illiquidity and high volatility in markets. Provided that long-term economic fundamentals remain sound and public debt does not deviate significantly from the stable path, helping to stabilise market conditions and to maintain a source of stable funding and pricing to the economy can contribute to mitigate some of the negative effects that the stress in the sovereign has on banks' own balance sheets. For example, the common view of the sovereign as a "floor" to other risks in the economy, can significantly affect refinancing costs not only for banks but also for companies and households in the country under stress. Assessing the net effects of these dynamics and the effects from other possible explanatory factors is something we leave for the future.

5 Building blocks for the prudential treatment of sovereign exposures

We have described in previous sections the current prudential treatment of banks' sovereign exposures and we have shown that one of the arguments motivating a change to the current treatment of sovereign exposures – *i.e.* the "carry-trade" incentives – is not well supported by empirical evidence for the case of domestic sovereign debt holdings. We have also argued that the first route to tackle the problem of sovereign risk in the EA is addressing the underlying weaknesses and vulnerabilities in individual countries and in the EA as a whole – *i.e.* adopting fundamental policies to ensure sound inter-temporal fiscal policy and coordination among euro countries –.

Yet, there are broader arguments suggesting the need of changing the current approach to sovereign exposures. Informally, these arguments can be summarised by the following general principle: "if an asset is risky, regulation should do something about it". This means that if sovereign exposures are risky, prudential regulation should provide the right incentives to avoid an excessive accumulation of sovereign debt. And, in consequence, that the prudential treatment of sovereign exposures should not bias banks' decisions towards sovereign debt (first argument in page 15). In addition, the same general principle also implies that prudential regulation should ensure that the banks have enough loss absorbency capacity to face potential losses from sovereign risk (second argument in page 15).

The rationale is that acting in this way prudential regulation would be contributing to increase banks' *ex ante* resilience – *i.e.* when risks accumulate but have yet not materialised

BUILDING BLOCKS OF A PRUDENCIAL APPROACH TO SOVEREIGN RISK TABLE 1

Building blocks	Special features of sovereign risk	Suggestions for policy
Block 1: Holistic approach	Covers a wide range of regulatory areas, not only in banking but also in insurance and market regulation. Intrinsically linked to monetary *(e.g.* transmission mechanism) and fiscal policy *(e.g.* stabilising fiscal policies). Subject to structural differences in financial systems.	Introduce a comprehensive and long-term perspective to the assessment of sovereign risk in regulation. Consider structural characteristics of different financial systems. Apply a macroprudential approach to allow for a wide but integrated view of the issue.
Block 2: Flexible and adaptable tools	Banks' actual exposure to a sovereign default goes well beyond their holdings of sovereign debt. Portfolios of 'high quality sovereign debt' are typically highly concentrated, subject to infrequent default episodes and with broad effects in case stress. Common mechanistic rules such as risk weighting and large exposure limits have important limitations when applied to sovereign exposures.	Apply a Pillar 2 approach to the treatment of sovereign exposures. Enhance current Pillar 2 by using quantitative techniques – *e.g.* stress-tests techniques to guide supervisory decisions; and a diversified set of risk metrics (block 3).
Block 3: Diversity of risk metrics and more and better information	Strong reliance on external credit ratings in the prudential treatment of sovereign risk. Current prudential treatment prone to procyclicality, cliff-edge effects and with low incentives for a diversity of risk metrics.	Reduce reliance on external credit ratings by improving the range of risk metrics used to guide supervisory decisions - *e.g.* drawing on debt sustainability analysis techniques. Improve sovereign risk disclosures to facilitate effective market discipline, e.g. using mandatory templates for banks' disclosures.

SOURCE: Authors´ elaboration.

(first argument) –, as well as their *ex post* resilience – *i.e.* when accumulated risks materialise (second argument) –.

Whilst we agree that the general principle and its implications hold for a variety of assets, we argue that sovereign risk exposures deserve a special consideration. Sovereign risk is, indeed, "special" in our view. We describe in this section the key characteristics that make sovereign risk special. Linked to each of these special characteristics we make a number of proposals to improve the design of prudential policy, provided that the root causes of sovereign risk in the EU are not well addressed in first instance. Many of these topics have already been debated at different fora, especially at the EU level, but we develop a joint framework in the form of high level building blocks and shed new light on the basis of our findings from the previous two sections. Table 1 summarises the framework of three building-blocks.

5.1 BLOCK 1: HOLISTIC APPROACH

The prudential treatment of sovereign exposures covers a wide range of issues, including banking, insurance and capital markets regulations. In addition, within each regulatory framework, sovereign bonds are involved in a number of areas, as for example risk-weights in credit risk capital requirements, in the composition of the mandatory liquidity buffers in liquidity risk regulation, and in the minimum haircuts applied in market operations and counterparty credit risk, among others. As it was discussed, sovereign debt also plays a central role in the transmission of monetary policy. And it is intrinsically linked to governments' stabilising fiscal policies, including the role of the government budget as a backstop to help to sustain the economy during systemic banking crises.

