



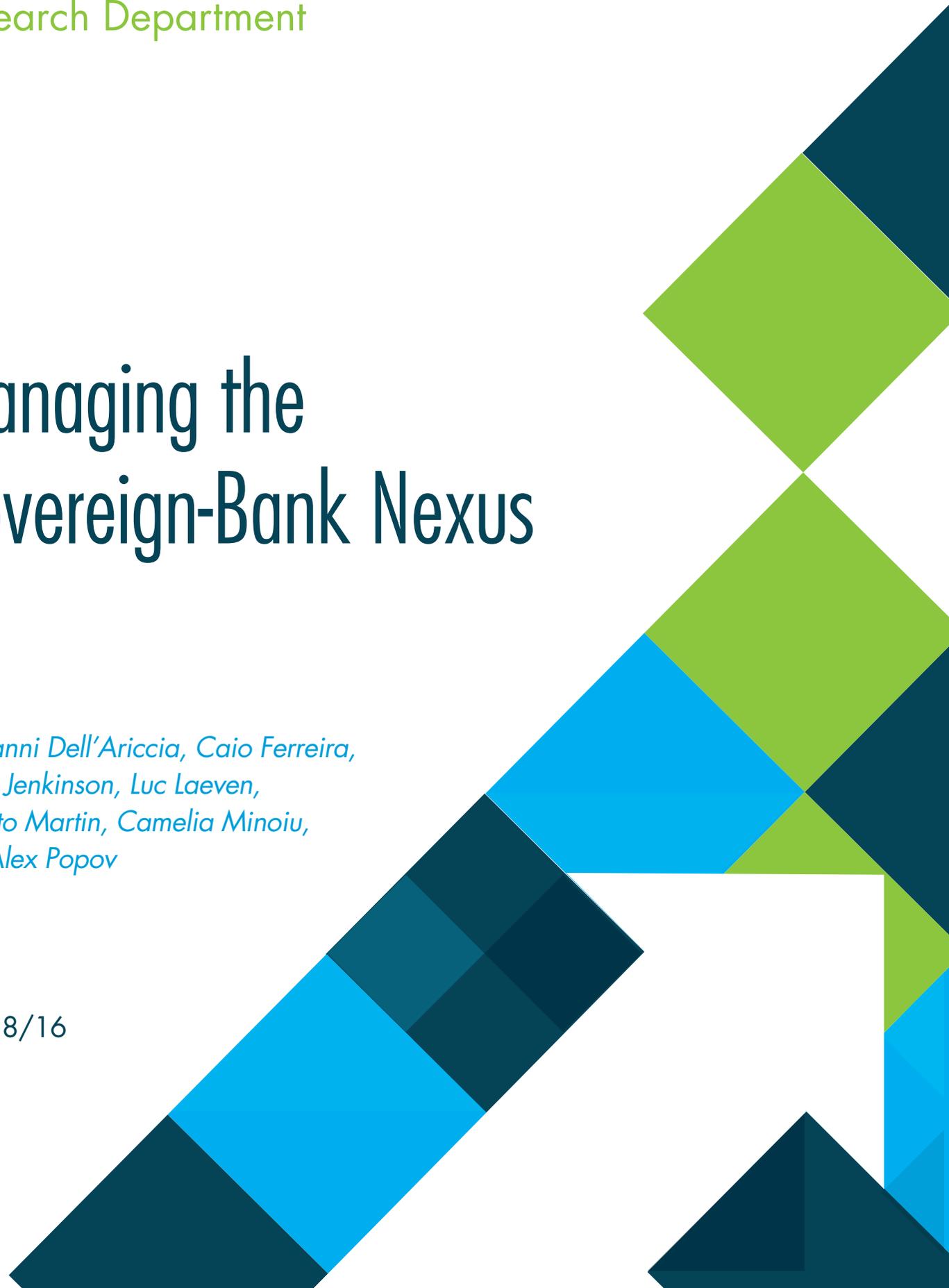
INTERNATIONAL MONETARY FUND

Monetary and Capital Markets Department  
Research Department

# Managing the Sovereign-Bank Nexus

*Giovanni Dell’Ariccia, Caio Ferreira,  
Nigel Jenkinson, Luc Laeven,  
Alberto Martin, Camelia Minoiu,  
and Alex Popov*

No. 18/16



Monetary and Capital Markets Department  
Research Department

# Managing the Sovereign-Bank Nexus

Giovanni Dell’Ariccia, Caio Ferreira, Nigel Jenkinson,  
Luc Laeven, Alberto Martin, Camelia Minoiu, and Alex Popov

Copyright ©2018 International Monetary Fund

**Cataloging-in-Publication Data**

Joint Bank-Fund Library

Names: Dell’Ariccia, Giovanni. | Ferreira, Caio. | Jenkinson, Nigel. | Laeven, Luc. | Martin, Alberto, 1974- | Minoiu, Camelia, 1977- | Popov, Alex. | International Monetary Fund.  
Title: Managing the sovereign-bank nexus / Giovanni Dell’Ariccia, Caio Ferreira, Nigel Jenkinson, Luc Laeven, Alberto Martin, Camelia Minoiu, Alex Popov.  
Description: Washington, DC : International Monetary Fund, [2018] || Includes bibliographical references.  
Identifiers: ISBN 9781484359624 (paper)  
Subjects: LCSH: Banks and banking--State supervision. | Debts, Public.  
Classification: LCC HG1725.D44 2018

This Departmental Paper has been authored by Giovanni Dell’Ariccia, Caio Ferreira, Nigel Jenkinson, and Camelia Minoiu of the International Monetary Fund and Luc Laeven, Alberto Martin, and Alex Popov, currently of the European Central Bank.

Publication orders may be placed online, by fax, or through the mail:  
International Monetary Fund, Publication Services  
P.O. Box 92780, Washington, DC 20090, U.S.A.  
Tel. (202) 623-7430 Fax: (202) 623-7201  
E-mail: [publications@imf.org](mailto:publications@imf.org)  
[www.imfbookstore.org](http://www.imfbookstore.org)

[www.elibrary.imf.org](http://www.elibrary.imf.org)

# Contents

Executive Summary .....	v
1. Introduction .....	1
2. The Underpinnings of the Sovereign-Bank Nexus .....	5
3. The Sovereign Exposure Channel .....	7
Why Do Banks Hold Government Debt? .....	7
How Much Public Debt Do Banks Hold?.....	9
How Does Sovereign Exposure Vary over Time and across Countries? .....	10
The Effects of Bank Bond Holdings during Sovereign Distress .....	16
Bank Distress and Sovereign Bond Markets .....	18
4. The Safety Net Channel.....	19
The Effect of a Weaker Safety Net on Bank Stability .....	20
The Fiscal Cost of the Safety Net .....	22
5. The Macroeconomic Channel.....	27
Sovereign Crises and Macro Performance .....	27
The Costs of Banking Crises .....	28
6. Discussion and Policy Implications.....	31
Discussion.....	31
Policy Implications .....	33
References .....	41

