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An Analysis of Selected Regulatory Responses to the Global Financial Crisis

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Introduction

In the wake of the global financial crisis (GFC), it became clear that targeted macroprudential rules are indispensable to successfully manage financial cycles. Before the crisis, banking regulation was typically limited to the capital requirement of individual financial institution, while it had little focus on systemic risk. As a result, it could not prevent banks from taking excessive risks and to preserve financial stability. Moreover, the traditional monetary policy toolkit could control asset prices only at the cost of potentially large losses in the real economy. Macroprudential regulations have thus become an equally important part of the overall economic policy framework as fiscal and monetary policy, with the aim of reducing systemic risk and strengthening the resilience of the financial system as a whole.

In the aftermath of the GFC, an intensive regulatory work started off both at international and national levels. Reform pursuits focus on evolving the new regulatory toolkit as well as the new institutional framework.

First, the Basel Committee on Banking Supervision came up with a reform proposal that strengthens microprudential regulation and supervision as well as adds a macroprudential overlay that includes different capital buffers. Specifically, Basel III (transposed to the EU legislation in the CRR/CRD IV) rules include tighter requirements on the quality of capital by enhancing the focus on common equity, increasing its minimum level to 4.5 percent of risk-weighted assets.

Moreover, it introduces new capital buffers banks are required to hold for specific purposes on top of their minimum requirement. More specifically, systemic buffers serve as a cushion for higher risks that large institutions represent for the financial system. The capital conservation buffer is required in addition to the minimum capital requirement and is designed to ensure that banks build up capital buffers outside periods of stress which can be drawn down as losses are incurred, while national macro-prudential authorities must require banks located in a given country to maintain a Countercyclical Capital Buffer, with the aim of ensuring that banks accumulate sufficient capital during periods of credit growth that can be used to absorb losses in stressed periods.

Closely related to capital regulations, the concept of the leverage ratio has already been clarified; however, its minimum level and the scope of institutions that it should be applicable for are not yet fully implemented in the European legislation. The ultimate goal would be to complement the

capital requirements with a non-risk-based leverage ratio that includes also off-balance sheet exposures.

Second, liquidity also entered the regulatory scope. The Liquidity Coverage Ratio (LCR) requires banks to have sufficient high-quality liquid assets in order to be able to withstand a 30-day' stressed funding scenario that is specified by supervisors. Both new capital requirements and the LCR have already become effective; however, some of them will be fully phased in by 2019.

Third, the introduction of the Net Stable Funding Ratio (NSFR) has already been decided; however, its final architecture is still under discussion. The NSFR is a long-term structural ratio designed to address liquidity mismatches. It covers the entire balance sheet and provides incentives for banks to use stable sources of funding. Banks are supposed to meet the NSFR standards by 2018.

Fourth, one of the last major pieces of the new regulatory toolkit are the Total Loss Absorbing Capital (TLAC) for global systemically important banks and the Minimum Requirement of own funds and Eligible Liabilities (MREL) for domestically important EU banks. Similarly to the NSFR ratio, rules in this area remain to be finalized. The essence of these two requirements is to ensure that resources be sufficient to support the continuation of critical economic functions at the point of bank resolution. Based on an assumption that going concern capital is eroded on the way into resolution, the regulation ensures that there be sufficient loss absorbency ("bail-inable" instruments) to be converted to equity capital to stabilize the bank.

Fifth, during the GFC, the link between the risks of sovereigns and their domestic banking sectors led to the need for financial assistance for several countries. One side of this channel has already been limited by the bail-in requirement in the Bank Recovery and Resolution Directive (BRRD), but the transfer of sovereign risk to banks' balance sheet has so far not been addressed. Recently, however, discussions on adequate management of sovereign risks have been started. There are currently two proposals on the table: introducing non-zero risk weights on sovereign exposures and eliminating the exception of sovereign exposure from the large exposure limit regulation.

Sixth, beyond the common European rules, other new macroprudential regulations were also introduced at national level, typically aiming to set up minimum eligibility requirements, such as the loan-to-value ratio or debt-service-to-income ratio. Some countries, like Hungary, apply additional rules to tackle country-specific issues and/or solve crisis legacy problems. For

instance, the FX Funding Adequacy Ratio (FFAR) introduced in Hungary in 2012 as well as the Foreign Currency Equilibrium Ratio (FCER), ensure that banks have sufficient stable, on- and off-balance sheet FX funding for their long-term FX asset portfolio. Similarly, a new Mortgage Loan Financing Adequacy Ratio (MFAR) addresses the risks stemming from the forint maturity mismatch in the Hungarian banks' balance sheet following the conversion of the households' FX mortgage loans into local currency. The regulation requires that the minimum expected ratio of the mortgage bond financing in the case of mortgage loans be 15 per cent as of the second half of 2016. Similar rules are in place in Slovakia and Denmark.

Finally, apart from EU-wide rules and institutions, there is a set of legislation and institutional arrangements, known as the banking union, that currently applies to the euro area countries. The banking union consists of three pillars. The first is the Single Supervisory Mechanism (SSM), which is the main supervisory body for the systemically important banks in the euro area. The second pillar is the Single Resolution Board (SRB) whose mission is to ensure an orderly resolution of failing banks with minimum impact on the real economy and on public finances of the participating Member States and beyond. The third pillar is the European Deposit Guarantee Scheme (EDIS), which is still under construction. It would go further than the deposit insurance directive, which only sets minimum national deposit insurance requirements, by creating a new banking union-wide deposit insurance scheme.

In our dissertation, we analyzed the impact of two post-crisis regulations; one that is already in place and another one that is still under discussion. The first has a particular importance for Hungary as we apply a counterfactual analysis with the aim of understanding whether a selected macroprudential regulation could have helped limit FX lending, which became the main source of vulnerability in Hungary in the pre-GFC period. In Section 1, our main purpose is twofold. First, we aim to estimate the effect of the tightening of regulatory capital requirements on the real economy during a credit upswing. Second, we intend to show whether applying a countercyclical capital buffer measure, as per the Basel III rules, could have helped decelerate FX lending growth in Hungary, mitigating the build-up of vulnerabilities in the run-up to the global financial crisis. To answer these questions, we use a Vector Autoregression- based approach to understand how shocks affected to capital adequacy in the pre-crisis period. Our results suggest that regulatory authorities could have slowed the increase in lending temporarily. They would not, however, have been able to avoid the upswing in FX lending by requiring countercyclical capital buffers even if such a tool had been available and they had reacted quickly to accelerating credit growth.

Our results also suggest that a more pronounced tightening might have reduced FX lending substantially, but at the expense of real GDP growth. The reason is that an unsustainable fiscal policy led to a trade-off between economic growth and the build-up of new vulnerabilities in the form of FX lending.

The second policy proposal has been given a lot of publicity lately. Policy makers are now discussing how to address the treatment of sovereign debt on bank balance sheets, which is currently treated as risk free. As zero risk weights are applied, banks do not need to set aside capital to protect themselves from potential losses on these securities. Also, they do not have any limits on their exposure to a particular sovereign. The final regulation will most likely be introduced either at European level or even at international level. As such, it has a broader perspective, therefore we analyze the potential impacts for European banks. In Section 3, we assess the two widely discussed basic options to address the regulatory gap mentioned above: applying non-zero risk weights to sovereign exposures, and putting limits on exposures to sovereigns, akin to those in place for other exposures.

Both policy options would, according to our analysis, lead to improved bank risk management and render banks more resilient. They would equip them to better absorb losses: positive risk weights would require higher capital buffers and exposure limits would lead to greater diversification. Positive risk weights would also improve risk transparency and correct distorted incentives for investing in sovereign bonds. At the systemic level, leverage would decrease and losses in the event of default would be more spread out. On the downside, both regulatory proposals would lower bank profitability in the short run. In the longer run, positive risk-weights could permanently reduce bank profits by increasing their funding costs, while exposure limits would lead to a more diversified portfolio and lower funding costs.

The benefits in terms of increased resilience in the banking sector would come at a cost for some sovereigns. The two options could aggravate long-run macro-level cyclical developments for stressed sovereigns. During an economic downturn, an increased riskiness of a sovereign would translate into higher risk weights and a higher capital charge for the bank holding its debt. This would further worsen financing conditions for sovereigns precisely at the time when fiscal space is most needed. Similarly, exposure limits could lead to cliff effects in a downturn, if sovereigns fail to extend their investor base. We expect that introducing positive risk weights would have the largest effect on stressed sovereigns, while imposing exposure limits would impact sovereigns with large outstanding debt volumes the most.

1 Regulatory environment – where did we come from and where do we stand now?

1.1 Early phases of international bank regulation – setting up the Basel framework

The forces of globalization and deregulation, the increased competition, the new processes and technological progress exposed the banking sectors to higher risk. Challenges stemming from the new environment resulted in increasing efforts towards harmonization of international capital standards, which gained momentum after the setting up the Basel Committee on Banking Supervision (BCBS) in 1975. The BCBS is not a regulatory body; it issues guidelines that represent the best banking practice. As such, these standards are not legally binding, however, they have been widely implemented in national laws. The Committee organizes its work around two fundamental objectives: i) the framework should serve to strengthen the soundness and stability of the international banking system and ii) the framework should be fair and have a high degree of consistency in its application to banks in different countries with a view to diminishing an existing source of competitive inequality among international banks.

Based on PENIKAS (2015), the Basel Committee work on developing banking regulation can be broken into the five regulatory waves: i) the Concordat (1974-1986), ii) Basel I (1987-1998), iii) Basel II (1999-2008), iv) Basel III (2009-2011) and the v) Post Basel III (2012-).

The first wave of the regulatory work started with the publication of the Concordat, which focused primarily on the necessity of consolidated data for banks with foreign subsidiaries, participations and joint ventures (BCBS, 1979). The Committee agreed that it is essential for supervisors, in looking at a bank's solvency, to be in a position to do so on the basis that the risk-bearing assets of all foreign establishments in which a bank has a controlling interest should be consolidated with those of the parent institution. This means that consolidation should be applied by one means or another not only to the figures of banks' foreign branches but also to those of their wholly-owned and majority-owned foreign subsidiaries.

Though intensive internally, publicly the regulatory wave lasted until 1986 having only 11 documents published. Economic activity was tense at the start of the period after the 1973 oil price shock and Iran-Iraq war of 1982. Nevertheless, at that time the Basel Committee never published consultative documents.

In the second wave starting in 1987, the grounds of today's banking regulation were born by publishing the consultative version for Basel I. As PRAKASH (2008) summarized the Basel

Accord was endorsed by 12 countries (G-10 plus Luxembourg and Switzerland) in July 1988. Many banks were undercapitalized at that time, therefore, the minimum level capital was set at 7.25 percent level to be met by the end of 1990, and the 8 percent requirement was to be achieved by the end of 1992. The Accord was phased in by January 1993, and more than hundred countries have adopted the Basel standards since then.

The Basel I framework had three main elements (BCBS, 1988). The first two describe the framework in terms of the constituents of capital and the risk weighting system. The third section deals with the minimum capital requirement. The framework aimed to provide a fair and reasonable degree of consistency in the application of capital standards in different jurisdictions, on a common definition of capital.

At the early stages of the regulatory efforts, the definition of capital contained two different types of capital; Tier I and Tier II elements, which a bank is required to maintain in relation to its risk-weighted assets (RWA). Tier 1 capital comprises only those elements, which has the highest capacity for absorbing losses on an ongoing basis. Tier 2 capital mostly consists of hybrid capital/debt instruments the total of which was limited to 100 percent of Tier 1 capital. It is important to note that initially, the regulation required capital only for credit risk. The framework was complemented by Tier 3 elements (additional supplementary capital) in 1996, but this type of capital can only be used to meet capital requirements for market risk.

The Committee recommended a weighted risk ratio in which capital is related to different categories of assets or off-balance sheet exposures. The weights varied according to broad categories of relative riskiness. The rationale behind the risk-weighted approach was threefold. First, it aims to provide a fair basis for international comparison between banking systems whose structures may differ. Second, it allows off-balance sheet items to be incorporated more easily and last, it is not supposed to give disincentives for banks to hold liquid or other assets, which carry lower risks. During the second regulatory phase, operational risks did not receive either substantial attention or quantitative treatment, it was first mentioned in the related documentations in 1989.

Initially, the risk weights were set in a very simple way with only five different weights used for on-balance sheet items (0, 10, 20, 50 and 100 percent). It is important to note, that the preferential treatment of sovereign bonds originates here, at this very early stage of international capital regulation. The regulation assigned zero risk weights to government bonds of the countries that

were members of the OECD. Interbank exposures received 20 percent, while mortgage loans had a 50 percent risk weight in the capital requirement.

The minimum level of Tier 1 capital was set at 4 percent level, while total capital had to exceed 8 percent of the bank's risk weighted assets. In case of breaching the minimum requirements, shareholders may be permitted to retain control, provided that they recapitalize the bank to meet the minimum capital ratio in a reasonable timeframe. If the shareholders fail to do so, the bank's supervisory authority is empowered to withdraw the banking license and liquidate the bank.

The most important achievement of Basel I was the introduction of discipline through imposition of risk-based capital standards both as a measure of strength of banks and as a trigger for supervisors' intervention. However, Basel I had also many caveats. First, the regulation was not able to meet one of its main objectives, i.e. to ensure level playing field for international banks. Researches carried on in this field (SCOTT et al. 1994) showed that other factors, such as different legislative environment (e.g. insolvency and foreclosure laws) could also play an important role in the persistent market fragmentations. Second, the objective of increasing the soundness and stability of the banking system did not meet either, as capital adequacy regulation could even accentuate systemic risk by coordinating one segment of the banking system, but leaving unregulated others. The one-size-fits-all approach gave incentives for banks to use securitization and off-balance sheet instruments to lower their RWAs and take as much credit risk as they can by granting loans to borrowers with the highest expected return in a risk weighted class. Last, the most fundamental problem of Basel I was to define and measure portfolio risk by placing different types of bank exposures into separate buckets. This approach assumes that risks are homogenous within the portfolios and the sum of the portfolios' risks equals to the sum of the risks across the various buckets. Moreover, the rules do not take into account the changing nature of default risk either, i.e. the default risk is static. The shortcomings are compounded by the fact that Basel standards are calculated on book value and not market value.

The problems of the Basel I regulation became pronounced during the 1990s financial crisis. Asian banks' short-term borrowing in foreign currency was a major source of their vulnerability. The Basel I rules contributed to this problem by assigning relatively low risk weights to wholesale funding.

Although it has never been implemented to the national legislations, the Sydney Press Release issued in 1998 represents an unarguably important milestone in the international banking

regulation. Following the introduction of Basel I as well as the recent financial crisis, banks inclined to increase their capital adequacy by issuing innovative capital instruments, such as instruments with step-ups, with the aim of generating Tier 1 regulatory capital that is both cost-efficient and can be denominated, if necessary, in non-local currency. Although the Basel Committee highlighted the risks stemming from these capital elements, its recommendation was only confined to the limited use of these instruments (15% of Tier 1 capital) and more supervisory caution.

The third regulatory wave started in 1999 (BCBS, 1999). The amended version of the regulation introduced *inter alia* the concept of internal models for credit risk (internal ratings based – IRB - approach) and quantifiable capital charge for operational risk. The greater risk sensitivity under Basel II is achieved by linking each bank's capital requirements to empirically based measures of credit and operational risk as determined in part by risk parameters estimated by the organization, such as a loan's probability of default (PD) and its expected loss given default (LGD). Moreover, the Pillar framework also appeared first in the Basel II rules. Pillar I stood for minimum capital requirements, Pillar II (supervisory review process - SREP) represented the supervisory review results and Pillar III is for defining the principles of information disclosures. In addition, the Basel II framework is intended to promote a more forward-looking approach to capital supervision.

Under the first pillar, the measures for credit risk are more complex; market risk evaluation is the same, while the inclusion of operational risk is a new element. In terms of credit risk, the modified version of Basel I framework became the “standardized approach”, whereas the alternative methodology, which is subject to the explicit approval of the bank's supervisor, would allow banks to use their internal rating systems for credit risk. Moreover, the capital treatment of a number of credit risk mitigation techniques, risk-reducing effect of guarantees, credit derivatives and securitization was also provided under Pillar I.

The main consideration behind the standardized approach was to use external rating agencies to establish risk weights for corporate, bank and sovereign exposures. The regulation contained tables defining buckets of ratings for corporates and sovereign credits to translate a particular rating into a risk weight.

In terms of sovereign exposures, Basel II has a slightly different approach; zero-risk weight rule applies for claims on the sovereign of the country where the bank is incorporated, where the

claim is denominated in the currency of the sovereign and also funded in that currency. The application of this rule, however, is not entirely clear either in dollarized countries or in the euro area. The view that local currency claims are different (i.e. have lower credit risk) because of the central banks' role of lender of last resort appears to confuse credit risk with liquidity considerations and suggests that banks' capital requirements should explicitly reflect the fact that governments would be able to deflate away their debts. This, however, would contradict the central banks' primary mandate, i.e. typically low level of inflation.

The introduction of the IRB approach provides banks with the possibility to estimate their borrowers credit risk. The IRB approach includes five risk components: PD, LGD, Exposure at Default (EAD), maturity (M), sales volume to distinguish small and medium-sized enterprises (SMEs) and two alternative techniques to calculate the capital: i) foundation and (F-IRB) ii) advanced approach (A-IRB). In the former case, banks estimate the borrower PD, while the supervisor sets all the other parameters. In the advanced method, apart from the PDs, banks' also model the LGDs. Other necessary parameters, e.g. EAD are determined by the supervisory authority. The IRB approach is based on a single risk-factor model assuming that i) there is one systemic risk factor, ii) risk components are independent (PD, LGD etc.) and iii) loan portfolio is infinitely granular.

Ideally, IRB parameters should be estimated through the business cycles, however, the definition of the cycle has never been introduced. The minimum length of the time series to be used gives an indication, though, not less than 5 years for PD and at least 7 years for LGD.

Furthermore, market risk appears in the context where banks should hold capital for interest rate risk in their banking book, where the risk is well above the average. The prudential approach is based on the Value-at-Risk (VaR) concept, which was multiplied by 3 and resulted in the capital charge for market risk. One of the main drawbacks of the VaR concept is that it is not additive. Due to correlations between assets within a portfolio, the VaR of a portfolio containing assets A and B does not equal to the sum of VaR of asset A and VaR of asset B. Another important shortcoming of the VaR methodology is that it does not capture tail risks, i.e. losses that take place in a crisis situation¹. Mainly for this reason, the Basel 2.5 updated the relevant guidelines for market risk by introducing stressed value-at-risk requirement. Losses in most banks' trading

¹ More specifically, tail risk includes events that have a small probability of occurring and occur at the ends of a normal distribution curve.

books during the financial crisis have been significantly higher than the minimum capital requirements under the former Pillar 1 market risk rules. The Committee therefore requires banks to calculate a stressed value-at-risk taking into account a one-year observation period relating to significant losses, which must be calculated in addition to the value-at-risk based on the most recent one-year observation period. The additional stressed value-at-risk requirement will also help reduce the pro-cyclicality of the minimum capital requirements for market risk (BCBS (2011a)).²

In addition, the regulation also gives a definition for operational risk; risk of loss resulting from inadequate or failed internal processes, people and systems or from external events. The three possible methods to quantify operational risk are as follows: i) the Basic Indicator Approach (BIA), ii) Simplified Standardized Approach (SSA) iii) the Standardized Approach (SA) and iv) the Advanced Measurement Approach (AMA). The difference between the SA and the other approaches is the possibility to estimate operational charge on credit portfolio instead of gross income in the former case. AMA enables bank to use statistical models to support capital charge estimation.

In the course of the second pillar, the supervisor requires banks to prepare their Internal Capital Adequacy Assessment Process (ICAAP), which shows the bank own assessment of capital adequacy in relation to its risk profile. Also, the supervisory authority reviews the bank capital position under the second pillar and may impose additional capital requirements.

The third pillar serves as a disciplinary tool. As such, it includes a set of disclosure requirements to allow market participants assess the capital adequacy of the bank. It means that the bank should have a disclosure policy approved by the board of directors that addresses the bank's approach regarding the disclosures they make and the internal controls over the disclosure process.

Another new element of risk management, the stress testing was also introduced in Basel II. Under Pillar I, sensitivity analysis should be carried out for all type of risks (credit, market and

² Due to the above-mentioned shortcomings of the VaR measurement, the concept of Expected Shortfall (ES) started receiving more attention (BIS 2013) as it could potentially offer solutions to some of these drawbacks (ACERBI and TASCHE (2001)). VaR tends to underestimate the risk of portfolios with fat-tailed properties and a high potential for large losses. The tail risk of VaR emerges since it measures only a single quantile of the profit/loss distributions and disregards any loss beyond the VaR level. On the contrary, the ES is the conditional expectation of loss given that the loss is beyond the VaR level. Thus, by definition, expected shortfall considers loss beyond the VaR level.

operational risk), whereas Pillar II includes scenario analysis. In addition, Basel II requires running a reverse stress test, i.e. to find the macroeconomic scenario under which the bank fails.

Similarly to Basel I, Basel II also has some caveats, mostly relating to emerging markets. The relatively simple framework of Basel I has been replaced by a highly sophisticated methodology, which requires good quality data and the ability to process them. Moreover, the more sophisticated concept is difficult to implement for smaller banks. High reliance on rating agencies could also disadvantage to emerging markets, where rating agencies have limited penetration. In the absence of external ratings, banks cannot fully benefit from the flexibility of Basel II and most exposures end up in the highest risk-weight bucket. Furthermore, Basel II does not give indication for the supervisors on how the internal models should be evaluated and translated into additional capital requirement.

The most important criticism of Basel II is its pro-cyclicality, which stems from the credit risk models' short time horizon. The BCBS, however, argued that the pro-cyclicality could address by the various features of risk weights. For instance, the length of the observation period to estimate PD is 5 years and 7 years for the LGD models.

1.2 Regulatory responses to the financial crisis – Basel III standards

The recent financial crisis shed light on the weaknesses of the sophisticated analytical tools applied by Basel II. Specifically, it revealed that incomplete data and assumptions that have not been tested across business cycles could result in underestimating risks. In order to analyze the policy responses, we first need to understand the causes of the crisis. As an overarching crisis trigger, it is important to mention the psychological factors, namely, the “This time is different” syndrome that was identified by REINHART and ROGOFF (2011). It claims that the old rules of valuation no longer apply and that the new situation bears little similarity to past disasters, hence policy makers are not able to properly identify market failures and reluctant to intervene on time. They argue that even though countries do weather financial turbulences, short memories by definition lead to reoccurring crisis situations.

According to CLAESSENS et al. (2014), the more specific reasons for the past and recent crisis can be grouped into four common causes and four unique causes. The first common cause is the occurrence of a credit boom. Credit expansions typically come with deterioration of credit standards. Credit booms, however, do not necessarily trigger crises, but they make them happen more likely (DELL' ARICCIA et al. (2012)).

The second reason is the rapid asset price appreciation. In countries that went under IMF/EU program, the increase in real estate prices exceeded 30 percent during a decade. Increasing asset prices and credit expansion often go in parallel and amplify each other. Since houses are used as collaterals in mortgage loan agreements, their rising value facilitates lending growth and hence, increasing leverage in the economy.

Third, creation of new instruments, whose return assumes favorable economic conditions to be maintained infinitely, also contributed to the fallout of the GFC. Complicated products, such as Collateralized Debt Obligations (CDOs), where the payoff depends on the value of underlying assets, increased opacity and thus contributed to instability.

Lastly, financial deregulation is often mentioned as an important ingredient of the GFC. More complex models to estimate risks and the lack of supervisory capacity to adequately challenge these methods contributed to buildup of the crisis.

Among the new causes, the first and most significant is the sharp increase in household's leverage and the subsequent rise in non-performing loans. While increasing loan defaults occurred in previous downturns, extensive involvement of households was a new phenomenon. Lack of best practice to deal with widespread households' defaults could result in moral hazard problems.

The second unique problem was the extent to which increased leverage manifested in a wide of range economic agents and markets. The extent of many classes of borrowers' dependence on illiquid collateral limited the system's ability to absorb even small shocks.

The increased complexity and opacity was also a new element in a sense that it affected weak private credits. While the securitization was meant to spread risks, it turned out that risks were less widely distributed than envisaged and incentives to properly assess risks, including by rating agencies, were undermined. FARHI et al. (2009) add that lack of transparency is also due to the intensive removal of credit risk off balance-sheet. By acquiring protection against credit risks on the derivatives markets, by issuing credit securities whose return is dependent on the amortization paid by borrowers and by creating various Special Purpose Vehicles (SPV), banks could actively manage their capital levels at the cost of accumulating risks in other agents' balance sheets that were willing to take risks for a return which seemed very high at the time. These agents were part of the so-called shadow banking system, that is a set of institutions which operated as banks without being banks, raising resources in the short term, operating with very high leverage and

investing in long-term and illiquid assets. The most important feature of these shadow banks, however, is that they are unregulated without access to deposit insurance and the lender of last resort facilities of the central banks.

Finally, financial integration developed rapidly over the years before the crisis. Economic actors abroad often held complex products mentioned earlier, both in advanced and emerging markets. While developments had benefits during normal times, they quickly translated the turmoil into a global crisis.

Beyond these reasons, MERROUCHE et al. (2010) also mention the increasing global imbalances as well as supervisory and regulatory factors. The massive capital inflows to advanced economies kept the interest rates low and incentivized the economic actors for more risk-taking. This ultimately resulted in more leveraged financial institutions as they typically have nominal RoE targets. To compensate and maintain the same RoE in a low interest rate environment banks have an incentive to expand their balance sheet and increase leverage. Regarding the supervisory power, they found that strong powers on the part of the supervisors to intervene in problem banks and to resolve failing financial institutions may have reduced the build-up of banking sector leverage ahead of the crisis.

While the crisis was single-phase in the US, there was a second wave in Europe. European banks that had invested heavily in the American mortgage market were hit hard. In an attempt to stop some banks from failing, governments came to the rescue in many EU countries like Germany, France, the UK, Ireland, Denmark, the Netherlands and Belgium. But the cost of bailing out the banks proved very high. In Ireland, it almost bankrupted the government until fellow EU countries stepped in with financial assistance. As Europe slipped into recession in 2009, a problem that started in the banks began to affect governments more and more, as markets worried that some countries could not afford to rescue banks in trouble.

Investors began to look more closely at the finances of governments. Greece came under particular scrutiny because its economy was in very bad shape and successive governments had racked up debts nearly twice the size of the economy. What started as a banking crisis became a sovereign debt crisis as the interlinkages between the sovereigns and the banks were particularly strong in Europe.

At the early stage of the financial turbulence, BORIO (2007) already emphasized that despite major progress had been made in strengthening the financial system, there was still scope for

improving the balance of the different type initiatives. It is true that much had been done to strengthen the payment and settlement system infrastructure and accounting standards, as well as developing minimum capital standards, but more should have been done in designing policies that would seek to limit overextension in risk-taking and balance sheets. In fact, the further wave aimed to address these issues.

As an immediate response to the financial crisis, the Financial Stability Forum (FSF) made a comprehensive proposal in 2008 that includes *inter alia* full and prompt disclosure of risk exposures, urgent actions by accounting standard setters (especially relating to fair value accounting), strengthening risk management practices including stress testing and strengthening capital positions.

The BCBS announced in November 2008 its strategy to address the fundamental weaknesses revealed by the financial crisis. The key steps could be summarized as follows (BCBS (2008)):

- Strengthening risk capture of the Basel II framework
- Enhancing quality of Tier 1 capital
- Building up additional shock absorbers, such as countercyclical capital buffer
- Supplementing risk-based measures with simple gross measures of exposures, introducing leverage ratio requirement
- Introducing liquidity standards, both for short- and long-term (Liquidity Coverage Ratio and Net Stable Funding Ratio)
- Reducing too-big-to-fail problem by identifying Systemically Important Financial Institutions (SIFIs), and requiring additional capital from them (BCBS [2011b])
- Reforming national bank resolution schemes
- Developing macro-prudential policies to tackle systemic risk problems

The first consultative document for Basel III was published in 2009, which brought several innovations to banking risk regulation. First, it proposed quantitative measures for liquidity risks. Second, definition of capital has changed and capital buffers were increased. Third, unweighted capital ratio has been introduced. Last, unified rules for remuneration of risk-taking staff were proposed. The new guidelines have been finalized by 2011, which contains the revised requirements (BCBS (2011b)).

In 2013, the European Union adopted a legislative package to strengthen the regulation of the banking sector and to implement the Basel III agreement in the EU legal framework. The new

package replaces the current Capital Requirements Directives (2006/48 and 2006/49) with a Directive and a Regulation and is a major step towards creating a sounder and safer financial system.

The Regulation contains the detailed prudential requirements for credit institutions and investment firms while the new Directive covers areas of the current Capital Requirements Directive where EU provisions need to be transposed by Member States in a way suitable to their respective environment. The package applies as of 1 January 2014. Some of the new provisions will be phased-in between 2014 and 2019.

Among the new proposals, probably the capital related ones are considered the most important. Although the minimum total capital ratio has remained at 8% of risk-weighted assets (RWA) in the CRD IV/CRR, the proportion accounted for by Tier 1 capital has been increased. It means that the overall capital requirement did not change, however, banks need more good quality capital than before. Since 2015, the minimum CET1 ratio increased to 4.5% (gradually from 2% in 2012) and for Tier 1 capital ratio to 6% (gradually from 4% in 2012), while the requirement for total capital has remained stable at 8%. In addition, new capital buffers have been introduced as of 2016, increasing the minimum CET1 ratio in incremental steps until 2019.

From 2016, subject to transitional provisions, banks are required to hold capital buffers for specific purposes on top of their Pillar I requirement and additional capital established by the Supervisory Review and Evaluation Process (SREP). Table 1-1 provides a comprehensive picture on the elements of the required CET1 capital in 2019, following the phase-in periods.

Table 1-1: Components of CET1 requirements for SSM-supervised banks from 2019 onwards

CET1 components		Size	Determined by	Systemic vs. individual bank requirement
1. Pillar I		4.5%	CRR	Systemic
2. Pillar II	Add-on based on SREP exercise	Discretionary	SSM	Individual
3. Systemic Buffers (the highest of O-SII G-SII and SRB)	Global Systemically Important Institutions	Max. 3.5%	National supervisors	Individual, based on EBA rules

	(G-SII) Buffer			
	Other (domestically) Important Institutions (O-SII) Buffer	Max. 2%	National supervisors	Individual, based on EBA rules
	Systemic Risk Buffer (SRB)	Max. 5%	National supervisors	Individual
4. Capital Conservation Buffer		2.5%	CRR	Systemic
5. Countercyclical Capital Buffer		Max. 2.5%	National supervisors/ECB	Individual

Note: national supervisors and macro-prudential regulators are often the same entities, i.e. national central banks.

Source: CRR/CRD IV, author's collection.

I. Pillar I

The minimum CET1 ratio is 4.5% as of 2016 following a gradual increase from 2%. The requirement applies to the banking system as a whole, there is no difference at individual level.

II. Pillar II

Capital add-on is imposed by the SSM under the SREP exercise. The size of the capital requirement varies across banks and depends on the additional risks that the supervisor reveals during the SREP such as concentration risk, country risk, interest rate risk or liquidity risk. The requirement is bank-specific, i.e. it differs from bank to bank.

III. Systemic Buffers

Both G-SII and O-SII buffers serve as a cushion for higher risks that large institutions represent for the financial system. The maximum size of these buffers is kept at 3.5% and 2%, respectively, while the actual size depends on several factors:

- The actual size of the G-SII buffer depends on the sub-category/bucket to which a given banking group has been allocated by its supervisor and it currently varies from 1% to 2.5%. National supervisory authorities are responsible for implementing the methodology (developed by the EBA (2014)) based on quantitative indicators with respect to the size of

the group, its interconnectedness with the financial system, the sustainability of services provided by its financial infrastructure, its complexity and its cross-border activity. The outcome of the methodology is an overall score allocating each G-SII to a sub-category. The allocation of banks to G-SII buckets is reviewed every year.

- National supervisory authorities may require additional CET1 capital up to 2% for O-SIIs. The indicators used for identifying O-SIIs are similar to those of the G-SII methodology, but the focus is on the importance and potential impact of a given bank on the Member State's (MS) and the EU's economy.
- Where a banking group is subject to both G-SII and O-SII buffers, the higher of the two applies.
- Where an O-SII is a subsidiary of either a G-SII or another O-SII, the buffer that applies at individual level for the O-SII shall not exceed the higher of 1% and the G-SII or O-SII buffer rate applicable to the group at consolidated level.

If national supervisors find that the above buffers are not sufficient to capture all risks to which banks are exposed, they may introduce an additional buffer, the Systemic Risk Buffer (SRB), to prevent or mitigate long-term non-cyclical systemic or macro-prudential risks. The aim of the SRB is to mitigate the impact of specific risks (e.g. risks related to certain type of loans) on the whole banking system. It is normally applicable to all banks in a given country, based on the individual banks' contributions to the specific systemic risks, the size could thus differ bank by bank. Once it is introduced, the buffer must be set between 1% and 5%.

Before setting the buffer, the national authority should notify the European Commission (EC), the European Banking Authority (EBA) and the European Systemic Risk Board (ESRB) and the competent authorities of the other concerned MSs on the time of the introduction and the size of the buffer. Should a MS introduce an SRB between 3% and 5%, the national authority decisions are subject to the EC's approval. The EC will investigate whether the SRB to be introduced has disproportionate adverse effects on the whole or parts of the financial system of the MS or of the European Union as a whole and whether the SRB will form or create an obstacle to the proper functioning of the internal market.

Where authorities apply both SRB and SII buffers, only the highest of these 3 buffers is applicable. Nevertheless, where the systemic risk buffer applies to all exposures located in the MS that sets that buffer to address the macroprudential risk of that MS, but does not apply to exposures outside that MS, the systemic risk buffer shall be cumulative with the O-SII or G-SII

buffer. More specifically, if a country imposed SRB for a certain type of exposures that are located in that given country (e.g. mortgage loans in that country), SRB and other systemic buffers requirements add-up. By contrast, if a country imposed an SRB that is applicable to certain type of exposure irrespective of the location of the related risk, the highest of the three buffers applies. Slovakia has made use of this discretion to impose a high SRB threshold to the Slovakian exposures of some systemically important banks.