Also, as explained in Section 3.1, sovereign debt in advanced economies plays a key role in all financial systems as "risk-free" or "reference" assets. Yet, not all financial systems are the same. Some financial systems, for instance, are mostly dominated by banks, while others have a broader number of institutional investors and market makers, such as pension funds, insurance companies and mutual funds. This structural heterogeneity is also

suggesting a need for a broad view of the issue. The same prudential treatment is likely to have quite a different impact on financial stability when applied in different contexts.

More fundamentally, the sovereign crisis in the EA is not just "one other" simple example of a sovereign crisis. Being a monetary union, the economic effects and political implications of the European sovereign crisis are more extensive than some of the separated sovereign risk manifestations. In this sense, the prudential treatment of sovereign risk in the EA should be consistent with the overarching economic and political goals of the union, as well as with the on-going measures to correct the underlying structural weaknesses and vulnerabilities in the EU. As discussed previously, these include initiatives to improve fiscal governance in individual members and in the EA as a whole, and to advance towards the consolidation of a banking union. Any change to the current prudential treatment of sovereign risk in the EU should be sure to not hinder nor interfere with this process.

5.1.1 A possible way forward

All in all, there is a need to consider sovereign risk from a comprehensive and long-term perspective. But whilst a wide view is needed, the analysis should also be able to integrate the different areas involving the treatment of sovereign exposures. From this angle, a macroprudential approach to sovereign exposures appears as the most suitable way to address some of the sovereign risk manifestations in the EU and to guide supervisory decisions on the matter.

We suggest, in particular, giving proper consideration to the interactions and expected outcomes of the different regulatory reforms in train, to the on-going policy measures to address the root sources of the sovereign risk problem in the EA, and to consider structural differences between financial systems. This would help to avoid redundant or ineffective measures and to prevent unintended consequences.

Any assessment of possible policy measures cannot ignore the ongoing initiatives in the EA to progress towards the consolidation of a fiscal and banking union. From this perspective, it would not be fully appropriate to take the current situation as the benchmark situation in order to assess possible changes to the treatment of sovereign risk in the EU. The EU has already embarked in a series of reforms whose effects should not be front-run nor ignored.

5.2 BLOCK 2: FLEXIBLE AND ADAPTABLE TOOLS

It is very difficult for a single and uniform formula or model to handle sovereign risk. As the empirical evidence in Section 4 suggests, economic factors are central to explain the evolution of banks' holdings of domestic sovereign debt. From this perspective, banks' actual exposure to sovereign risk goes well beyond their direct holdings of sovereign debt. Sovereign risk affects the whole structure of banks' balance sheet through the "real economy" channel and it is generally perceived – and commonly used – as a reference "risk floor" to other risks in a given economy.[23]

For example, according to Eurostat, government spending represents more than 40% of GDP on average in the EA. As a consequence problems in governments' finances spread quickly to the whole economy. On the other side, the common perception of the sovereign

23 On the links between sovereign and banks risks, Wolff (2011) finds that banks' market valuations from July-October 2011 were not affected by their holdings of government debt of Italy, Spain, Portugal and Ireland. And Angeloni and Wolff (2012) do not find a very strong relationship between banks' sovereign holdings and their market valuation. In contrast, they find that the location of banks mattered for their market value. In line with our empirical findings, the authors also show that stock market performance varies significantly across countries, concluding that the sovereign-banking link appears to be less related to banks' holdings of sovereign debt and more to economic and country specific variables.

as a "risk floor" is often reflected in market practices, as for instance in investment policies limiting or completely banning investments in non-AAA countries [FSB (2010)]. Automatic "rating triggers" in investors' strategies can ignite fire-sales in domestic assets, by prompting sudden adjustments on investment portfolios following a downgrade in the sovereign.

As a result of the strong links between sovereign and financial stability, even a bank with absolutely no holdings of domestic sovereign debt is likely to see most of its balance sheet affected in times of stress in the domestic sovereign. Related to the discussion on the multiple risk transmission channels from sovereign to banks, De Paoli *et al.* (2009) find that two thirds of sovereign crises in their sample overlap with banking crises with most of the banking crises starting after the sovereign crises.

But besides the broad and profound links between sovereign risk and banks' balance sheets, there are specific characteristics of sovereign exposures which limit the effectiveness of mechanistic rules for the prudential treatment of sovereign risk as for example standard price-based *(e.g.* risk weights) and quantity-based *(e.g.* limits to large exposures) microprudential tools.