## Box

1. Regulatory Treatment of Sovereign Exposure.....	39
--	----

## Figures

1. Banks' Government Debt Exposures around Sovereign Crises.....	13
2. Sovereign Exposures of Euro Area Banks .....	14
3. Deposit Rates and Sovereign CDS Spreads.....	21
4. The Fiscal Cost of Systemic Banking Crises.....	25

## Tables

1. Banking Crises and Sovereign Distress.....	2
2. Bank Holdings of Government Bonds by Country Income Level .....	10

3. Determinants of Banks' Governemtn Debt Holdings .....	11
4. Euro Area Bank Holdings of Government Bonds.....	13
5. Change in Bank's Exposure to Government Debt: Moral Suasion versus Risk Shifting.....	15
6. Bank Capital Losses Associated with Sovereign Debt Restructuring Events.....	17
7. Banks' Exposure to Government Debt and Stock/CDS Market Performance.....	17
8. Bank Deposit Rates, Bank Risk, and Sovereign Risk .....	21
9. Bank Stock Returns and Safety Net.....	23
10. Outcomes of Systemic Banking Crises.....	25

## Executive Summary

The financial health of banks and sovereigns is intertwined in a “sovereign-bank nexus” that may multiply and accelerate vulnerabilities in each sector, and lead to adverse feedback loops. Increasing resilience requires reducing the likelihood of severe stress in each sector, as well as lowering the potency of the nexus. However, designing effective reforms requires a clear understanding of the interaction between and the magnitude of the different channels that give rise to the nexus. This paper identifies these channels, assesses their empirical relevance, and discusses the policy implications of these findings.

The main conclusions from the analysis in this paper are the following:

First, banks and sovereigns are linked by multiple interacting channels: (1) the sovereign-exposure channel (banks hold large amounts of sovereign debt), (2) the safety net channel (banks are protected by government guarantees), and (3) the macroeconomic channel (the health of banks and governments affect and is affected by economic activity). Evidence suggests that all three channels are relevant.

Second, policies aimed at weakening the nexus should be designed from a holistic point of view. Measures targeting one channel may have undesired consequences for others (and thus could be counterproductive). In a related vein, because of the systemic nature of banks and sovereigns, the nexus can be weakened but not completely severed. Policies should be designed acknowledging this constraint.

Third, stronger balance sheets and governance of banks and sovereigns may not sever the nexus, but they will reduce its relevance. Larger fiscal buffers and better management of public debt improve debt sustainability and reduce the risk of sovereign-related bank distress. Larger capital buffers and better

prudential frameworks strengthen banks and reduce the risk of bank-induced sovereign distress.

Fourth, policies that discourage banks from holding excessive amounts of sovereign bonds, such as positive risk weights or limits on exposures, can improve financial stability and market efficiency. But they should be designed to minimize their procyclical effects. Further, banks hold some sovereign bonds as a natural feature of the financial system, so calibration should consider the benefits and costs of smaller holdings. Additional disclosure of sovereign holdings would strengthen market discipline.

Fifth, limits on public guarantees and private loss-sharing arrangements for bank resolution may reduce excessive risk taking (*ex ante*) and the direct fiscal cost of bank resolution (*ex post*). Efforts to “end too-big-to-fail” go in the right direction. However, simply limiting government backstops and safety nets could worsen an eventual banking crisis and increase its indirect fiscal and economic costs. Reforms of safety net arrangements should start with a sound resolution framework with broad resolution powers and tools, effective cross-border cooperation, and robust early intervention powers.

Sixth, there is an international dimension to the sovereign-bank nexus. In theory, the nexus would be weakened if banks were fully diversified across countries and had access to a supra-national safety net. However, because the latter is missing, cross-border diversification should not lead to complacency as bank exposures (and thus the strength of the nexus) can change quickly during crises. The lack of effective arrangements for cross-border resolution complicates the matter.

# 1 Introduction

The global financial crisis has brought the relationship between banks and their sovereigns, the sovereign-bank nexus, to the center stage of the economic policy debate.<sup>1</sup> In several countries, banking crises led to sharp increases in public debt, reflecting direct bailouts and emergency fiscal stimuli. In others, fiscal distress and the associated widening in sovereign spreads hit bank balance sheets, which in turn further complicated the fiscal situation. The euro area sovereign debt crisis has provided several examples of such spirals.<sup>2</sup> But the relationship between banking systems and their governments is not limited to currency unions. It is a prevalent feature of modern economies.

Banks and governments are important economic actors and it is not surprising that their health is intertwined. During banking crises, for instance, economic activity suffers and so does the government's fiscal position. During fiscal crises, in turn, governments adopt austerity measures that, at least in the short term, depress economic activity, hurting the banking system via higher default rates and a lower demand for credit. For these and related reasons, banking and sovereign crises tend to occur hand in hand (see Table 1).

To some extent, these links exist between the sovereign and any important sector of the economy. Banks, however, are special: they mobilize savings, provide liquidity for other institutions, screen and finance projects, and act as the conduit for the transmission of monetary policy. And their relationship with the sovereign is strengthened by a complex set of linkages that are

---

<sup>1</sup>The issues raised are particularly important across the broad membership of the Fund, as the nexus has proved particularly potent in cases when the domestic banking system is heavily exposed to sovereign debt and where the debt itself is assessed to be high risk. Banks in lower income and emerging market economies that are not typically represented in standard-setting discussions often hold high levels of domestic sovereign debt.

<sup>2</sup>As *The Economist* put it: "Europe's troubled banks and broke governments are in a dangerous embrace" (*The Economist*, December 17, 2011. <http://www.economist.com/node/21541858>).

**Table 1. Banking Crises and Sovereign Distress**

Type of twin crisis	Conditional probability
Sovereign debt crisis, conditional on banking crisis	51.00%
Banking crisis, conditional on sovereign debt crisis	22.30%

Note: The table depicts the share of crisis-years identified as a banking crisis or sovereign debt crisis, conditional on a banking crisis or sovereign debt crisis occurring, respectively, during 2000–14 for 66 countries. Banking crises are defined as in Laeven and Valencia (2013a). Sovereign debt crises are identified using Laeven and Valencia (2013b), Moody's Default & Recovery database, Standard & Poor's sovereign ratings, and years when a given sovereign's Credit Default Swap spreads exceed the long-term mean.

absent or less relevant for other sectors. First, banks and sovereigns are linked through direct balance sheet exposures (through banks' holdings of sovereign bonds). Second, the banking system operates against the background of safety net arrangements that support financial stability. And since this is generally backstopped by central banks and governments, it creates implicit and explicit government guarantees. Third, banks provide credit to households and firms, and thus financial instability and banking crises can have a large impact on real economic activity, worsening the fiscal accounts (Levine 2005; Kroszner, Laeven, and Klingebiel 2007; Dell'Ariccia, Detragiache, and Rajan 2008). Finally, the banking system is an important channel of transmission for monetary policy (Peek and Rosengren 2014) and its impairment can put an undue burden on fiscal policy.