IV. Capital Conservation Buffer

Capital Conservation Buffer is required in addition to the Pillar I requirement of 4.5%. Its size will be 2.5% in 2019 and is constant across the EU banking system. The SSM has announced its intention to keep the combined (Pillar II + Capital Conservation Buffer) CET1 requirement broadly constant until 2019, which would imply a gradual decrease of Pillar II requirements as the Capital Conservation Buffer is phased in.

V. Countercyclical Capital Buffer

National macro-prudential authorities must require banks located in a given country to maintain a Countercyclical Capital Buffer, with the aim of ensuring that banks accumulate sufficient capital during periods of credit growth that can be used to absorb losses in stressed periods. The size of the buffer is between 0% and 2.5%. The buffer is set on systemic level, which is further broken down into individual bank level depending on the banks' contribution to the systemic risks. Although the power is at national level, the ECB has a right to override the requirements of the national authority. **Figure 1-1** shows the elements of CET1. Overall, the maximum level of additional capital based on national discretion could be significant, which leaves substantial power at national level. Nevertheless, additional capital requirements imposed by the local regulator are mostly capped and subject to some limitations/controls, specifically the ECB right to override the counter cyclical buffer national decisions, and the EBA rules that guide the determination of SII buffers.

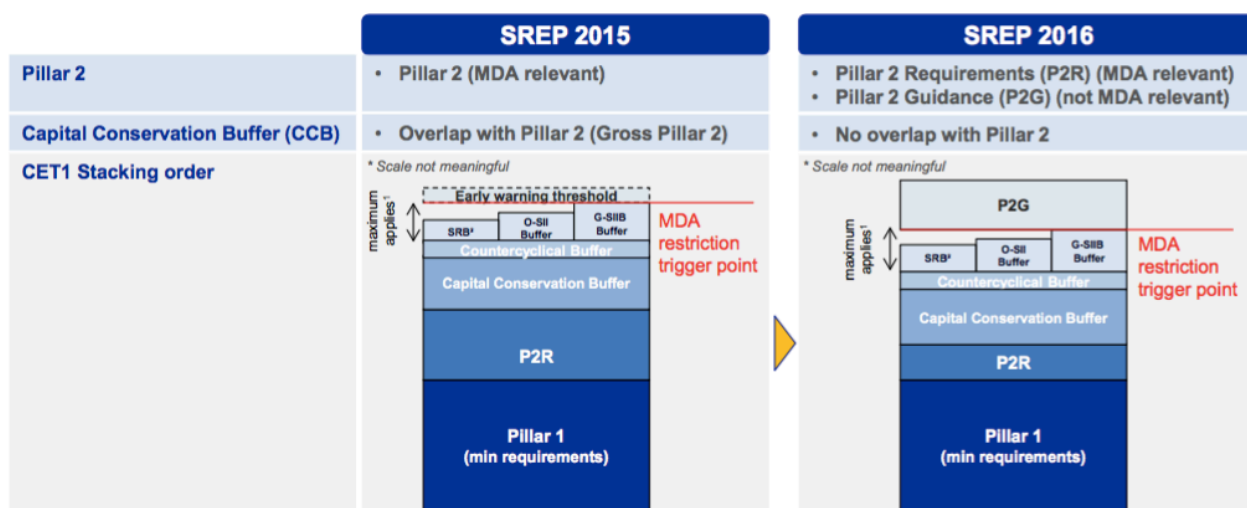


Figure 1-1: Components of CET1 requirement as of 2019 (fully phased-in status)

Source: ECB, Banking Supervision.

Breaches of the combined buffer requirement (CBR) – defined as the sum of the applicable buffers – lead to mandatory restrictions on distributions (e.g. dividends, coupon payments on Additional Tier 1 capital instruments, discretionary bonuses). A bank that fails to meet its CBR will be automatically prohibited from distributing more than the Maximum Distributable Amount (MDA).³

If a bank CET1 ratio goes below a specified threshold, any contingent convertible bond (CoCo) that it may have issued will automatically convert into equity. CRR IV sets the minimum CET1 level, where CoCos must be transferred into equity, at 5.125%, however, market practice shows a higher level of 7%, on average. If a bank CET1 ratio breaches the 4.5% minimum requirement, then the bank loses its banking license and is put automatically in resolution. Resolution could also result from the SSM assessing that a bank is likely to fail, i.e. to meet its 4.5% minimum capital requirement.

The ECB also has an array of supervisory measures it can impose upon a bank, in particular the right to impose changes in the bank's business strategy and to remove the management. These measures are discretionary and therefore not necessarily related to breaches of capital ratios.

On top of the above CET1 capital requirements, the SSM has also introduced a so called 'Pillar 2 Guidance', which aims to build buffers for less predictable risks, such as for capital shortfalls

³ MDA is the bank's distributable profit multiplied by a factor ranging between 0 and 0.6 depending how much CET1 capital is missing to meet the CBR.

stemming from the stress tests' adverse scenario. It is not a binding requirement (i.e. does not trigger Maximum Distributable Amount rule), but the SSM applies closer monitoring in case a bank's CET1 ratio enters this range.

As mentioned earlier, Basel III prescribes introducing adjustment for systemically important financial institutions by using 1.25 multiplier in front of a correlation function implying capital overcharge when lending to SIFIs. It has to be used by banks that lend to SIFIs, not necessarily being SIFIs themselves. The Committee is also proposing standards to promote more rigorous supervision, and risk management of risk concentrations, off-balance sheet exposures, securitizations and related reputation risks. With respect to the concentration risk, additional capital is needed if exposure to a single entity exceeds 25% of total capital, except when lending to SIFIs, in which case the limit is 15%.

1.3 Additional reforms at the EU level – setting up the Banking Union

From the euro area perspective, the financial crisis evolved in 2010/2011 made clear that strengthening the banking sector is not the only prerequisite of economic recovery. It has become clear that more has to be done, in particular to break the vicious circle between banks and their national public finances (EUROPEAN COMMISSION (2015)).

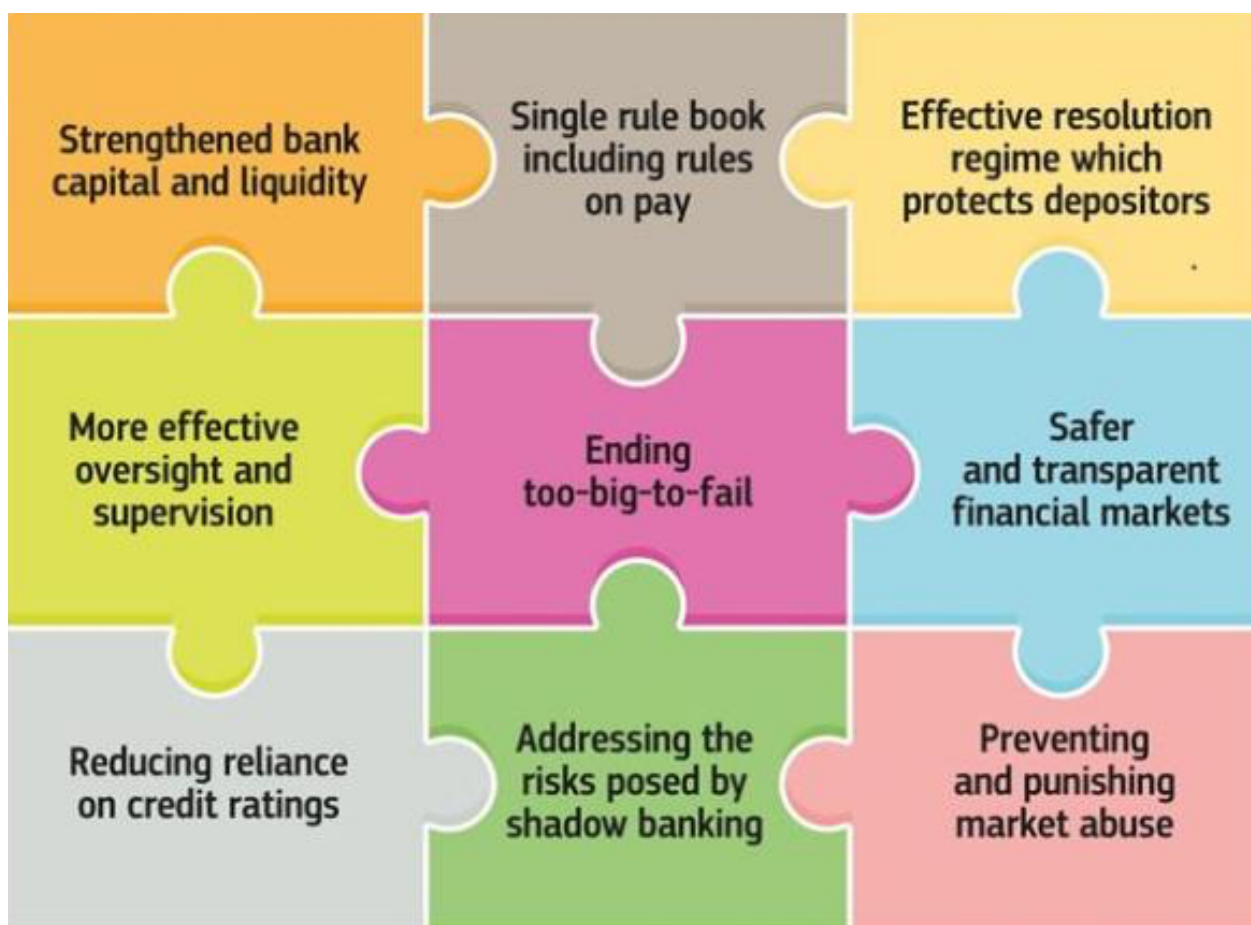


Figure 1-2: Key pieces of the EU-wide financial reform puzzle

Source: European Commission (2015).

The new regulatory framework with common rules within the European Union, set out in a single rulebook, is the foundation of the banking union. Common rules (in particular Capital Requirements Directive and Regulation) help prevent bank crises in the first place and, if banks do end up in difficulty, set out a common framework to manage the process, including a means to wind them down in an orderly manner (Directive on Bank Recovery and Resolution - BRRD). Common rules also ensure that all EU savers are guaranteed that their deposits up to €100,000 (per depositor/ per bank) are protected in the EU (Directive on Scheme –DGS). However, national DGS can be vulnerable to large local shocks. To this end, the Commission’s proposal for a European Deposit Insurance Scheme (EDIS) would provide a stronger and more uniform degree of insurance cover for all retail depositors in the banking union⁴.

⁴ The European Commission submitted its proposal in November 2015, which will be subjected to further discussion in the legislative process.

The banking union ensures the common implementation of those rules in the euro area. First, as of November 2014, the European Central Bank (ECB) became the direct supervisor of systemically important banks (129 currently) in the euro area in the framework of the Single Supervisory Mechanism (SSM). In order to ensure that the ECB has a clear view of the situation of banks it supervises from the outset, as a first supervisory action, a comprehensive assessment of banks' financial health was carried out already in 2014. Second, in the rare cases when banks fail despite stronger supervision, the Single Resolution Mechanism (SRM) will allow bank resolution to be managed more effectively through a Single Resolution Board (SRB) and a Single Resolution Fund (SRF).

As part of the resolution toolkit, bail-in was also introduced. If a bank needs to resort to bail-in, authorities would first write down all shareholders and would then follow a pre-determined order in bailing in other eligible liabilities. Shareholders and holders of hybrid/junior instruments, such as convertible bonds and junior bonds would take the first loss piece. Insured deposits (under € 100,000) would not be touched: they are entirely protected at all times. To the furthest extent possible, the responsibility of covering bank losses is placed on private investors and the banking sector as a whole by ex ante contributing to the resolution fund; not taxpayers. The new regulatory framework puts an end to the era of massive bailouts paid for by taxpayers and helps restore financial stability.

Moreover, the Five Presidents' Report published in June 2015 sets out a number of steps to further strengthen European Monetary Union (EMU). One of them is to move towards EDIS as a further step to a fully-fledged Banking Union. EDIS would mark an important step towards reinforcing financial stability by further weakening the link between banks and their national sovereigns and by delivering even greater trust in the safety of retail bank deposits, regardless of a bank's location in the Union. However, the implementation of the last pillar seems difficult, as additional risk sharing at this stage is politically not palatable for some Member States.



Figure 1-3: The elements of the Banking Union

Source: European Commission (2015).

1.4 Regulatory efforts in Hungary – life outside the Banking Union

Regulatory responses were somewhat different in Hungary than in other countries. It could be explained by the modest direct impact of the crisis as well as with the different systemic risks built up in the banking system. MNB (2016) mentions that as a main driving force behind the build-up of Hungarian systemic risks, foreign currency lending was not only responsible for increased credit risks, but it also contributed to the excessive reliance on short-term external funds on the funding side. As a result of the unfavorable market conditions, non-performing loans drastically increased from 2008 onwards in all segments.

As VÁRHEGYI (2011) identifies, the role of state-aid was far less important in the crisis resolution framework in Hungary than in other countries. Toxic assets less contaminated the banking system; hence the direct impact of the crisis was less severe. It is important to note however, that most banks' mother companies received state-aid in their home countries. As a result, monetary policy tools seemed sufficient to alleviate the crisis effects in Hungary. The Central Bank of Hungary (MNB) introduced new facilities to maintain and increase liquidity in the banking sector. Initially, public recapitalization was only possible for banks without foreign strategic investor base, which was changed in 2009 and allowed state-aid also for subsidiaries.

Self-regulatory actions also helped in maintaining financial stability in the Central Eastern European region. The Vienna Initiative, which was borne by the EBRD and some euro area banks that had substantial interest in Eastern Europe, aimed to prevent massive withdrawals of foreign funding (VIENNA INITIATIVE (2009)). The participating banks publicly committed themselves

to maintain their exposures in their subsidiaries and recapitalize them if needed under the condition that the country is under a EU/IMF economic adjustment program.

The commitments taken in the first Vienna Initiative ceased to exist when Hungary quit the EU/IMF program in 2010. Furthermore, increasing capital requirements made the parent banks' situation difficult, therefore, the Vienna Initiative was not renewed in its original form after the onset of the sovereign crisis in the euro area.

Since there was no macroprudential body in Hungary at the beginning of the financial crisis, early regulations were issued by the Ministry of Finance in the form of decrees or by the Parliament. The first element of the crisis management was the introduction of the bank levy. In general, there are two basic arguments to impose a special tax on the banking sector: i) to compensate the costs of bank bail-outs, and ii) to set up a resolution fund for future bank failures. The Hungarian practice, however, does not meet any of these objectives. The tax base is the total assets of banks in 2009 and the tax rate is progressively changing with the size of the balance sheet (Act LIX of 2006 on bank levy). The Hungarian bank levy has at least two specialties. Firstly, it represents the highest burden in proportion to the GDP in the EU, and, secondly, it does so despite the relatively low public participation in the crisis handling.

The widespread foreign-currency lending also required public intervention. The MNB and the Hungarian Financial Supervisory Authority (HFSA) issued a recommendation discussing the risks related to lending in Japanese Yen in 2008, but the first binding legislation was published only in 2009, when they completely prohibited lending in Japanese Yen. As a second step, the government restricted foreign currency lending and blocked mortgage lending in foreign currency in 2010 (Decree no. 361/2009). The new rules also set different Loan-to-Value (LTV) ratios for lending in Hungarian forint and foreign currency, setting the maximum value higher for forint loans. The law also differentiates between denominations by applying different Payment-to-Income (PTI) ratios.

To mitigate the widespread FX lending problem, the government introduced a new scheme, which allowed the borrowers to fix the exchange rate at an arbitrary level. This way, the loans were split into two parts, one was put in a warehouse, which was the accumulated monthly installments that were postponed by the exchange rate fixing, and the other part that remained performing. The frozen part was converted into a domestic currency loan, which was guaranteed by the state.

In October 2011, the foreclosure moratorium was suspended and foreclosure quotas were introduced instead, in order to limit the price effect of auctions in the real estate market. At the same time, National Asset Management Agency (NAMA) has been set up and started buying real estates and leases them back to the previous owners. The capacity of the NAMA was limited, though; it was only able to buy 5,000 real estates per year.

Overall, neither the exchange rate limit scheme nor the NAMA were able to reduce successfully the non-performing loans in the household sector. One of the main reasons was the availability of similar restructuring products offered by the banks. The increasing defaults and the widespread social dissatisfaction resulted in a more drastic solution by the government, i.e. opening the possibility for borrowers to repay their FX loans at a favorable exchange rate (Act CXXI of 2011). The favorable exchange rates were fixed in the law; 180 for Swiss franc and 250 for euro. The losses stemming from the difference between the actual and the fixed exchange rate were fully borne by the banking sector putting their profitability under pressure.

On the liquidity side, Decree no. 366/2011 (XII.30.) introduced minimum requirements for sufficient amount of stable foreign currency funding in proportion to the banks' foreign currency assets as well as minimum level of short-term liquidity.

As international regulatory work progressed, the role of macroprudential policies became clearer. The legislative environment of both the European Union and Hungary determines the functioning of the Hungarian macroprudential policy. The prevailing EU bank regulation system is based on the CRR and CRD IV, which give relatively limited room for national discretion. With respect to addressing special risks arising at the Member State level and to individual responses to the different phases of financial cycles, actual room for maneuver is provided by the macroprudential instruments remaining under national competence.

The acts constituting the legal basis of Hungarian macroprudential regulation are rooted in these EU foundations. The basis of the Hungarian legislation comprises two pillars: the Act on Credit Institutions and Financial Enterprises (Act CCXXXVII of 2013) along with the Act on Investment Firms laying down the prudential and supervisory requirements for the implementation of CRD IV, and the Act on the Magyar Nemzeti Bank (Act CXXXIX of 2013) enshrining the macroprudential regulatory mandate and specifying the application method of the relevant instruments.

In Hungary, the Central Bank of Hungary (MNB) was provided with a clear and strong macroprudential mandate as of 2013. The primary objective of the MNB is to achieve and maintain price stability, and it harnesses monetary policy instruments to achieve this goal. However, without prejudice to this primary objective, the MNB maintains the stability of the financial intermediary system, and assists in enhancing the resilience of the financial system and in ensuring its sustainable contribution to economic growth. Within the organization of the MNB, the Monetary Policy Council (MC) establishes the strategic framework regarding macroprudential policy, while the body responsible for the definition and achievement of specific macroprudential policy objectives is the Financial Stability Board (FSB). In addition to macroprudential analytical and regulatory tasks, the FSB is responsible for tasks related to microprudential policy and consumer protection, and for decisions relating to the supervisory and resolution authorities.

MNB (2016) presents the main elements of the regulatory process: risk analysis, intervention and follow up. Figure 1-4 shows the steps of macroprudential regulatory decision-making. First, the MNB identifies existing and potential risks. This is followed by the identification of potential intervention instruments and, as appropriate, regulatory steps. The selected policy response is evaluated in the next phase.

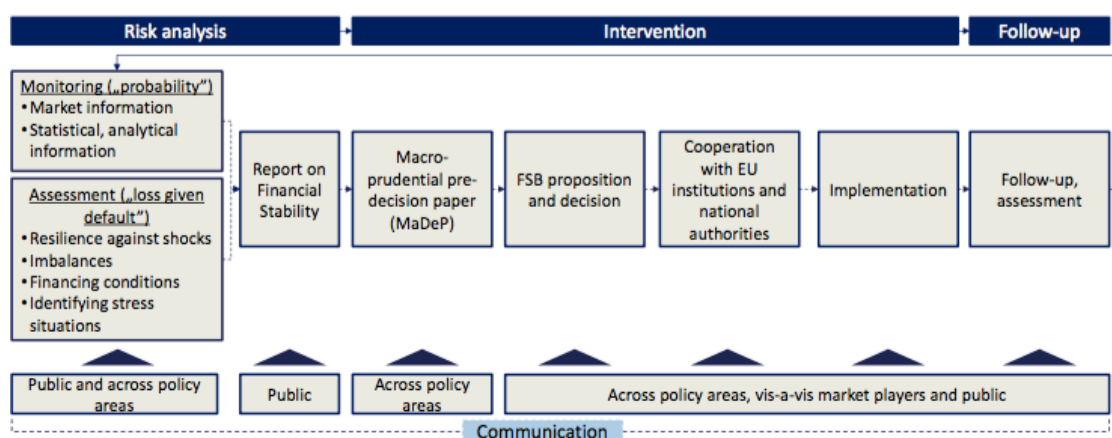


Figure 1-4: Phases of the macroprudential regulatory cycle

Source: MNB (2016).

Some instruments available for the MNB are determined at the EU level. With respect to these tools, it is the role of the MNB to fine-tune these instruments and to adjust them to the national needs. As regards excessive credit flows, systemic liquidity risks and risks related to the financial infrastructure, the MNB is entitled to issue decrees irrespective of the EU legislation.

The macroprudential tools of the MNB can be grouped into two main categories: i) policy instruments that are harmonized across the EU and ii) instruments applicable under national competence. With respect to the tools that are under national discretion, they mainly focus on liquidity issues to address legacy problems, such as maturity mismatch. For the complete list of macroprudential tool, see Annex 1.

1.5 Is the new regulatory framework complete and able to prevent the next crisis? – Questions remain

Beforehand, we have reviewed the regulatory environment's development since the onset of the financial crisis. Two questions remain, however: i) whether these new rules will live up to expectations (forward-looking), and ii) whether these rules having been effective before the crisis would have helped avoid the problems (counterfactual). It is difficult to answer any of them, but they have an utmost importance from the regulatory authorities' point of view. There are many different objectives according to which the effectiveness of the new rules can be evaluated. CLAESSENS et al (2014) suggests the following prerequisites for an efficient regulatory framework⁵: think system-wide and try to explicitly address market failures and externalities, improve incentives individually and collectively, of all those involved in finance, collect more, higher quality data and conduct better analysis and improve crisis management.

Despite much discussion and some tentative steps forward, as of yet macroprudential approaches remain largely micro-prudential. For the most part, Basel III is still micro-prudentially oriented., however, based on the nature of the calibration, microprudential tools could also serve macroprudential purposes. Basel III requires more and higher quality capital, however, more capital only helps cushion the bank's losses and hence the systemic nature of multiple and simultaneous bank distress is only partially addressed. Other macroprudential tools, such as LtV and taxes, are in the correct direction as their ultimate goal is to give the right incentives to reduce systemic risks. However, much has to be done in terms of adequate calibration of these tools. Another important element of the system-wide approach is mitigating the procyclical nature of the regulation. The first step would be to allocate compensation on a risk-adjusted profit basis. A second and probably more efficient one could be to do so through the cycle.

As CLAESSENS (2014) highlights the new rules do not perform particularly well in terms of giving right incentives. Especially from the long-term perspective, where activities can migrate to

⁵ Efficient in a sense whether the new regulations are able to prevent or at least mitigate the impact of a future crisis.

less regulated parts of the industry thanks to higher requirements. Steps were also taken towards reducing the moral hazard stemming from the Too-Big-To-Fail (TBTF) problem. Capital surcharges have been introduced for systemically important financial institutions; however, it is not entirely clear whether these requirements provide sufficient incentives to avoid failure. MÉRŐ (2011) highlighted that additional capital requirement decreased the RoE through increasing the denominator. If the calibration of the additional capital requirement is sufficient to offset the lower funding costs stemming from the TBTF status, then the regulation would be able to limit incentives to grow further. If the regulation fails to find the right amount additional capital, the TBTF problem remains or it overshoots and results in competitive disadvantage for banks in subject.

Although, substantial amount of work has been devoted to setting up criteria for a more comprehensive regulations that could prevent or mitigate the impacts of a future crisis, less has been done so far on testing the new regulations' effectiveness retroactively. In the first part of the dissertation we are looking for answers to this type of questions, i.e. what would have happened if these rules were already in place? First, we would like to answer the question whether higher minimum capital requirement would have resulted in a less intensive raise in FX lending in Hungary. Second, we are looking for some evidence whether regulatory authorities could have prevented the FX lending crisis by requiring a countercyclical capital buffer (assuming they would have had the opportunity to apply such a tool). Thirdly, we try to find an answer whether tighter capital regulation would have been worth in terms of GDP sacrifice.

Despite the enthralling speed of standard setting, regulatory work has not finished, further efforts has to be made in many areas. More specifically, rules on Total Loss Absorption Capacity (TLAC) for G-SIIs and the Minimum Requirement for own funds and Eligible Liabilities (MREL) for O-SIIs have to be finalized.

One overarching objective of the BRRD framework is to shift the burden of bank rescues from taxpayers to bank creditors. To that end, resolution authorities were given the power to allocate losses to shareholders and creditors (the "bail in" tool), in line with the valuation of the failing business. Shareholders and creditors must therefore absorb losses for an amount of at least 8% of total liabilities including own funds before any use of the resolution fund.

As bailing-in some liabilities may be legally difficult (for example for those issued in foreign jurisdictions) or potentially disruptive for the real economy (such as deposits from households

and SMEs), the BRRD provides for a list of liabilities which must not be bailed-in, in particular covered deposits and secured liabilities. It appears that, upon resolution, a failing institution may not hold a sufficient amount of bail-inable liabilities. To tackle this issue, Article 45 BRRD provides that institutions shall meet at all times a minimum requirement for own funds and eligible liabilities (MREL), to be determined by the resolution authority. The MREL therefore constitutes an anchor point for the new resolution framework, as it determines the credibility of the bail-in regime.

MREL does not impose any mandatory minimum levels over and above the minimum regulatory capital requirement of 8% of RWA, which is already enshrined in CRR/ CRD IV, but delegates to the relevant resolution authorities the power to set MREL individually for each bank on a case-by-case basis (“Pillar 2”). Capital buffers are not additive, i.e. CET1 capital used to cover capital buffers may also be counted towards MREL. However, the recent suggestion on this issue published by the EBA (2016) asks for more clarification on the stacking order of the different capital buffers.

Similarly to MREL, TLAC also requires sufficient amount of bail-inable liabilities from G-SIIs. TLAC, however, is a global standard issued by the Financial Stability Board (FSB) and the Basel Committee on Banking Supervision (BCBS) in November 2015. It covers only the 30 largest global banks, which have been designated G-SIIs by the FSB. From 2019 onwards, G-SIIs will be required to hold mandatory minimum TLAC levels equivalent to 16% of risk-weighted assets (RWA) or 6% of total exposure, rising to 18% and 6.75% in 2022. In addition to regulatory capital (min. 8% of RWA), TLAC may include subordinated or unsecured senior debt (8-10% of RWA). Capital buffers, which typically range from 2.5 to 6.0% of RWA, are not included and must be covered by additional equity (CET1) capital. TLAC is a mandatory “Pillar 1” requirement under Basel III and will apply to all G-SIIs globally.

Apart from TLAC/MREL regulations, additional key elements are to be finalised by the end of the year including agreement on the final design of the leverage ratio. The BCBS is currently working on the final aspects of the leverage ratio and will finalise the calibration in 2016. It has been agreed that the minimum level of the Tier 1 leverage ratio should be 3% with additional requirements for G-SIIs. Any final adjustments must be made to the framework by 1 January 2017, with a view to migrating to a Pillar 1 treatment on 1 January 2018 (ECB (2016)).

Another area that has to be properly regulated is the vicious circle between the sovereigns and the banking sectors. This feedback loop (Figure 1-5) between sovereign and bank credit risk was the hallmark of the 2009-12 sovereign debt crisis in the periphery of the euro area. The deterioration of sovereign creditworthiness reduced the market value of banks' holdings of domestic sovereign debt. This reduced the perceived solvency of domestic banks and curtailed their lending activity. The resulting bank distress increased the chances that banks would have to be bailed out by their (domestic) government, which increased sovereign distress even further, engendering a "bailout loop". Moreover, the recessionary impact of the credit crunch led to a reduction in tax revenue, which also contributed to weakening government solvency in these countries, triggering a "real-economy loop".

By implementing the BRRD, one angle of this vicious circle has already been broken, namely there will not be bailout costs anymore. However, the contagion stemming from the banking sectors' large exposures to the domestic sovereigns still has to be addressed. There are several options currently on the regulators' table (ESRB (2015)). The proposals vary in a wide range; from introducing positive risk weights for sovereign exposures to extending the large exposure limit rules for sovereign bond holdings.

The impact of such regulatory change would be manifold but it will certainly be the most substantial among the pending regulatory proposals. It would most likely trigger substantial adjustment both for the banking sectors and the sovereigns. As such, the topic has received particularly high publicity and has been discussed in many forums. To contribute to the international debate, in the second part of the dissertation, we try to find answers to the following questions. Firstly, whether introducing positive risk weights and limits on sovereign exposures could reduce the impact of a potential crisis. Secondly, whether banks' ability to accommodate temporary large swings in financing needs of the sovereigns would be constrained by either of the two policy options. Lastly, whether banks would lower their demand for sovereign debt and if so, what would be the implications for the sovereigns.

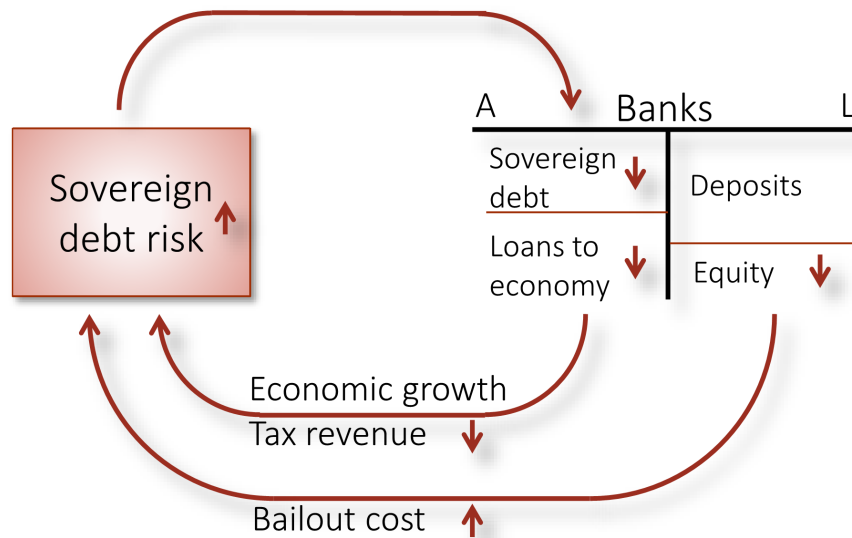


Figure 1-5: Two Diabolic Loops

Source: BRUNNEMEIER et al. (2011).

2 A Counterfactual Analysis of Regulatory Changes in Hungary⁶

2.1 Introduction

The global financial crisis (GFC) shed light on the importance of the so-called macro-financial linkages through which financial sector activity could have a meaningful impact on economic activity. At the same time, it was also made clear that neither pre-crisis financial supervisory practices nor monetary policy succeeded in ensuring financial stability. As part of a general reassessment of economic policies, macroprudential policies gained traction and have become a part of the overall policy response to the challenges the crisis posed.

Several factors have complicated the adoption of these policies.⁷ First, macroprudential policies should be motivated by externalities and market failures. However, there is no clear guidance on the design of these policies. Second, given that most countries resorted to macroprudential policies only recently, there is limited experience and empirical analysis to judge their efficiency.

Hungary, like other countries, also had to realize the importance of macro-financial linkages. In contrast to several other countries that experienced an asset price boom and/or excessive credit growth in the pre-crisis period, however, the main source of vulnerability was the currency

⁶ A version of this chapter was published in *Acta Oeconomica* (SIKLÓS, 2016).

⁷ See CLAESSENS (2014).

mismatch stemming from the foreign currency, mostly Swiss franc, borrowing by households and corporations as well as the maturity mismatch of banks. Specifically, the banking sector financed its long-term foreign currency lending with short-term off-balance sheet transactions (mostly FX, but also currency interest rate swaps). The GFC impacted the banking sector in at least three key ways. First, increased risk aversion in global financial markets prompted a flight to safe assets, including the Swiss franc. The rising debt service of households and corporations stemming from the appreciation of the Swiss franc then led to an increase in bank losses on their loan portfolio. Second, banks had to meet margin calls on their FX swaps due to the depreciation of the Hungarian forint. Third, a few banks had difficulties in rolling over their short-term FX swaps during the crisis.

In this chapter, we apply a counterfactual analysis to assess whether excessive credit growth and the build-up of FX loans could have been prevented by the use of macroprudential policies.⁸ Specifically, by estimating the historical relationship between aggregate capital adequacy, lending and a set of macroeconomic variables, we calculate an alternative scenario of pre-crisis lending based on a hypothetical capital adequacy regulation.

It is important to note, however, that such a counterfactual analysis has at least one notable caveat. Namely that it provides some retrospective indications for the impact of stringent prudential rules only for those regulatory instruments that had existed before the crisis. The concept of the SVAR analysis is to identify similar situations in the past, where capital increase was followed by a decrease in credit supply and estimate the potential macroeconomic impact of tightening capital requirements. As such, it is not able to analyse the counterfactuals for non-existing regulations, e.g. liquidity or leverage ratio rules that were introduced after the GFC. Despite this drawback, we still consider it as a useful tool. Our aim is to answer the probably most puzzling question of the FX lending crisis, i.e. whether it could have been avoided if the authorities had applied all the possible tools that were available at that time. We do not try to simulate the impacts of other regulations that would have mitigate some aspects of the crisis, but had been identified only after the turbulences.

The structure of the chapter is as follows. Section 2.2 reviews the literature. Section 2.3 gives an overview on the motivation of the analysis. Sections 2.4 and 2.5 describe the data and the

⁸ Based on IMF (2000), aggregate capital adequacy ratio is considered to be a macroprudential indicator.

estimation technique, respectively. Section 2.6 summarizes the estimation results and Section 2.7 concludes.