5.2.1 Price-based microprudential tools: risk-weights

There are important limitations in the current risk weighting mechanism embedded in Basel regulation when applied to portfolios of "high quality sovereign debt" – as for instance, sovereign debt portfolios from advanced economies –. These portfolios are typically highly concentrated, with very low-default frequency, and very high-impact. As with the risk inputs estimations for sovereign risk exposures *(e.g.* PDs), these characteristics raise difficult challenges for a proper risk weights calibration. For example, risk-weights are normally calibrated for relatively well diversified portfolios – as for example, corporates or retail exposures – with much higher default frequencies and lower impact than sovereign debt from advanced economies. Further to this, the inherited concentration in high quality sovereign debt portfolios together with potential contagion effects as the ones already seen in the EU cast doubts on the possibility of calibrating realistic shock-absorbing capital charges.

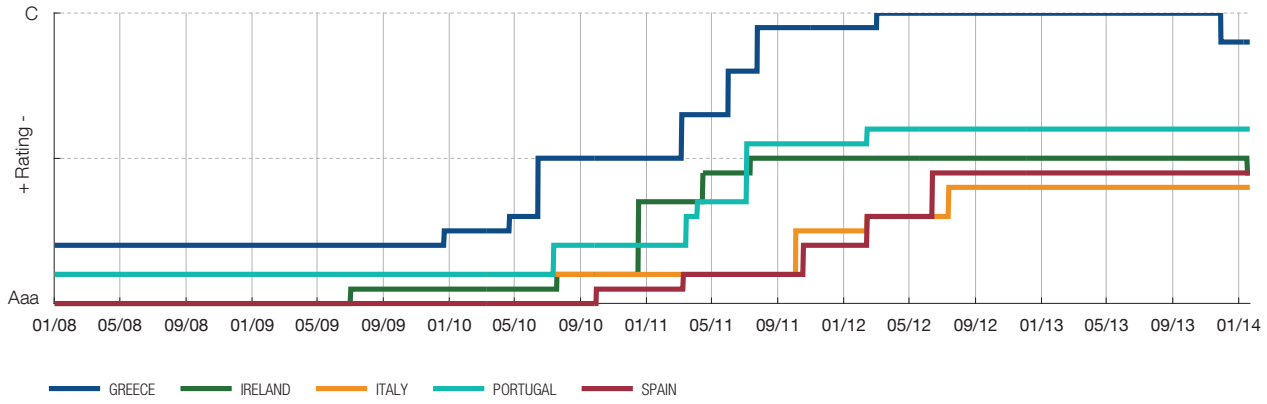
But capital charges for sovereign exposures may still be useful from an ex-ante perspective. That is, capital charges can help to curb banks' incentives to accumulate sovereign debt by introducing an extra cost on banks' holdings, thus acting as a penalisation device. Although this may help in some particular circumstances, this is not generally the case for sovereign exposures, especially for banks' holdings of domestic debt in advanced economies. Public sector debt tends to be counter-cyclical [see for example, Drehmann, Borio and Tsatsaronis (2011), p. 8]. As seen in the recent financial crisis, banks' sovereign debt holdings gradually decreased in the run up period, and then increased rapidly once the crisis unfolded (Chart 1).

This can be explained because in normal or boom times banks' incentives to hold assets with meagre returns – such as sovereign bonds from advanced economies – tend to be very low in profitability terms. Contrary to other asset classes, as for example real estate exposures, there are not many incentives to curb in this case. It is in adverse times when a gradual accumulation of public debt has been observed. As discussed, this can be explained by a number of factors in play as for example widespread uncertainty, "flight to safety", macroeconomic deterioration and cross-country effects. Mechanistic increases in capital requirements in this context, without assessing changes to economic fundamentals, the lack of profitable investment opportunities in a situation of high funding costs and fragmentation, or which carefully judge the timing for supervisory reactions could amplify shocks to the economy and increase tensions in debt markets.