For all these reasons, powerful feedback effects between banks and sovereigns are likely. In adverse conditions, "doom loops" may emerge: a crisis originating in the banking system (sovereign) will weaken the sovereign (banking system), which in turn will worsen the banking (sovereign) crisis itself (Farhi and Tirole 2014). Put differently, the sovereign-bank nexus acts as a multiplier and accelerant of vulnerabilities in both sectors.<sup>3</sup>

The regulatory framework, including crisis management policies, has a powerful influence on the nexus. In particular, policies that favor sovereign bond holdings, ineffective resolution schemes, and inadequate treatment of systemically important institutions all strengthen the nexus. Recognizing these dangers, in the aftermath of the global financial crisis, reforms have aimed at reducing the likelihood of severe financial and fiscal stress, as well as lowering the potency of the sovereign-bank amplification mechanism. Reforms have raised banks' loss-absorption capacity by increasing capital, liquidity, and leverage requirements, and by introducing long-term unsecured debt instruments that can be written down or converted into equity in case of resolution. And stronger macroprudential frameworks have aimed at containing systemic risk. Moreover, to minimize the need for taxpayer funding in the event of a crisis (ending too-big-to-fail), these reforms have gone hand in

---

<sup>3</sup>The mechanism can also work in reverse. Improvements in the fiscal position may strengthen the capital position of the banking system, among other things. However, these "virtuous loops" are likely to be less powerful if, as in other contexts, the relaxation of constraint has a lesser impact than the imposition of one.

hand with initiatives to enhance crisis management tools and improve resolution frameworks for systemic banks. In addition, the Basel Committee has reviewed the regulatory treatment of sovereign exposures, and the merits and demerits of policy options, such as positive risk weights and exposure limits on banks' (own) sovereign holdings. But it could not reach a consensus on whether to introduce these weights and limits (Basel Committee on Banking Supervision 2017).

Because of its complexity, weakening the sovereign-bank nexus is easier said than done. Measures aimed at dealing with one particular channel of transmission may have undesired side effects on others. For instance, restrictions on a government's ability to support financial institutions may limit the direct exposure of the sovereign to bank distress, but may exacerbate overall banking distress through spillover effects and may also worsen the macro effects of the crisis and thus indirectly hurt the fiscal accounts.<sup>4</sup>

Thus, a better understanding of the interaction of the different channels that form the nexus and of their quantitative relevance is critical for the design of effective reforms. This paper attempts to shed light on these issues by identifying the main channels that link sovereign and bank stability and assessing their empirical relevance. Drawing on this analysis, it then offers policy suggestions.

---

<sup>4</sup>See also Lanotte, Manzelli, Rinaldi, Taboga, and Tommasino (2016).



## The Underpinnings of the Sovereign-Bank Nexus

The sovereign-bank nexus stems from a complex set of relationships. These linkages work simultaneously and interact along multiple dimensions, often in a bidirectional fashion. Yet, it is useful to attempt to isolate the main channels of transmission. This section focuses on three of them:

- *The sovereign exposure channel:* Banks demand and hold large amounts of sovereign debt for liquidity management, credit exposure, market-making, and other purposes. As such, they not only are directly exposed to sovereign risk, but also are an important source of financing for the government. Section IV discusses this channel.
- *The safety net channel:* The banking system operates against the backdrop of safety net arrangements and backstops provided by central banks and sovereigns. These backstops generate spillovers from bank to sovereign risk and vice versa. On the one hand, an increase in sovereign risk lowers the government's ability to assist the banking system if it runs into trouble (that is, to provide a backstop), thereby hurting banks. On the other hand, banking crises activate backstops, guarantees, and other costly resolution policies with negative effects on the fiscal accounts. In addition, in some jurisdictions, the significant role played by state-owned banks strengthens this channel. Section V provides an overview.
- *The macroeconomic channel:* Increases in sovereign risk have contractionary effects on economic activity because of the associated need for fiscal consolidation, higher funding costs throughout the economy, and the impact on policy uncertainty. Weaker economic activity will in turn have a negative impact on the banking system's stability, due to the likely deterioration of the banks' loan portfolio resulting from the economic slowdown. Of course, this channel operates in reverse as well. Banking crises have a negative impact on economic activity, including by impairing monetary

policy transmission, and thus on government finances. This channel is discussed in Section VI.

As mentioned, these channels operate simultaneously and interact with each other. For instance, a deterioration of a country's fiscal position and credit-worthiness may reduce sovereign bond prices, generating losses and weakening banks' capital position through their holdings of sovereign paper. This may undermine the system's ability to provide credit to the private sector, which, in turn, would lead to lower economic activity and a further deterioration of the fiscal position. At the same time, an adverse shock to banks' balance sheets will affect their demand for sovereign bonds. On the one hand, banks may react by reducing risk exposures and hence increase the relative weight of sovereign bonds in their portfolios. On the other, their overall portfolios may shrink with negative consequences for both fiscal balances and the real economy.

The following sections discuss these channels in greater detail. Measuring the relative contribution of each channel is difficult. The objective is instead to provide as direct evidence as possible of whether each channel is empirically relevant.

## The Sovereign Exposure Channel

Banks hold a substantial amount of public debt. This implies that sovereign distress has an immediate and direct impact on bank balance sheets (as, for instance, in the euro area or the Argentina sovereign crises).<sup>1</sup> In turn, because banks absorb a significant portion of bond issuances, their distress may lead to problems in sovereign bond markets. This section explores this link by summarizing existing theories of bank sovereign holdings and reviewing recent empirical evidence.

### Why Do Banks Hold Government Debt?

Banks hold sovereign debt for several reasons spanning from portfolio management to regulatory incentives. The relative safe status of sovereign exposures gives them a key role in the operation of financial systems, transforming sovereign debt into a source of liquidity, a safe haven during financial storms, and a reference for market pricing. These characteristics make sovereign instruments widely accepted collateral for financial transactions and important assets for the operation of the banking system. The literature identifies three non-mutually-exclusive rationales for sovereign bond holdings.

*Liquidity:* Leveraged financial institutions like banks need to maintain a pool of liquid assets to back short-term funding—assets that convert into cash without meaningful loss of value to deal with an unexpected loss of funding. Due to its relative safe status, its usually sizable and active market, and the diversification benefits that reduce volatility and the correlation with risky assets, sovereign paper is frequently the most liquid asset and provides the natural benchmark for pricing other securities (Nakaso 2013). Sovereign debt is thus an attractive asset to satisfy bank liquidity requirements

---

<sup>1</sup>See also Bocola (2016).

and, in countries with underdeveloped capital markets, may be the only one readily available.