2.2 Related Literature

Given the brief history of the application of macroprudential policies, there is only a small number of empirical papers analyzing the efficiency of these tools. Estimating the effect of macroprudential rules is complicated for at least two reasons: (i) they rarely existed before the GFC; and (ii) those already in place (especially the capital adequacy ratio) were broadly stable in the pre-crisis period.

Based on the applied method, we can group the existing literature into two categories:

1. Bottom-up approach, i.e. estimations using micro-level data

BRIDGES et al. (2014) analyzed the effect of changes in the regulatory capital requirements on lending, based on bank-level data. They used estimation results from panel regressions of lending to different sectors on regulatory capital requirements and observed capital ratios to build impulse responses with the aim of understanding the effects of a permanent 1 percentage point increase in capital requirements. Although the results vary across sectors, they found that an increase in capital requirements reduces loan growth with a lag of one year and a recovery within three years. The cumulative effect of a 1 percentage point increase in the regulatory capital on loan volumes is -3.5 percent after 12 quarters. BRUN et al. (2014) used loan-level data in France with the aim of estimating the effect of an easing of the capital requirement on corporate lending. Their time span covered the transition from Basel I to Basel II in order to estimate the elasticity of corporate lending to capital requirement. They found a relatively large effect of capital requirements on lending, i.e. a 1 percentage point decrease in capital requirements led to a 0.75 percent growth in outstanding corporate loans. BERROSPIDE et al. (2010) examined the effect of capital injection programs in the U.S., such as that of the Capital Purchase Program (CPP). They carried out both panel regression and VAR-based analysis, and found only a modest effect of capital on lending. According to their results, a 1 percentage point increase in the capital-to-assets ratio triggered an increase of 0.7-1.2 percentage point in lending growth.

2. Top-down approach, i.e. estimations using aggregated data

As a part of their impact studies for Basel III, BIS (2010) implemented two different one-step top-down approaches for estimating the effect of increasing capital requirements. First, they used DSGE models that explicitly incorporated the banking sector. The results are modest, with a 1 percentage point increase in the target capital adequacy ratio leading to a decrease of 0.14 percent in output after 18 quarters. Second, they estimated VAR models that included standard macroeconomic variables such as real GDP growth, GDP deflator and interest rates as well as banking sector variables such as aggregate bank loans and capital/asset ratios. The results from these estimations were more pronounced, with a 1 percentage point increase in the target capital ratio leading to a 0.4 percent decrease in output. NOSS – TOFFANO (2014) assessed the impact of changes in capital requirements on lending in the United Kingdom, by estimating a SVAR model. They assumed that an increase in banks' capital requirements would have a negative effect on lending at least in the short run. This assumption is necessary to understand to what extent the change in bank lending behavior was a result of the increasing capital requirement, rather than broader macroeconomic developments. They found that a 15 basis point increase in capital requirements during an economic upswing is associated with a 1.4 percentage point decrease in lending after 16 quarters. At the same time, its effect on GDP was found to be insignificant.

A few studies aimed to estimate the effect of changes in regulatory capital in Hungary. Following the introduction of regulations based on Basel II, ZSÁMBOKI (2007) investigated their potential consequences, in particular on financial stability. He pointed out that given the procyclical nature of the regulation, banks should build up capital reserves above the regulatory minimum requirements during an economic upswing in order to be able to cover any future losses. Although the analysis drew attention to the procyclical nature of the Basel II regulation, it did not examine its potential effect on the real economy. SZOMBATI (2010) analyzed the macroeconomic effect of Basel III rules. She found that a 1 percent (equivalent to around 13 basis points) increase in the capital requirement is associated with a decrease of 0.63-1.05 percent in real GDP after 32 quarters. These results assumed that (i) the banking sector adapts to the new regulation in equal measure with capital increases and asset reductions; (ii) the adjustment would be faster in corporate lending than in household lending; and (iii) banks with larger capital buffers could take over loans from other banks with lower capital buffers.

TAMÁSI – VILÁGI (2011) and HOSSZÚ et al. (2013) estimated a Bayesian VAR model for the Hungarian economy and applied sign restrictions to identify macroeconomic and credit supply shocks. Assuming that different types of credit supply shocks might require different policy responses, they analyzed the effect of changing risk assessments of financial institutions as well as that of changing regulatory requirements (credit spread shock). They found that the impact of the two shocks differs substantially. For changing risk assessment, the response of credit portfolio and real GDP are much more pronounced and permanent than for a credit spread shock. Their results show that changing risk assessment indicates a 1 percent decrease in lending and 0.21 percent decrease in real GDP, while changing regulatory requirements has a negative effect of 0.18 percent on real GDP. The order of magnitude and the permanence of the response of real variables could be explained by the fact that the underlying VAR model contained only corporate loans whose duration is typically lower than that of households.

2.3 Motivation: Excessive Borrowing in Foreign Currency?

Private sector borrowing increased substantially between 2004 and 2009 mostly driven by foreign currency (Swiss franc) denominated loans (Figure 2-1). Both non-financial corporations and households increased their foreign currency borrowing; however, the borrowing was more pronounced in the household sector.

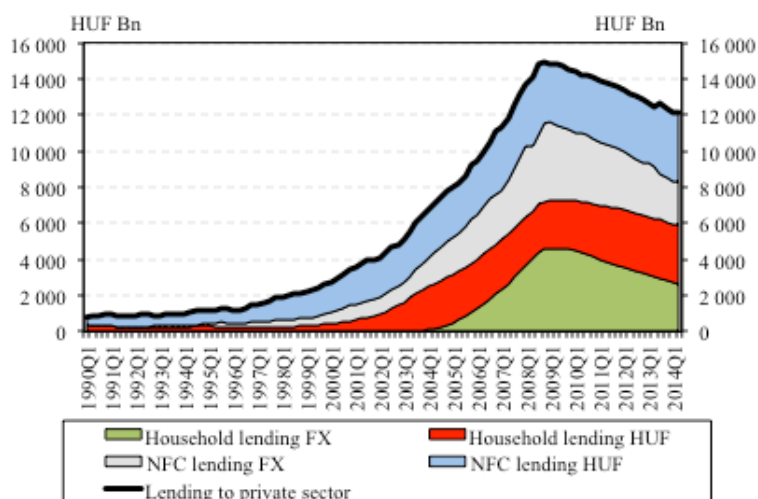


Figure 2-1: Lending to private sector

Note: Household FX lending has been corrected for the effect of the early repayment scheme (starting in 2011 Q4). Data are adjusted for changes in the exchange rate.

Source: Central Bank of Hungary

Using four different trend-filtering methods, HOSSZÚ et al. (2015) showed that in the early 2000s, the initially negative credit gap turned into a significant positive credit gap both in the

household and corporate sectors. Their results are mostly in line with that of HOLLÓ (2012). He found that the imbalances in the Hungarian banking system, namely the excessive credit growth and the sharp increase in the ratio of total liabilities to stable funds, started to emerge in the last quarter of 2005 and lasted until the onset of the financial crisis. KISS et al. (2006) concluded that although credit growth between 2004 and 2005 was somewhat faster than its equilibrium rate,⁹ this can be justified by convergence. It implies that it was not the speed of lending growth per se that should have given rise to concerns but rather its currency composition; i.e. the excessive lending in foreign currency.

There are several possible explanations why foreign currency lending gained momentum in Hungary. To find explanations, we first try to identify whether the motivation originated from the demand or the supply side.

BETHLENDI et al. (2005) found that the increase in FX lending, which started in 2004, was mostly due to rising demand, possibly reflected by the opening of Hungarian banks' on-balance sheet FX position and their increasing loan-to-deposit ratio (Figure 2-2).

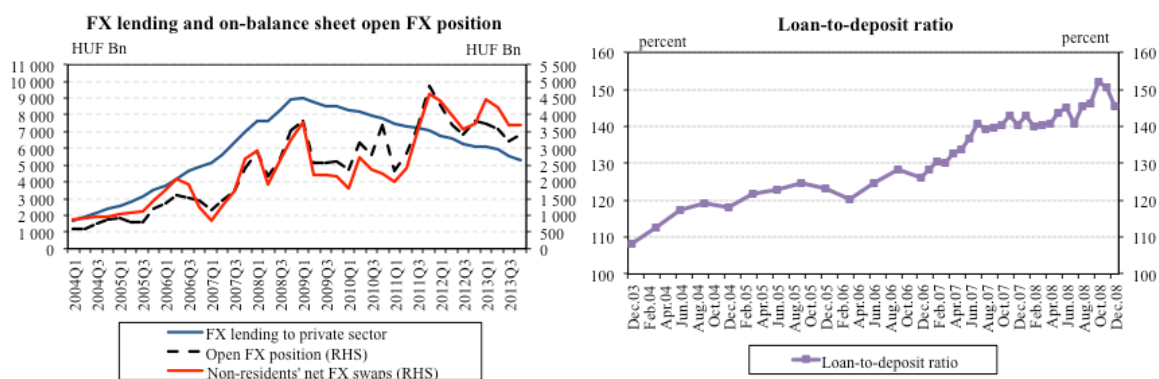


Figure 2-2: FX lending, on-balance sheet open FX position and loan-to-deposit ratio of Hungarian banks

Source: Central Bank of Hungary

BETHLENDI et al. (2005), ROSENBERG – TIRPÁK (2008) and CSAJBÓK et al. (2010) identified the following factors on the demand side that presumably contributed to the increase in FX lending. The first three are more relevant for households, while the fourth concerns mostly non-financial corporations.

⁹ The equilibrium level is identified by some fundamental macroeconomic variables for developed countries based on a longer time frame.

- **Interest rate differentials:** The increasing share of FX lending in the private sector stems from a portfolio allocation decision based on the uncovered interest rate parity. Specifically, the domestic interest rate is equal to the sum of the foreign interest rate, the expected depreciation of the exchange rate and the exchange rate risk premium. As long as the risk awareness of borrowers is the same as the sum of expected exchange rate movements and exchange rate risk premium, changes in interest rate differential do not induce substitution between domestic and foreign currency loans. Substitution only happens if exchange rate expectations are not homogenous. Since households had relatively good experiences with consumer FX loans, their risk sensitivity against exchange rate and interest rate was probably quite low. The substantial interest rate differential thus led households to borrow in foreign currency. The latter was also an important factor for non-financial corporations operating in the non-tradable sector (BODNÁR, 2006), therefore they became exposed to exchange rate risks to a similar extent as households.
- **'Fear-of-floating' factor:** Given lack of fixed-rate domestic currency loans, borrowers might weigh the risks associated with floating-rate domestic currency loans against foreign currency loans. Specifically, to the extent domestic currency interest rate volatility exceeds exchange rate volatility, borrowers might find foreign currency borrowing more attractive. This can be reinforced by the monetary authority, if it uses interest rate policy to smooth exchange rate movements.
- **Liquidity constraint:** If a household is only able to pay more than a certain proportion of its income to service its debt, the size of the monthly debt service and its variance are crucial factors. Most households could not afford the high monthly repayment of HUF loans. Households with stronger liquidity constraints typically generated demand for cheaper FX loans. Moreover, the longer the maturity of the loan, the larger the effect of the interest rate differential on the monthly repayments.
- **Regulatory changes:** The tightening of the eligibility criteria of subsidized mortgage loans in 2004 could also have prompted households to switch to cheaper FX loans.
- **Hedging FX deposits:** Non-financial corporations that have FX revenues borrowed in foreign currency in order to hedge their FX income.

HUDE CZ (2012) also mentions moral hazard issues and externalities as potential reasons for FX loans. It could be that debtors knowing the policy makers' preferences are betting that they would be bailed-out in case of an extreme macroeconomic scenario. Also, neither borrowers, nor lenders take into account the fact that the large open FX position at macro level increases the vulnerability of the country. As a result, financial products will most likely be mispriced as the externality is a missing component. Moreover, empirical studies showed that lax fiscal policy and over indebtedness increase the risk premia in the funding costs and the resulting crowding effect limit the private sector's accessibility to bank credit.

On the supply side, the authors mention that the availability of foreign funds stemming from strong financial ties between domestic commercial banks and their parent banks residing in the EU might also have influenced the currency composition of loans.

The private sector's increasing demand for FX loans increased the banking sector's need for FX funds. Hungarian banks collecting mostly HUF deposits had two possibilities to fulfil this need:

1. on-balance sheet foreign currency financing, typically from parent banks,
2. off-balance sheet swap transactions.

Both forms of FX funding contributed to the build-up of macroeconomic vulnerabilities. First, risks related to on-balance sheet FX funding stem from a country's increasing external debt (**Figure 2-3**). Moreover, banks typically financed long-term mortgage FX loans with short-term foreign funds, leading to a maturity mismatch and thus substantial roll-over risks as well as potential reliance on emergency FX liquidity facilities.

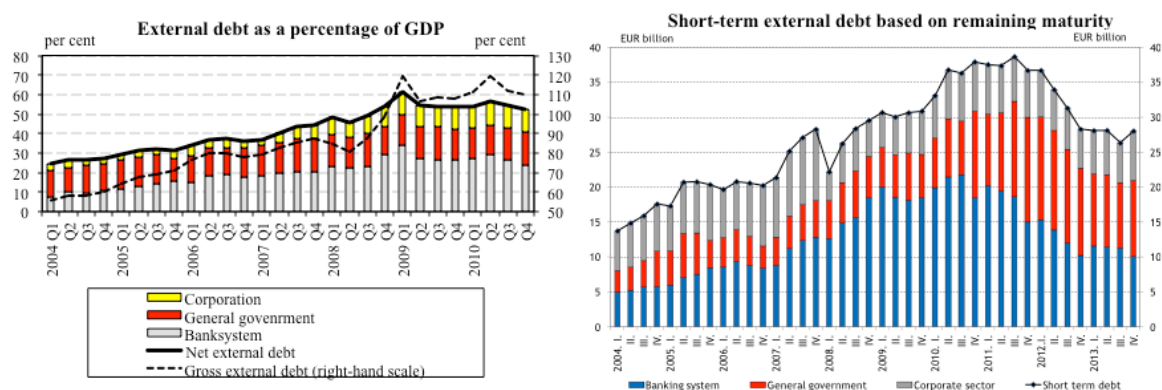


Figure 2-3: External debt as a percentage of GDP and short-term gross external debt based on remaining maturity and by sector

Source: Central Bank of Hungary, Central Bank of Hungary (2014)

Second, synthetically creating FX exposure through swaps is even riskier. In addition to increasing the country's external debt,¹⁰ it has further drawbacks: (i) while foreign funds enhance liquidity, bolstering the balance sheet of the banking sector, FX swaps only change the denomination of existing liquidity without any change in total liquidity and balance sheet; (ii) the maturity of FX swaps has been generally shorter than that of foreign funds (**Figure 2-4**). As a result, the rollover risk is even higher than in the case of foreign funds.

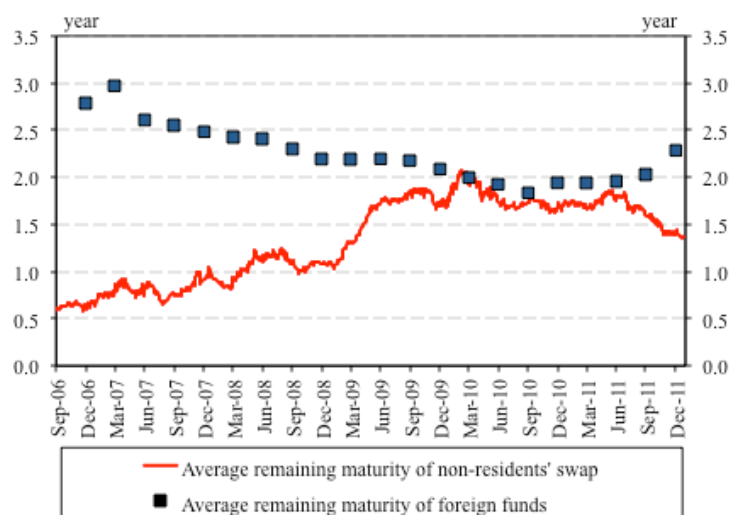


Figure 2-4: Average remaining maturity of foreign funds and gross foreign swaps

Note: Data for the remaining maturity of the banking sector's foreign funds are available from 2006.

Source: Central Bank of Hungary

These vulnerabilities had serious consequences for Hungary during the crisis when risk aversion intensified and investors flew to safe-haven currencies, such as the Swiss franc. First, the weakening of the Hungarian forint against the Swiss franc substantially increased the monthly repayments for households. Eventually, this resulted in increasing non-performing loan (NPL) ratios as well as decreasing consumption and investments (Figure 2-5).

¹⁰ Assuming that foreign counterparts place their HUF liquidity in the Hungarian banking sector.

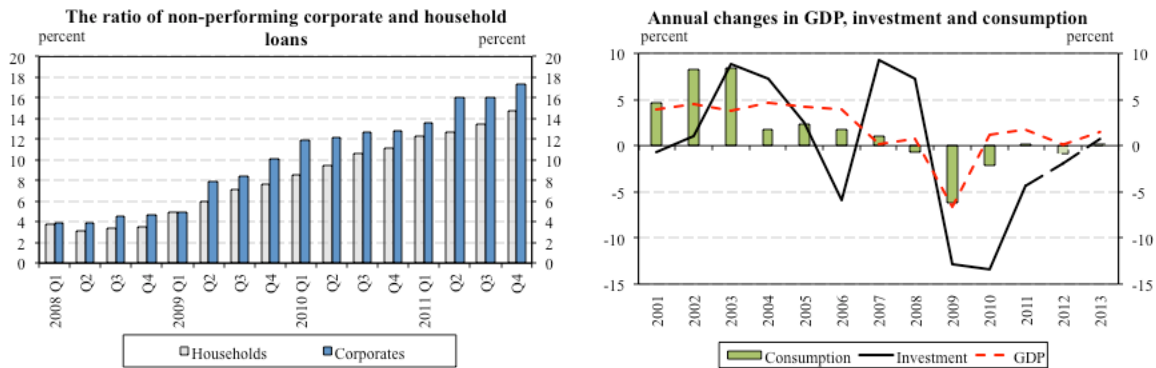


Figure 2-5: Ratio of non-performing corporate and household loans within total loan portfolio and annual changes in GDP, investment and consumption

Source: Central Bank of Hungary

Second, the renewal of foreign funds and swaps became more expensive as the country's and the parent banks' CDS spreads, the most important pricing component, increased substantially (PÁLES – HOMOLYA, 2011) (Figure 2-6).

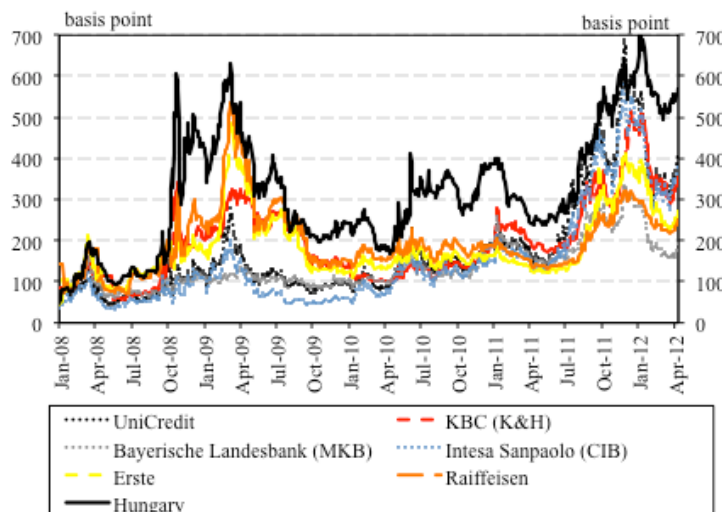


Figure 2-6: 5-year CDS spreads of Hungary and parent banks

Source: Central Bank of Hungary, Bloomberg

The prevalence of FX loans **played** an important role in the deepening of the crisis. Increasing funding costs and NPL ratios put pressure on the banking sector's income-generating capabilities, limiting its ability to contribute to real GDP growth (Figure 2-7). As such, it is of great importance to examine whether the excessive FX lending could have been avoided by requiring a countercyclical capital buffer as per Basel III rules and if so, at what macroeconomic costs.

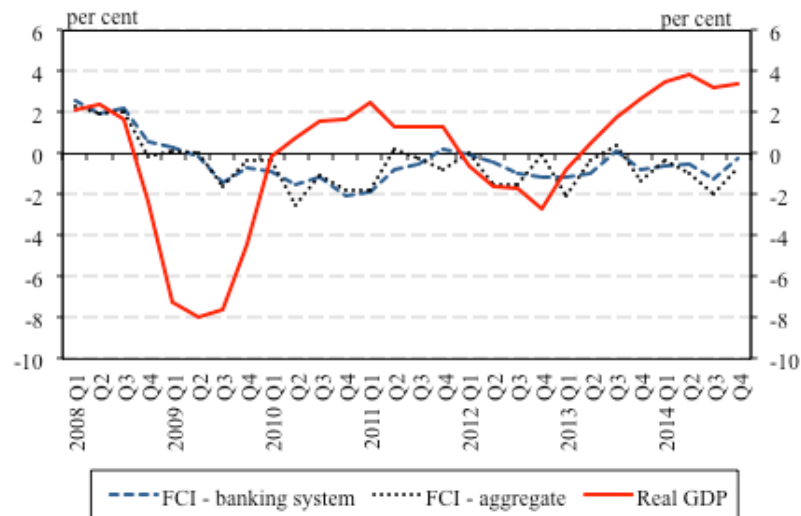


Figure 2-7: Financial Conditions Index (FCI) and annual real GDP growth

Note: The annual growth rate of FCI shows the contribution of the financial intermediary system (banking sector) to the annual growth rate of real GDP. While the banking sector sub-index only contains the variables related to lending, the ‘overall’ index also contains the monetary conditions, i.e. the interbank rate and the exchange rate. A revision was made on the time series because of the transition of the model to a transactional basis.

Source: Central Bank of Hungary

In this chapter, using a Vector Autoregression Model (VAR), we estimate the effect of changes in regulatory capital requirements based on the pre-crisis relationship between aggregate capital adequacy ratio and other macroeconomic variables. The results could provide policy makers with a sense of the macroeconomic effect of changes in macroprudential capital requirements.

2.4 Data

In the previous chapter, we identified 2004-2009 as a period of credit upswing in Hungary. The year 2004 was chosen as the start because households had hardly done any FX lending before that year. Lending to the private sector increased on a year-to-year basis even after the onset of the GFC until the end of 2009, therefore we consider it the turning point. In the estimation the following quarterly variables were used:

1. **Real GDP growth:** The source of the data is the Hungarian Central Statistical Office. Seasonally adjusted growth rates were used for the estimation.
2. **Growth rate of real lending to private sector:** Data published by the Central Bank of Hungary. We adjusted growth rates seasonally and for exchange rate changes.
3. **Alternative funding sources (growth rate):** These refer to non-financial corporations (NFCs) and include loans from non-financial entities, other financial corporates, public

institutions, households and foreign entities as well as bonds issued by non-financial corporates. The data, published by the Central Bank of Hungary, were seasonally and exchange rate adjusted. Since bank financing is by far the most dominant form of funding for corporates in Hungary, the explanatory power of this variable might be limited. However, given its importance in some segments of the economy, we decided to include it in the baseline model. More importantly, the inclusion of alternative funding is necessary to simulate a credit supply shock.

4. **Hungarian sovereign CDS spread** represents the FX funding costs of the Hungarian banking sector. PÁLES et al. (2011) showed that before the onset of the crisis, Hungarian banks were able to obtain foreign funds at levels corresponding to those of their parent banks and Hungarian sovereign CDS spreads. Between the onset of the crisis and 2009, both the funding costs of parent banks and Hungarian sovereign CDS spreads increased substantially. Although the funding costs of Hungarian banks remained at the level of those of their parent companies during this period, they started to decouple significantly at the beginning of 2010. As a result, the Hungarian sovereign CDS spread seems a good proxy for the funding costs of banks between 2004 and 2009. CDS spreads were downloaded from Bloomberg.
5. **Hungarian 3-month money market rate (BUBOR)**: Similarly to CDS spreads, this variable is used to capture Hungarian banks' HUF funding costs. BUBOR is expected to have an impact through the substitution channel, i.e. the higher HUF borrowing costs, the more households move toward borrowing in FX. The Central Bank of Hungary publishes data on a monthly basis.
6. **Real Effective Exchange Rate (CPI based REER)**: This variable measures the country's competitiveness compared to its main international trade partners. Time series are published by the Central Bank of Hungary.
7. **Capital Adequacy Ratio (CAD ratio)**: Data are coming from regulatory reports submitted to the Central Bank of Hungary. The denominator of the ratio is the risk weighted assets of the banks and is calculated according to Basel II rules.¹¹ Although there

¹¹ Although the impact of an increase of the CAD ratio is likely to depend on the composition of capital injection (e.g., common equity versus subordinated debt), the limited availability of data does not allow for distinguishing between different types of capital injection.

are arguments for using total assets instead of risk weighted assets in order to filter out the effect of any potential attempts made by banks trying to alter their balance sheet, the official CAD ratio still seems a better alternative given that the main purpose is to quantify the effect of changes in the CAD ratio. The capital adequacy ratio required under Pillar II by the authorities differs from bank to bank, but we assume that there is no bank with a higher required capital adequacy ratio than the sector average. This assumption ensures that an increase in the required capital ratio would lead to a decrease in banks' capital buffer.

The first three variables are expressed as growth rates, in the case of BUBOR and REER, their levels are used, while CDS spreads and the aggregate capital adequacy ratio are in first difference in order to ensure their stationarity. As a preliminary attempt, the levels of these variables were used, but the estimated VAR did not satisfy the stability criteria.

Table 2-1 shows descriptive statistics of the variables, while Table 2-2 contains their correlation matrix. The correlation matrix reveals that real GDP is positively correlated with real lending, alternative funding and the aggregate CAD ratio (albeit only weakly in the latter case), while it is negatively correlated with the Hungarian sovereign CDS spreads. Real lending is negatively correlated with alternative funding, CDS spreads, BUBOR and the CAD ratio. Notwithstanding the intuitive relations between the variables, the contemporaneous correlations do not differ significantly from zero in most cases suggesting that lagged values might have better explanatory power.

Table 2-1: Descriptive statistics, quarterly data, 2004Q1 – 2009Q4

	CAD ratio	Real lending	Real lending growth	Real GDP growth	Alternative funding sources*	Alternative funding sources growth rate	CDS spread	CDS spread change	BUBOR 3M (real)	REER
Mean	11.80	11 110.5	3.61	0.57	11 460.5	4.77	106.4	0.18	2.85	75.87
Std Dev	0.80	2 865.8	4.66	1.51	3 526.9	3.17	141.0	0.60	2.59	4.43
Min	10.06	6 748.3	-5.32	-3.54	6 379.8	-1.02	14.6	-0.33	-3.58	66.30
Max	13.35	15 355.0	10.26	3.62	18 412.2	13.75	490.1	2.03	6.99	84.24

Note: It contains bond issuance, other non-FI loans and loans from abroad of NFC.

Source: Central Bank of Hungary, author's calculations

Table 2-2: Contemporaneous pairwise correlation, quarterly data, 2004Q1 – 2009Q4

	Real GDP	Real lending	Alternative funding	CDS spread	CAD ratio	BUBOR 3M	REER
Real GDP	1.00000						
Real lending	0.18400	1.00000					
Alternative funding	0.15910	-0.04400	1.00000				
CDS spread	-0.29210	-0.31430	-0.21450	1.00000			
CAD ratio	0.01000	-0.22110	-0.60240	-0.05410	1.00000		
BUBOR 3M	-0.23430	-0.24310	-0.31190	0.04870	0.23010	1.00000	
REER	0.19400	0.23510	-0.00330	-0.13250	-0.06570	0.15570	1.00000

Source: Central Bank of Hungary, author's calculations

Figure 2-8 shows the correlation of lagged lending and contemporaneous GDP, i.e. the correlation between lending growth in period $t + \text{lag}$ and GDP growth in period t , as well as between lagged CAD ratio and lending growth. Lending growth in any period has the highest correlation with GDP growth two quarters earlier, suggesting that corporations and households tend to arrange credit facilities during economic upswings, so that they have liquidity buffers during downturns. The relationship between the lagged CAD ratio and lending growth seems to confirm the pro-cyclical behavior of the banking sector: banks increase their leverage during upturns by increasing lending.

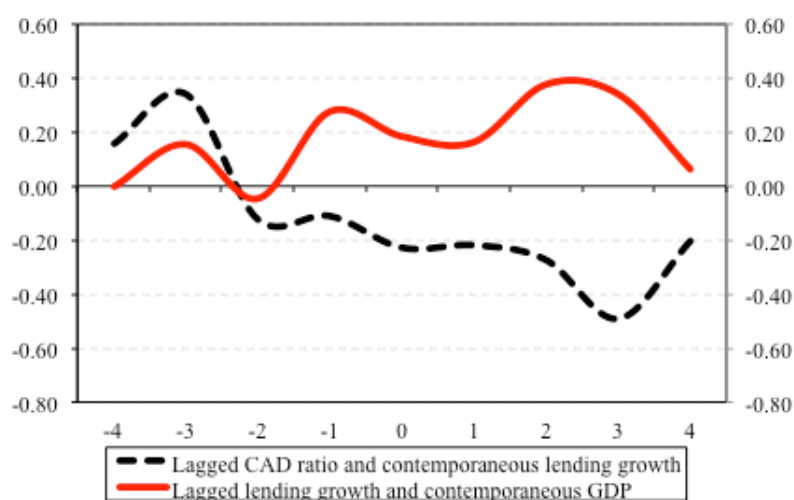


Figure 2-8: Correlation between lagged and contemporaneous lending growth, GDP growth and CAD ratio, quarterly data, 2004Q1-2009Q4

Note: Calculated using the level of CAD ratio.

Source: Central Bank of Hungary, author's calculations

The intuitive relationship between banks' capital adequacy ratio and real lending is also supported by post-crisis data. Between 2004 and 2009 capital ratios decreased as lending expanded, while in recent years the situation reversed (Figure 2-9).

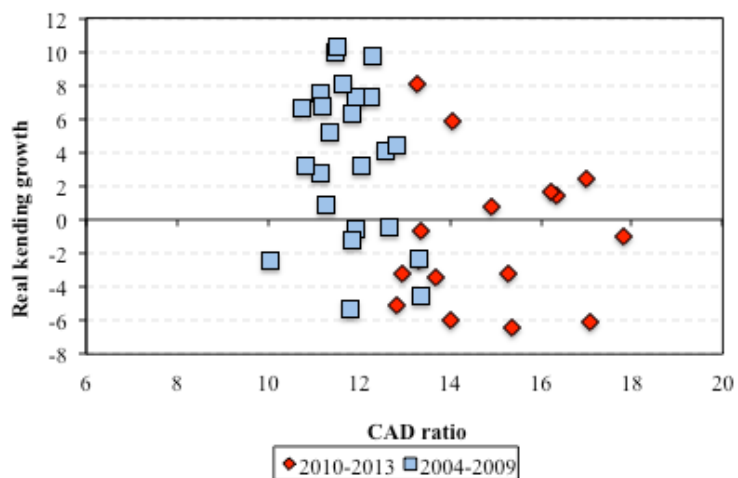


Figure 2-9: Real quarterly lending growth versus aggregate capital adequacy ratio

Source: Central Bank of Hungary

2.5 Model

Our first goal is to understand the impact of changes in capital requirements on banks' funding costs. Based on the Modigliani-Miller (M&M) theorem (MODIGLIANI – MILLER, 1958), an increase in the regulatory capital requirement does not change banks' overall funding cost. However, this statement is conditional on a number of underlying assumptions, including the absence of frictions and taxes. In reality, the M&M theory does not fully hold for the following reasons:

1. Taxes: Since interest payments on debt are tax-deductible, banks have an incentive to operate with higher leverage.

ADMATI – HELLWIG (2013) highlight two additional factors that create incentives for banks to increase leverage:

2. Explicit state guarantee: Deposit insurance schemes reimburse losses not covered by banks' assets, thereby lowering banks' funding costs. Moreover, during the recent financial crisis, governments extended guarantees even for non-deposit liabilities of banks.

3. Implicit state guarantee: By reducing the funding costs of too-big-to-fail institutions, it provides these banks with an advantage over other banks.

As a result of these factors, banks' funding costs are lower than they would otherwise be.

During the pre-crisis period, investors' risk perception related to the financial sector was very small. As a result, banks were able to borrow at low rates. In this environment, an increase in capital requirements was considered to be a credit supply shock, i.e. it would have caused banks' funding costs to increase. Possible responses could have included the following: (i) decrease lending; (ii) increase retained earnings; or (iii) raise capital. However, the first option seems the most likely outcome given some constraints associated with the second and third responses. Specifically, an increase in retained earnings is constrained by sticky dividend payments and banks' reluctance to reduce spending during economic upswing. Similarly, banks tend not to raise capital during those periods when they usually accumulated liquidity buffers. The reason is that investors are aware of the fact that a bank does not need to issue new equity, but if it does so, it would be a sign of the firm being overvalued (MYERS – MAJLUF, 1984).

The above relationship between banks' funding costs and the level of the regulatory capital ratio, however, changed after the crisis. Specifically, it changed from positive to negative, i.e. higher capital requirements are associated with lower funding costs. The GFC revealed significant imbalances in the financial sector that were overlooked by investors in the pre-crisis period. In such an environment, an increase in the regulatory capital level could increase investors' confidence in the banking sector, by supporting banks' resilience as well as their ability to increase lending (NOSS – TOFFANO, 2014).

Due to the above-mentioned ambiguous effect of an increase in the regulatory capital on lending, following NOSS – TOFFANO (2014) we estimated two different models: (i) an unconstrained VAR model in which there are no assumptions regarding the impact of a capital adequacy shock; and (ii) a Structural VAR (SVAR) where we introduced a sign restriction on lending and on alternative funding growth, i.e. an increase in capital requirements is associated with a reduction in lending and an increase in alternative funding. The latter reflects the assumption that the relationship between capital requirements and lending was negative before the crisis. This way, the results stemming from the two models could serve as a reasonable range for policy makers to estimate the effect of macroprudential regulation on the real economy regardless of the economic cycle.