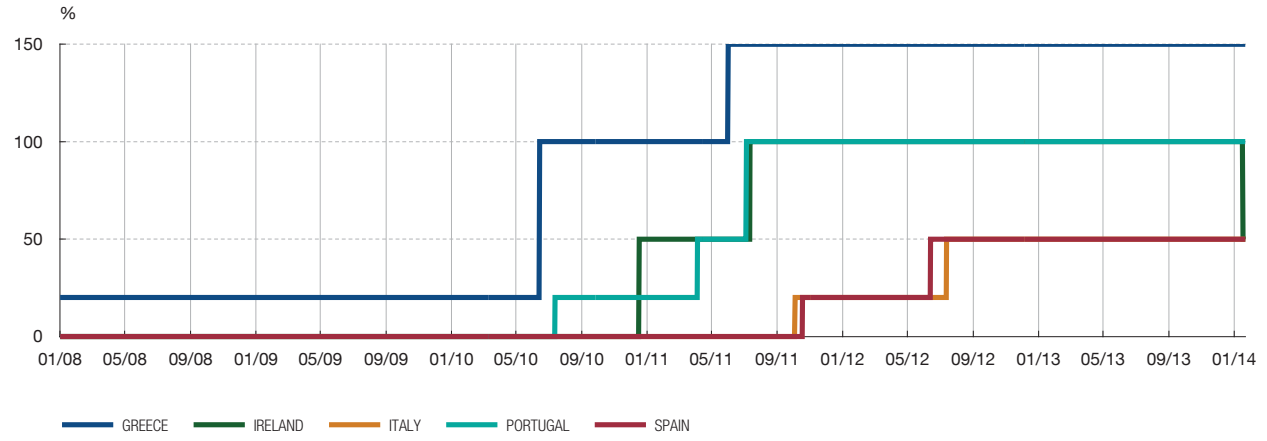
PROCYCLICALITY IN CAPITAL CHARGES

CHART 10

A. MOODY'S RATINGS OF LONG TERM SOVEREIGN DEBT IN DOMESTIC CURRENCY FOR SELECTED EURO AREA COUNTRIES



B. IMPLIED RISK WEIGHTS FOR SOME EURO AREA SOVEREIGNS IN THE STANDARDISED APPROACH



SOURCE: Moody´s and Authors´ elaboration.
NOTE: The risk weights have been computed using the standardized approach as stated in Paragraph 53 of Basel Committee (2006).

From this perspective, a mechanistic allocation of capital for sovereign risk can be very procyclical, especially when applied in the case of banking-led sovereign crises. An increase in capital requirements in this scenario would create a need for extra capital at the worse possible moment. That is, when banks' positions have been significantly weakened by the effects of the preceding banking crisis. Chart 10 illustrates this potential procyclical effects by simulating the effects of removing the carve-out on domestic sovereign debt.[24] The graphs show that had the carve-out been not applied, the larger increases in risk-weights and consequently in capital requirements following ratings downgrades would have happened mostly by the second half of 2011 and during 2012. This is very procyclical. This would be raising capital requirements in a moment when banks are experiencing greater difficulties in raising new capital as the effects of the global financial crisis feel more severely. Banks' expected reaction in this scenario is usually cutting further back on their credit provision, thereby amplifying the deterioration in the real economy [Kashyap and Stein (2004); Repullo and Suárez (2013)].

24 Cliff effects from the "hard wiring" of CRA ratings thresholds intro regulatory regimes can amplify procyclicality [FSB (2010)]. Problems from over reliance on a single risk metric – as for example CRA ratings – are however discussed in Section 5.3.

5.2.2 Quantity-based microprudential tools: concentration limits

Quantity-based rules – as for example limits to large exposures –, can also be problematic when applied mechanistically to sovereign exposures. This happens for three reasons. First, the large exposures limits can be at odds with different parts of the regulatory standards, as for example the new Basel liquidity standards. In the Liquidity Coverage Ratio (LCR), sovereign bonds are at the top notch of the ranking of eligible liquid assets and there are no limits to the amount of domestic sovereign debt that banks can hold in their liquidity buffers. Second, hard limits to banks' holdings of domestic sovereign debt are also prone to procyclicality. Banks do not have incentives to hold sovereign debt in normal times in first place. And in crisis times, there are scarce safe assets or investment opportunities able to match banks' higher funding costs. Third, in a context of widespread market illiquidity, increased market volatility not explained by fundamentals, or short speculative attacks in sovereign debt markets, it would be in banks own interest to help to sustain a stable source of funding and pricing for the economy thereby mitigating the negative spillovers effects on their balance sheets. Since sovereign crises are systemic in nature, these effects can prevail over the direct effects from banks' holdings of domestic debt. On this, Angeloni and Wolff (2012) find a relatively weak relationship between banks' holdings of sovereign debt and banks' market valuations. They find instead that economic factors play a more prominent role.

More generally, imposing diversification constraints to inherently concentrated assets such as high-quality sovereign debt can result in rules that may not be achievable in practice. After all, there are not so many "high-quality" sovereign bonds in the world. Just as an illustration, let's assume that a benchmark portfolio of high-quality sovereign bonds can only include sovereign debt from advanced economies. The IMF in its *World Economic Outlook* of April 2013 classifies 34 countries (excluding San Marino) as advanced economies. If we consider that 17 of these countries belong to the euro-zone and thus they are euro-denominated debt, we get a list of 18 advanced economies or jurisdictions issuing sovereign debt in different currencies. The inherent concentration of this portfolio becomes evident when compared with corporate or retail portfolios which are typically comprised by thousands of exposures from different counterparties.

All this is in addition to banks' efforts to match FX positions in their portfolios – including when sovereign debt holdings are used as reserves or as liquidity buffers –. For example, following the Basel provisions on the composition of high-quality liquidity buffers in different currencies, banks are expected to adjust their portfolios of sovereign debt to make them consistent with the distribution of their sources of funding by currency. These factors create serious challenges for the operationalisation of effective diversification rules in practice.