In addition, sovereign debt plays a key role in the payment system as it is frequently used as collateral to secure credit, and to support hedging, as well as banks' broader financial market operations and activity. The relative low volatility and relative safety of sovereign instruments make them the most used asset in this kind of arrangement. Moreover, central bank liquidity operations with banks are typically conducted extensively through government debt. Finally, the current regulatory framework (see Box 1)<sup>2</sup> also favors (domestic) sovereign holdings. The Basel Committee standardized approach to credit risk provides a widely utilized regulatory exemption that allows banks to apply zero risk weights on domestic government bonds in local currency irrespective of sovereign risk, making them relatively more attractive to banks. Other features of the regulatory framework, such as the liquidity standards, also favor sovereign debt holding.<sup>3</sup>

When frictions or incompleteness in financial markets prevent the private sector from supplying equivalent securities,<sup>4</sup> bank holdings of government debt may constitute an optimal response to an underlying market imperfection. For instance, if weak institutions and poor enforcement of creditor rights hamper the supply of financial assets by the private sector, government debt may provide a store of liquidity to transfer idle resources into the future (Holmstrom and Tirole 1998). Then, the provision of debt backed by taxation can improve the allocation of resources and raise welfare.<sup>5</sup> Moreover, the role of domestic government bonds in central bank liquidity operations can explain why banks predominantly prefer to hold them instead of foreign bonds, resulting in a home bias in sovereign bond holdings (Van Nieuwerburgh and Veldkamp 2009; Gennaioli, Martin, and Rossi 2014b; Battistini, Pagano, and Simonelli 2014; Angelini, Grande, and Panetta 2014).

*Risk taking:* Banks hold government debt as a source of credit exposure and returns. In the absence of frictions, these holdings would be socially optimal. But when the associated risks are not priced correctly, holdings may be "excessive." Banks may not fully price the risk associated with government bonds because they expect to be bailed out, partially or fully, in the event of a sovereign default (Broner and others 2014; Farhi and Tirole 2014). Risk

---

<sup>2</sup>Also see [http://www.bis.org/publ/qtrpdf/r\\_qt1312v.htm](http://www.bis.org/publ/qtrpdf/r_qt1312v.htm) and ESRB (2015).

<sup>3</sup>The liquidity coverage ratio, for instance, requires banks to maintain a buffer of liquid assets that meet certain characteristics. Different securities can potentially form the buffer but the strict criteria governing eligibility frequently narrow the options available and lead to a large share of sovereign debt (Box 1).

<sup>4</sup>This assumption finds empirical backing; Krishnamurthy and Vissing-Jorgensen (2012) find that US Treasuries command a substantial liquidity and safety premium over private assets.

<sup>5</sup>See also Brutti (2011); Gennaioli, Martin, and Rossi (2014b); Bolton and Jeanne (2011); and Angeletos and others (2013).

shifting associated with limited liability can have similar results: namely, banks bet on risky government debt because there is a correlation between the government's risk of default and their own risk of bankruptcy or distress (see, for example, Livshits and Schoors 2009). Thus, when banks purchase government debt, they transfer risk to states of the world in which they are more likely to go bankrupt anyway (Angelini, Grande, and Panetta 2014).<sup>6</sup>

*Financial repression:* Banks may hold sovereign debt not because they want to (meaning because it is individually optimal), but rather because, either implicitly or explicitly, governments introduce policies that encourage or force them to do so. There is ample evidence that financial repression was widely practiced in the aftermath of World War II, which left a legacy of high public debt in many advanced economies (Reinhart 2012; Reinhart and Sbrancia 2015). Between 1945 and 1980, a combination of interest rate ceilings, directed lending to governments, and regulation of international capital movements helped boost banks' sovereign exposure. Although explicit financial repression is harder to implement in today's more open and less regulated economies, it might still be practiced implicitly through *moral suasion*—that is, government pressure on banks to increase their holdings of government debt (Ongena, Popov, and van Horen 2016).

## How Much Public Debt Do Banks Hold?

There is ample evidence that banks hold significant amounts of government debt. Table 2 reports average sovereign exposures for a sample of advanced and developing economies. Between 1999 and 2014, the average bank exposure to government debt in advanced economies ranged from 6.0 percent to 9.1 percent of bank assets.<sup>7</sup> The figure for emerging and developing economies was higher, ranging from 15.6 percent to 20.9 percent of total assets.<sup>8</sup> This higher exposure may reflect less developed private banking and bond markets, the greater role of state-owned banks, more pervasive financial repression, and banks' greater expectations of special treatment. It is, thus, consistent with all three rationales behind bank sovereign bond holdings. An important limitation of large bank-level data sets such as Bankscope is that they do not report bank sovereign holdings by the nationality of issuer. However, there is a strong presumption that the bulk of sovereign debt banks hold is domestic; available data for a subset of countries (produced by the European Banking Authority, EBA) confirm that assumption. In certain countries,

<sup>6</sup>Dell'Ariccia and Ratnovski (2013) model similar behavior in the context of bank contagion.

<sup>7</sup>The range is slightly different, 4.4–8.4 percent, when computed using SNL Financial data focusing on larger banks.

<sup>8</sup>This difference is in line with what is found by existing research and is robust to changes in the sample period and data sources. See Arslanalp and Tsuda (2014) and Gennaioli, Martin, and Rossi (2014a).

**Table 2. Bank Holdings of Government Bonds by Country Income Level**

	Mean exposure			Median exposure		
	All	AEs	EMDEs	All	AEs	EMDEs
1999	8.1	6.4	17.7	4.8	4.2	15.7
2000	7.7	5.9	18.4	4.5	3.9	15.3
2001	8.2	6.2	19.6	4.8	4.3	18.5
2002	8.2	6.0	20.9	4.7	3.9	19.2
2003	8.5	6.6	20.0	5.3	4.7	18.1
2004	8.8	7.0	19.2	5.8	4.9	17.2
2005	9.0	7.5	18.0	6.3	5.4	17.3
2006	8.7	7.3	16.7	6.0	5.0	15.1
2007	8.1	6.8	15.7	5.3	4.5	14.8
2008	7.8	6.4	15.6	5.0	4.4	15.6
2009	8.9	7.4	17.5	6.1	5.3	16.7
2010	9.1	7.7	17.6	6.4	5.6	16.9
2011	9.3	8.1	16.6	6.7	5.9	18.1
2012	9.8	8.6	16.7	7.0	6.1	18.2
2013	10.0	8.8	17.0	7.4	6.7	17.9
2014	10.2	9.1	17.1	7.6	6.8	16.8
2005–14	9.1	7.8	16.8	6.3	5.5	16.7

Source: Bankscope.