The approach has strengths, specifically in identifying capital adequacy tightening-like situations in the past to gauge the impact of future changes when such policy action is not present in the historical data. But it also has several caveats. Change in the regulatory minimum, for example, does not necessarily require banks to increase their capital adequacy ratios since they typically hold buffers above that minimum¹². As a result, the shock that we apply in the model could be interpreted in the following ways:

- Provided banks intend to keep their buffers constant in longer terms, an increase in the regulatory capital requirement has a one-to-one effect on the capital adequacy ratios. BRIDGES et al. (2014) showed that regulatory capital requirements impact bank capital ratios, i.e. banks typically rebuild their buffers following a tightening of capital regulations.
- The change can reflect a rise in the applicable risk weights for FX loans that leads to an increase in the capital requirement and a decrease in capital buffers.
- The tightening can also be considered as implementation of a countercyclical capital buffer as per the Basel III rules.

The primitive form of the Vector Auto Regression (VAR) model can be defined as follows (ENDERS, 2010):

$$Bx_t = \Gamma_0 + \sum_{i=1}^p \Gamma_i x_{t-i} + \varepsilon_t \quad (1)$$

where

p is the number of lags

x_t is a vector of the endogenous variables

$$x_t = \begin{pmatrix} realgdp_t \\ reallending_t \\ cds\ spread_t \\ alternative\ funding\ sources_t \\ CAD\ ratio_t \end{pmatrix}$$

B contains the contemporaneous effect of a unit change of an endogenous variable on another endogenous variable.

¹² Moreover, regulatory authorities could maintain the same level of capital requirement, but request for more, better quality capital, such as CET1. However, assuming that CET1 capital is the most costly option for banks, this tightening ultimately has the same consequences on bank lending, i.e. reducing credit supply.

$$B = \begin{pmatrix} 1 & \cdots & b_{1p} \\ \vdots & \ddots & \vdots \\ b_{p1} & \cdots & b_{pp} \end{pmatrix}$$

Γ_0 is the constant

$$\Gamma_0 = \begin{pmatrix} b_{10} \\ b_{20} \\ b_{30} \\ b_{40} \\ b_{50} \end{pmatrix}$$

Γ_1 is a $p \times p$ matrix that contains the coefficients of the lagged endogenous variables

$$\Gamma_1 = \begin{pmatrix} \gamma_{11} & \cdots & \gamma_{1p} \\ \vdots & \ddots & \vdots \\ \gamma_{p1} & \cdots & \gamma_{pp} \end{pmatrix}$$

ε_t is the error term

$$\varepsilon_t = \begin{pmatrix} \varepsilon_{realgdp_t} \\ \varepsilon_{reallending_t} \\ \varepsilon_{CDS\ spread_t} \\ \varepsilon_{alternative\ funding\ sources_t} \\ \varepsilon_{CAD\ ratio_t} \end{pmatrix}$$

Multiplying equation (1) by B^{-1} allows us to obtain a VAR model in standard form:

$$x_t = A_0 + \sum_{i=1}^p A_i x_{t-i} + e_t \quad (2)$$

where

$$A_0 = B^{-1}\Gamma_0, A_1 = B^{-1}\Gamma_1, \text{ and } e_t = B^{-1}\varepsilon_t.$$

In this model two lags were used in the estimation of the VAR based on the likelihood ratio (LR) test. According to the standard information criteria, four lags should have been included in the model, but the resulting VAR did not satisfy the stability criteria. Moreover, the selection of two lags reflects the low degrees of freedom arising from having relatively few observations, relative to the number of variables in the model. As a robustness test, we also ran the VAR with one lag (although none of the information criteria suggested this form) and we got similar estimation results. As such, we use the VAR(2) model for our further analysis.

Sign restrictions were introduced in the following way based on FRY – PAGAN (2007).

The relationship between residuals from the standard form and those from the primitive form of the VAR is as follows: $e_t = B^{-1}\varepsilon_t$. If there is an S matrix with the estimated standard deviations of the ε_t on the diagonal and zeros elsewhere, we could express residuals as $e_t = B^{-1}SS^{-1}\varepsilon_t = T\eta_t$, where $\eta_t = S^{-1}\varepsilon_t$ has unit variances.

Assuming that there is a Q matrix such that $Q'Q = QQ' = I$, we can rewrite residuals as follows:

$$e_t = TQ'Q\eta_t = T^*\eta_t^*$$

This results in a new set of estimated shocks η_t^* with a covariance matrix I since $E(\eta_t^*; \eta_t^*) = QE(\eta_t; \eta_t')Q' = I$. As a result we have a combination of the shocks η_t^* that have the same covariance matrix as η_t , but a different impact on e_t , hence the x_t .

To create the above impulse responses and Q matrices, we take the following steps:

1. We compute $E(e_t; e_t') = \Sigma$ and assume that $B^{-1} = \text{chol}(\Sigma)$,¹³ such that $e_t = B^{-1}\varepsilon_t$;
2. Then we draw a matrix K, whose cells are $N(0,1)$;
3. We apply QR decomposition on K matrix so that $K=QR$, where Q is orthogonal;
4. Q is orthogonal ($QQ'=I$), therefore $\Sigma = B^{-1}QQB^{-1'}$, that forms another possible decomposition of the covariance matrix and $B^{-1'} = B^{-1}Q$;
5. We then repeat these steps 1,000 times and keep the results that satisfy the sign restrictions.

Interpreting the impulse responses that satisfy the scheme of imposed restrictions is not straightforward, since the model that produced the median response for one variable might not be the same for the other variables. FRY – PAGAN (2007, 2011) suggest a solution to this problem that chooses those impulses that are the closest to the median responses (Median Target Method). To implement it, we first need to standardize our results by subtracting the median from each impulse response value and dividing it by its standard deviation over all models that satisfy the sign restrictions. These standardized impulses are placed in a vector $\phi^{(l)}$ for each impulse response value $\theta^{(l)}$. Subsequently we choose the l that minimizes $MT = \phi^{(l)'}\phi^{(l)}$ and then use $\theta^{(l)}$ to calculate impulse responses. This process does not necessarily provide a unique l, but in our case, the closest impulse response to the median came from the same model for all variables.

¹³ B^{-1} is usually indicated with A in econometric software.

2.6 Estimation Results¹⁴¹⁵

The VAR(2) model described in the previous section was estimated for a seven-equation system. The coefficients were jointly significant in each equation (for more details of the model and the post estimation statistics, please see Annex 2).

The magnitude of the shock was chosen such that policy makers would have intervened to maintain capital adequacy ratios at their 2005Q1 level (12.04 percent) (Figure 2-10). This choice seems plausible as (i) it is greater than levels observed in the pre-crisis period but lower than levels seen in the aftermath of the crisis; and (ii) it is reasonable to assume that if a countercyclical capital buffer measure had been available, the authorities would have had enough time (four quarters after the start of the credit upswing) to react to increasing lending by requiring additional capital.

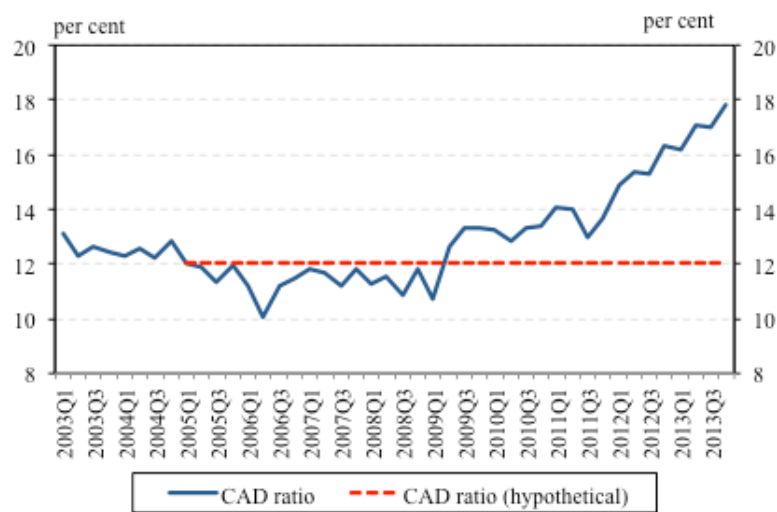


Figure 2-10: Aggregate CAD ratio

Source: Central Bank of Hungary

In the remainder of this section, we describe the impact of changes in capital requirements based on the results of both the unconstrained and the constrained models.

Figure 2-11 shows the unconstrained effects of a macroprudential tightening on real GDP growth, real lending and alternative funding growth. As we mentioned earlier, the unconstrained model intends to simulate the post-crisis behaviour of the banking sector and investors, i.e. a tightening of capital requirements does not necessarily induce a credit supply shock. The response of real

¹⁴ The models were estimated by using STATA 13 as well as MATA for the matrix transformations.

¹⁵ For basic statistics and postestimation results, please see the Annex 2.

GDP growth to an increase in the capital adequacy ratio is moderate; following a temporary increase, it returns to its pre-shock level after 10 quarters. The overall effect on real lending growth is similar to that on real GDP, i.e. it returns to its initial level after 10 quarters, albeit the initial increase proves to be more persistent.

The reason for the increase in real GDP and lending as a response to increasing capital requirements is at least twofold. First, as we argued in section 3, demand-side factors appear to be the main drivers of lending growth, in particular FX lending growth. Our estimation results seem to confirm this. Specifically, the positive impact of higher capital adequacy on lending suggests that strong demand could actually have resulted in an even higher lending growth rate. In other words, the latter was prevented by credit supply. As a result, an increase in capital adequacy could have allowed banks to better satisfy loan demand and thus could have led to higher lending growth. Second, as indicated in section 5, the relationship between capital adequacy and lending is ambiguous. Specifically, if higher capital adequacy improves investor confidence in the banking sector, it leads to lower funding costs, i.e. it could make it easier for banks to finance a further expansion in their loan portfolio.

NOSS – TOFFANO (2014) found similarly weak positive responses for lending when they excluded the sign restriction. They explained it as lending being the only potential transmission channel for macroprudential capital requirements. It seems plausible in periods of credit upswing, when banks' cost of debt is insensitive to their capital level.

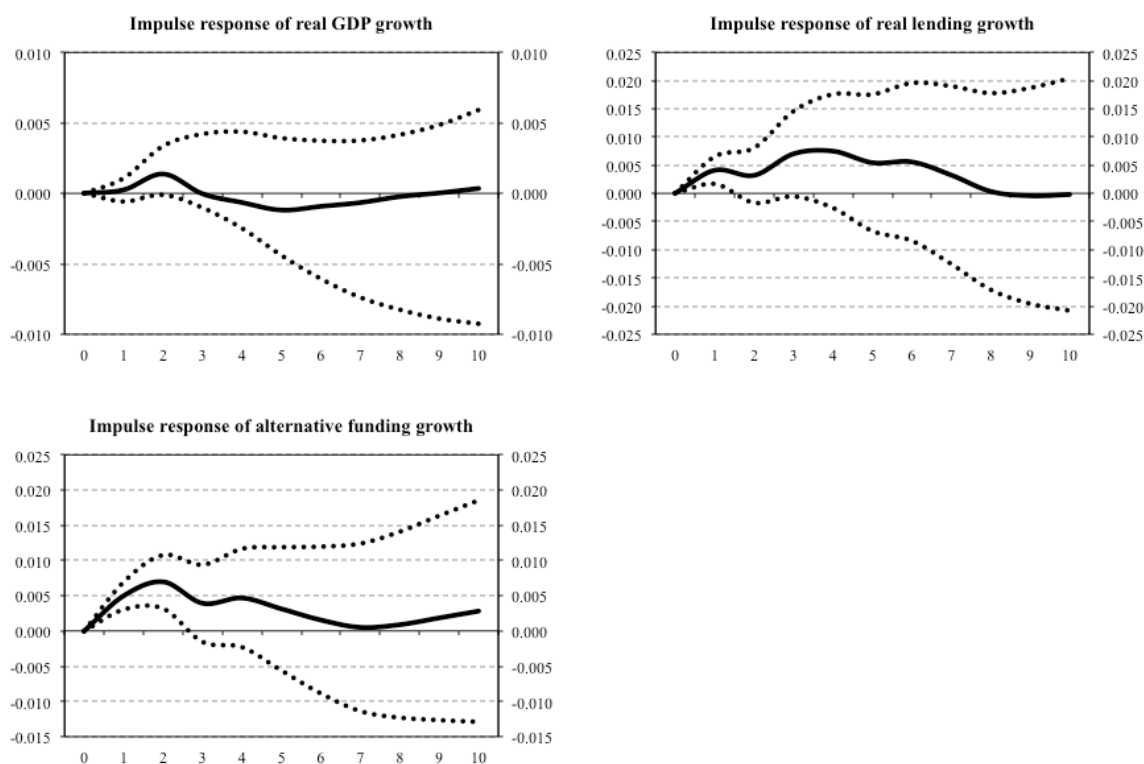


Figure 2-11: Impulse responses of a 13 basis point shock to the change in the aggregate CAD ratio

Source: author's calculations

The reaction of alternative funding growth to an increase in the capital requirement seems puzzling at first glance as an increase in the supply of bank lending is associated with an increase in alternative funding, i.e. companies do not substitute bank funding with alternative sources. However, taking a closer look at the historical relationship of real lending growth and alternative funding growth could explain this. As it is shown in Figure 2-12, lending to corporations and funding from alternative sources moved together until the onset of the GFC. Two factors could be behind this: either (i) corporations faced a scarcity of bank funding, i.e. bank and alternative funding complemented each other; or (ii) they used other funding channels for specific reasons (e.g., the signalling effect of bond issuance in the case of listed companies). Given that the model was estimated for the pre-crisis period, it captures this positive relationship between bank and alternative funding. As a result, a change in capital adequacy affects these funding sources in the same directions. However, the GFC revealed that this relationship can change during periods of distress. As the figure shows, bank funding decreased during the crisis, while alternative funding increased slightly, suggesting that companies that have access to alternative sources of funding substituted for bank lending to some extent.

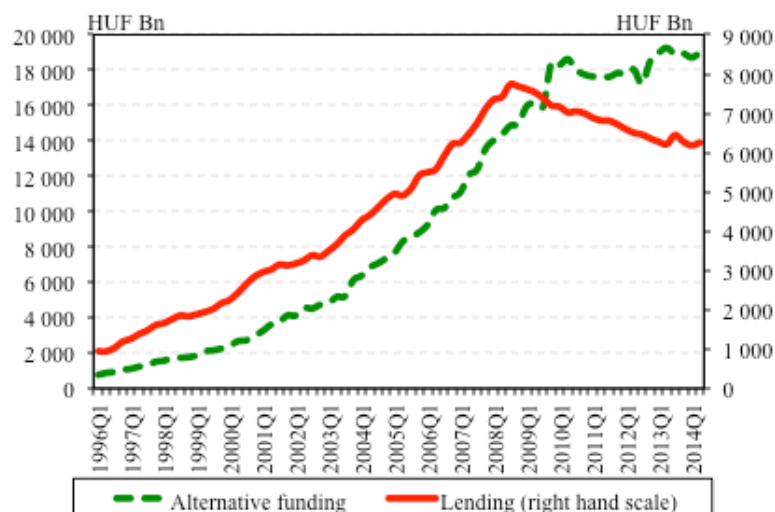


Figure 2-12: Lending to corporations and alternative funding sources

Note: Alternative funding contains bond issuance and loans from non-bank entities, such as households, public institutions, other-financial institutions, other corporations and foreign entities.

Source: Central Bank of Hungary

Figure 2-13 shows the results from the SVAR model, i.e. where sign restrictions were introduced in order to simulate a credit supply shock. Specifically, an increase in the regulatory capital requirement is expected to lead to a decrease in lending and an increase in alternative funding growth. In line with our prior expectations, such a policy change has a stronger impact on real variables than the unconstrained VAR; however, its overall effect remains modest.

Real GDP growth has a relatively modest immediate response; however, it strengthens after 10 quarters. This pace of reaction could be due to a number of factors. An increase in capital requirements immediately restricts banks' risk-taking ability and thus reduces the availability of bank lending for companies. The resulting cancellation or postponement of leveraged investment projects might have a more pronounced impact on GDP as investments are partly financed with own resources. Moreover, the cancellation of investment has a multiplier effect on GDP. According to our results, lending growth also falls sharply in the third quarter and, after a temporary recovery, it continues to decrease afterwards. Alternative funding shows an opposite moving pattern, suggesting that companies seek for other funding sources as access to bank lending decreases. However, the demand for alternative funding fades after 10 quarters as real GDP growth declines.

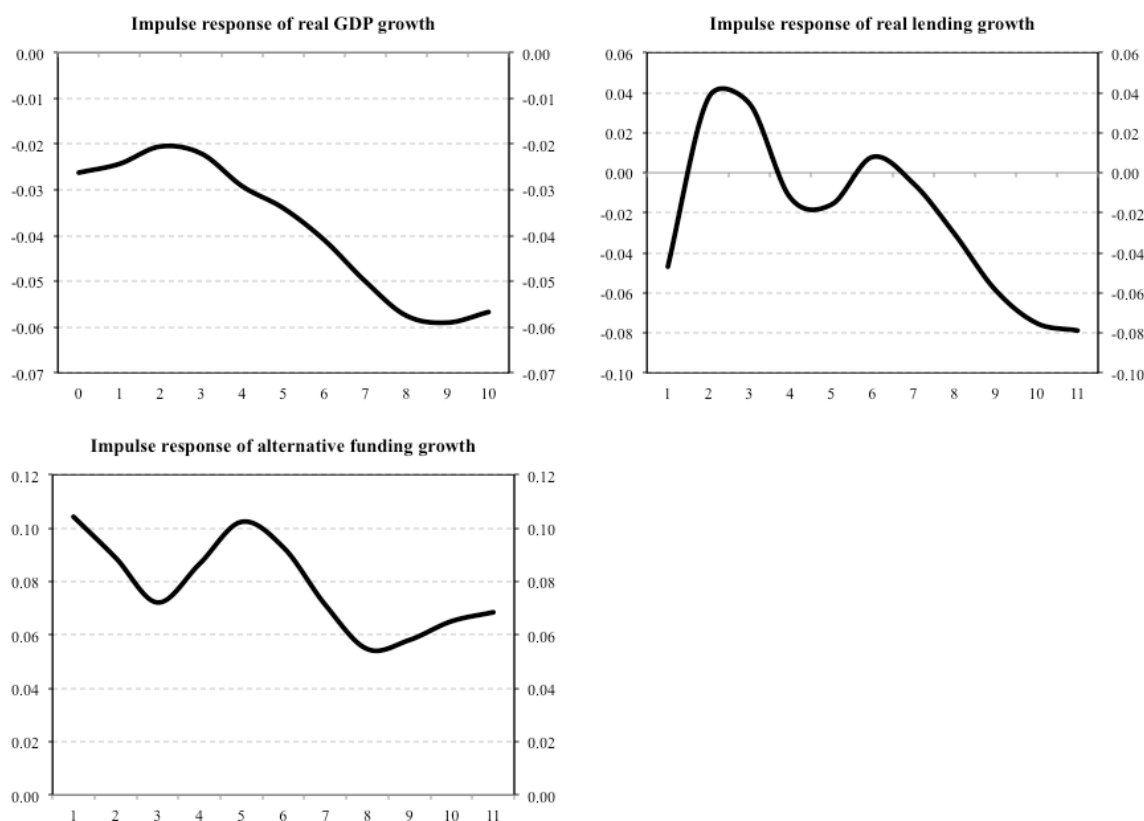


Figure 2-13: Impulse responses of a 13 basis point structural shock to the change in the aggregate CAD ratio

Source: author's calculations

Using our estimation results, we conducted a counterfactual exercise. Specifically, we calculated the hypothetical evolution of real GDP and lending in the presence of a shock to capital adequacy at the beginning of 2005. The alternative paths of real lending can be seen in Figure 2-14. An increase in capital requirements would have had a modest effect on lending: the difference between actual and counterfactual outstanding loans would have been in the range of around HUF -900 billion (constrained model) and HUF 5 billion (unconstrained model) at the end of the period. While actual lending to the private sector doubled in real terms during this period, it would have increased by 86 percent in the constrained counterfactual scenario, i.e. increasing capital requirements would have had only a moderate impact on lending.

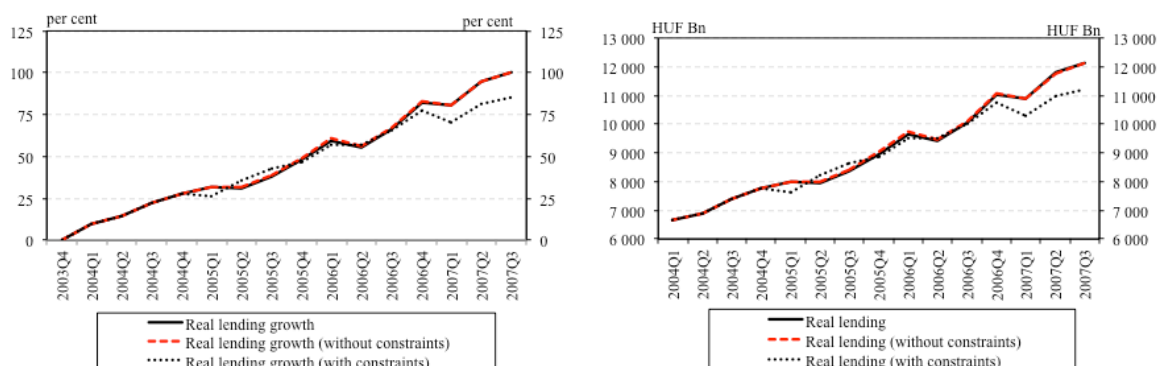


Figure 2-14: Growth and level of real lending in the alternative scenarios

Source: Central Bank of Hungary, author's calculations

Given that real lending would not have changed notably, tightening the regulatory capital requirements would also have had a minor impact on real GDP growth. Specifically, the difference between the actual and counterfactual cumulative real GDP growth is in the range of +0.2 to -6.5 percentage points after 10 quarters (Figure 2-15).

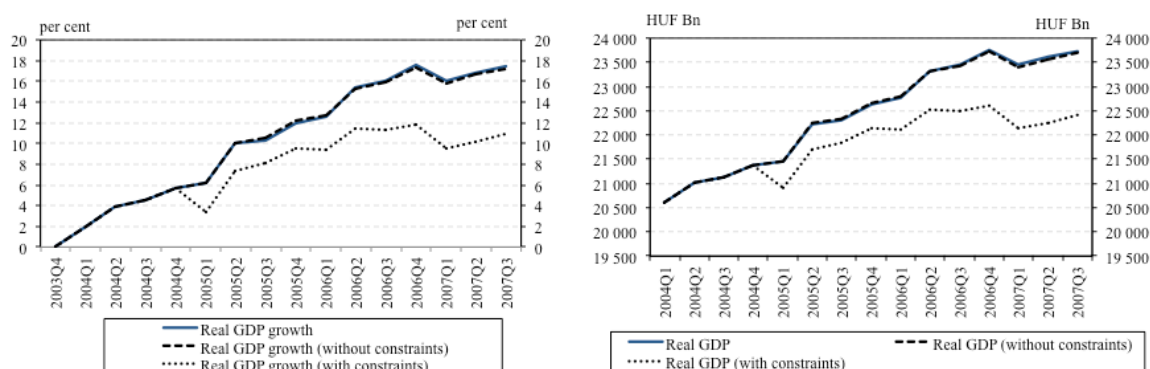


Figure 2-15: Growth and level of real GDP in the alternative scenarios

Source: Central Bank of Hungary, author's calculations

The overall effect of an increased regulatory capital level could not have slowed the increase of the credit-to-GDP ratio. Although it could have held back lending growth, but it would have inferred an equal drop in real GDP growth (Figure 2-16). As a result, the difference in the ratio would have been only +0.1 percentage points after 10 quarters.

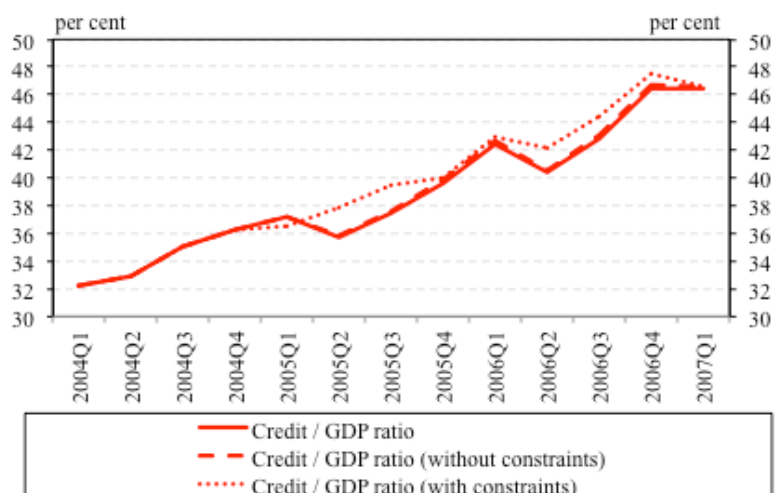


Figure 2-16: Credit / GDP ratio

Note: Credit-to-GDP ratio is calculated by using level of real lending and real GDP.

Source: Central Bank of Hungary, author's calculations

The total impact of our hypothetical regulatory tightening would have been modest in preventing the build-up of vulnerabilities in the banking sector. Even if regulatory authorities had reacted quickly, the use of countercyclical capital buffer would not have been able to significantly lower either the level of lending or its growth rate.

Although the overall impact of an increasing regulatory capital requirement is found to be modest, it is also interesting to see how this measure would have affected lending to different sectors. Since sectoral lending was not included in the VAR models due to identification difficulties (i.e. the number of variables in VAR would have been too large relative to the number of observations), we ran a “satellite model”, in which we regressed the structural shocks of the capital adequacy ratio on changes in lending to different sectors:¹⁶

$$\text{sectoral lending growth}_t = \alpha * \text{sectoral lending growth}_{t-1} + \beta * \text{structural shock}_t + \varepsilon_t \quad (3)$$

where,

sectoral lending growth_t includes lending to households and corporations in local and foreign currency. To capture the fading impact of the regulation, we used the lagged version of the lending components. With the multiplication of these coefficients, we are able to give a flavour for the adjustment path.

¹⁶ See also *NOSS – TOFFANO (2014)*.

The results of these regressions can be seen in Table 2-3. The second column shows that the regression coefficients on the structural shock are negative and significant at 10 percent level for each category except for household lending in HUF, i.e. an increase in capital requirement is associated with a reduction in growth in lending in the specific sectors. The lagged variables were used to simulate whether the impact of the shock fades over time. Although the signs are all positive in line with our prior expectations, they are not significant in the case of lending in HUF either in the household or in the corporate sector.

Table 2-3: Estimation results from the regression of sectoral lending growth on the series of structural shocks

	Lagged sectoral lending growth (α)	Contemporaneous structural shock (β)
Household FX lending	0.8754*** (0.0000)	-0.0951* (0.0970)
NFC FX lending	0.4427** (0.0260)	-0.0778** (0.0390)
Household HUF lending	-0.2893 (0.1930)	-0.0817 (0.1500)
NFC HUF lending	-0.2182 (0.2720)	-0.0715* (0.0770)

Note: *, ** and *** indicate significance at the 10, 5 and 1 percent level, respectively.

Source: author's calculations

Using these estimation results, our calculations suggest that 53 percent of the total decrease in lending would have materialized in foreign currency lending (both in households and the corporate sector) and 47 percent in HUF lending (Figure 2-17). In the foreign currency segment, lending to households would have decreased roughly equally in lending to households and corporates. In contrast with the intuitive assumption that adjustment is faster in the corporate segment, our results thus suggest that the banking sector would have reacted more intensely in the household segment.

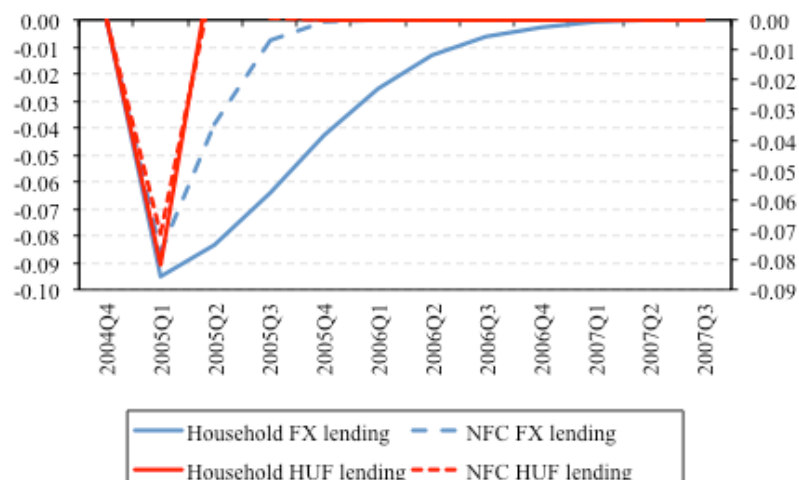


Figure 2-17: Impulse responses of a 13 basis point shock to the change in the aggregate CAD ratio on growth of lending to different sectors

Source: author's calculations

Based on the results of the SVAR model and the above regression, Figure 2-18 demonstrates the alternative evolution of lending to the private sector in the most pessimistic case, i.e. where the increase in the capital requirement was considered a credit supply shock. It shows that even if regulatory authorities had reacted to the increasing (FX) lending by requiring a countercyclical capital buffer, they would have been able to slow down the build-up of FX loans only temporarily. The outstanding amount of household loans denominated in HUF and FX would have been lower by around 8 percent in both cases, while the reduction in corporate loans denominated in HUF and FX would have been 6 percent for both categories, at the end of the period.

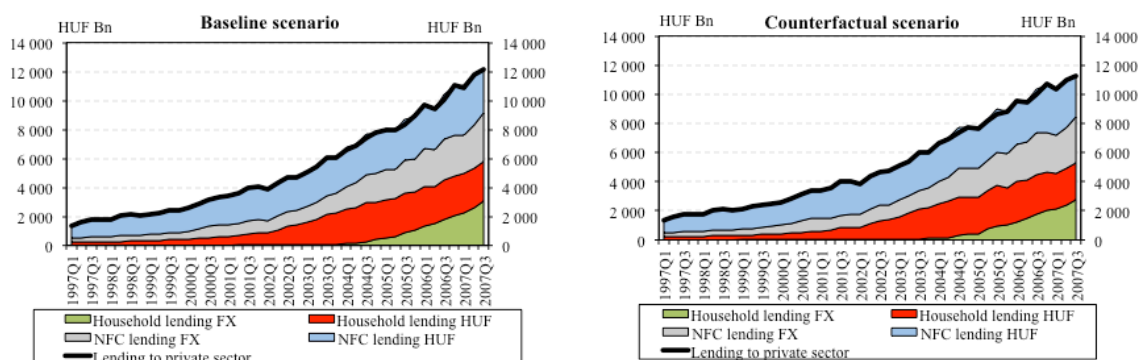


Figure 2-18: Lending to private sector under different scenarios

Source: Central Bank of Hungary, author's calculations

2.7 Conclusions

The main purpose of this analysis was twofold. First, it aimed to estimate the effect of the tightening of the regulatory capital requirements on the real economy during credit upswing. Second, it intended to show whether applying a countercyclical capital buffer measure as per the Basel III rules could have helped decelerate FX lending growth in Hungary, reducing the build-up of vulnerabilities in the run-up to the GFC. To answer these questions, we used a VAR based approach to understand how shocks affected capital adequacy in the pre-crisis period. An increase in the regulatory capital requirement is typically considered to be a credit supply shock since it increases banks' funding costs. However, this relationship could have changed during the recent GFC. Specifically, higher regulatory capital requirements could lower funding costs, by improving investor confidence.

Since the relationship between regulatory capital and lending growth is ambiguous, we estimated two VAR models. The unconstrained version aimed to provide the upper bound for the effect of macroprudential tightening on the real economy, as the shock need not be a supply shock. It allows, therefore, for the post-crisis assumption of the changed relationship between lending and capital. In contrast with this, in the SVAR model we introduced sign restrictions on lending and alternative funding growth (negative sign for the former and positive for the latter) in line with our assumption about their pre-crisis behaviour. The results of this estimation serve as the lower bound for the possible effects on the real economy. The analysis concludes that an increase of 13 basis points in aggregate capital adequacy ratio, i.e. keeping the ratio at its 2005 Q1 level, is associated with a decline of 0-14 percentage points in cumulative real lending growth compared to actual growth after 10 quarters. Given that actual cumulative growth was 100 percent between 2004Q1 and 2007Q3, our estimation results thus indicate only a modest slowdown to 86 percent. As mentioned earlier, this type of counterfactual analysis can only be applicable for capital requirements as these were the only supervisory tools available before the GFC. As such, results should be interpreted with caution. Risks related to the widespread FX lending are not limited to credit risk, but contained also liquidity risks due to the aggressive maturity transformation. Should the regulatory authorities had been able to combine the tighter capital rules with minimum liquidity requirements, the impact on lending would most likely have been more pronounced, but the economic consequences might have been softened or avoided. However, as we highlighted at the beginning of the analysis, our focus is to provide some evidence whether the available supervisory tools would have been sufficient to mitigate or avoid the crisis.

Our results have the following important implications.

First, regulatory authorities could not have avoided the upswing in FX lending by requiring countercyclical capital buffers even if such a tool had been available and they had reacted quickly to accelerating credit growth. By using this tool, they could have slowed the increase in lending only temporarily; however, after 4 quarters it would have regained its momentum.

Second, a more pronounced tightening might have eliminated FX lending, but at the expense of real GDP growth. Macroeconomic fundamentals were fragile when FX lending started, with the significant fiscal vulnerabilities requiring the central bank to keep the policy rate at elevated levels. Due to the high differential between HUF and FX interest rates and households' low risk awareness regarding exchange-rate volatility, FX lending became very popular and contributed significantly to real GDP growth in the pre-crisis period. The bottom line is that an unsustainable fiscal policy led to a trade-off between economic growth and the build-up of new vulnerabilities in the form of FX lending.