In conclusion, as a result of the multiple interconnections between sovereign risk and banks' stability – and with fiscal and monetary policy – the distinctive characteristics of "high quality" sovereign portfolios, and the different types of sovereign crises – *e.g.* "bank-led' or "pure" sovereign crises –, more flexible and adaptable approaches would be necessary to manage sovereign risk.

5.2.3 A possible way forward

We believe that Pillar 2 approaches to banking regulation are better equipped to manage the very special case of sovereign risk. Supervisory measures via Pillar 2 can consider aspects which can hardly be encapsulated in a formula or model. And they can also better fine-tune the timing of the supervisory responses to avoid exacerbating instability. Supervisory actions can also be usefully informed and guided by quantitative techniques as for example macro stress-tests [Nouy (2012)].

For the "Pillar 2" measures to work effectively, coordination among EU supervisors and well established procedures should be in place. This will help to get round "inaction" and "inhibition" biases in supervisory actions, and to ensure consistency among different supervisors.[25] The work of the SSM on this front will be fundamental for a consistent implementation of future supervisory measures.

5.3 BLOCK 3: DIVERSITY OF RISK METRICS AND MORE AND BETTER INFORMATION

There are several areas where the Basel capital framework relies heavily on ratings from Credit Rating Agencies (CRAs), but this reliance is particularly strong for the treatment of sovereign exposures. The risk inputs for the calculation of capital requirements for sovereign exposures depend on the approach banks follow. In the Standardised Approach (SA) for credit risk there is a direct mapping from CRAs ratings to risk weights [see Basel Committee (2006)]. In the Internal Ratings Based Approach (IRBA), risk weights for sovereign exposures are a function of banks internal estimations of probabilities of default. Both types of mappings from CRAs or internal risk inputs to risk weights have significant problems when applied to sovereign exposures.

5.3.1 Problems when using CRA ratings for sovereign exposures

There are at least three problems when CRA ratings are used to allocate capital for sovereign exposures. First, CRA ratings do not provide the type of input that risk-weights need. Risk weights require ratings to provide a cardinal risk metric – for instance, a level of probability of default for a given exposure –. But CRAs have widely recognized that their ratings scale reflect ordinal risk ratings, rather than targeting specific default probabilities or expected losses [see IMF (2010)]. Even when cardinal metrics for each rating grade could be derived – for example, from transition matrices – the calibration and validation of specific metrics for sovereign risk is difficult to achieve as result of the very few number of default events in advanced economies.

Second, CRA ratings can create significant cliff-edge effects in capital requirements as high-lighted by the FSB (2010). Partly due to the very low frequency of defaults in high-quality sovereign portfolios, migrations between grades tend to occur quite abruptly, which translates to sudden jumps in risk-weights and capital requirements (see Chart 10). This mechanistic feed-through of CRA ratings to risk-weights can in turn exacerbate the procyclicality of microprudential capital requirements. The issue of procyclicality in rating-based regulation (both internal and external ratings) is one of broad policy concern [see for example Repullo, Saurina and Trucharte (2010)]. But the problem is particularly acute for sovereign risk.

Arguably, this "discontinuity problem" may be alleviated by using more granular risk weights scales. But this is unlikely to be of much help in practice. CRA ratings migrations for high-quality sovereign bonds are not smooth. And there is a "clustering effect" which reduces the number of ratings grades actually perceived. Market practices tend to "cluster" rating grades (around 21 for major agencies) around a few buckets: investment grade, non-investment grade, and speculative or in default. This "clustering effect" amplifies the "cliff-edge" effects observed from rating transitions and produces a negative externality for the downgraded sovereign which can lead to destabilising spillovers.[26] For example, the distinction between investment and sub-investment grade for sovereign debt creates a discontinuity in the perception of risk which can trigger sharp increases in banks' funding

25 Inaction bias may occur at the moment of having to implement or activate a given policy or instrument. By contrast, inhibition bias may occur at the moment of having to retreat or relax a given policy or instrument. Both biases are relevant to the case of sovereign risk.

26 The clustering of CRA ratings is also associated to the "certification" role that CRA ratings is commonly attributed. In this role, CRA are perceived as a certification that a given assets belong to a particular sub-class.

cost, adding to the increases due to the "sovereign floor" effect. On this, the empirical analysis from the IMF (2010) shows that CRA ratings do have an impact on the funding costs of issuers and consequently their actions can have an effect on financial stability.

Third, the "hard-wiring" of CRA ratings for capital allocation affects market participants' incentives accentuating over-reliance on external credit ratings as the only source of information to assess sovereign risk. This over-reliance on CRA ratings also reduces regulators and banks' incentives to investigate and exploit a more diversified set of information to assess the fundamentals of their public debt exposures. CRA judgements may be seen as the single and "official" truth. A mechanistic and automatic allocation of ratings to risk weights and capital plays down the potential role of more comprehensive approaches to assess the net effect of sovereign risk on banks' balance sheets.