Note: The table reports mean and median total sovereign exposures in percent of total assets. Bankscope data are consolidated at the banking group level (if unavailable, unconsolidated). Estimates are reported for the 858 banks from 46 countries with continuing information throughout the 1999–2014 period (732 banks from advanced economies and 126 banks from emerging markets and developing economies, EMDEs).

such as many oil exporters, banks are exposed to the sovereign also on the liability side, through sizable government deposits. When fiscal deficits rise (for instance, in response to falling oil prices) deposits may be withdrawn and create liquidity pressures (IMF 2017).

Overall, the data highlight the potential importance of the bond-holding channel. For a hypothetical bank with a leverage ratio of 6.6 percent (meaning whose assets were 15 times capital) and a sovereign exposure of 10 percent of assets, a 10 percent loss on sovereign bonds would imply a 15 percent reduction in bank capital. Further, as discussed above, sovereign bonds typically carry zero to low risk weights, so banks may assign little or no capital against such potential losses.

## How Does Sovereign Exposure Vary over Time and across Countries?

As discussed above, banks use sovereign bonds as a store of liquidity; according to this view, bond holdings should be higher for banks with fewer lending opportunities and in environments where private alternatives do not abound. If it takes time to adjust the balance sheet on the liability side (for instance, because it is difficult to increase/decrease the deposit base rapidly), sovereign bond holdings can act as a buffer to absorb shocks to loan demand and more generally to the investment landscape (Gennaioli, Martin, and Rossi 2014a). At the same time, banks with volatile liabilities may use gov-

**Table 3. Determinants of Banks' Government Debt Holdings**

	(1)	(2)	(3)
T-bill rate	0.0982** (0.040)	0.1588*** (0.058)	0.1194** (0.055)
Real GDP growth	20.0056 (0.085)	0.1128 (0.076)	0.0518 (0.075)
Inflation (eop)	0.0166 (0.030)	20.0604 (0.053)	20.0420 (0.056)
NER (% change, eop)	20.0309* (0.016)	20.0073 (0.020)	20.0096 (0.022)
Public debt (% GDP)	0.0644** (0.030)	0.0773** (0.035)	0.0751** (0.031)
Credit/GDP	20.0863*** (0.031)		
Stock market capitalization (% GDP)		20.0319*** (0.011)	
Number of listed companies (per 1,000,000 people)			20.0291* (0.015)
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	1,763	954	1,002
R-squared	0.723	0.789	0.775
No. countries	94	70	70

Sources: Laeven and Valencia 2013a. IMF: World Economic Outlook and International Financial Statistics. World Bank: Global Financial Development Database and World Development Indicators.

Note: The dependent variable is banks' government debt holdings in percent of total banking sector assets. Regressions are run at the system (country-year level) during 1981–2014. Government debt holdings are aggregated by residence ("claims on central government" series 22a in the International Financial Statistics). Total banking sector assets are calculated as the sum of bank reserves (series 22), banks' foreign assets (series 21), and their claims on central government (series 22a), state and local governments (series 22b), nonfinancial public enterprises (series 22c), the private sector (series 22d), and nonbank financial institutions (series 22g). All explanatory variables are lagged one year. Pre-euro observations of euro area countries are dropped to ensure consistency of variable definitions. A constant term is included, but the coefficient is not shown. Standard errors clustered at the country appear in parentheses, where \*\*\* indicates significance at the 1 percent level, \*\* at the 5 percent level, and \* at the 10 percent level.

ernment debt as a buffer against funding shocks. Special facilities offered by central banks during the global financial crisis to provide long-term liquidity may also have encouraged banks to hold government debt.

This "liquidity view" was tested using data on government debt holdings (bonds and loans) for a large number of countries. Table 3 shows specifications at the banking system (country) level that explain the time-series variation in government debt holdings as a function of macroeconomic variables (T-bill rate, real GDP growth, inflation, and so forth) and proxies for the availability of alternative investment opportunities. These include equity market capitalization and number of listed companies. The estimates confirm that banks hold more government debt during periods of high interest rates and in countries with lower private sector credit to GDP ratios. In addition, banks operating in less developed financial systems—for instance, with fewer high-quality lending opportunities—also hold more government debt.

The results broadly support the view that sovereign bonds are used as a store of liquidity and help banks manage their portfolio. The question is,

then, what happens when sovereign debt loses some (or all) of its liquidity advantages? During periods of sovereign distress—in the run-up to defaults, or more generally, when sovereign spreads are abnormally high—according to the pure liquidity view, and all other things being equal, banks should diminish their exposure to public debt. In contrast, other rationales for sovereign holdings, such as risk shifting and financial repression, may become more important.

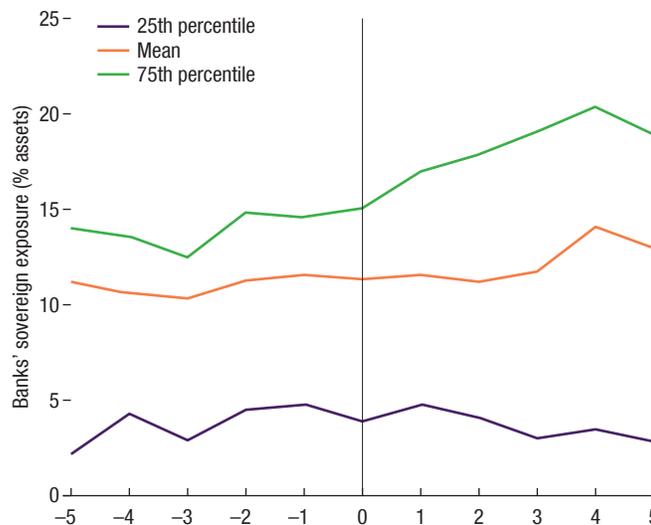
Figure 1 depicts the share of government exposure over total bank assets around episodes of sovereign distress (calculated across 53 advanced and emerging economies that experienced sovereign debt crises during 1970–2014). On average banks do not change their exposure during periods of sovereign distress. However, this evidence does not lend itself to a straightforward interpretation. On the one hand, because sovereign debt becomes less liquid during distress, the fact that banks maintain their exposures is in itself evidence in support of the risk taking and financial repression views. On the other hand, perhaps more simply, banks may just be stuck with securities that have become difficult to sell at par and for which they would have to book a loss if they sell them below par. And because sovereign distress typically coincides with deep economic recessions, such assets may still offer the most valuable source of domestic liquidity, notwithstanding sovereign distress.