Third, the results support the post-crisis conventional wisdom about the inadequacy of pre-crisis regulatory frameworks. Therefore, it points toward providing the authorities responsible for financial stability with more power and flexibility so that they can identify systemic risks and respond to them quickly and more efficiently.

3 Tackling Sovereign Risk in European Banks¹⁷

3.1 Introduction

During the financial crisis, the link between the risks of sovereigns and their domestic banking sectors resulted in several countries needing financial assistance. Recapitalizations led sovereigns to take on banking sector risks, while banks had incentives to increase their – in particular domestic – sovereign exposure. Private sector involvement in the Greek debt restructuring in 2012 dealt a strong blow to the Cypriot banking sector, laying the problem bare. In Ireland and Spain, a rapid deterioration of asset quality in the banking sector strained the sustainability of the fiscal accounts. This sovereign-bank link fed on itself and intensified during the crisis in many European countries.

Reform efforts since the crisis have focused on introducing firewalls into the system. Several policy initiatives address the channel of bank risk spilling onto sovereign balance sheets. Most importantly, the bail-in requirement in the Bank Recovery and Resolution Directive (BRRD) renders bank bailouts by the state virtually impossible.¹⁸ Furthermore, higher capital requirements and increases in so-called loss absorption capacity have generally increased the resilience of banks, and, in particular of systemic institutions. At the institutional level, backstops were set up to guarantee an orderly unwinding of systemic banks without straining the sovereign: a Single Resolution Mechanism including a dedicated financing arrangement, an ESM loan facility for the banking sector restructuring, and, an ESM instrument to directly invest in banks.

The transfer of sovereign risk to bank balance sheets has so far not been addressed, despite extensive reforms in bank regulation over the past 5 years. Sovereign exposures de facto receive a zero risk weight in EU legislation and are exempted from limitations on concentration risk. Regulation treats sovereigns as risk-free. This circumstance is usually justified by historical ties between the sovereign and the domestic banking sector. In addition, it is believed that domestic banks are the only reliable source of funding of the sovereign in times of crisis.

¹⁷ A version of this chapter was co-authored with Andreja Lenarčič and Dirk Mevis, and published as ESM Discussion Paper (LENARČIČ et al., 2016).

¹⁸ The bail-in requirement is binding from January 1, 2016.

More recently however, the discussion on an adequate management of sovereign risks on bank balance sheets has picked up. In March 2015, the European Systemic Risk Board (ESRB) published an extensive report on the treatment of sovereign exposures including several policy options.¹⁹ The Basel Committee has set up a task force which is due to publish recommendations by June 2016. Also, the Economic and Financial Committee of the ECOFIN has set up a high level working group on the topic.²⁰

With this analysis we aim to add to the policy discussion by assessing the likely effects of two basic policy options, (1) applying non-zero risk weights to sovereign bond holdings and (2) applying large exposure limits also to sovereign exposures. In our analysis we focus on these two basic options to illustrate clearly what the potential costs and trade-offs are. With this we also aim to provide a basis for calibrating more complex alternatives that could ease the negative aspects of these two basic options.

Given the close ties between the sovereign and the banking sector, any regulatory change could have a large initial impact. Banks traditionally hold particularly large amounts of sovereign debt, which implies that unwinding this relationship may result in a considerable rewiring of financial architecture in some countries. It is not uncommon for the euro area banking sectors to hold around 20-30% of their domestic sovereign outstanding debt. Furthermore, among the banks in the EBA 2013 transparency exercise, 60% of total sovereign exposure was with the domestic sovereign. Any change to that set of incentives would cause a structural break that could imply costs. In the current environment, which is still marked by legacies of the crisis, those costs could have a destabilizing effect. Hence, a gradual and transparent transition would be crucial for a successful implementation of any regulatory change.

By looking at some stylized facts and analyzing how the banks would adjust in the transition to the new regulatory regime, we attempt to give an idea of the magnitude of the transition effects. Our calculations show that introducing sovereign exposure limits would have a significant impact on countries with large outstanding public debt. For example, applying large exposure limits on a sample of the largest EU banks' sovereign holdings would result in €275 billion in extra supply

¹⁹ See ESRB (2015).

²⁰ Unsatisfied with the regulatory inertia at the international level, some jurisdictions have also moved on their own. In October 2015, the Swedish FSA announced that it would require its four largest banks to apply positive risk weights on their sovereign exposure after it had already implemented capital requirements on sovereign exposures one year earlier under the pillar 2 requirements.

of sovereign bonds on secondary markets. This represents nearly 3% of the EU's outstanding sovereign debt. Applying non-zero risk weights for sovereign exposures based on their riskiness as assessed by credit rating agencies or internal models would affect banks in program/post-program countries the most. The largest EU banks would need an additional €31 billion in fresh capital. Moreover, the program/post-program countries would be most affected in terms of their funding conditions.

In addition, we provide a qualitative assessment of what the two basic options for regulatory treatment of sovereign exposures could achieve and what their broader macroeconomic and market consequences would be. The main conclusions are as follows. On the banking sector side, both positive risk weights and exposure limits would deliver beneficial results in terms of banks' resilience to sovereign risk, by improving the ability of banks to absorb losses and limit the accumulation of excessive risks. Neither of the two options could however guarantee complete loss absorption in the case of sovereign default. While positive risk weights would also improve the risk transparency and correct distorted incentives for investing in sovereign bonds, sovereign exposure limits would not deliver these specific results. At the systemic level we would see a decrease in leverage, more spread out losses in case of default and consequently more resilient banks. At the same time, a more diversified portfolio creates a higher probability of contagion. As regards bank profitability, both regulatory proposals would result in lower profit generating capacity at systemic level in the short-run, with a neutral effect for those banks that do not need to significantly change their current business model. In the longer run, we expect that the more diversified fixed income portfolio would be reflected in lower funding costs in case of the large exposure limit, whereas positive risk weights would permanently reduce banks' profits by increasing funding costs.

The benefits in terms of increased resilience of the banking sector could come at a cost for some sovereigns. First, both policy options may lower liquidity in sovereign debt markets, as they affect the cost and ability of banks to warehouse sovereign paper and provide market-making services. Second, in the transition phase, banks would try to deal with excess sovereign bonds on their balance sheets by injecting fresh capital or by rebalancing their portfolio of sovereign bonds. The increased supply of sovereign paper or lack of demand for new issues would raise the funding cost of stressed sovereigns or those with large outstanding debt volumes. Third, with banks paring down their sovereign exposures, the governments would need to move towards a more diversified investor base. Finding new investors could prove difficult, in particular for more

stressed sovereigns and those with illiquid sovereign debt markets. Additionally, a broader investor base could imply more volatility and a higher risk premium. Fourth, once in place, both options could aggravate financing conditions for the sovereign in the downturn. Risk weights would increase in recessions or periods of stress for the sovereign and limit a country's fiscal space precisely at the time when the sovereign would need to support the economy.²¹ Such regulation would thus lead to pro-cyclical effects at the macro level. The effects of sovereign exposure limits could be similar, even if they do not move with the cycle by themselves. Exposure limits could lead to cliff effects in the downturn, if they become binding due to increased sovereign financing needs and if the sovereigns fail to find new investors. Fifth, while bank lending to the private sector could increase after the introduction of either of the two regulatory changes, the size of this effect is uncertain, and conditional on demand. At the same time, an increase in the cost of funding for stressed sovereigns is expected to be translated to more expensive financing for the whole economy. Finally, positive risk weights could lead to sovereign bond prices that better reflect the underlying risks. On the other hand, sovereign exposure limits would penalize countries with a larger nominal stock of debt and distort prices.

The significance of the presented findings calls for carefully designed transition arrangements. Reforming the regulatory treatment of sovereign exposures of banks affects important elements of banks' asset and liability structure. It also affects the funding of sovereigns in a significant manner. All of this calls for transitional phases that would help avoid abrupt shocks to markets, pricing and sovereign funding conditions.

The structure of the chapter is as follows. Section 3.2 gives an overview of current regulatory arrangements and the treatment of sovereign risk. In Section 3.3, we set out the specific objectives that a potential change to regulation might have. We also briefly address what has already been done on other fronts to achieve these objectives. Section 3.4 discusses the introduction of positive risk weights for sovereign exposures while Section 3.5 discusses large exposure limits for sovereign bonds. Section 3.6 reviews transitional arrangements and Section 3.7 concludes.

3.2 Current Arrangements

In this section, we first explain the current regulation on risk weighting and current diversification requirements, the underpinning rationale, and, their implementation in EU law.

²¹ This implication is more important for countries with a small fiscal space.

Subsequently, we discuss banks' motivations to hold sovereign exposures and provide a short overview of the current holdings of sovereign exposures and shed some light on developments over the past years.

3.2.1 The Underlying Rationale of Risk Weighting Exposures

Basel II introduced the notion of risk weighting exposures according to credit risk in order to better adapt the capital holdings to the actual capital impact in case of default and to prevent the excess build-up of risks. The idea of loss-absorbing capital is based on the concept that expected losses represent a normal cost to banks. Unexpected losses that exceed the normal threshold of expected losses are to be absorbed by capital and capital levels need to be set to the Value at Risk level that the supervisor is willing to accept.²² The underlying model should be portfolio invariant, meaning that the capital required for each exposure should only depend on the risk that this exposure represents to the bank.

The Basel framework allows for two possible approaches to risk weighting. For smaller domestically active banks, and, for small non-significant exposures, the Standardized Approach (StA) assigns risk weights to buckets of similar risk. The buckets that apply to specific exposures are tied to external ratings assigned by so called ECAI (External Credit Assessment Institutions) such as credit rating agencies (CRA).²³

The Internal Risk Based (IRB) approach allows for a more nuanced treatment, by relying on banks' internal rating models.²⁴ Banks use them to generate continuous risk parameters for each exposure, which subsequently determines the risk weight and the appropriate capital allocation to this exposure. Usually banks can reduce their risk weighted assets by switching to the IRB approach because they can compute the risk weight for each asset class individually.

The Basel framework requires banks that are using the IRB framework to apply this framework consistently to the majority of the exposures they hold on their balance sheet. It makes exceptions

²² See BCBS (2005).

²³ The weights assigned to the buckets range from 0% to 150%.

²⁴ In this note the acronym IRB will refer to both the foundation and advanced variants. The main difference is that banks that apply foundation IRB (F-IRB) are allowed to determine their own probability of default for each borrower while banks applying advanced IRB (A-IRB) also determine the Loss Given Default and Exposure at Default values themselves on an exposure-by-exposure basis. The models that banks use to do this require supervisory approval.

for asset classes that are immaterial in nature and for non-significant business units, for which it allows the application of the standardized approach.

3.2.2 Current Treatment of Sovereign Risk in EU Legislation

The Capital Requirements Regulation (CRR) and the Capital Requirements Directive IV (CRD IV) implement Basel III standards into EU regulation.²⁵ They are part of the broader “single rulebook” effort aimed at harmonizing financial sector regulation in the European Union. The CRR as a regulation applies directly to banks in the EU while the CRD IV requires previous implementation into national law by member states. Most of the capital standards are fixed in the CRR but some require Implementing Technical Standards (ITS) to be issued by European Banking Authority (EBA) or by the Joint Committee of European supervisory bodies.

While the CRR in principle foresees positive risk weights for sovereigns, its Article 114(4) stipulates that sovereign bonds issued in the own currency of the sovereign can be assigned a zero risk weight.²⁶ The original rationale was that a sovereign exposure in the domestic currency is essentially risk-free because in case of default, the central bank is always able to fulfill the sovereign’s commitment to an unlimited amount. However, the CRR ignores the fact that in the EMU the fiscal authority has no influence on the (common) monetary authority. In addition, the Treaty on the Functioning of the European Union prohibits monetary financing in Article 123.

In the context of monetary union, this exemption implies in practice that any euro area bank may apply a zero risk weight to any euro area sovereign. In addition, there is a transitional arrangement (Article 114(5)) that allows a zero risk weight for any bonds issued by any EU member state, irrespective of the currency, until 31 December 2017.

The CRR/CRD IV framework extends this exemption to IRB banks. In principle, the exemptions of Article 114 should not affect the treatment of IRB banks (and hence of any major EU banks) since they apply specifically to StA. However, CRR Articles 148 and 150 allow competent authorities²⁷ to grant banks the right to deviate from the IRB approach for a number of exposures. This allows major banks to permanently apply the StA to all sovereign exposures.

²⁵ Regulation (EU) No 575/2013 on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012.

²⁶ This principle was already part of Basel II.

²⁷ From the CRR text it is not clear whether competent authority relates to the regulator or to the supervisor.

This “permanent partial use” exemption in combination with the exemptions assigned to the standardized approach in Article 114 for sovereign exposures leads to a situation whereby EU banks effectively do not have to hold any capital for exposures to EU sovereigns. Furthermore, in order to assure a level playing field, the CRR allows the application of zero risk weights on any sovereign exposure if the domestic supervisor of that sovereign allows for this. This means that the lenient treatment of sovereigns domestically propagates throughout the entire European banking system.

BCBS (2014) notes that this has material implications for a sample of large EU banks. In a sample of 20 major EU banks, they find significant amounts of sovereign EU exposures and, as a result, the exposures that are subject to permanent and temporary partial use exemptions reach 9% of total balance sheets.²⁸ Considering that this treatment leads to materially lower capital holdings than would be prescribed by Basel III, the Basel Committee grades the CRR/CRD IV to be materially non-compliant with Basel III in respect to the credit risk approach.

3.2.3 Current Regulation on Large Exposures

The large exposures framework complements the risk-based capital standards. It is designed to protect banks from large losses resulting from the sudden default of a single counterparty. In addition, the calculation of capital requirements implicitly assumes that banks hold infinitely granular portfolios, which implies that no form of concentration risk is considered.²⁹ Imposing large exposure limits would assure that this assumption holds.

In the CRR, Article 395 requires banks to monitor and control their large exposures in a way that ensures diversification of the bank’s holdings and avoids systemic risk associated with excessive exposures to any given counterparty. To avoid risk concentration, current regulation therefore limits exposures to any counterparty to 25 percent of own funds. However, Article 400 exempts domestic and other 0-percent risk-weighted government bonds from large exposure limits.³⁰

²⁸ BCBS (2014) uses data as of end-2013.

²⁹ For more details, see <http://www.bis.org/publ/bcbs283.pdf> , Standards of the Supervisory framework for measuring and controlling large exposures, BIS, April 2014

³⁰ The regulation links the exemption to the exposure limit to the 0% risk weight that competent authorities attach to the sovereign exposure. Hence, if one would attach a positive risk weight to sovereign exposures, this would imply the application of the exposure limit cap.

3.2.4 Motivation of Banks for Holding Sovereign Bonds and Implications

As one of the main pillars of financial intermediation, banks have for a long time had a dominant position in sovereign debt markets. While this role is changing as financial markets are developing and becoming more diverse and sophisticated, banks remain an important player and represent a large share of demand for sovereign bonds. In euro area countries, banks frequently hold between 20-30% of outstanding debt of the domestic sovereign. Figure 3-1 shows the developments of holdings of domestic debt by banks for selected countries. Domestic banks in countries that traditionally held large shares of domestic debt like e.g. Germany have reduced their holdings over the past years, while in some peripheral countries, like Portugal for example, holdings have gone up. In the United States the share of domestic debt held by the domestic banking sector stood at 30% in 2005 but has fallen to below 20% since. This could be related to the quantitative easing of the Federal Reserve over this period of time. In the United Kingdom, banks held only 12% of domestic sovereign debt in 2014. At the same time, the financial sector as a whole held more than 60%.

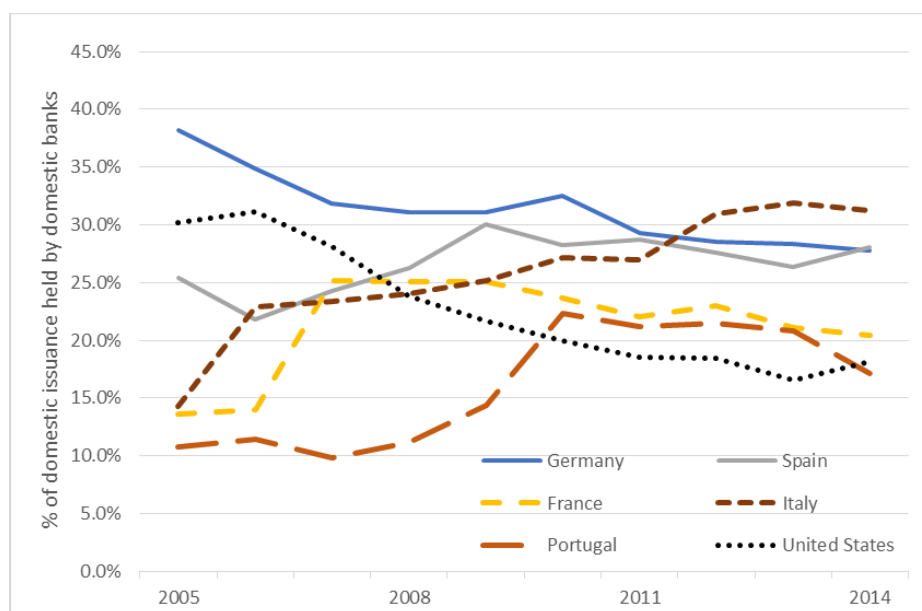


Figure 3-1: Share of domestic sovereign debt held by domestic banks

Source: Eurostat, ECB, Federal Reserve Board.

There are different characteristics of sovereign bonds that make them attractive to hold for banks. Some of these reasons may be permanent and structural in nature while others are temporary.

Sovereign exposure is generally less costly than other assets. First, since it is considered to be low-risk, it can be used to de-risk the balance sheet and lower the bank's funding costs. However, this effect may weaken if the financial situation of the sovereign deteriorates as markets will not

perceive the sovereign as risk-free.³¹ Capital regulation and the zero risk weight add to the cost advantage. KORTE – STEFFEN (2015), for example, calculate the “sovereign subsidy” (in terms of a reduced capital need), amounting to €750 billion for a sample of 54 large European banks in 2013.³²

The cost advantage in terms of capital may have played more strongly in recent years. Banks that were under pressure over the past years to increase their capital adequacy ratio partially rebalanced their portfolio to sovereign bonds (see Figure 3-3). In this way, the pressure on capital ratios emerging from deteriorating asset quality and their impact on risk weights was mitigated without resorting to more expensive capital raising. This implies that even if banks reshuffled their portfolio towards sovereign bonds to relieve pressure on capital ratios, they did not actually deleverage.

The liquidity of some sovereign bond markets and the fact that sovereign bonds can be used as collateral to access central bank liquidity also render them attractive for banks. Since sovereign bonds typically qualify as eligible assets, they are used in repo transactions with central banks and banks always keep a certain amount of sovereign bonds in their balance sheet. Apart from central bank eligibility, they also qualify as High Quality Liquid Assets (HQLA) in the Liquidity Coverage Ratio (LCR) requirement that was introduced under Basel III. Furthermore, there may be close substitutes (e.g. cash, covered bonds, etc.) that could or already do replace sovereign paper in this function but may come at a cost. The floor to banks’ demand for sovereign bonds is determined by liquidity regulation. The LCR ratio that was introduced in Basel III requires banks to hold HQLAs equaling at least the net outflows that occur over a 30-day period.³³ It is still safe to assume that most of the HQLA that banks hold will consist of government bonds, in particular if other assets like for example cash are more costly to hold.

³¹ See for example CGFS (2011). Also, Acharya and Steffen discuss in great detail the extreme case of Dexia group which before its decline held a sovereign bond portfolio as large as a third of their balance sheet (€203 billion out of total assets of €630 billion). Simultaneously, they had financed a large part of this (€260 billion) via short-term debt. Eventually, investors decided that this portfolio was too risky and quickly withdrew the funding (see ACHARYA – STEFFEN, 2013) which led to the group’s demise.

³² Obviously these types of calculations are very sensitive to the assumptions made regarding the level of risk weights. See also a more elaborate description of KORTE – STEFFEN (2015) below.

³³ See BCBS (2013). For most banks the so called LCR ratio needs to equal 100% as of 2015. Some banks have an extended transition period until 2017.

These motivations create a close connection between the balance sheet of banks and that of the sovereign. While some of these motivations are inherent in the banking system, others are promoted by regulation. Normally this connection does not pose a particular issue but in times of crisis, it may lead to concrete losses for the banking sector.

For example, over the past 5 years many banks engaged in the so-called “carry trade” where they were benefitting from loose monetary conditions and high returns on risky sovereign bonds. ACHARYA – STEFFEN (2013) show that a number of European banks in 2010 stocked up on peripheral European sovereign bonds. Beyond the already ample liquidity injection since the onset of the crisis, the ECB gave additional support to this in 2011 with their extensive Long Term Refinancing Operation (LTRO), which provided €1 trillion in funding to the banking sector. For banks the rationale was clear: in case euro area sovereign yields were to converge again, banks would benefit from the price increases. Figure 3-2 provides an aggregate view of this for the Portuguese banking sector by contrasting bank holdings of sovereign debt and their liabilities to the Eurosystem. The figure shows how the developments of central bank liabilities and sovereign bond holdings were closely aligned during the apex of the crisis. During this time, Portuguese banks were scrambling to find sufficient liquidity to secure their funding.

The Greek debt restructuring in February 2012 shattered the illusion that sovereign debt was risk-free and banks that had engaged in the carry trade using Greek sovereign debt suffered a direct haircut on their holdings. Cypriot banks for example, which held significant exposures to the Greek sovereign, made large losses which led to the subsequent bail-in of depositors.

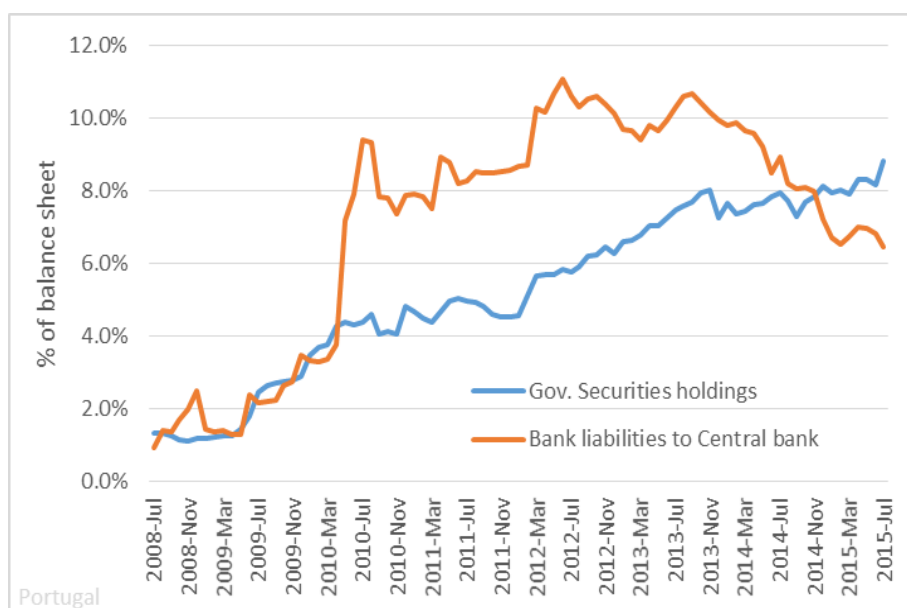


Figure 3-2: Holdings of sovereign bonds of Portuguese banks and their liabilities towards the European system of central banks.

Source: ECB

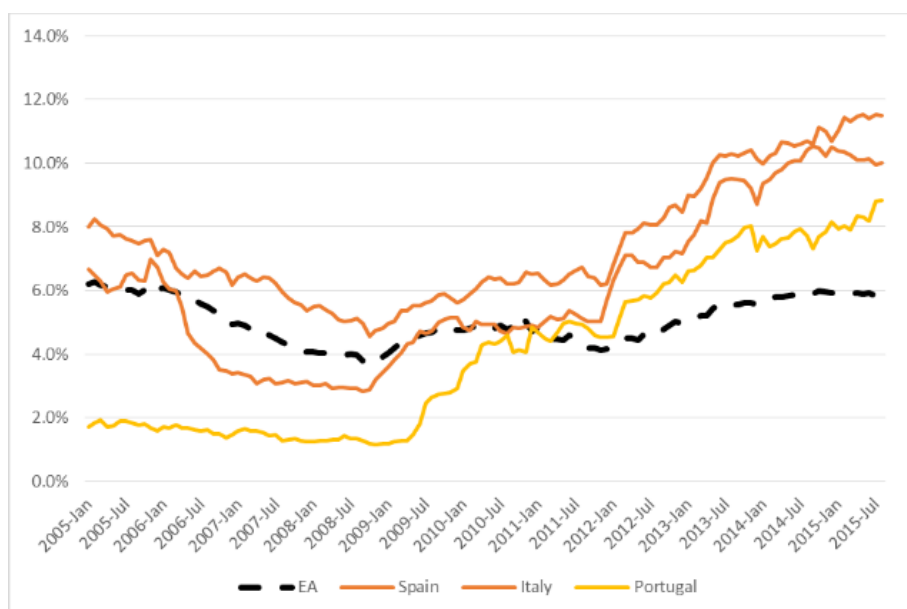


Figure 3-3: Holdings of sovereign bonds (any country) as share of balance sheet total in Portugal, Spain and Italy.

Note that these figures represent market prices. While the market value of Portuguese debt dropped by 10% below its face value in early 2010, for Spain the drop was less pronounced (-4%). In both countries the market value recovered quickly thereafter.

Source: ECB

Beyond the immediate credit risk, banks' holdings of vulnerable sovereigns can suffer from mark-to-market losses in the Available-for-Sale and trading books. This fact led to significant criticism of the 2011 stress tests of the European Banking Authority (EBA) as banks had

“parked” a significant share of their sovereign exposures in the banking book. This protected the exposures from price changes that would have led to larger losses in the adverse scenario of the stress test.³⁴ Later on, the EBA changed its methodology requiring more of the sovereign exposures to be marked-to-market.

The “Home Bias” in Sovereign Debt Holdings

Banks may have incentives to hold domestic sovereign paper in particular. This preference became particularly visible across European countries after the onset of the financial crisis. Many possible explanations have been proposed for the so-called home bias. However, they often remain case-specific and none of them provides a general explanation. Many explanations are related to situations in which the likelihood of a sovereign default increases.

Political pressure from national debt management offices during the crisis may have led banks to hold additional sovereign exposure. In particular, treasuries in countries with weak fiscal accounts, which experienced high yields in secondary markets may have asked their domestic banking sectors for help. BRONER et al. (2014) also suggest that when the risk of sovereign default increases, the expected return for domestic creditors is higher because they are more likely to be compensated in case of a selective default.

Furthermore, banks may keep more domestic sovereign bonds to hedge against redenomination risk.³⁵ Increasing financial difficulties in stressed countries amplified concerns of the euro area’s collapse. The rising likelihood of redenomination of the domestic currency could have contributed to a substantial accumulation of domestic sovereign bonds in euro area countries. Moreover, banks hold large amounts of the domestic sovereigns also for purposes of geographic matching of assets and liabilities. In addition, banks may overinvest in domestic sovereign bonds due to their relatively higher supply. Deteriorating macroeconomic fundamentals typically lead to larger fiscal deficits and increasing public debt issuance. The excess supply of government bonds is at least partly absorbed by the domestic banking sector. The absorption may have also increased during the crisis due to the retrenchment of the foreign investors (ASONUMA et al., 2015). Also, the fear of spill-overs from the sovereign may induce self-preservation behavior on

³⁴ See for example: <http://www.bloomberg.com/news/articles/2011-07-17/stress-tests-missing-sovereign-default-fail-to-convince-analysts>

³⁵ See ESRB (2015).

the part of banks, where they prefer to invest in the domestic sovereign in an attempt to reduce the probability of default of the sovereign (ERCE, 2015).

3.3 Objectives and Scope of the Change in Regulation

From a risk management perspective, the case for an adjustment of regulation would be clear. The actual risk of sovereign exposures and the corresponding costs in terms of capital should be taken into account when making portfolio choices. For instance, as long as the risk weight on sovereign bonds is zero, the return on these bonds is not risk adjusted and leads to distorted incentives. This can lead to excessive risk-taking in order to reap benefits of positive yields without any cost of capital (carry-trade). At the same time, an insufficient capital buffer leaves banks vulnerable to sovereign risk. There is also a need to address the risks stemming from the concentration of sovereign holdings. The regulatory change addressing these issues directly also affects the systemic risk in the banking sector.

The main driver of the renewed debate on regulatory treatment of sovereign exposures is, however, a broader issue of the sovereign-bank nexus that has strengthened during the crisis and pushed countries close to financial collapse. Reforming the regulatory treatment of sovereign exposures aims at mitigating the negative effects of the sovereign-bank feedback loop. Introducing regulatory change that strengthens banks' resilience to sovereign risk and improves risk transparency would help to reduce the transfer of sovereign risk to bank balance sheets. At the same time, the changes in regulation should be designed in a way that does not impair the stability of the sovereigns.

In our view, the specific goals of regulatory reform relate mostly to the banking sector itself³⁶:

- 1) **Increasing banks' resilience to sovereign risk** by improving the ability to absorb losses via adequate capital buffers and reducing the home bias via better diversification of fixed income portfolios of banks.
- 2) **Improving risk transparency**, which promotes correct incentives in portfolio allocation and consequently limits the build-up of risks.

³⁶ With respect to the goals of the new regulation, the ESRB also represents similar views. They also highlight that bank regulation should focus on market failures concentrating in the banking sector and cannot be used to enforce fiscal discipline.

- 3) **Reducing systemic risks in the banking sector** by preventing fire-sales and spill-overs, preserving bank profitability, decreasing bank leverage and generally severing the sovereign-bank nexus.

At the same time, the regulatory treatment of sovereign exposures inevitably affects sovereign funding conditions and by extension, the cost of financing in the economy. We list additional desired (or desirable) outcomes of the regulatory reform. It is important to note that these are the outcomes that we find essential when one is considering any of the regulatory options described earlier.

- 4) **Avoiding price distortions** on the sovereign bond market.
- 5) **Maintaining liquidity in sovereign debt markets**, also in the light of banks' provision of warehousing and market-making services to the sovereigns.
- 6) **Avoiding crisis amplification for vulnerable countries** that could occur due to worse financing conditions or bank resolution costs. No comparative disadvantage for EA/EU sovereign debt issuers.
- 7) **Potentially support lending to the real economy** and thereby facilitating economic recovery.

No reform will achieve all of these objectives at once. Europe has been active on other fronts to address some of the issues that are mentioned in the objectives above. Most notably, the BRRD that became binding in 2015 and 2016, deeply reformed the way in which banks are resolved and restructured and how national agencies coordinate in cross-border settings. One of the major changes was the introduction of bail-in, which requires shareholders and creditors to cover the costs of resolution. According to the BRRD, losses and resolution costs must now be covered by bailing in all unsecured liabilities except insured deposits. For the latter, the deposit guarantee scheme may be required to cover. Only after 13% of the balance sheet has been bailed in, the resolution authority may look for alternative sources of funding (including for example state aid).³⁷ This lowers the bearing of contingent liabilities on the state budget considerably.

Bail-in only works well if a crisis is not systemic and markets are not generally in turmoil. In order to reduce the risk of crises, the general institutional setup of supervision has been

³⁷ The BRRD requires a minimum bail-in of 8% of total liabilities plus own funds. However, the resolution authority may decide to exempt certain liabilities from bail-in and cover the incurred losses with contributions from the resolution fund. The minimum amount of bail-in could then potentially reach 13% of total liabilities plus own funds.

strengthened. The supervision and resolution of systemically important institutions have been moved to supranational-level, with the inception of corresponding new institutions, the Single Supervisory Mechanism (SSM) and the Single Resolution Board (SRB). Capital requirements have been overhauled and generally increased. Additional buffers apply for specific risks and the macroprudential perspective has been added to the toolkit. A number of supervisory soundness checks, including the asset quality review of the SSM and EBA and the EBA transparency exercises and the Supervisory Review and Evaluation Process, have been applied to screen the portfolios of banks and improve their resilience.

Other aspects of the regulatory change should be kept in mind. Two important aspects are the geographical and material scope of the change in regulation. First, in terms of geographical scope, if the new regulation is to be applied at the EU level, effects are slightly different for the non-EA members of the EU. Banks outside the EA would face additional foreign currency risk when rebalancing their portfolios and, similarly, the non-EA sovereigns would have bigger problems finding alternative investors. Moreover, changing the regulation only at the European level and not globally would be suboptimal if it implies a disadvantage for European banks and sovereigns. Ideally, the new regulation should not give EA/EU banks a competitive disadvantage compared to other banks in terms of funding costs or profit generating ability. Similarly, it should not introduce a competitive disadvantage for sovereigns in terms of financing conditions.

Second, in terms of the material scope, it should be well defined whether 'sovereign exposure' includes exposure to the central government (CG) only, to the general government (GG) or it includes also exposure to the local/regional governments, government guarantees and central bank (CB) deposits. The qualitative analysis in this note assumes that the new regulation would apply to sovereign exposures excluding CB deposits. Further definition is necessary in the quantitative part, including scenario analysis, where we also provide exact definitions. For ease of reference, hereinafter 'sovereign bonds' and 'sovereign exposures' are used interchangeably, except when specified differently.

3.4 Introducing Positive Risk Weights

The general idea of any reform would be to move closer to the objectives laid out above while mitigating the fallout from the transition. We analyze the implications of the removal of zero risk weights for banks and the effects on sovereign debt markets, where banks have an important role

as investors and market makers. Next, we discuss the implications for the sovereigns and their funding options.

3.4.1 Impact on Banks

Currently banks can hold (EU-) sovereign debt without accounting for the risk that they load onto their balance sheets. The introduction of positive risk weights on sovereign bond holdings would attach a cost in terms of having to reserve some regulatory capital for their sovereign exposures. We discuss introduction of positive risk weights by applying in full either the StA or IRB approach.