Whilst one could think that some of the problems of using mechanistic rules based on CRA ratings could be mitigated by using banks' own internal estimation, the fact that sovereign defaults are very rare events in advanced economies also pose significant challenges for the estimation and validation of the risk inputs used in the internal estimations. And in practice, banks' internal models tend still to rely on CRA ratings, for example as benchmarks for their own internal estimations [Deb *et al.* (2011)].

Arguably, CRA ratings have made progress to avoid being reactive, to increase the stability of their ratings and to give anticipated signals of their expected movements *(e.g.* through "outlook" notifications). Yet, the net effect of these actions in practice – particularly during crises as the recently experienced – has not been fully assessed yet.

5.3.2 A possible way forward

Standard setters and regulators have been called to reduce the reliance on CRAs. This does not mean that CRA ratings could not and should not still be a valuable source of information for market participants, particularly for new securities or for those ones where information is insufficient or inadequate. This means that efforts should be made to avoid that CRA ratings end up being the "only" source of information for risk assessments in regulation and in investors' decisions. One way to contribute to this aim is promoting and making available more transparent and diversified sources of information and risk metrics. These include structural risk metrics which are less subject to destabilising cliff-effects, and which could take into consideration the multiple dimensions of sovereign risk.

Drawing on elements from Debt Sustainability Analysis (DSA) techniques could be a useful way to enrich the range of risk metrics to guide supervisory decisions on sovereign risk. For example, it could be explored the opportunity of using elements from well established debt sustainability frameworks –as for example, the IMF framework for public debt sustainability analysis [IMF (2013)] in combination with other approaches usually applied in emerging economies [see for example, Borensztein *et al.* (2013)].

Market data can also be a source of information to enhance decision taking. There are, however, some well-known limitations when market data is used for regulatory purposes [Bond, Goldstein and Prescott (2010)]. One of the usual problems is that it can induce further procyclicality in the system.[27] In addition, market prices may be reflecting a variety of factors simultaneously. Data on sovereigns CDS, for instance, showed very little movements in the run-up of the crisis with all major CDS in the EU at very similar low levels

27 Related to this, see for example IMF (2008) for an empirical analysis of the effects of fair value accounting on procyclicality.

and with quite synchronous fluctuations. This may had been suggesting in principle the existence of quite even fundamentals among EU countries. But, since autumn 2008 there have been large and abrupt swings in some sovereign CDS spreads and a broad "decoupling" into two distinct groups which are difficult to justify solely based on changes in fundamentals. Factors such as market illiquidity, the perceived "safe haven" status of some securities, and collective changes in investors' appetite towards risk may have also played a role in addition to possible changes in fundamentals. How to disentangle these factors is not easy in practice. As a consequence of these difficulties, regulators may be more willing to accept the idea of tightening requirements when market indicators worsen, but they may be less determined to revert on their decisions once market indicators improve. This "inhibition bias" in policy reactions can perpetuate in time measures which were originally assumed as temporary – or at least conditional to fluctuations in market indicators –. And ultimately, this can lessen the effectiveness of these measures in the future.

One way to improve the quality of market data and also to help market discipline to work effectively is by providing adequate and timely disclosures. More and better information on sovereign risk in banks' balance sheets allows better assessments both from market participants as well as from supervisors. Comparability of sovereign risk disclosures could also be improved by implementing mandatory reporting templates containing a minimum set of standardised information on the subject, which could be periodically adjusted by supervisors.

5.4 CONNECTING THE DOTS

Sovereign risk is special. It affects and is affected by macroeconomic dynamics; it is closely related to fiscal and monetary policy and plays a key role as a risk-free or reference asset for the working of financial markets and the economy as a whole. All this creates many and profound interconnections between sovereign risk and financial stability.

Against this background, a macroprudential Pillar 2 approach to sovereign exposures appears as the most suitable way to address some of the sovereign risk manifestations in the EU and to guide supervisory decisions on the matter.[28] The key advantage of a macroprudential approach would be its capacity to adopt a wide but also integrated view of the issue. Additionally, as discussed in the second block, sovereign risk calls for the need of flexible, adaptable tools and able to gauge the extent and timing of regulatory measures to different contexts and circumstances.

Following a "constrained discretion" scheme, the macroprudential Pillar 2 approach envisaged is one which can be guided both by quantitative techniques – *e.g.* macro stress-tests, risk metrics from DSA –, and also qualitative information – *e.g.* experts' judgement –. This approach should also be complemented with general principles and guidelines for the macroprudential authorities, and with adequate and timely disclosures. Related to use of macro stress-tests to help guiding supervisory decisions, the experienced being gained with the implementation of stress-tests in the EU is proving to be a valuable contribution in this direction.

Applying a comprehensive costs and benefits assessment for the measures being sought is also an integral part of the approach proposed. This assessment, in particular, should assess interactions with stabilising fiscal policies, take into account sovereign risk special characteristics and provide specific answers to the problems identified.