The euro area crisis offers an ideal ground to test further the role of risk shifting and financial repression. Throughout the crisis, euro area countries' sovereign bonds continued to be accepted as collateral by the European Central Bank (ECB), although subject to variable haircuts. Hence, from the banks' standpoint they largely maintained their liquidity features. Moreover, the ECB expanded its liquidity provision facilities, increasing the range and value of eligible collateral. Studying the bond holdings by euro area banks should allow the effects of risk shifting and financial repression/moral suasion to be isolated.

Table 4 summarizes the evolution of banks' total sovereign exposure in the euro area between late 2007 and mid-2013. ECB data show a steady increase in banks' holdings of sovereign debt, from approximately 4 percent to 6.5 percent of assets. Bankscope data depict a similar trend, despite differences in sample composition and level of aggregation. More interestingly, this increase in exposure was almost exclusively due to an intake of domestic debt (see Figure 2, panel 1). In fact, holdings of foreign sovereign debt remained approximately constant at about 1.5 percent of assets.

This increase in banks' exposure to domestic sovereign debt took place against a backdrop of sovereign distress in some of the euro area member countries. In fact, it happened precisely in countries and periods when government

**Figure 1. Bank's Government Debt Exposures around Sovereign Crises**



Sources: IMF International Financial Statistics; Laeven and Valencia (2013a); Moody's, Default & Recovery database; and Standard & Poor's sovereign ratings.  
 Note: The figure shows banks' government debt holdings in percent of total banking sector assets. The sample comprises 53 default episodes in advanced and emerging economies during 1970–2014.

**Table 4. Euro Area Bank Holdings of Government Bonds**

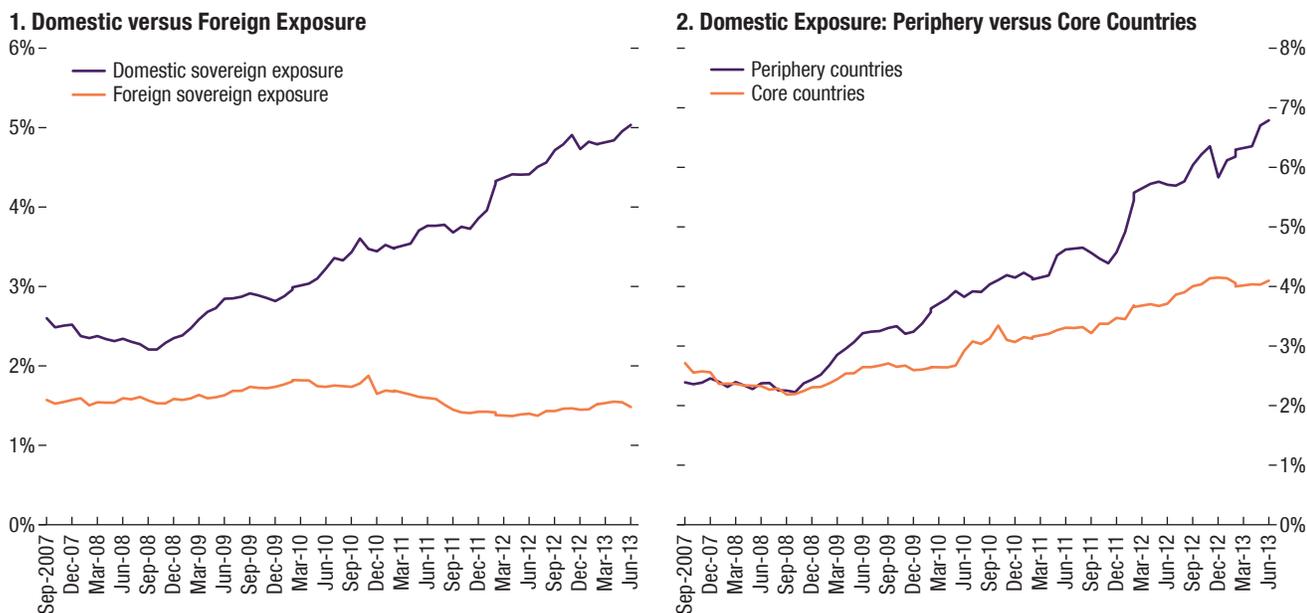
	ECB Individual MFI Balance Sheet Statistics				Bankscope	
	Total	Domestic	Foreign	GIIPS		Total
Sep-07	4.2	2.6	1.6	2.4	Dec-07	4.5
Dec-08	3.9	2.3	1.6	2.4	Dec-08	4.0
Dec-09	4.6	2.8	1.7	3.2	Dec-09	4.8
Dec-10	5.1	3.4	1.6	4.1	Dec-10	5.1
Dec-11	5.3	3.9	1.4	4.6	Dec-11	5.2
Dec-12	6.2	4.7	1.4	5.8	Dec-12	5.7
Jun-13	6.5	5.0	1.5	6.8	Dec-13	6.0
<b>2007–2013</b>	<b>5.0</b>	<b>3.4</b>	<b>1.6</b>	<b>4.0</b>	<b>2007–2013</b>	<b>5.1</b>

Sources: Bankscope; and European Central Bank, Individual MFI Balance Sheet Statistics.

Note: Mean total sovereign exposures by euro area banks from the Individual MFI Balance Sheet Statistics (monthly) data set (ECB) and Bankscope (yearly), in percent of total assets. Sample sizes are 247 banks and 442 banks, respectively. The ECB data set reports unconsolidated data. Unconsolidated data from Bankscope were used (if unavailable, then consolidated).

debt was perceived as increasingly risky (see, for example, Broner and others 2014). The evolution of domestic sovereign exposure for distressed countries (Greece, Ireland, Italy, Portugal, Spain) versus non-distressed ones (Austria, Belgium, Finland, France, Germany, Luxembourg, the Netherlands) reveals that domestic exposure increased disproportionately more in distressed countries—from 2.5 percent to 7 percent of assets (Figure 2, panel 2).

**Figure 2. Sovereign Exposures of Euro Area Banks**  
(Domestic versus foreign bonds)



Sources: Bankscope; and European Central Bank, Individual MFI Balance Sheet Statistics.

Note: The sample comprises 247 banks from euro area countries. Periphery countries include Greece, Ireland, Italy, Portugal, and Spain. Core countries include Austria, Belgium, Finland, France, Germany, Luxembourg, and the Netherlands. Sovereign exposures are expressed in percent of total bank assets.

Of course, this evidence is consistent with all three views of bond holdings. Both the risk-taking and the financial-repression views apply to periods of high debt or high sovereign risk, in which governments find it difficult to ensure debt sustainability at market rates. Indeed, it is exactly when yields are higher that risk shifting makes investing in “weaker” sovereigns more attractive. But it is also true that, as macroeconomic conditions deteriorated more sharply in distressed countries, the sharper increase in sovereign bond holdings in these countries could be attributed to the liquidity view as well. That said, banks in distressed countries did not increase their holdings of other euro area foreign sovereign bonds, suggesting that liquidity was not the main driver behind their actions.