Introducing positive risk weights by imposing the StA would not make a large difference in risk weights for highly rated euro area sovereigns. In some cases, however, like for peripheral euro area sovereigns, the impact could be quite large. Table 3-1 below shows that 7 out of 19 countries would retain a zero risk weight while for the rest risk weights between 13% and 150% would apply.³⁸

The regular Standardized Approach would lead to more transparency regarding the credit risk of sovereign exposures. At the same time, the reliance of the StA on credit ratings has a number of shortcomings. First, CRA ratings tend to be backward looking. Second, they tend to be optimistic in good times and overly negative in the downturns. Finally, downward adjustments are often abrupt.³⁹ In addition, the StA is fairly blunt on its own terms, since it follows a bucketing approach. For example, a downgrade of a given asset from one credit quality step to the next could lead to a significant jump in the risk weight. These characteristics combined lead to many issues including cliff effects that exacerbate the impact of pro-cyclicality.

To improve on the issue of discrete jumps, Basel II already foresees the IRB approach⁴⁰ whereby banks use their own internal models to compute risk weights in a more continuous manner, i.e. to avoid the potentially high jumps in the applied risk-weights that stems from the less regular review of PDs by the CRAs. This avoids cliff effects by assigning a specific and a more frequently updated probability of default (PD), Loss-given-Default (LgD) and Exposure-at-

³⁸ The date of the ratings used in computing the StA risk weights in the table is October 5, 2015. The table uses an equal weighting for the ratings of all four major rating agencies.

³⁹ The shortcomings of CRA ratings led to the policy initiative to reduce reliance on the CRA ratings in standards, laws and regulations, proposed and discussed in a number of fora, including the FSB, G20, EU bodies and BCBS.

⁴⁰ The IRB treatment was introduced in Basel II and did not change in Basel III.

Default (EaD) to every asset class and based on this would assign a small, albeit positive risk weight accordingly. This would cause the need for a positive allocation of capital to each exposure. Table 3-2 below gives an illustration of how risk weights could look as a function of the assigned probability of default.⁴¹

For example, assuming a bond with a probability of default of 0.1% for a given sovereign would lead (according to Table 3-2) to a risk weight of around 30%. This would mean that for each euro invested in such a bond, and assuming a regulatory capital ratio of 8%, the bank would have to hold $(30\% \times 8\% \times 1\text{€}) = 2.7 \text{ €-cents}$ of capital. This would still be below the threshold that the new Basel III leverage ratio of 3% imposes on banks. If the probability of default would be multiplied by 10 to 1%, the capital requirement would increase to 7.4 € cents.

As opposed to the standardized approach which bundles risks in buckets, the IRB approach is based on a continuous function depending on the assumed PD, LGD and average maturity. Hence, any change in any of these parameters will lead to a more gradual change in the capital cost of holding this asset.

Table 3-1: StA risk weights on EA sovereign exposures under the StA approach

StA risk weights on EA sovereign exposures		
DE	0% PT	88%
FR	0% GR	150%
NL	0% CY	100%
AT	0% SK	20%
FI	0% SI	40%
LU	0% MT	28%
BE	0% EE	13%
IT	43% LV	20%
ES	43% LT	20%
IE	28%	

Own calculations based on ratings of the 4 major rating agencies and the JC Credit Quality Step mapping as per CRR Art. 136 and JC/CP/2014/01add.

Table 3-2: Illustration of risk weights under the IRB approach as a function of the probability of default

Probability of default (%)	Risk Weight (%)
0,01	7,53
0,05	19,65
0,10	29,65
0,25	49,47
0,50	69,61
1,00	92,32
5,00	149,86
10,0	193,09

Note: Table 3-2 sets out PDs and their associated risk weights for banks in the BIS sample using the Foundation IRB approach. This variant of the IRB, in contrast to its advanced counterpart, allows banks to rely on their risk assessments for PDs but requires them to use a standard LGD of 45% set by supervisors. The PDs are subject to supervisory validation. Data collected by the Basel Committee covering 201 large

⁴¹ The table was taken from BIS (2014). The formula for the risk weight assumes an LgD of 45% and an average maturity of 2.5 years.

banks show a weighted mean PD for sovereign exposures subject to the IRB approach of 0.1%

Source: ESM staff calculation.

Source: BIS (2013).

The use of positive risk weights would represent a consistent approach to risk management. For the bank, this would mean that it holds enough capital to cover even unexpected losses that could occur on this exposure, in the case of IRB subject to the confidence level accepted by the supervisor. At the same time, as noted by GROS (2013) “lumpiness” of sovereign risk poses an issue in this respect. The term “lumpiness” points to the empirical fact that sovereign defaults are rare, but when they occur, losses are typically large.⁴² Thus, even relatively high risk weights fail to guarantee full loss absorption in the case of sovereign default.

The application of non-zero risk weights to sovereign exposures would create the scope for cost optimization with regard to holding specific sovereigns and could lead to substitution effects, since all sovereigns would no longer carry a zero risk weight. Banks would seek to reduce their costs of holding sovereign exposures subject to other motives they have for holding a specific bond. For example, potential political motives of holding the domestic sovereign would suddenly compete with the cost that holding this exposure implies. Introducing proper risk weighting of sovereign exposures would hence have the potential to weaken the link between banks and their domestic sovereign.

Adjustments in Bank Balance Sheets – The Transition and the Steady State

An introduction of non-zero sovereign risk weights, either based on the CRA ratings or internal calculations following the IRB approach would lead to an increase in the Risk Weighted Assets (RWA). This would happen both, in the transition period when the regulatory changes are being phased in and also in the long run, whenever there would be an increase in the riskiness of any sovereign held in the banks’ portfolio that would imply an increase in risk weights. Higher RWA will lead banks to either look for more capital or adjust their portfolios and/or their balance sheet size. Note that the size of the effect will be larger for banks with large exposures to peripheral/stressed sovereigns with low ratings. Due to the home bias in sovereign bond holdings, these are currently in most cases banks domiciled in the stressed European countries.

When deciding how to adjust after an increase in risk weights, in order to comply with the Capital Requirements Regulation, banks will consider 1) whether they have sufficient capital

⁴² For example in the Private Sector Involvement in Greece in 2012, the average haircut on Greek sovereign debt was just above 53%.

buffers or can raise additional capital, 2) whether they can dispose of the affected sovereign exposure at a reasonable price, keeping in mind potential losses, and 3) whether they can find suitable substitutes to invest in, keeping in mind their yield and the effects on bank profitability. In addition, banks are also limited by the LCR regulatory ratio.

In case banks could not raise sufficient capital, they would need to adjust on the asset side, by disposing the affected sovereign exposure and either substituting it with other investment or reducing the total balance sheet size. The extent to which they would reduce exposure to the sovereigns with increased risk weight depends crucially on the losses they would incur by doing so. In the transition period, if given enough time to adjust, banks could decide to keep sovereign paper until maturity and limit participation in the primary market. On the other hand, an alternative scenario is possible, where banks try to sell the relevant sovereign exposures as soon as possible in order to minimize their losses. The shedding of sovereign exposures and the price effects would depend crucially on the amount of exposures in the Held-to-Maturity (HTM) portfolio, which is valued at book value, and price elasticity of the sovereign paper.^{43,44} In the steady state, sudden increases in risk weights on certain sovereigns would also have a potential to lead to such sell-offs.

Banks can match the resulting reduction in exposure to sovereigns with increased risk weights by:

- Investing in suitable alternatives and keeping the size of the balance sheet unchanged (see Figure 3-4, panel A). Banks will look for alternative investment options in order to keep their RWA constant. If the LCR regulation is binding, they will invest in HQLA, like deposits at the central bank and sovereign bonds with lower or zero risk weights.⁴⁵ In this case, lower

⁴³ The purchases the ECB and NCBs are making in the framework of the Public Sector Purchase Program of the ECB could counter the price effects of bond shedding to some extent.

⁴⁴ Immediate selling of sovereign bonds is only possible from the trading book or from the Available-for-Sale (AFS) portfolio. HTM securities can be reclassified as AFS if the holder no longer intends (or is no longer able) to hold the debt to maturity. The carrying value is re-measured to the security's fair value, with any difference recognized in other comprehensive income. Reclassifying a HTM security may prevent the holder from classifying other debt securities as HTM, or even require other HTM debt to be reclassified as AFS. Reclassification of AFS instruments to HTM under certain conditions is also possible if a financial asset is no longer held for the purpose of selling. In this case, financial assets should be reclassified at its fair value on the date of date of reclassification.

⁴⁵ In the transition period, if following the IRB approach, banks would move from zero to positive risk weights on the whole sovereign portfolio. Therefore, switching to other less risky sovereign paper would not eliminate the need for additional capital. Even the least risky sovereigns would still get attached a positive risk weight instead of zero.

yields on these assets will have a negative impact on banks' profitability. At the same time, due to the lower riskiness of the portfolio, banks' funding costs could decrease, to the extent this effect is not counteracted by higher costs of financing for the whole economy and increases in financing costs due to lower profitability. If instead the LCR requirement is not binding, banks might also consider to invest in other asset classes with relatively high yields, like corporate bonds and loans, as long as these would imply a move back to the initial RWA.⁴⁶

- Alternatively, by decreasing debt on the liabilities side if no suitable investment options are available (see Figure 3-4, panel B). This would decrease the cost of funding due to the lower riskiness of assets and lower leverage, making the bank more resilient. Again, if positive risk weights increase the cost of financing for the whole economy or banks incurs losses, funding costs for the bank could nevertheless increase, depending on which factor prevails.

If banks are able to raise new capital, they could meet the CAR requirement in two ways:

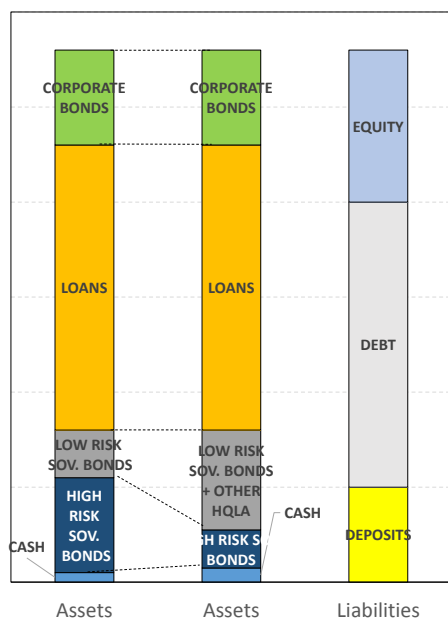
- Banks could adjust only on the liabilities side, by reducing debt financing and increasing their own funds, keeping the balance sheet size unchanged (see Figure 3-4, panel C). The funding cost would increase⁴⁷.
- Alternatively, banks could swap affected sovereign holdings with corporate bonds and loans that carry risk weights between original and new risk weights of the relevant sovereign bonds. Also in this case the balance sheet size would remain unchanged but capital needs would still increase, due to higher RWA (see Figure 3-4, panel D).

Note also that short-term government bills could get assigned lower risk weights than bonds with longer maturities from the same sovereign if the bank was following the IRB approach.

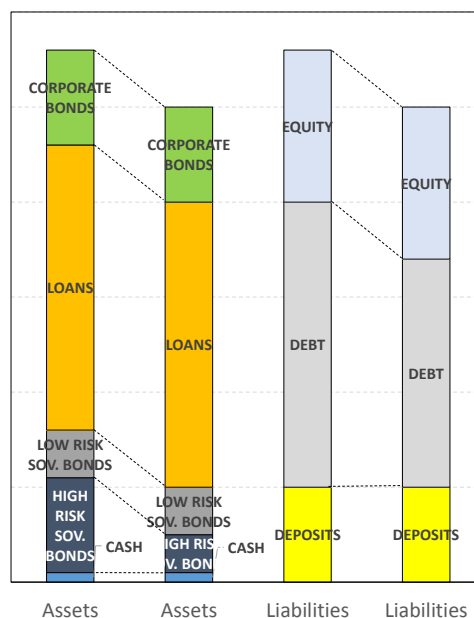
⁴⁶ This could be foreseen only for cases where risk weights increase from an already relatively high level to an even higher one, thus only in the steady state.

⁴⁷ We assume that the Modigliani-Miller theorem does not fully hold for the following reasons: i) taxes: since interest payments on debt are tax-deductible, banks have an incentive to operate with higher leverage and ii) explicit state guarantee: deposit insurance schemes reimburse losses not covered by banks' assets. As a result of these factors, banks' funding costs decline by increasing debt in the funding structure.

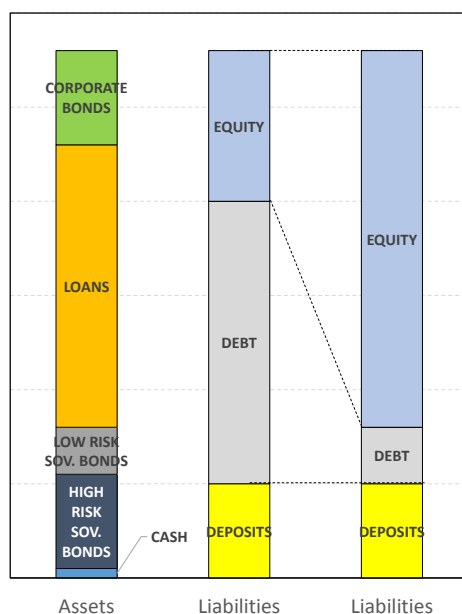
A. Balance sheet size unchanged, reallocation away from risky sov. exposure, LCR binding



B. Decreasing balance sheet size, shedding of risky sovereign exposure



C. Balance sheet size unchanged, adjustment on liabilities side - increasing own funds



D. Balance sheet size unchanged, reallocation away from risky sov. exposure, LCR not binding, increasing own funds

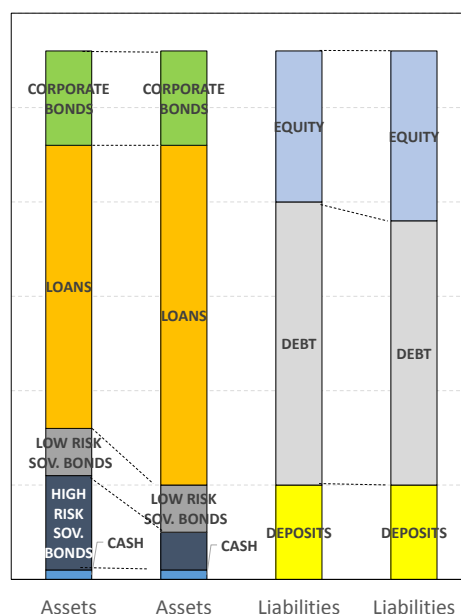


Figure 3-4: Banks' balance sheet - portfolio readjustment

Source: authors' compilation

The first two options (or a combination of the two) are the more likely outcome, since they do not require recapitalizations, which are costly and in certain cases hard to implement. This is particularly the case for banks in stressed countries. In the initial period, banks would probably

adjust by substitution due to limitations on the liabilities side. In the longer run, however, we expect to see more banks decreasing their balance sheet size, as the alternative investments with zero risk-weights could have a negative effect on profitability. The amount of shedding would depend on the length of the transition period, the proportion of assets in the HTM portfolio and the price elasticity of the sovereign paper. According to the data provided under the EBA 2013 transparency exercise, only 20-30 percent of the banks' sovereign exposure was classified as HTM. Since a majority of the sovereign exposure can be sold immediately, frontloading risks are significant. The last two options (options C and D in Figure 3-4) are probable in banks that would not have problems with increasing their own funds via retained earnings, conditional on a sufficiently long transition period or those that have higher capital than the regulatory requirement.

The application of positive risk weights to sovereign exposures would almost certainly reduce leverage in the banking system, except if all banks adjusted according to the first option, which is unlikely. Lowering leverage per se reduces systemic risk as leverage typically magnifies the propagation of shocks across the financial sector and can render smaller shocks systemic.⁴⁸

Quantifying the Effects of Introducing Positive Sovereign Risk Weights in the Transition Period

Under the current regulatory setting, banks benefit from capital savings due to the application of de-facto zero risk weights for European sovereign exposures. KORTE – STEFFEN (2015) estimate the size of this “sovereign subsidy” to amount to approximately €750 billion as of June 2013 for a sample of 54 EBA banks.⁴⁹ This exercise applies positive (IRB-style) risk weights to all non-domestic sovereign exposures of the sample banks and assumes that capital ratios and exposures are kept constant.

We analyze the potential transition effects of new regulation on the banking sector by using StA based risk weights in Table 3-1 for all the sovereign exposures, including domestic ones. We use the data of the EBA transparency exercise performed in 2013, which covers a sample of 54 banks. As such, the analysis is static and considered a scenario analysis, where only one variable is changing. Sovereign exposure in this exercise is defined as the accounting value of sovereign exposures gross of provisions. Exposures cover only exposures (bonds and loans) to central,

⁴⁸ See ADRIAN – SHIN (2010).

⁴⁹ Their sample includes banks that were a part of EBA stress testing and AQR exercises over the period March 2010 to June 2013. The sample includes the largest banks in Europe, thus it usually makes up more than 90% of the exposures in all banks that formed part of the EBA exercises.

regional and local governments on an immediate borrower basis and do not include exposures to other counterparts with full or partial government guarantees. Figure 3-5 provides a picture of the distribution of banks' sovereign bond holdings by risk-weights attached. The "home bias" phenomenon described above is reflected in a very large share of domestic exposure in banks' holdings of sovereign bonds. The concentration is particularly high in stressed EA countries, such as Portugal, Spain and Greece, where 90 percent of banks' sovereign bond portfolio includes domestic government bonds.

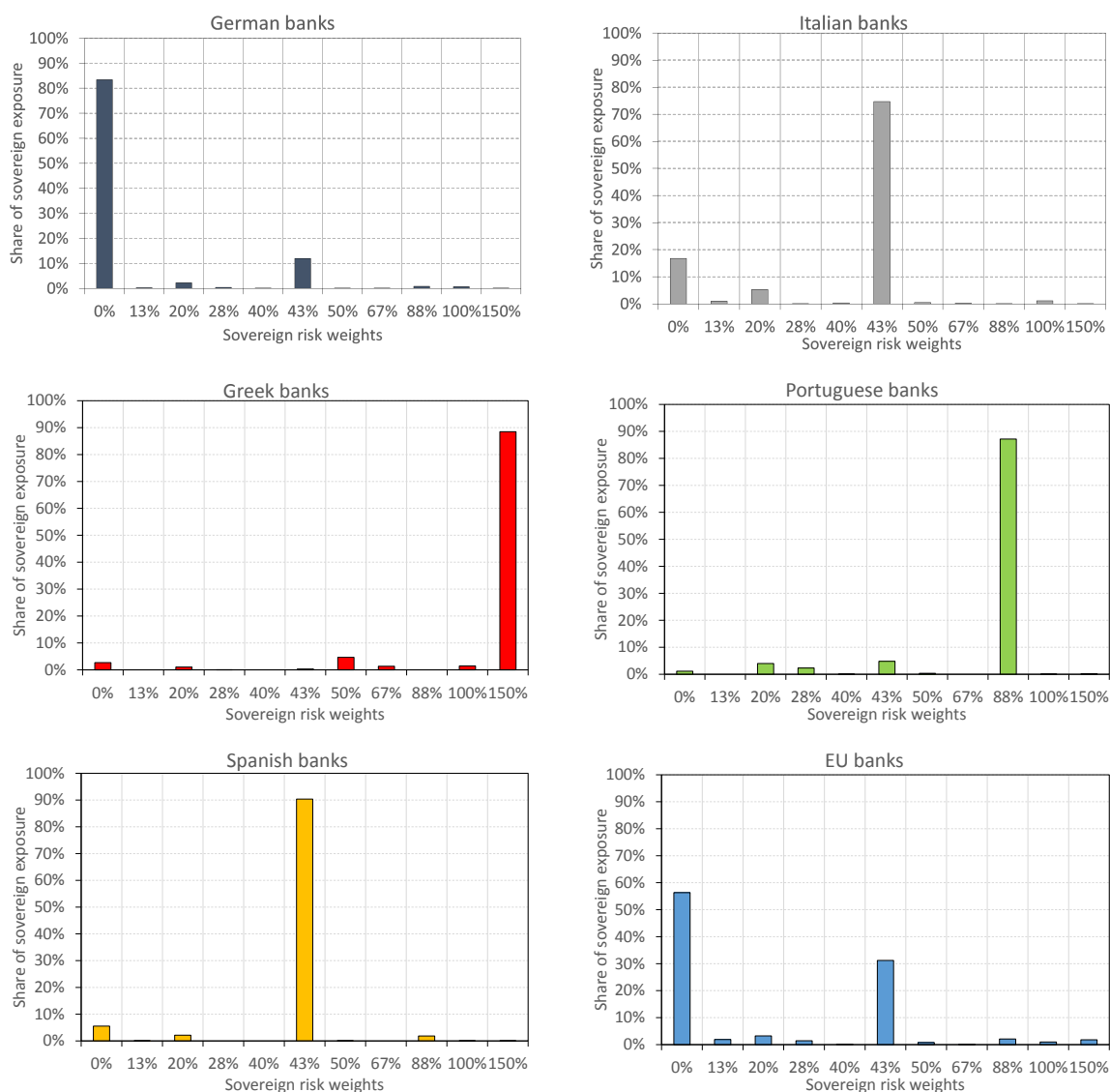


Figure 3-5: Distribution of EU banks' government exposures by risk weights

Note: Figures are aggregate gross exposures across EU banks participating in the EBA's exercise 2013.

Source: SnL

In nominal terms, Italian banks hold the largest sovereign exposure that would have positive risk weights, with more than €200 billion in exposures, while Spanish banks follow closely with €170 billion. The next two banking sectors, German and French have smaller exposures to sovereigns that would receive positive risk weights, with amounts of around €60-70 billion (Figure 3-6).

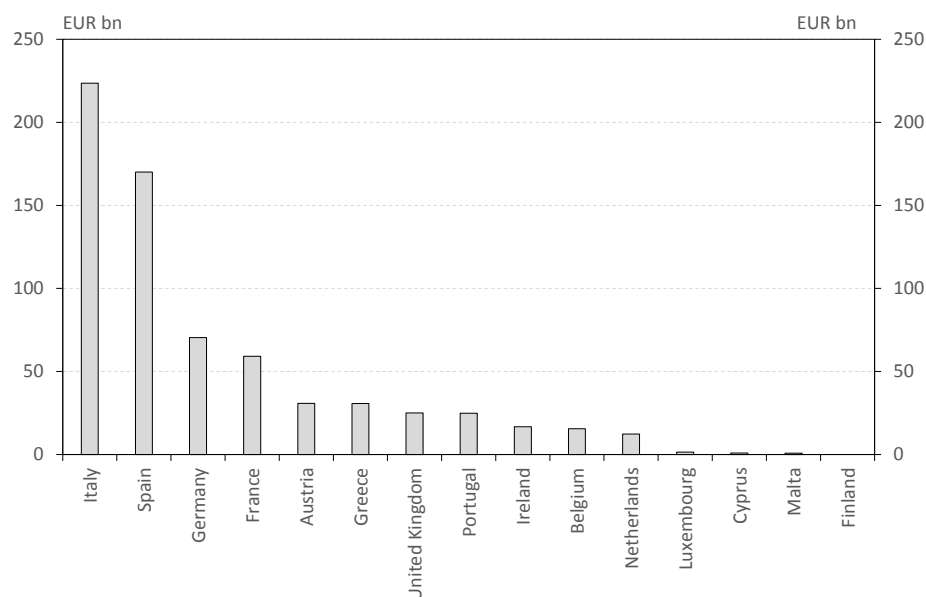


Figure 3-6: Non-zero risk weighted sovereign exposure

Note: Figures are aggregate gross exposures across EU banks participating in the EBA's exercise 2013.

Source: SnL

In what follows, we analyzed a few potential scenarios of the banks' adjustment to the new regulation during the transition period, assuming that all the other parameters are unchanged, especially that there is no change in bond prices. Since risk weights would increase on most of the sovereign bond holdings during the transition, banks would need to decide how to adjust their portfolios. The adjustment options could be summarized in 4 scenarios:

- i) increasing capital without selling sovereign bonds,
- ii) selling bonds with risk-weights beyond 88%⁵⁰ (Portuguese, Cypriot and Greek) and increasing capital to cover for other sovereign bonds with new non-zero risk-weights,
- iii) selling bonds with higher than 40% risk-weight (bonds mentioned above plus Italian, Spanish and Slovenian bonds) and increasing capital to cover for other risky sovereigns, or
- iv) selling all bonds with non-zero risk-weight (i.e. higher than 0%).⁵¹

⁵⁰ 88% is the risk weight assigned to Portugal in a StA setting under the assumptions in Table 3-1.

⁵¹ Note that scenario i) corresponds to option (3) in the previous section. In scenarios ii)-iv), sovereign exposures with newly non-zero risk weights could be either substituted with less risky assets (option 1) or the bank could decide to shed them and let the total balance sheet shrink (option2). Alternatively, there could be a mixture of the two. Scenarios ii)-iii) would then correspond to a mix of options (1) and (2), combined also with capital increases

In the first scenario, banks would need to increase capital by some €32 billion in order to maintain their current CET 1 ratio (Table 3-3).⁵² In the fourth scenario, as the other extreme, banks would dispose of nearly €700 billion of sovereign bonds from their portfolio. About 60 percent of this supply would originate from Spanish and Italian banks.

In our view, an intermediate scenario seems to be the most realistic. For example, in Scenario ii) banks simultaneously adjust the asset and liabilities side of the balance sheet. In our analysis, banks would dispose of their Portuguese, Cypriot and Greek bonds and increase capital by €25 billion. This scenario would still result in bond portfolios being sold or reallocated in the amount of 10 percent of the outstanding government debt in the affected countries. Scenario iii) works along similar lines with a smaller amount of additional capital needed and with the banks having to shed a much bigger portion of their sovereign bond holdings.

Table 3-3: Bond selling and capital need under different scenarios

Banks in (EUR mn)	Scenario i)		Scenario ii)		Scenario iii)		Scenario iv)	
	Bond selling	Capital increase	Bond selling [150%-88%]	Capital increase	Bond selling [150%-40%]	Capital increase	Bond selling [150%-13%]	Capital increase
Germany	0.0	2,817.8	6,393.0	2,320.3	58,452.0	237.9	70,381.8	0.0
France	0.0	2,708.1	1,789.5	2,517.5	50,064.2	167.5	59,144.5	0.0
Italy	0.0	10,031.2	3,201.5	9,683.7	206,641.3	348.8	223,574.8	0.0
Spain	0.0	7,073.6	3,390.2	6,815.5	166,216.5	80.0	170,086.9	0.0
United Kingdom	0.0	1,227.6	1,791.7	1,036.1	21,272.4	99.4	25,075.6	0.0
Netherlands	0.0	513.1	1,010.1	401.0	6,001.3	145.1	12,297.9	0.0
Austria	0.0	1,112.8	2,994.1	780.0	10,184.5	377.7	30,823.9	0.0
Belgium	0.0	666.3	3,652.2	239.5	4,680.5	185.6	15,563.5	0.0
Greece	0.0	1,942.4	28,343.4	78.2	30,329.7	6.0	30,672.2	0.0
Portugal	0.0	2,619.9	21,991.4	129.8	23,294.6	48.4	24,880.6	0.0
Ireland	0.0	723.2	25.4	719.8	308.5	701.6	16,676.8	0.0
Luxembourg	0.0	106.0	207.6	77.9	1,370.5	1.9	1,434.0	0.0
Finland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Malta	0.0	24.5	9.8	23.5	15.6	23.2	798.5	0.0
Total	0.0	31,566.5	74,799.7	24,822.9	578,831.7	2,423.2	681,411.1	0.0

Note: Figures are aggregate gross exposures across EU banks participating in the EBA's exercise 2013.

Source: SnL

Note that once the new regulation is in place (i.e. after the transition period), the change in the riskiness of one sovereign and implied risk weights would lead to significantly smaller sell-offs and/or changes in required capital.

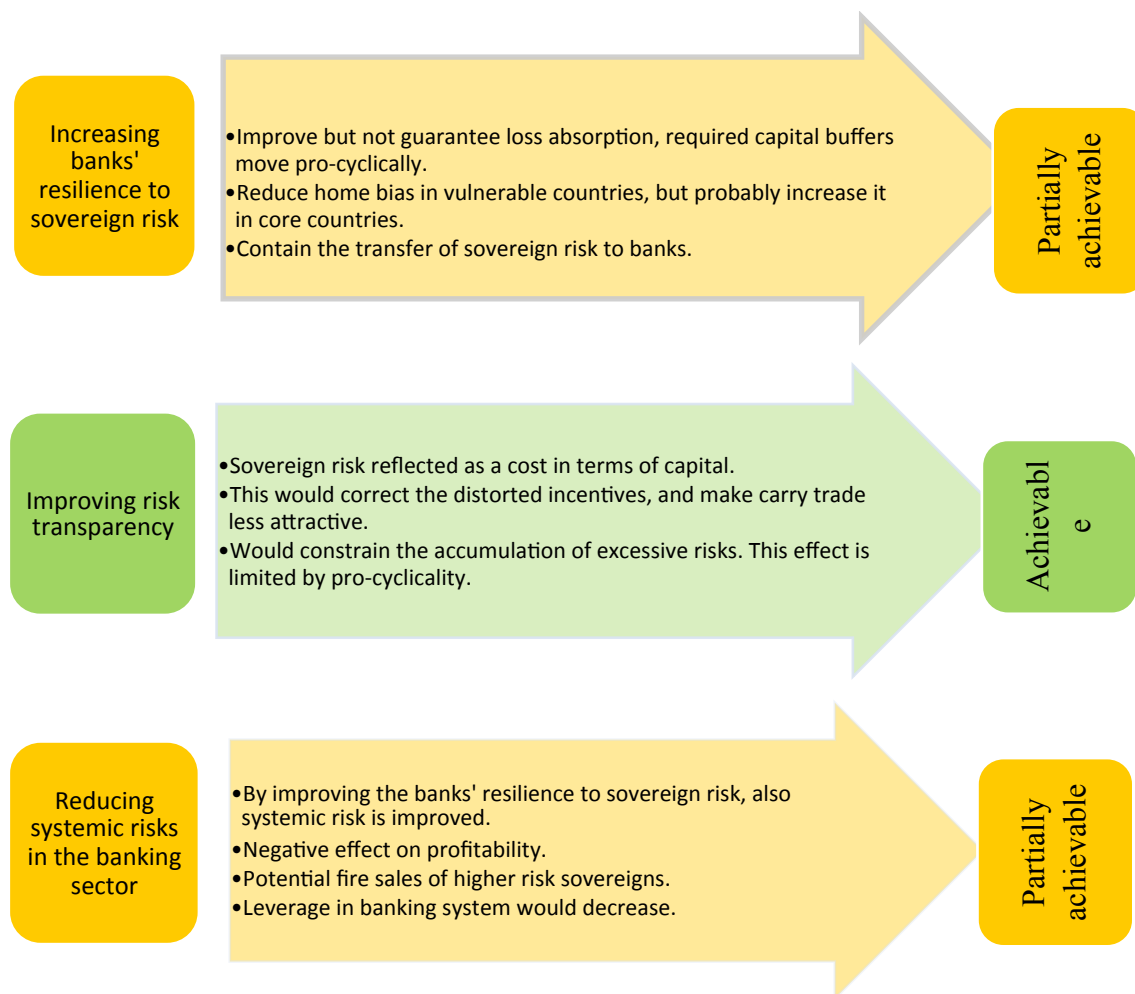
(i.e. option (3)) to cover for the rest of the sovereign portfolio with newly increased risk weights. Scenario iv) would correspond to a mix of options (1) and (2), without the need to inject new capital.

⁵² This figure does not take into account that banks may have some capital buffers, which would accommodate part of the increase in the risk weights.

Fulfillment of Objectives in the Steady State

Table 3-4 summarizes to what extent the positive risk weights are able to fulfill the objectives set out in Chapter 3.3 in the steady state.

Table 3-4: Objectives of the proposed regulatory changes and their fulfillment by introducing non-zero risk weights in the steady state



Source: authors' compilation

3.4.2 Impact on Sovereign Debt Markets

The features that render sovereign bonds attractive to banks are diverse and hence, the impact of positive risk weights would go in several directions. The decision-making inside banks is complex and the primary effects might fall on the trading desks inside banks. Positive risk weights on sovereign exposures would mean higher costs of holding inventories (warehousing) for banks that are acting as primary dealers and market makers in the sovereign bond markets. While due to other regulatory changes, banks' participation in these activities has already

dropped to a low point, this could strengthen the move of banks from a dealer to a brokerage model in which they – for cost reasons – no longer take principal risk and commit their balance sheets. The withdrawal of banks from dealing would have important liquidity effects on these markets and could increase sovereign borrowing costs due to a higher liquidity premium. While one can argue that the current low level of the liquidity premium is due to the favorable treatment of sovereign exposures,⁵³ moving to an equilibrium without such a bias would still require careful calibration. A reduction in market-making activities would also lead to higher volatility in the sovereign bond markets, which can further decrease liquidity.

However, there are other desks that hold sovereign bonds. Asset – liability management would mostly be interested in the liquidity features of sovereign bonds and base their demand on regulatory requirements and the need for collateral. Other parts of the bank, like the syndication desk or investment banking would again be driven by different motivations. In sum, it is difficult to predict the overall impact of a regulatory change on banks' engagement in sovereign debt markets. It seems, however, plausible to assume that banks would start rebalancing their portfolio by reducing their exposure to sovereigns with higher risk weights. The supply of those bonds would increase with an unmatched demand, leading to higher prices and a potentially less liquid market. The speed of adjustment would depend on the proportion of the sovereign bond portfolio marked-to-market and the transitional arrangements.