28 Chapter 6 of the ESRB (2014) handbook on operationalising macroprudential instruments provides further details on possible macroprudential uses of the Pillar 2.

For example, policy measures which do not solve the problem of over-reliance on external credit ratings, which ignore the interconnections with stabilising policies in a context of widespread market illiquidity, short-term speculative attacks and "flight to safety", or are blind to the ongoing economic environments, risk falling into the bag of "medicines that are worse than the disease".

6 Conclusions

Sovereign debt plays a central role in the economy and it is intimately linked to the notion of safe assets. Sovereign debt acts as a reserve of value, as a "reference rate" in financial systems and as a source of liquidity in markets *(e.g.* sovereign debt is widely used as collateral in central bank and market operations). As a result, sovereign debt is close to the concept of fiat money *(i.e.* "cash equivalent") in advanced economies, and therefore it is essential for the smooth transmission of monetary policy. Sovereign debt is also a key component in the implementation of inter-temporal fiscal policy. Governments with good preconditions can afford to implement stabilising fiscal policies thus helping to smooth macroeconomic cycles and – in times of stress –, to mitigate the negative effects of crises. Lastly, sovereign debt is also a key concept within prudential regulation, involving a number of regulatory areas, not only in banking regulation but also in other sectors, as for example insurance and market regulation.

The unprecedented severity of the EA sovereign crisis has prompted a lively debate on the regulatory treatment of sovereign exposures and the potential routes for reforming the current prudential treatment of sovereign risk in the EA. Three main arguments have been posed thus far. First, that the current regulatory treatment of sovereign debt biases the banks' decisions towards sovereign debt. Second, that the current treatment was not reflecting risks from banks' sovereign debt. And third, that the current regulatory treatment of sovereign debt generates incentives to pursue "carry trade" strategies. The first and second arguments boil down to a broader point on the loss of the "risk-free status" for EA sovereign assets and the consequent need for regulation to reflect the risks stemming from banks' holdings of this now risky debt. The third one is a more specific argument on a potential effect from the current regulatory treatment of sovereign risk in the EU.

On the third of these arguments, we do not find evidence that "carry trades" explain the changes in domestic debt holdings in our sample. Increasing sovereign yields either did not significantly affect domestic sovereign debt holdings or had the opposite sign. In contrast, we do find a significant effect of macroeconomic variables – such as industry production and unemployment – on debt holdings. Our results support the view that the macroeconomic situation in the countries hit by the recent crisis has been the main determinant of banks' domestic sovereign exposures, rather than risk seeking strategies such as "carry trades". Lack of profitable investment alternatives, higher funding costs for banks in countries under stress, the introduction of new liquidity standards, and striving to mitigate the effects of the crisis on the whole economy and thus on banks' balance sheets themselves, are some of the factors explaining this link between macroeconomic deterioration and the observed increase in domestic sovereign debt holdings. Due to lack of data, we cannot carry out a similar analysis on the determinants of non-domestic sovereign debt holdings. In this case, carry trade opportunities might still play a role. The macroeconomic explanations that we have discussed do not apply in many EA countries which already have growing economies, and the incentives to hold peripheral sovereign debt might have increased since the stabilisation of the sovereign crisis but large sovereign spreads differentials still remain.

On the first two arguments, whilst we agree that the argument holds for a variety of assets, we argue that sovereign risk in the EA is a very special risk which needs to be tackled at its root source in first instance and which merits a distinctive treatment in prudential

regulation. This implies that solving the existent fiscal imbalances and ensuring sound inter-temporal fiscal policy both at the individual and EA level is one of the main challenges ahead and a necessary condition for a stable financial system.

As a second route, we describe the key characteristics of sovereign risk and – based on them – we construct a set of three building blocks for the design of prudential policy in this area. In our view, a "macroprudential Pillar 2 approach" is the best suited to manage the special characteristics of sovereign debt exposures in advanced economies, including the EA case. A macroprudential Pillar 2 approach would allow for a wide but integrated view of the issue. As such, it is better equipped to assess the multiple interrelationships between sovereign and financial stability, as well as the interactions with fiscal and monetary policy.

Following a "constrained discretion" scheme, the approach proposed can integrate elements both from quantitative techniques – *e.g.* macro stress-tests – as well as qualitative analysis – *e.g.* experts' judgement –. This approach proposed should also be complemented with general principles and guidelines for the macroprudential authorities and with adequate and timely disclosures – *e.g.* using mandatory standardised templates could be explored –.

We suggest expanding the diversity of the risk metrics being used to guide supervisory decisions – *e.g.* drawing on elements from DSA techniques – and taking into account differences among financial systems. As part of the macroprudential Pillar 2 approach proposed, we also suggest applying comprehensive cost and benefit analyses to reflect the special characteristics of sovereign risk and to capture effects on stabilising policies.