To confirm this hypothesis further, start from the observation that the main determinant of the amount of newly issued sovereign debt is the stock of maturing sovereign debt (Ongena, Popov, and van Horen 2016). Because of the maturity structure of debt issued in the past, rollover needs fluctuate significantly on a monthly basis. This exogenous variation in the need to issue new debt can be exploited to compare the behavior of domestic banks to that

**Table 5. Change in Banks' Exposure to Government Debt: Moral Suasion versus Risk Shifting**

	(1)	(2)
High need * Domestic bank	0.034* (0.019)	0.035* (0.021)
Size * Domestic bank	0.006 (0.109)	0.001 (0.136)
Capital * Domestic bank	0.487 (0.357)	0.873* (0.441)
Size	20.064 (0.105)	20.008 (0.026)
Deposits/Assets	20.057 (0.128)	20.114 (0.147)
Loans/Deposits	0.062* (0.038)	0.059 (0.040)
Equity/Assets	20.109 (0.259)	20.517 (0.370)
Bank FE	Yes	Yes
Country-year-month FE	Yes	Yes
Number of banks	41	36
Number of countries	5	5
Observations	1138	994
R-squared	0.09	0.06

Sources: Bankscope; Bloomberg; and European Central Bank, Individual MFI Balance Sheet Statistics.

Note: The dependent variable is the ratio of the bank's net flow of securities issued by the domestic sovereign at time  $t$  to the bank's total holdings of securities issued by the domestic sovereign at time  $t - 1$ . Regressions are run at the bank-month level. The sample includes 41 banks in Greece, Ireland, Italy, Portugal, and Spain (column 1) and 36 banks in Ireland, Italy, Portugal, and Spain (column 2). The sample period is May 2010–August 2012 for banks in Greece, Ireland, and Portugal, and August 2011–August 2012 for banks in Italy and Spain. "High need" is an indicator for months in which the total amount of new debt auctioned by the domestic government is above the median for the sample period. "Domestic bank" is an indicator for domestically owned banks. "Size" denotes the natural logarithm of the bank's total assets (in millions of euros). All bank controls are lagged by one year. A constant term is included (coefficient not shown). Standard errors clustered at the bank level appear in parentheses, where \*\*\* indicates significance at the 1 percent level, \*\* at the 5 percent level, and \* at the 10 percent level.

of foreign banks, under the assumption that domestic banks are more easily swayed by moral suasion.

Table 5 applies this methodology to a sample of 76 euro area banks. The results show that domestic banks are considerably more likely to purchase domestic sovereign bonds than are foreign banks in months when the need of financing by the domestic sovereign is high (albeit with a relatively low level of statistical significance). Consistently, there is also evidence that banks with closer links to governments (either through direct ownership or board seats) increased their exposure to domestic government debt disproportionately between 2010 and 2013, but only during periods of high sovereign risk, defined as periods in which the sovereign credit default swap (CDS) spread exceeded 100 basis points (Becker and Ivashina 2018; see also Brutti and Sauré 2015). Both these findings are consistent with the financial repression hypothesis, that is, with the notion that, when faced with debt-servicing

problems, sovereigns encourage banks to increase their exposure to public debt. In contrast, there is little evidence that banks that received government bailouts bought more bonds than those that did not (Acharya and Steffen 2015). Under the presumption that banks receiving public funds were more responsive to government influence, this finding would not support the moral suasion view of bank behavior. Evidence about risk shifting is mixed. Acharya and Steffen (2015) find that institutions with lower capital and riskier portfolios tended to load up disproportionately more on government debt during the period of greatest sovereign distress (2010–12). In contrast, in the sample in this paper, there is not a negative correlation between a bank's holdings of domestic sovereign bonds and its net worth.

### **The Effects of Bank Bond Holdings during Sovereign Distress**

Banks' exposure to government debt makes their balance sheets sensitive to fluctuations in sovereign risk. As discussed, for instance, a 10 percent loss on a sovereign bond portfolio representing 10 percent of banks assets would imply a 15 percent reduction in bank capital for a bank with a 6.6 percent leverage ratio.

In practice, losses in episodes of sovereign debt restructurings tend to be much larger (and banks can be more levered than in the example). In those instances, capital depletion tends to be much more dramatic. Table 6 reports estimated bank capital losses due to sovereign restructuring considering haircuts of 37 percent (average for the sample period 1978–2010; see Cruces and Trebesch, 2013) and 50 percent (average for the sample period 1998–2010). The resulting losses range from about 35 percent to over 75 percent of bank capital depending on the country group and haircut assumption.

It is, therefore, no surprise that sovereign debt crises affect bank health and often result in outright banking crises. Changes in banks' stock prices and CDS spreads in the 10 trading days following each EBA public release of stress test data can illustrate these effects (with first-time information on banks' individual-country sovereign exposures). Table 7 reports the results of regressions controlling for bank and country characteristics. The estimated coefficient on the interaction of bank holdings of domestic sovereign debt and sovereign CDS is negative and significant (columns 1–3). This sign implies that, other things being equal, banks with greater exposures to risky sovereign debt experienced a larger fall in their stock market values once this information became public.<sup>9</sup> Columns 4–5 repeat the exercise but look

---

<sup>9</sup>Event studies help minimize the risk of a simultaneity bias. However, this would not be entirely eliminated to the extent that weaker banks loaded up disproportionately more on sovereign bonds and that the stress test revealed new information on banks' health other than their sovereign holdings.

**Table 6. Bank Capital Losses Associated with Sovereign Debt Restructuring Events**

	Means			Medians		
	All	AEs	EMDEs	All	AEs	EMDEs
[1] Sovereign exposure/Total assets	9.5	7.7	15.9	6.5	5.4	14.0
[2] Comm equity/Total assets	7.1	6.4	10.6	6.1	5.8	9.3
[3] Loss on sov exp after haircut: 37% (of total assets)	3.5	2.9	5.9	2.4	2.0	5.2
[4] Loss on sov exp after haircut: 50% (of total assets)	4.7	3.9	8.0	3.2	2.7	7.0
[5] Comm equity/Total assets after haircut: 37%	3.6	3.5	4.7	3.7	3.8	4.2
[6] Comm equity/Total assets after haircut: 50%	2.3	2.5	2.6	2.9	3.1	2.3
[7] Loss on sov exp after haircut: 37% (of common equity)	49.5	44.8	55.8	39.2	34.2	55.4
[8] Loss on sov exp after haircut: 50% (of common equity)	66.9	60.5	75.5	53.0	46.3	74.9

Sources: Cruces and Trebesch 2013 for haircuts; and Bankscope.