Introducing positive risk weights would also likely have an impact on the yield curve, although the potential effects are ambiguous and the final outcome is not known. To the extent that internal risk models are used, government exposures with shorter maturities would be assigned a lower risk weight under the new regulation. This could mean that banks would try to move to shorter maturities and cause a steepening of the yield curve. On the other hand, as regulation would generally increase costs, banks could try to match the higher cost with a higher return by moving up the maturity spectrum. This would flatten the yield curve and increase the maturity mismatch on banks' balance sheets.

3.4.3 *Impact on Sovereigns*

Given the possible adjustment options for the banks following an increase in risk weights discussed in the previous chapter, there are a number of ways in which the new regulation

⁵³ This is the so-called “liquidity illusion”. See CGFS (2015).

imposing non-zero risk weights would affect the sovereigns both in transition period and in the steady state, after the introduction of new regulation.

First, a reduction of exposures to stressed sovereigns and a lower demand for their paper on the primary market can have significant effects on sovereign bond prices and yields. While proper risk-weighting would remove distortion in the bond prices, it can have potentially very damaging effects for vulnerable sovereigns, as it leads to increased funding costs and more difficult market access. In addition, non-zero risk weights would lead to reduced liquidity on the affected sovereign bond market, which would increase the financing costs of the vulnerable country via an increase in the liquidity premium. At the same time, the demand for less risky sovereign bonds would increase as banks would rebalance their balance sheets, lowering their yield. Both developments together would lead to a divergence in sovereign bond prices across the EU. These developments can also arise in the steady state, since exposures to a particular sovereign would vary with the risk weights. Regulation based on pro-cyclical CRA ratings could thus fuel the vicious circle of increases in risk weights due to downgrades, reduction of sovereign exposures and increases in required yield, triggering further downgrades. Similarly, the feedback loop would also be present for IRB based risk weights. Note that the upward pressures on sovereign yields could be aggravated if the regulation was changed solely at the EU/EA level, since it would lead to a comparative disadvantage of stressed EU/EA member states in terms of funding conditions vis-a-vis the (potentially equally risky) issuers in the rest of the world.

Second, since sovereign bonds serve as a benchmark for other fixed income assets, an increase in their yields leads to a higher cost of financing for the whole economy. Following an increase in sovereign risk, we would thus see firms in stressed countries facing higher financing costs, leading to a negative impact on economic recovery. Similarly, banks' cost of funding could increase, counteracting a potential decrease in this cost stemming from a reduction in the riskiness of banks portfolios. This effect is present in the transition phase and in the steady state.

Third, in the steady state, we could see some positive effects of non-zero sovereign risk weights, as the cost of holding sovereign bonds in terms of capital would increase vis-à-vis the cost of loans to the private sector. Banks would thus potentially (if the liquidity requirements are not binding) replace part of the stressed sovereign exposure with lending to the private sector. The size of this effect is uncertain, and would be limited by the demand for loans.

Finally, higher capital needs due to higher RWA can result in the need for sovereign participation in cases when the banks are state-owned. Due to the presence of home bias in sovereign bond holdings, this channel becomes especially problematic in stressed countries, potentially leading to funding problems of these sovereigns. These considerations are valid both in the transition to the new regulatory regime and in the steady state.

3.4.4 Pro-Cyclicality of Risk Weights

Since risk parameters vary with the cycle, risk weights would move pro-cyclically, irrespective of whether the banks apply the StA or the IRB approach.⁵⁴ For the StA – which relies on CRA ratings – the pro-cyclicality materializes in the movement of agency ratings with the cycle. Additionally, the changes in ratings can sometimes be abrupt, which may lead to cliff effects. In contrast, the IRB approach does not cause cliff effects.

As a result, risk assessments may be excessively lenient when the economy is in an upturn, whereas, during broad-based price declines, views on risk may be too pessimistic. In the up-cycle too little capital is held, while banks may be desperately seeking more capital in a downturn.

This is a general feature (and problem) of risk weighting exposures of banks and has led to insufficient capital buffers in a number of banks during the financial crisis. In recognition of this, Basel III has introduced the leverage ratio which is independent of the risk of an exposure. The leverage ratio will complement risk-related capital holdings by effectively introducing a floor on capital holdings at the aggregate balance sheet level of the bank.

Risk weights are also pro-cyclical from a macroeconomic perspective. They normally increase during recessions, when the state of public finances deteriorates due to the workings of automatic stabilizers and increased use of fiscal stimulus. Thus, at a time when sovereign fiscal space is already squeezed, financing costs for the sovereign would further increase due to changes in banks' willingness to hold the bonds of that sovereign.

This is true for sovereigns that do not have sound fiscal accounts. In this spirit and as a countermeasure to excessive pro-cyclicality, GROS (2013) proposes linking risk weights to the public debt or deficit figures and their compliance with the Maastricht rules, or to the Excessive Deficit Procedure. For instance, risk weight could remain at zero if both debt and the deficit as a percentage of GDP remain below 60% and 3% respectively, and increase if the deficit or debt are

⁵⁴ See for example ADRIAN – SHIN (2011) and SHIN (2011).

higher than these limits for a number of years.⁵⁵ This approach would according to GROS (2015) lead to less pro-cyclicality than the CRA based weights, as the deficit and debt change only slowly over time. This proposal fails to remove pro-cyclicality in macroeconomic terms but leads to more objective risk weights and avoids the cliff effect. It also penalizes exceeding the stability criteria of the Stability and Growth Pact (SGP), thus motivating a more conservative fiscal policy.

In order to mitigate pro-cyclicality in the up-cycle, the ESRB (2015) suggested introducing a floor on risk weights for sovereign exposures. This floor would assign a fixed positive risk weight to any sovereign exposure irrespective of its credit risk, to be applied in both in the StA and IRB approaches.⁵⁶ It would avoid pro-cyclicality in the upturn of the cycle and would decrease the amount of capital shortfall in a downturn.

Risk weights would ideally be constructed in a countercyclical way, in analogy to the idea of countercyclical capital buffers. Higher risk weights in the boom could prevent the build-up of excess sovereign debt holdings and increase the capital buffer that could be consumed when a crisis hits. During the crisis, the risk weights would decrease to accommodate the need for larger fiscal space. The risk weight floor, listed as one of the options in ESRB (2015) goes only half the way, since it mitigates pro-cyclicality but does not have countercyclical elements. At the same time, it avoids the difficulty of identifying the current and future state of the cycle in advance and mapping different states of the cycle to specific risk weights.

A recent note by the European Political Strategy Centre notes that large exposure limits (as discussed in the next section) are preferable over positive risk weights, precisely because they are not pro-cyclical.⁵⁷

⁵⁵ GROS (2013) suggests to add 30% to the risk weight for every percentage point of deficit (in relation to GDP) in excess of the Maastricht target. Alternatively, the author suggests to add to the risk weight the number of percentage points, by which the country is exceeding the Maastricht 60% debt-to-GDP target.

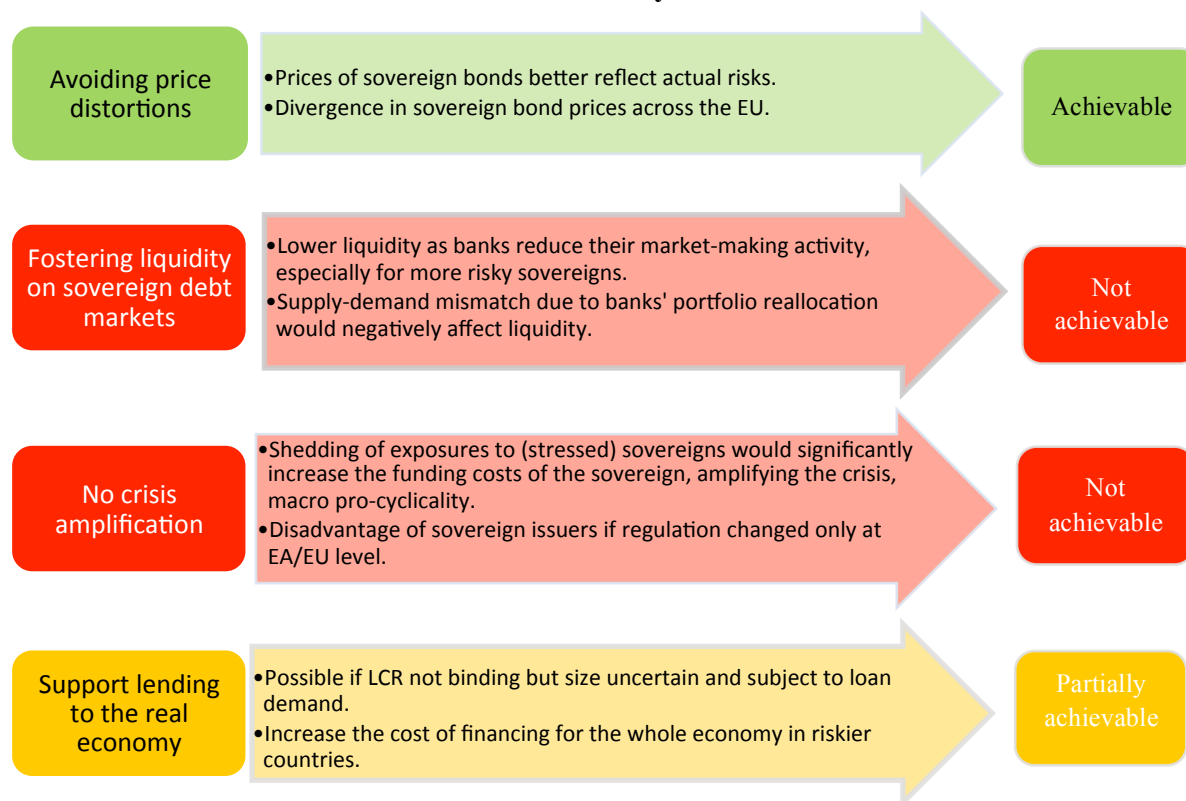
⁵⁶ See ESRB (2015).

⁵⁷ See “Further Risk Reduction in the Banking Union” Five Presidents’ Report Series, Issue 03/2015, 9 November 2015.

Fulfillment of Desired Outcomes in the Steady State

Table 3-5 summarizes the effects of positive risk weights on the sovereign financing conditions and economy in the steady state.

Table 3-5: Desired outcomes and their fulfillment by introducing non-zero risk weights in the steady state



Source: authors' compilation

3.5 Introducing Sovereign Exposure Limits

Although limits on sovereign exposure and positive risk weights both have the same objective, namely to minimize the feedback loop between sovereigns and banks and increase the banks' resilience to sovereign risk, they are different in many aspects. First, the sovereign exposure limit is a diversification tool that aims to reduce the risk in bank balance sheets by limiting the exposure to any single counterparty. Second, it does not intend to incorporate the real risk of the sovereign by requiring more capital for the riskier sovereign exposures. It ignores credit risk per se and seeks risk reduction via diversification. Lastly, it is less pro-cyclical. At a system level (i.e. in the euro area) banks will be forced to hold a diversified government bond portfolio, but that does not preclude them from absorbing additional sovereign bonds from other issuers. However, in a situation of stress, if the domestic banking sector could no longer absorb the additional

supply of government bonds and banks from other jurisdictions and other sectors were unwilling to do so, exposure limits could result in cliff effects and put further pressure on the funding conditions of the sovereign that is already under stress. Furthermore, due to internal capital generation in the upward phase of the cycle and losses in the downturns, bank equity and as a consequence, the nominal limit changes in a pro-cyclical manner. In the transition, government debt agencies would be required to build a geographically more diversified investor base, which could prove challenging. This could be particularly difficult for smaller countries with less liquid sovereign bond markets.

3.5.1 Impact on Banks

As mentioned before, current regulation limits exposures to any counterparty to 25 percent of own funds. Based on the same dataset as above, EU banks have almost €2,000 billion exposure to different sovereigns⁵⁸. German bank portfolios are most concentrated, with more than €300 billion in domestic government bonds. Their exposure to Austria, Italy and Spain also exceeds 25 percent of their capital (Figure 3-7). The home bias is also strong in Italy and Spain, while less pronounced in the UK and France. Banks with an extended international subsidiary network typically have large exposures to the subsidiaries' sovereigns.

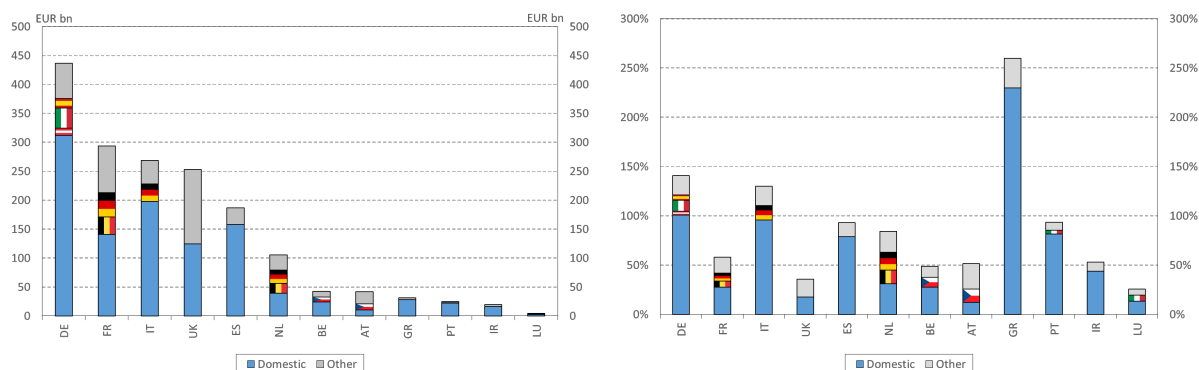


Figure 3-7: Sovereign exposures of EU Banks in nominal terms (left panel) and in % of own funds (right panel)

Note: Figures are aggregate gross exposures across EU banks participating in the EBA exercise 2013. National flags represent large exposure to that specific country.

Source: SnL

⁵⁸ We used the EBA 2013 transparency exercise dataset. Sovereign exposure in this exercise is defined as the accounting value of sovereign exposures gross of provisions. Exposures cover only exposures (bonds and loans) to central, regional and local governments on an immediate borrower basis and do not include exposures to other counterparts with full or partial government guarantees.

Adjustments in Bank Balance Sheets – Transition to the Steady State

Banks' adjustments strategy are similar to those discussed in the capital charge option above. If exposure limits are introduced and restrict banks' desired holdings of sovereign paper, they can choose between keeping their total assets unchanged and substituting some of their sovereign holdings or adapt their balance sheet size. Their choice how to adjust to the new regulation would be driven by two factors: whether there were sufficient close substitutes on the market, and, if not, how they would rearrange their portfolios.

If there were sufficient close substitutes on the market, banks could substitute their domestic government bond portfolios with similar assets:

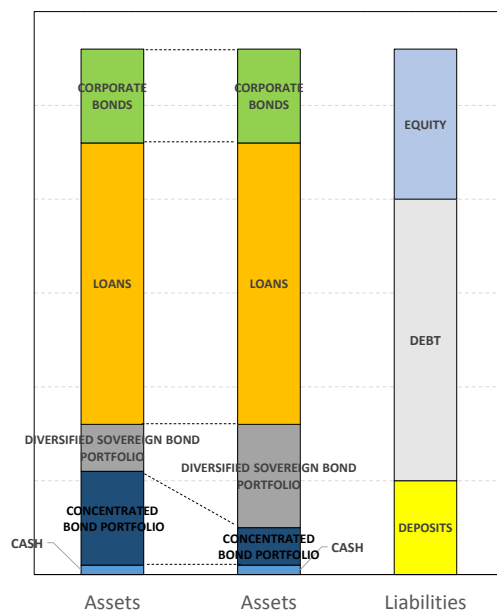
- They could switch to *other sovereign/supranational bonds* with a similar risk level and same risk weights (Figure 3-8, panel A).
- They could also substitute the sovereign bonds that they have to shed with a deposit at the central bank that carries a zero risk-weight. Although this instrument is not a perfect substitute for government bonds, it is easily accessible and similarly liquid according to LCR standards. However, such adjustment could reduce profitability.

In case liquidity regulation is binding, the substitutes should not only be similarly risky and liquid, but should also qualify as HQLA. However, most instruments on the markets with similar liquidity and risk-return characteristics as government bonds, qualify as HQLA.

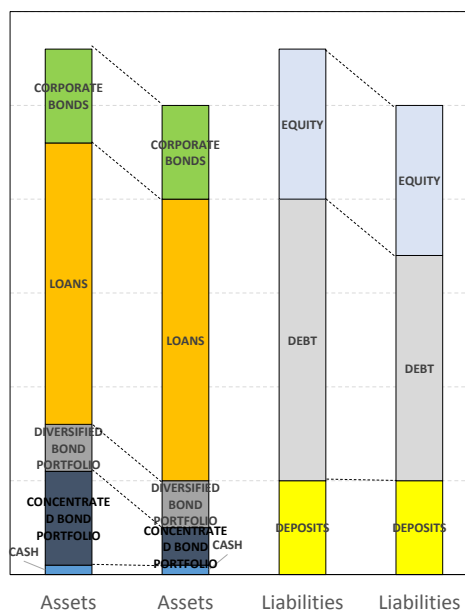
If banks do not find instruments to substitute their government bond portfolio, they need to adapt their balance sheet by decreasing leverage.

- If they decided to decrease their activity, they could diversify by disposing of their excess sovereign bonds and reduce their outstanding debt simultaneously (Figure 3-8, panel B).
- If they chose to maintain their size and are able to get new capital, they can either adjust on the liabilities side and match an increase in their own funds with a decrease in debt, or reshuffle their portfolio and invest in other asset classes, such as loans, other sovereign bonds or corporate bonds. (Figure 3-8, Panel C and D).

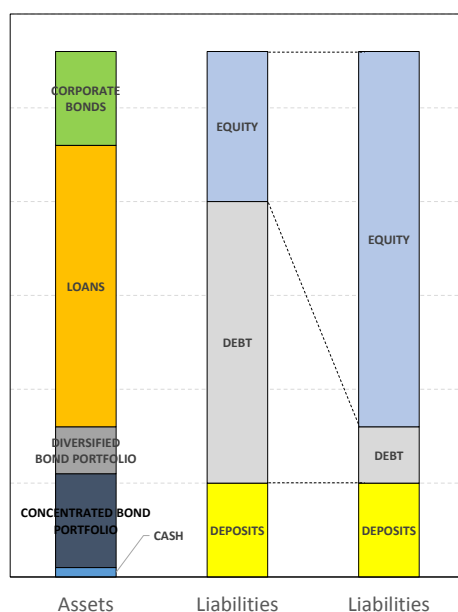
A. Balance sheet size unchanged, reallocation away concentrated sovereign exposure



B. Decreasing balance sheet size, shedding of excess sovereign exposure



C. Balance sheet size unchanged, adjustment on liabilities side - increasing own funds



D. Balance sheet size unchanged, reallocation away from concentrated sovereign exposure, increasing own funds

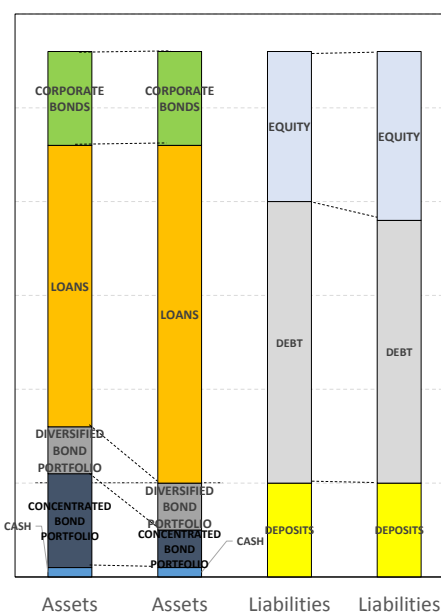


Figure 3-8: Banks' balance sheet - portfolio readjustment

Source: authors' compilation

In our view, the banks' response could depend on the available time to adjust, the size of the mark-to-market portfolio and the possibility to invest in other sovereigns with a similar risk-profile. Given that a significant part of banks' sovereign exposures is ready to be sold immediately and banks tend to frontload regulatory changes, a large part of sovereign bond

portfolio could be shed early in the transition period. In the short run, banks' funding structure could limit the ability to adjust by shrinking the balance sheet size. In this case, banks would substitute their sovereign exposure with other instruments that have a similar risk profile, if possible, or increase their investments in central bank facilities.⁵⁹ After an initial adjustment phase, we expect also some adjustment via deleveraging.

Quantifying the Effects of Introducing Limits on Sovereign Exposures in the Transition Period

Assuming that the standard large exposure limit of 25 percent of total capital would be applicable to sovereign bond exposures without considering any transition arrangements, the rebalancing need would be around €820 billion at the aggregate EU level. On average, this represents 8 percent of the outstanding government debt market. In nominal terms, the highest need for portfolio reallocation would arise in Germany, where banks would need to accommodate the disposal of nearly €270 billion of government bonds (Table 3-6).

Since both the size of the sovereign bond market and the concentration of domestic sovereign bonds in banks' balance sheets differ from country to country, the supply of government bonds and the demand for other sovereign bonds will not necessarily offset each other. In order to demonstrate this, we analyzed the potential impacts of such a regulatory change with the following assumptions:

- First, banks will look for perfect/close substitutes. We consider a government bond perfect or close substitute if it has the same risk-weights in EBA's suggested framework⁶⁰. Based on this assumption, we differentiate four country groups⁶¹. Non-euro area government bonds are considered to be close, but not perfect substitute mostly because these instruments hold currency risk.
- Sovereign bond markets are sufficiently liquid, transactions can be settled without substantial delays and at low cost.

⁵⁹ For more details on reliance on central bank facilities after the introduction of regulatory changes, see CGFS (2015).

⁶⁰ For more details, see <https://www.eba.europa.eu/documents/10180/877382/JC-CP-2014-01add+%28Addendum+to+Joint+CP+on+draft+ITS+on+the+mapping+of+ECAIs%29%20-for+publication.pdf>

⁶¹ Group 1 consists of Germany, Luxembourg, Netherlands, UK, Austria, France and Belgium, Group 2 contains Ireland and Malta, Italy and Spain form Group 3, while Portugal and Greece are the single countries in Group 4 and Group 5 respectively.

- Once they exhaust their diversification possibilities within the groups, banks will start looking for other alternatives.
- Sovereign exposures remain with zero-risk weights and bond prices remain unchanged.
- FX swap markets function smoothly, i.e. currency risk can be hedged easily.

Table 3-6: Rebalancing needs in EU banks

Banks in the country	Average Rating	Total allowed (EUR bn)	Rebalancing need (EUR bn)	Total Government Bond Holding as a % of Own Funds	General Government Gross Debt (EUR bn)	Rebalancing need as a % of General Government Gross Debt	Excess demand from banks
Germany	AAA	77.57	273.41	140.65%	2,179.81	12.54%	236.16
Netherlands	AAA	31.43	34.04	84.15%	426.15	7.99%	
Luxembourg	AAA	4.27	1.91	25.54%	9.61	19.87%	
UK	AA+	176.37	45.33	35.85%	1,740.78	2.60%	
Austria	AA+	20.53	14.33	51.35%	258.53	5.54%	
France	AA	126.89	88.43	57.85%	1,869.16	4.73%	53.07
Belgium	AA	21.66	24.71	48.82%	403.17	6.13%	
Ireland	A	9.32	10.18	52.90%	210.24	4.84%	
Malta	A-	0.28	0.62	72.30%	4.87	12.66%	
Italy	BBB	51.62	177.32	130.08%	1,988.90	8.92%	
Spain	BBB	50.10	121.89	93.13%	890.98	13.68%	
Portugal	BB+	6.73	17.10	93.54%	211.78	8.08%	
Greece	CCC	3.03	10.61	259.76%	304.71	3.48%	
Sum		579.80	819.88	79.22%	10,498.69	7.81%	289.23

Note: Total Government Bonds Holding as a share of own funds hides the fact that in some cases, there is no rebalancing need at the aggregate level, however, certain banks in a given country need to reduce their domestic sovereign bond holdings.

Source: SnL, EBA transparency exercise 2013.

According to our impact analysis, banks in smaller countries with the best ratings (between AAA and A-) could nearly satisfy their needs within their groups. The Greek and Portuguese banks would need to swap their domestic sovereign bonds to higher rated ones (to Portuguese and German, respectively). However, German and Italian banks would not be able to find enough sovereign government bonds to substitute their current large exposures. As a result, banks would be left with roughly €290 billion sovereign bonds still to be shed (Table 3-6). It is important to note, however, that banking groups could exploit synergies with their subsidiaries, hence the overall effect could be more restrained.

If banks decided to increase capital and keep their large exposures to sovereign bonds, additional capital of €1,200 billion would be needed. They can also reduce their debt, by either maintaining total assets at the initial level or by decreasing the asset side as well. Table 3-7 summarizes the effects of different scenarios. It is important to note, however, that should other euro area banks decide to take over the excess government bonds from German and Italian banks on top of their own diversification needs, lending could decrease in the euro area as a whole.

Table 3-7: Possible effects on banks' capital, lending and debt under different assumptions

Scenario	Possible effect on:			
	Domestic government bond portfolio	Capital	Lending	Debt
i) Decreasing debt (Figure 3-8, panel B)	-€300 bn	€0 bn	€0 bn	- €300 bn
ii) Reshuffling the liability side – increasing capital (Figure 3-8, panel C)	€0 bn	€1,200 bn	€0 bn	-€1200 bn
iii) Reshuffling the asset side - increase in lending (Figure 3-8, panel D)	-€300 bn	€150 bn	€300 bn	€-150 bn
Sum	-€300 – 0 bn	€0 – 1,200 bn	€0 – 300 bn	-€1200 - -150 bn

Source: ESM staff calculations based on EBA transparency exercise 2013.

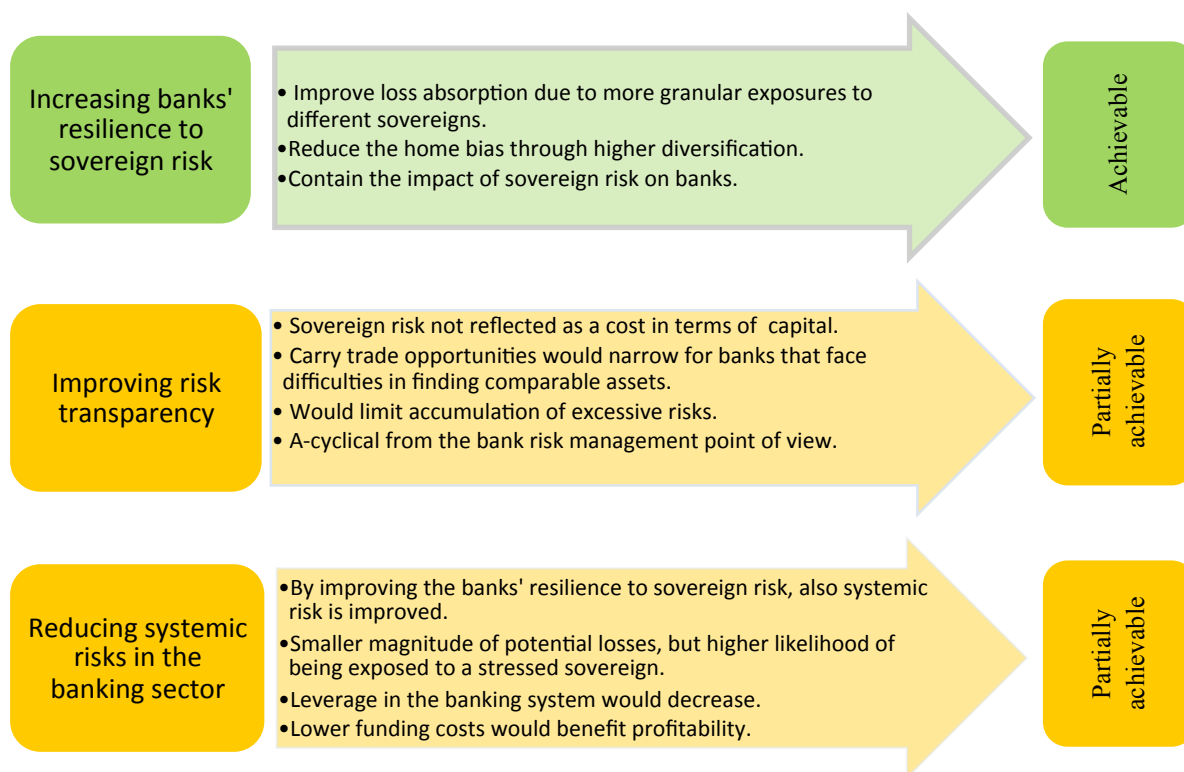
In the short-term, the new regulation would most likely be neutral for banks in countries with mid-range ratings, since their profitability would not change considerably. However, it would be clearly negative for banks in countries with large amounts of outstanding government debt (in nominal terms) since some of them would not be able to substitute their excess government bond holdings. Whatever these banks' adaptation choice will be, their average funding costs will increase during the transition phase since their funding structure becomes more tilted toward equity (decrease in leverage) or their business model becomes more risky.

Fulfillment of Objectives in the Steady State

In the steady state, the banks' less risky (more diversified) profile would probably result in lower funding costs, which would strengthen the banking system as a whole. This could contribute to the recovery of lending to the private sector. Overall, such a regulatory change would result in higher geographic diversification of sovereign debt but would not result in any winner on the individual bank level. Moreover, imposing limits on sovereign bond exposure is an appropriate tool to remove the distortions incentivizing the home bias and to mitigate risks stemming from highly concentrated bond portfolios but it is unable to make the actual risk of sovereigns reflected in the cost of capital.

In Section 2 we set out the expected objectives of the new regulatory proposals. Table 3-8 summarizes these goals and evaluates whether the limits on sovereign exposures would help reaching them.

Table 3-8: Objectives of the proposed regulatory changes and their fulfillment by introducing sovereign exposure limits in the steady state



Source: authors' compilation

3.5.2 Impact on Sovereign Debt Markets

Similar to the non-zero risk weight option, the new regulation could give negative incentives for banks to act as primary dealers and market-makers and could thus reduce market liquidity and increase the liquidity premium of government bonds. However, the impact of the exposure limit on sovereign debt markets could be eased if new actors entered into the primary market. Pension funds, insurance companies as well as other non-bank financial intermediaries (the shadow banking sector) could take over this role from the banking sector. This, however, could be problematic from two aspects. First, finding a new investor base could prove to be challenging for the sovereigns. Second, new investors entering the primary market would change market parameters, as these entities have different investment strategies. For example, increasing the participation of the shadow banking sector would most likely result in higher volatility, which to some extent could be offset by long-term investors, such as pension funds and insurance companies. Market liquidity would also be damaged if the excess sovereign bond supply is taken over by the private sector (such as households and corporates), as these actors tend to hold their

government portfolio until maturity. On the contrary, increasing participation of foreign investors could have the opposite effect, but it could also lead to higher volatility. The overall impact on sovereign bond markets would thus depend on the composition of new entrants and the dominant investment strategy.

3.5.3 Impact on Sovereigns

Similar to the consequences of the non-zero risk weights, limits on sovereign exposures could have multiple impacts on the sovereign in the transition period, depending on the adjustment of the banking sector. First, the effect of regulation would be very different for countries that have peers in terms of rating and size of their government bond markets, compared to those that have larger outstanding sovereign debt in absolute terms. Imposing limits on sovereign bond exposures would mean that banks need to further diversify their bond portfolios. Substituting the excess government bonds with similar assets would be particularly difficult for banks in countries with large absolute outstanding government debt (e.g. Germany and Italy) simply because other EU banks cannot fully absorb the excess supply of government bonds. As a result, these countries could face difficulties in finding new investors for their government bond portfolio. Our scenario analysis shows that due to the EU banks' limited absorption capacity, there would be an excess supply of more than €200 billion of German bonds, which corresponds to 10 percent of the outstanding German government debt (Table 3-9). This could lead to decreasing bond prices and increasing yields, however, given German bonds' safe-haven status, it might not materialise in this particular case. Generally, the new regulation could lead to a price convergence between countries with high outstanding debt and those that have relatively smaller government bond markets (in absolute terms).

Table 3-9: Effect of sovereign exposure limit on the sovereign bond markets

Sovereign	General Government Gross Debt (EUR bn)	Rebalancing need as a % of General Government Gross Debt	Excess supply in bond markets (EUR bn)	Remaining bonds in the market
Germany	2,179.81	12.54%	224.16	10.28%
Netherlands	426.15	7.99%		
Luxembourg	9.61	19.87%		
UK	1,740.78	2.60%		
Austria	258.53	5.54%		
France	1,869.16	4.73%		
Belgium	403.17	6.13%		
Ireland	210.24	4.84%		
Malta	4.87	12.66%		
Italy	1,988.90	8.92%	34.19	1.72%
Spain	890.98	13.68%		
Portugal	211.78	8.08%	6.39	3.02%
Greece	304.71	3.48%	10.61	3.48%
Sum	10,498.69	7.81%	275.35	2.62%

Note: Excess demand from banks in Table 3-6 is not equal to the excess supply of bonds since EA banks also have large exposures to non-EA countries that were not included in the EBA exercise, hence they were not part of the impact analysis.

Source: SnL, EBA transparency exercise 2013.

Second, the limited ability for diversification requires adjustment on the liability side, i.e. increasing the proportion of equity in the funding structure. Depending on the magnitude, this could create a burden for sovereigns in the case of state-owned banks.

In the steady state, the banking system's ability to hold government bonds becomes limited, hence its excess government bond portfolio has to be taken over by other sectors. They could be either i) the domestic private sector (households or corporates); ii) foreign investors; and in longer-run, sovereigns could eventually decrease their outstanding debt. In the first two cases (both in short- and long-run), the level of crowding-out (private investments already crowded out by borrowing of the government) would not change, since only the ownership of the outstanding debt changes. In the last case, however, it would decline as governments reduce their budget deficits and release private savings. This argument, however, only holds when there is no price fragmentation within the investor base. ARSLANALP et al. (2014) showed that prices could indeed be different depending on the investor, which could have an effect on bank balance sheets and income statements once they are forced to sell these assets. More specifically, it is very likely that households or corporates do not attach any value to a government bond related to its eligibility for central bank operations. This would be reflected in the purchase price, resulting in a

loss for the bank and an increase in the bond yield. Higher government bond yields lead to higher lending rates, which ultimately results in an increasing crowding-out effect.