Finally, the analysis on the prudential treatment of sovereign risk should consider in our view the extent to which the measures proposed do contribute to solve the underlying problems identified – *e.g.* over-reliance on external credit ratings – or, in contrast, to reinforce them.

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Appendix. Unit root and cointegration tests

We study the presence of unit roots in Table A.1. Using the whole sample, we cannot reject the presence of unit roots in the sovereign yields, the spread, industrial production and unemployment. This means that these series are not stationary for the sample period analysed. The only exception is the Irish industrial production. In contrast, the evidence in favour of unit roots in domestic debt is weaker. Specifically, we obtain rejections of the unit root hypothesis for some core EA countries (Austria, Belgium, Finland, France and Netherlands). To check the robustness of these results, we consider only the pre-crisis sample in Table A.1.B. These results show that, for core EA countries, only the unit root rejection of the Dutch variable is robust to the testing sample. In addition, in the pre-crisis sample we obtain unit root rejections in the domestic debt variables of Ireland and Portugal. We also observe some sensitivity of the tests to the sample for the spread and industrial production of Greece and Ireland. As a result and despite these few exceptions, we will take the first differences of all variables in order to perform a consistent treatment across countries.

P-VALUES OF THE AUGMENTED DICKEY-FULLER UNIT ROOT TESTS

TABLE A.1

A. FULL SAMPLE (200001-201309)

	Domestic debt	Own yield	Spread	Industrial production	Unemployment
Austria	0.032**	0.700	0.240	0.644	0.321
Belgium	0.011**	0.578	0.538	0.470	0.392
Finland	0.005***	0.728	0.374	0.314	0.165
France	0.018**	0.604	0.615	0.787	0.797
Germany	0.618	0.763		0.511	0.878
Greece	0.568	0.999	1.000	0.987	0.978
Ireland	0.739	0.448	0.687	0.004***	0.916
Italy	0.737	0.112	0.752	0.889	0.987
Netherlands	0.001***	0.700	0.343	0.181	0.944
Portugal	0.999	0.464	0.717	0.895	0.939
Spain	0.779	0.219	0.831	0.971	0.941

B. PRE-CRISIS SAMPLE (200001-200712)

	Domestic debt	Own yield	Spread	Industrial production	Unemployment
Austria	0.216	0.429	0.545	0.971	0.662
Belgium	0.823	0.438	0.531	0.964	0.532
Finland	0.200	0.463	0.532	0.967	0.998
France	0.476	0.401	0.338	0.487	0.715
Germany	0.701	0.387	1.000	0.999	0.439
Greece	0.968	0.243	0.017**	0.002***	0.850
Ireland	0.003***	0.435	0.456	0.089*	0.115
Italy	0.763	0.445	0.596	0.610	0.396
Netherlands	0.001***	0.416	0.283	0.982	0.683
Portugal	0.046**	0.462	0.537	0.626	0.708
Spain	0.909	0.454	0.652	0.961	0.695

SOURCE: Authors´ elaboration.
NOTES: The null hypothesis is that the variable contains a unit root in a model where up to two lags of the endogenous variable are allowed. IP denotes the natural logarithm of industrial production. The Greek sample considered in Panel a only includes data until 2010. One, two and three asterisks denote statistical significance at the 90%, 95% and 99% levels, respectively.

COINTEGRATION TESTS

TABLE A.2

	Pre-crisis sample		Full sample	
	Cointegration rank	Domestic debt	Cointegration rank	Domestic debt
Austria	1	2.57**	1	-0.26***
Belgium	0		0	
Finland	0		0	
France	0		1	-0.56
Greece	0		0	
Ireland	1	-0.83***	1	-8.01***
Italy	0		1	-0.32*
Netherlands	1	-0.08**	1	1.89***
Portugal	1	0.05	1	61.66
Spain	0		0	

SOURCE: Authors´ elaboration.
NOTES: The columns labeled as “Cointegration rank" report the rank estimate at the 95% level of a vector error correction model of the national sovereign yield, the German bund yield and domestic debt for each Euro Area country. For those cases in which the rank is greater than zero, the factor loading of domestic debt is reported. A restricted constant and up to three lags of the dependent variables in first dierences are allowed. One, two and three asterisks denote statistical significance at the 90%, 95% and 99% levels, respectively.

We report the results of cointegration tests in Table A.2. In some cases (Belgium, Finland, Greece and Spain for the full sample), we obtain a zero cointegration rank estimate. In other cases (France and Portugal), we do find a cointegration relationship, but the coefficient of domestic debt is not significant. And in some of the remaining cases, the presence of a unit root in domestic debt is not robust to the testing sample. In sum, we do not find enough statistical evidence to consider a cointegration in the levels that includes the holdings of domestic debt together with sovereign yields (see Table A.2). Hence, the data does not seem to support the strong restrictions that a long run relationship between sovereign yields and banks’ sovereign debt holdings would imply.