Furthermore, more debt held by foreign investors could increase the country's vulnerability. Foreign investors monitor closely whether a country's foreign debt is sustainable. If global concerns arise and there are uncertainties about the short-term sustainability of a country's foreign debt,⁶² it could lead to fire sales of domestic assets. This would result in increasing yields, decreasing prices, and also increasing roll-over risks.

Based on our scenario analysis, it seems that in Germany 80 percent of banks' excess sovereign bonds should be taken over by other sectors. If other sectors take over the same proportion of the excess supply as their current share, debt held by foreign investors would increase to 73 percent from 62 percent, while debt held by the domestic private sector would change from 14 percent to 19 percent (Figure 3-9).

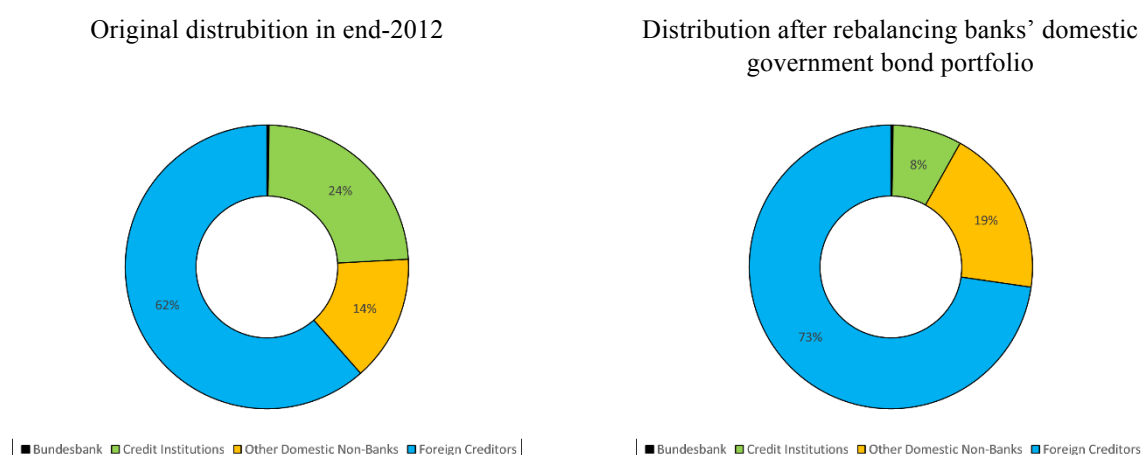


Figure 3-9: Holders of German government debt in end-2012 (left-hand panel) and after rebalancing banks' government bond portfolio (right-hand panel)
Source: Bundesbank, ESM staff calculations.

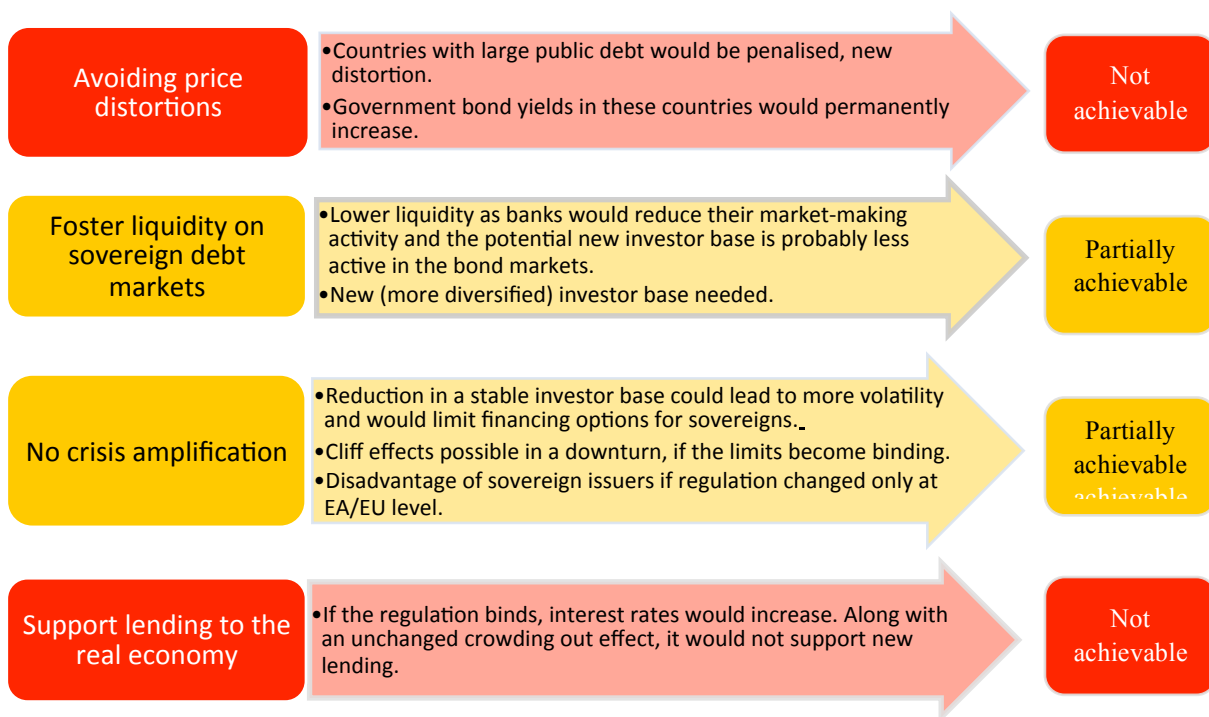
Fulfillment of Desired Outcomes in the Steady State

As we noted in the previous chapter, vulnerability and sovereign bond yields could increase in countries with high outstanding public debt and - to a lower extent - in stressed countries in the short-term. However, higher vulnerability and higher sovereign bond yields could be mitigated in the longer-run if the sovereign is willing to undertake fiscal adjustments. If not, high vulnerability and high yields could stabilise at their short-term levels.

⁶² For example, if the Guidotti-Greenspan ratio which measures the ratio of short-term external debt to FX reserves, goes below 100 percent.

In Section 2 we set out our desired outcomes of the new regulatory proposals. Table 3-10 summarizes these outcomes and evaluates whether the limits on sovereign exposures would help reaching them.

Table 3-10: Desired outcomes for the sovereigns and their fulfillment by introducing sovereign exposure limits in the steady state



Source: authors' compilation

3.6 Transition to a New Regime

The state of current sovereign holdings reflects the incentives that are currently in place in the markets, for banks and for sovereigns. In order to avoid a costly structural break, any adjustment of regulation in this domain would thus require some kind of transition arrangement.

For the large exposure limit, grandfathering seems the most promising transition arrangement. Such a procedure would imply that the limit would only apply to new acquisitions of sovereign bonds. A large supply shock to secondary markets (see Table 3-9) would be avoided. At the same time banks would likely reduce their demand at primary auctions for some time. Sovereign debt management offices could also gradually re-arrange their investor base as maturities come due over time. Phasing in would be another viable option, decreasing the limit over a number of years.

Regarding the introduction of risk weights, the options are more complicated and also depend on the type of reform one would envisage. Moving from a regime of total exemption to, say, the actual StA appears to be the simplest step as risk weights are public and the computation is comparably simple (see Table 3-2). Furthermore, abstracting from changes in the rating that change the credit quality step, the risk weights would remain comparably stable. In such a case, one could apply a transition phase where the applicable risk weight would be adjusted over the course of multiple years with intermittent steps that slowly converge to the new risk weight. Such a transition phase would avoid abrupt changes and was applied for the introduction of the new CET1 ratio from Basel 2.5 to Basel 3 and for the introduction of the LCR, for example. For IRB risk weights, the transition may turn out more complicated as they themselves may be subject to more frequent change. Also, as they are generated by intransparent internal risk models, control may be more difficult. Nevertheless, again a gradual transition would be advisable.

Transition arrangements can only facilitate regulatory changes but cannot force banks to behave in a certain way. It may happen, for example, that stronger banks would be willing to take some losses in order to improve the perception that markets have of their riskiness. They could preempt regulation by frontloading the sale of excess sovereign debt. Banks could also lower their demand for new issues even before the regulation is in effect. Front-loading could for example be observed in the past, when capital requirements were increased. This could ultimately lead to a stigmatization of banks that continue to hold on to large stocks of (riskier) sovereign debt.

The crucial element in the transition to the new regime are the price elasticities that are difficult to estimate, leaving the impact on sovereign bond prices difficult to predict. HTM portfolios, which are valued at book value, could be absorbers for the price effects. Given that a significant part of banks' sovereign exposures is ready to be sold immediately and banks' willingness to catch up quickly to the new requirements (supported by past experiences), a fast sell-off of sovereign bonds and the inherent price effects could be significant.

The quantitative easing policy of the ECB would provide a favorable backdrop to easing the transition towards lower sovereign holdings of banks. As described above, any serious reform of the regulatory treatment of sovereign exposures would affect the market balance of supply and demand of these assets. Hence, the current environment in which the ECB buys sovereign paper could be favorable to ensuring a smooth transition.

Lastly, the leverage ratio that was introduced under Basel III also mitigates the effects of the transition. Under the current regime, banks do not have to hold any capital for sovereign exposures according to the regular capital adequacy ratio. However, the leverage ratio assures that on average they hold capital to at least the amount of 3% of their balance sheet. This means that for banks that hold large sovereign exposures, the leverage ratio becomes the binding capital requirement. For illustration of this point, consider that in the extreme, a bank that only holds sovereign bonds currently would not have to hold any capital under the capital adequacy ratio requirement. However, the leverage ratio would still be binding for this bank and hence it would not start from zero when it would apply a new regulation to sovereign exposures.

3.7 Impacts on Central and Eastern European countries

For EU countries outside the euro area the impact of changing the regulatory treatment of sovereign exposures can proportionally be even larger than within the euro area. In most countries of the Central and Eastern Europe (CEE) the share of government exposure in bank assets is larger than in the countries of the euro area. The share of domestic government bonds in total assets is the highest in Romania and Hungary. However, the recent trends reveal differences among countries. While domestic government bonds' share in the balance sheets remained stable in most banking sector, it increased intensively in Hungary due to the “self-financing” intention of the central bank (Figure 3-10).

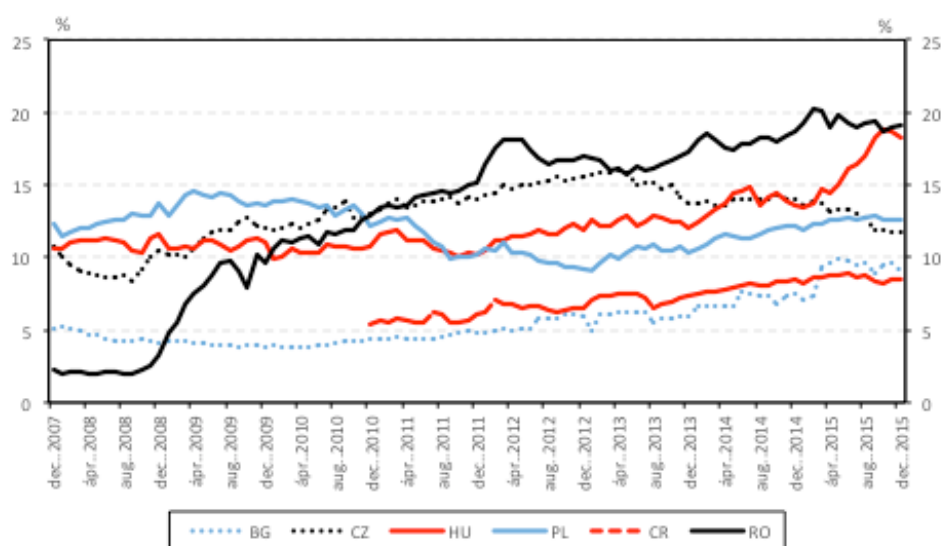


Figure 3-10: Banks' domestic government bond holdings in CEE countries in proportion to total assets

Source: ECB.

Figure 3-11 reveals that the introduction of a limit on sovereign exposures at the level of 25 per cent of own funds would be strongly binding in Poland, the Czech Republic, Hungary and Romania. The effect would be less severe in Bulgaria and Croatia. The overall rebalancing need amounts to about EUR 120bn according to the ECB data. Comparing the rebalancing need to the size of the government bond markets, however, shows that the impact is much larger outside than inside the euro area. In many CEE countries the rebalancing need amounts to 15 to 30 per cent of the outstanding government debt. In proportional terms, the most affected country is Bulgaria, the Czech Republic, where almost 30 per cent of the outstanding government securities would need to be placed on the market in case of the introduction of a large exposure limit. As a consequence, the likely impact of a large exposure limit on local debt markets would be disruptive.

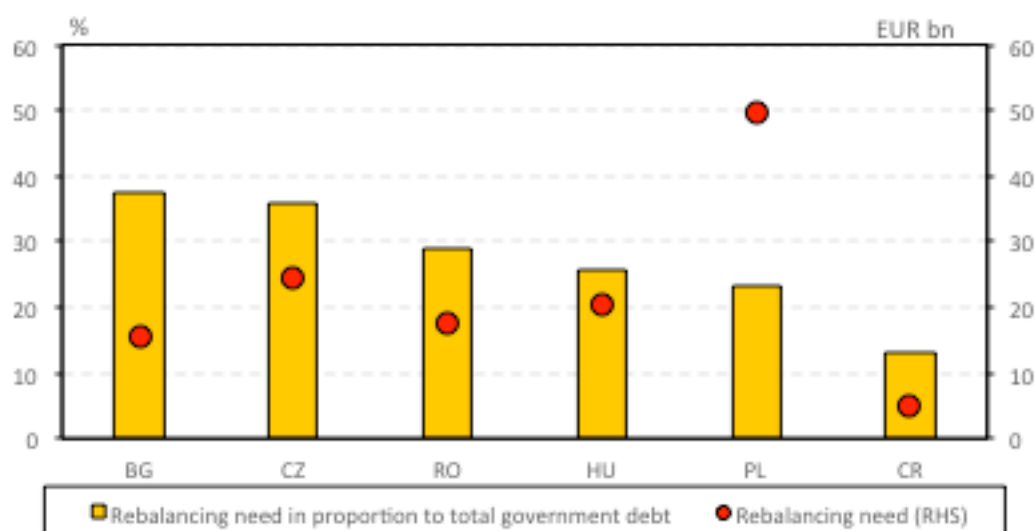


Figure 3-11: CEE banks' rebalancing need based on December 2015 data

Source: ECB.

The introduction of non-zero risk weights would result in the highest adjustment need in the Hungarian banking sector as the country's rating is relatively low, while the banks' domestic government bond portfolio is quite large. Hungarian banks would need either to increase their capital by more than 3 billion euros or sell more than 20 billion euro government bonds (**Table 3-11**). Such a capital increase is equivalent to 3% of the GDP. The impact would be less pronounced in the other CEE countries.

Table 3-11: Effect of sovereign exposure limit on the sovereign bond markets

	Capital increase	Bond selling
Bulgaria	0.9	3.0
Czech republic	0.5	3.2
Romania	1.7	8.8
Hungary	3.5	20.5
Poland	1.6	9.9
Croatia	0.9	4.9
Total	9.1	50.4

Source: ECB.

Overall, replacing the government bond portfolio would result in additional risk taking for these countries, as they would need to invest in bonds denominated in foreign currency. This would raise further questions, such as central bank eligibility of FX denominated government bonds. Currently, the central banks of these countries provide liquidity backstop where typically government bonds can be used as collaterals. Should the regulatory change force banks to change denomination of their liquidity buffers, it would no longer be obvious that the central banks are able to provide emergency liquidity facilities, hence meeting the minimum liquidity requirements could also be difficult. Even if central banks solve this issue by establishing swap line agreements with other countries, the overall macroeconomic impacts could be significantly larger for countries outside the euro zone.

3.8 Conclusions

An adjustment in the treatment of sovereign exposures provides an avenue to improve stability but considering the complexity of the issue, a successful implementation of any measure would imply overcoming important risks and would thus require a thoughtful and balanced process.

As we have shown in the discussion above, the treatment of sovereign exposures in bank balance sheets affects two important sectors of the economy. Hence, while one could argue that this is purely an issue of bank risk management, this would be myopic as it ignores important effects on the sovereign and the economy as a whole, which in turn could feed back into the banking sector, at least in the short term. This fact puts increased emphasis on the transition arrangements and on the details of the regulatory treatment of sovereign exposures. Moreover, long-run implications,

like pro-cyclicality of risk-weights and cliff-effects in the case of large exposure limits should receive adequate recognition.

With either of the two basic options for addressing sovereign risk in place, the impact of a potential crisis could be reduced due to higher ability of banks for loss absorption, more diversified portfolio, better risk transparency and reduced systemic risk. Also, the potential for twin crises – sovereign and banking – would be reduced due to weaker ties between the balance sheets of these two sectors. At the same time, these two proposals for a regulatory change could aggravate future economic crises by limiting the funding options for sovereigns.

As banks would lower their demand for sovereign paper, either for cost reasons or because of hard limits, sovereigns would need to find new investors. Finding and dealing with a new investor base could prove to be very difficult, in particular for more stressed sovereigns and countries with small and illiquid sovereign debt markets. Additionally, new regulation would in practice have a large effect on the absorption capacity of the local investors, which are very important as an investor base, as they tend to be more reliable and give cues also for foreign investors. Sovereigns would have to adjust to the new market, potentially having to deal with more volatility, currency risks or new requirements regarding sustainability.

Since banks' ability to accommodate temporary large swings in financing needs of the sovereigns would be constrained, this could call for an improved fiscal framework at the European level. A credible backstop should be in place to signal to investors that sovereigns have access to sufficient funds in case of need and ward off any short-term market fluctuations.

The effect of the new regulations on sovereigns depends on the modality and timing of the introduction. A gradual increase in the risk weights and a relatively long period of time for the phasing-in could alleviate the pressure on sovereign debt markets and help avoid strained fiscal adjustments. This way, both the banking sector and the sovereigns would have time for adjustment, which could significantly lower the macroeconomic costs of the new regulations. Nevertheless, judged by recent experience with banks' adjustments in response to regulatory changes, the possibility of the new regulation being frontloaded is high. The amount of frontloading would depend on the price elasticities of sovereign paper and the share of sovereign exposure that the banks are able to value at book value.

There are further important issues that could affect the overall impact of the new regulation. For instance, the geographical scope of regulation should be clarified. EU banks operating outside the

euro area would face additional costs and liquidity risks stemming from hedging exchange rate risks, as they would need to substitute their sovereign exposures denominated in domestic currency. Moreover, decreasing domestic demand for government bonds could incentivize non-EA sovereigns to issue foreign currency denominated bonds, which increases these countries' vulnerabilities. For these countries, an additional cost-benefit analysis should be carried out.

In addition, a precise definition of sovereign exposure is also indispensable, as it could significantly impact the adjustment needs. Regulation should be designed to address sources of credit or concentration risks. For instance, exposures to the central bank do not bear either credit or concentration risk, while constraining them could limit the effectiveness of monetary policy.

Finally, the lack of reciprocity at international level could result in a comparative disadvantage for banks under the new regulation and could motivate them to exploit regulatory arbitrage by changing their country of incorporation or by changing the legal status of subsidiaries to branches. Therefore, a coordinated approach would be more beneficial.

Summary

In the dissertation, we analyzed the potential impact of selected regulatory responses to the GFC in two geographical regions. First, we estimated the effect of changes in capital adequacy regulations on the Hungarian banking sector. Specifically, we aimed to show whether the pre-GFC introduction of a countercyclical capital buffer as per the Basel III rules could have helped decelerate FX lending growth in Hungary. Since the relationship between regulatory capital and lending growth is ambiguous, we estimated two VAR models. The unconstrained version aimed to provide the upper bound for the effect of macroprudential tightening on the real economy, as it does not require the increase in capital requirement to be a supply shock. At the same time, the SVAR model serves as the lower bound since sign restrictions on lending and alternative funding growth ensure that the increase in capital requirement is considered a supply shock. Based on our analysis, we made the following conclusions:

Thesis 1. Keeping the capital adequacy ratio requirement at its 2005 Q1 level, would have resulted in a moderate decline in cumulative real lending growth.

Both our Vector Autoregression (VAR) and Structural Vector Autoregression (SVAR) estimations suggest that an increase of 13 basis points in aggregate capital adequacy ratio, i.e. keeping the ratio at its 2005 Q1 level, is associated with a decline of 0-14 percentage points in cumulative real lending growth compared to actual growth after 10 quarters. Given that actual cumulative growth was 100 per cent between 2004Q1 and 2007Q3, our estimation results thus indicate only a modest slowdown to 86 per cent.

Thesis 2. The modest impact of a change in capital requirement on lending suggests that regulatory authorities could not have avoided the upswing in FX lending by requiring countercyclical capital buffers even if such a tool had been available and they had reacted quickly to accelerating credit growth.

Our estimation results suggest that authorities could only have slowed the increase in lending temporarily, it would have regained its momentum after 4 quarters. The results support the post-crisis conventional wisdom about the inadequacy of pre-crisis regulatory frameworks. Therefore, it points toward providing the authorities responsible for financial stability with more power and flexibility so that they can identify systemic risks and respond to them quickly and more efficiently.

Thesis 3. A more pronounced tightening might have eliminated FX lending, but at the expense of real GDP growth.

Macroeconomic fundamentals were fragile when FX lending started, with the significant fiscal vulnerabilities requiring the central bank to keep the policy rate at elevated levels. Due to the high differential between HUF and FX interest rates and households' low risk awareness regarding exchange-rate volatility, FX lending became very popular and contributed significantly to real GDP growth in the pre-crisis period. The bottom line is that an unsustainable fiscal policy led to a trade-off between economic growth and the build-up of new vulnerabilities in the form of FX lending.

Thesis 4. Both introducing positive risk weights and limits on sovereign exposures could reduce the impact of a potential crisis due to higher ability of banks for loss absorption, more diversified portfolio, better risk transparency and reduced systemic risk.

In our dissertation, we analyzed the two widely discussed basic options to address this regulatory gap: applying non-zero risk weights to sovereign exposures, and putting limits on exposures to sovereigns, akin to those in place for other exposures. Although this paper analyses each option in isolation, the two complement one another as they target different facets of risk. Positive risk weights address counterparty credit risk, whereas large exposure limits address concentration risk.

Both policy options would, according to our analysis, lead to improved bank risk management and render banks more resilient. They would equip them to better absorb losses: positive risk weights would require higher capital buffers and exposure limits would lead to greater diversification. Positive risk weights would also improve risk transparency and correct distorted incentives for investing in sovereign bonds. At the systemic level, leverage would decrease and losses in the event of default would be more spread out. On the downside, both regulatory proposals would lower bank profitability in the short run. In the longer run, positive risk-weights could permanently reduce bank profits by increasing their funding costs, while exposure limits would lead to a more diversified portfolio and lower funding costs.

Moreover, they could also lower the potential for twin crises – sovereign and banking – due to weaker ties between the balance sheets of these two sectors. At the same time, they could aggravate future economic crises by limiting the funding options for sovereigns.

Thesis 5. Since banks' ability to accommodate temporary large swings in financing needs of the sovereigns would be constrained by either of the two policy options, this could call for an improved fiscal framework at the European level.

A credible backstop should be in place to signal to investors that sovereigns have access to sufficient funds in case of need and ward off any short-term market fluctuations.

The effect of the new regulations on sovereigns depends on the modality and timing of the introduction. A gradual increase in the risk weights and a relatively long phasing-in period could alleviate the pressure on sovereign debt markets and help avoid strained fiscal adjustments, thereby lowering the macroeconomic costs of the new regulations. Nevertheless, based on recent experience with banks' adjustments in response to regulatory changes, the possibility of the new regulation being frontloaded is high. The extent of frontloading would depend on the price elasticity of sovereign debt and the share of sovereign exposure that the banks are able to value at book value.

Thesis 6. As banks would lower their demand for sovereign debt, sovereigns would need to find new investors that could prove difficult for some countries.

The benefits in terms of increased resilience in the banking sector would come at a cost for some sovereigns. Sovereign bond holdings would become more costly in terms of capital if positive risk weights were applied or the exposures were capped by a hard limit. In both cases, banks would try to deal with excess sovereign bonds on their balance sheets by injecting fresh capital or reducing their portfolio of sovereign bonds. An increased supply of sovereign paper, or a lack of demand for new issues, would raise funding costs for the sovereign and consequently for the whole economy. Furthermore, both policy options would lower liquidity in the sovereign debt markets, as they add to the cost and hinder the ability of banks to provide market-making services. Exposure limits in particular would have significant repercussions on markets in the short run, as banks traditionally have large exposures to domestic sovereigns that they would have to shed. Other market participants would need to absorb this additional supply. Sovereigns would need to re-arrange their financing sources, which could prove challenging. As the demand of local investors for sovereign debt tends to be more reliable and stable, sovereigns would have to adjust to the new market, potentially having to deal with more volatility, currency risk or new requirements regarding sustainability.

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Annex 1.

Error! Reference source not found.Macprudential policy instruments available to the MNB

Macprudential policy instruments harmonized across the EU	
Instrument	Indicators considered
Containing the risks of excessive credit growth and leverage	
Countercyclical capital buffer Effective as of 1 January 2016	- Indicators: departure of credit-to-GDP ratio from its long-term trend, Cyclical Systemic Risk Map, system- wide financial stress indicator (SWFSI) - Expert opinion: level of over-heatedness, potential contagion risks, country-specific factors
Definition of the risk weight of exposures secured by real estate collateral and minimum loss given default (LGD) requirement for exposures vis-à-vis households secured by real estate collateral	- Indicators: Cyclical Systemic Risk Map, level of utilization of debt cap limits - Expert opinion: level of over-heatedness, region- specific circumstances, relevance of international comparison
Limiting the impact of misaligned incentives and exposure concentrations	
Identification of other systemically important institutions and the applicable additional capital requirement Effective as of 1 January 2017	- Indicators: scores and limits defined in accordance with the methodology developed by the MNB - Expert opinion: necessity and expected effects of the introduction of the capital buffer requirement, time requirement of the preparation for introduction
Systemic risk buffer Effective as of 1 January 2017	- Indicators: Macprudential indicators (details included in the Report on Financial Stability) - Expert opinion: exploration of systemic risks unmanageable efficiently with any other tool, measurement of the contribution of individual institutions, definition of proportionate capital buffers
Addressing excessive maturity mismatches and liquidity risks	
Short-term and long-term liquidity requirements Effective as of 1 October 2015	- Indicators: Cyclical Systemic Risk Map, LCR and NSFR data - Expert opinion: intensity of liquidity risks, degree of vulnerability
May be applied in order to achieve any intermediate objective	
In case of a change in the	Indicators: Macprudential indicators,

intensity of systemic risks, tightening of the following requirements: • minimum regulatory capital requirements; • large exposure limits; • capital conservation buffer; • liquidity reserves; • net stable funding requirements; • risk weights for residential and commercial real estate exposures	Cyclical Systemic Risk Map • Expert opinion: country-specific factors, changes in the intensity and real economy effects of systemic risks, selection of instruments most suitable for managing the effects
--	--

Instruments applicable under national competence	
Instrument	Indicators considered
Containing the risks of excessive credit growth and leverage	
Debt cap rules Effective as of 1 January 2015	• Indicators: Cyclical Systemic Risk Map, level of utilization of debt cap limits • Expert opinion: lending developments, build-up of potential risks • Market experience: consultation with market participants and the supervisory area
Addressing excessive maturity or currency mismatches and liquidity risks	
Regulation of maturity mismatches between assets and liabilities Effective as of 1 October 2016	• Indicators: Macroprudential indicators, Mortgage Funding Adequacy Ratio (MFAR) requirement, Foreign Exchange Funding Adequacy Ratio (FFAR) requirement, Loan-to-Deposit (LTD) ratio • Expert opinion: maturity mismatch developments in the financial intermediary system, build-up of potential risks • Market experience: consultation with market participants and the supervisory area
Regulation of currency mismatches between assets and liabilities Effective as of 1 January 2016	• Indicators: Macroprudential indicators, Foreign Exchange Coverage Ratio (FECR) requirement, FFAR requirement • Expert opinion: on-balance sheet currency mismatch developments in the financial intermediary system, build-up of potential risks • Market experience: consultation with

	market participants and the supervisory area
Prescription of short-term liquidity coverage requirement for the minimum level of liquidity	• Indicators: Macroprudential indicators, LCR, stress tests • Expert opinion: short-term liquidity developments in the financial intermediary system, level of vulnerability, build-up of potential risks • Market experience: consultation with market participants and the supervisory area
Strengthening the adaptiveness of financial infrastructures	
Management of risks associated with non- banking institutions, Strengthening the resilience of institutions serving the financial infrastructure, Compensation policies	• Indicators: Cyclical Systemic Risk Map, Payment Systems Report • Expert opinion: continuous monitoring of systemic risks arising from the activity of non-banking institutions • Market experience: communication with other relevant policy areas • If the macroprudential mandate fails to offer adequate options for risk management, the MNB turns to the government with a proposal for legislation
May be applied in order to achieve any intermediate objective	
Restriction or prohibition of the performance of certain activities for maximum 90 days	• Indicator: SWFSI, macroprudential indicators • Expert opinion: riskiness of activity, ineffectiveness of other instruments in risk management, inevitable restrictions of the freedom to contract • Market experience: ascertaining the existence of a substantial infringement of interests or the reduction of the transparency of the financial intermediary system in the absence of the restriction or prohibition

Source: MNB (2016).

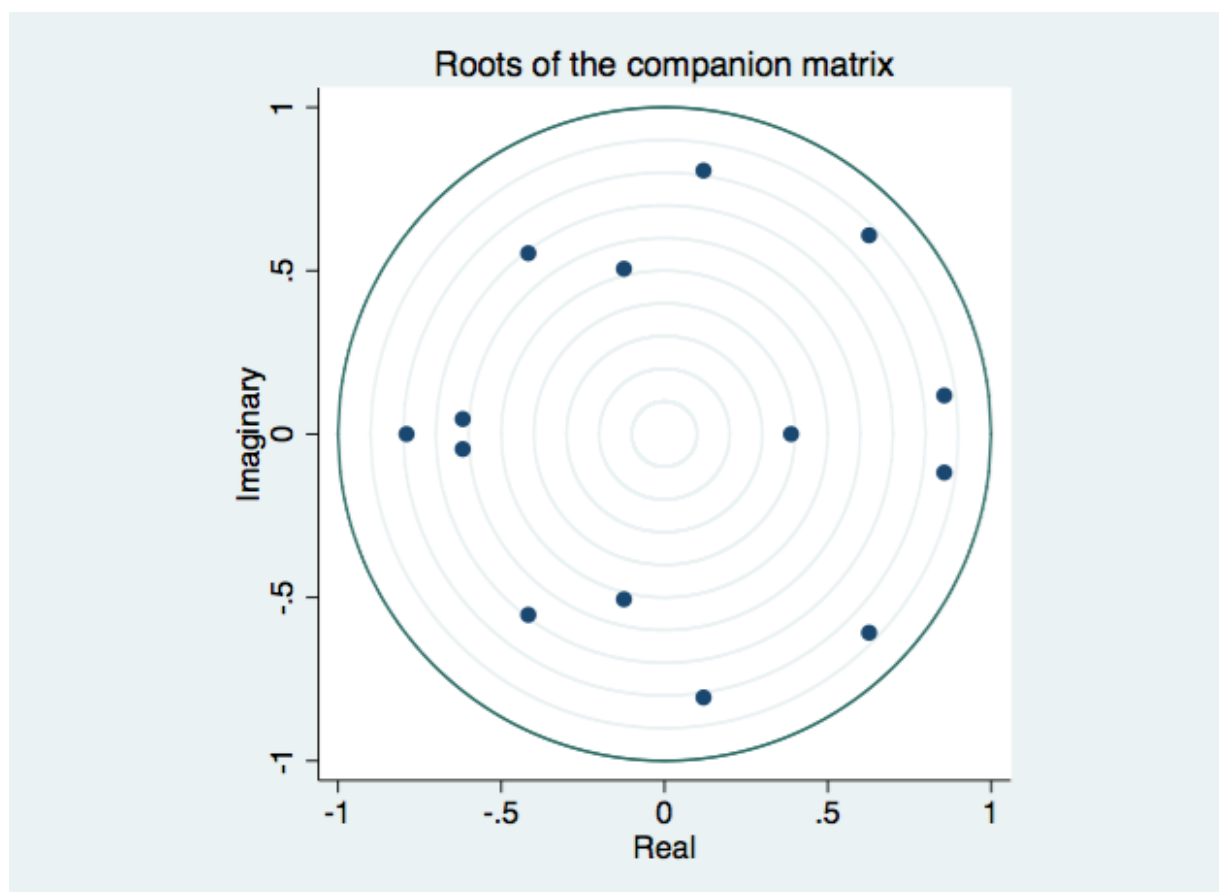
Annex 2.

Estimation and post-estimation results of the primitive for of VAR

VAR equations – 2 lags

	Parms	RMSE	R-sq	chi2	P>chi2
realgdsa	15	0.0145	0.6380	42.2892	0.0001
reallesa	15	0.0425	0.6744	49.7086	0.0000
cdsspreadchange	15	0.5374	0.6829	51.6769	0.0000
alternativfundingsourcesgrowth	15	0.0342	0.6436	43.3314	0.0001
realbubor3month	15	2.5031	0.6356	41.8570	0.0001
reer	15	2.8745	0.8354	121.7992	0.0000
cadratiochange	15	0.6606	0.6356	41.8586	0.0001

VAR stability – 2 lags



Autocorrelation in the residuals:

Lagrange-multiplier test			
lag	chi2	df	Prob>chi2
1	37.1724	49	0.89221
2	83.3909	49	0.00158
H0: no autocorrelation at lag order			