Note: Calculations are based on bank balance sheet data for the continuing sample of banks over 2005–13. AEs:

**Table 7. Banks' Exposure to Government Debt and Stock/CDS Market Performance**

	(1)	(2)	(3)	(4)	(5)
	Banks' stock market returns			Banks' CDS spreads	
Sovereign CDS*Domestic sovereign exposure	21.664*** (0.396)	21.782*** (0.425)	21.690*** (0.401)	0.159*** (0.062)	0.115*** (0.047)
Domestic sovereign exposure (% assets)	20.009 (0.038)		0.003 (0.040)	0.443* (0.266)	0.596*** (0.183)
Sovereign CDS	20.177*** (0.035)	20.182*** (0.037)	20.186*** (0.035)	0.041*** (0.005)	
Bank FE	Yes		Yes	Yes	Yes
Country FE	Yes	Yes		Yes	
Year				Yes	
Year-month FE	Yes				
Bank-year-month FE		Yes			
Country-year-month FE			Yes		Yes
Number of countries	12	12	12	5	5
Number of banks	33	33	33	29	29
Observations	1,468	1,468	1,468	1,849	1,849
R-squared	0.234	0.305	0.273	0.60	0.66

Sources: Bankscope; Bloomberg; Datastream; European Central Bank, Individual MFI Balance Sheet Statistics; European Banking Authority; and SNL Financial.

Note: In columns 1–3 the dependent variable is the bank's stock market return and the sample contains 33 domestic banks from 12 euro area countries. The data are pooled over European Banking Agency stress test release periods, where each period includes the day of data release and the subsequent 10 trading days, during March 2010–December 2013. Regressions are run at the bank-trading-day level. "Domestic sovereign exposure" is the ratio of the bank's total holdings of domestic sovereign bonds to the bank's total assets (regression coefficient divided by 1,000). "Sovereign CDS" is the log-difference of daily CDS spreads on a five-year government bond. In columns 4–5 the dependent variable is the bank's CDS spread and the sample includes 29 domestic banks in Greece, Ireland, Italy, Portugal, and Spain. Regressions are run at the bank-month level. The time period is August 2007–June 2013. "Sovereign CDS" is the maximum CDS spread (in basis points) on a 10-year sovereign bond during the month. "Domestic sovereign exposure" is the ratio of the bank's total holdings of domestic sovereign bonds to the bank's total assets (regression coefficient divided by 1,000). A constant term is included (coefficient not shown). Standard errors clustered at the bank level appear in parentheses, where \*\*\* indicates significance at the 1 percent level, \*\* at the 5 percent level, and \* at the 10 percent level.

at banks' average CDS spreads instead and use monthly sovereign exposure data.<sup>10</sup> Banks in stressed countries have higher CDS spreads if they hold a larger share of their assets in domestic sovereign debt. Moreover, the correlation of bank and sovereign CDS spreads is higher for such banks.<sup>11</sup> A bank with 10 percent of domestic sovereign bond holdings (relative to its total

<sup>10</sup>Acharya and Steffen (2015) also provide evidence in this regard.

<sup>11</sup>This result is robust to including bank variables such as size, deposit-to-asset ratio, loan-to-deposit ratio, and capitalization.

assets) has a CDS spread higher by 44.3 basis points than a bank with zero such holdings (column 4).

This evidence confirms that banks' valuations and costs of funding—as captured by CDS spreads—suffer from exposure to sovereign risk. Further, there is some evidence that these valuation effects translate into lower bank credit and, ultimately, into lower economic activity (Bottero, Lenzu, and Mezzanotti 2014; Acharya, Eisert, Eufinger, and Hirsch 2018). Sovereign defaults in a panel of emerging and developed countries between the years 1980 and 2005 tended to be followed by a decline in credit to the private sector, and this decline was more pronounced when the banking system held larger amounts of public debt (Gennaioli, Martin, and Rossi 2014a, 2014b; Baskaya and Kalemlı-Ozcan 2016). Evidence from syndicated loans suggests that core euro area banks with greater exposures to distressed sovereigns decreased lending disproportionately more. As spreads on distressed debt rose toward the end of 2010, banks with substantial holdings of such debt reduced syndicated lending by 21.3 percent relative to banks with marginal holdings of it (Popov and van Horen 2015). In related work, Grigorian and Manole (2017) found that banks more exposed to sovereign risk (as measured by a higher relative frequency of press reports mentioning both the name of the bank and wording related to sovereign risk) find it harder to attract deposits. In turn this may affect their cost of funding and their ability to extend loans (this evidence is also consistent with the safety net channel discussed in the next section).

## **Bank Distress and Sovereign Bond Markets**

The sovereign exposure channel may also work in reverse, though most likely to a much lesser extent. As documented above, banks absorb a significant portion of government bonds. It follows that bank distress may affect demand and liquidity conditions on sovereign bond markets. Indeed, a growing literature has shown that banks reduce liquidity provision to markets in response to adverse shocks during financial crises, as their capital requirements become more stringent when their assets become less liquid due to increased volatility (Brunnermeier and Pedersen 2009; He and Krishnamurthy 2012). And there is evidence that liquidity shocks in corporate bond markets are more pronounced during episodes of bank distress (Friedwald, Jankowitsch, and Subrahmanyam 2012; Acharya, Amihud, and Bharath 2013). In principle, such effects could also play a role for government bonds. In practice, however, they are rarely observed or mitigated because central banks tend to intervene in sovereign bond markets when bank distress poses a threat to the transmission channel of monetary policy. Further, during times of stress, banks can also opt to rebalance their portfolio toward safe and liquid assets. This flight to quality frequently favors sovereign bonds.

## The Safety Net Channel

Banks hold government promises not only in the form of bonds, but also in the form of potential backstops and guarantees. Creditors may expect bank claims to be backed by some type of government support. This may be explicit, as in the case of insured deposits or central banks' emergency liquidity facilities, or implicit, as in the case of support of institutions that are deemed too big to fail. These mechanisms are designed to reduce information frictions in normal times and to lower the probability and impact of financial disruption during severe stress.

Sovereign distress can call into question the credibility of this backstop. This, in turn, may increase the cost of banks' liabilities and possibly their ability to attract funding. This link also operates in the other direction: when banks fail, guarantees and other costly crisis resolution policies can place a heavy burden on the fiscal accounts.

State ownership of commercial banks could be considered an extreme case of the safety net channel. In some countries, the government holds substantial amounts of banks' equity. When banks face an adverse shock, in addition to potential recapitalization needs, the authorities can suffer from the loss of the equity investment and the fall in dividend revenues, which could lead to fiscal strain. The fiscal deterioration may in turn damage banks' creditworthiness, increasing their cost of funding.<sup>1</sup>

The global financial crisis has highlighted these mechanisms, and substantial policy work has been done to remove implicit guarantees and reduce the associated potential moral hazard. The proposals to end too-big-to-fail, including requiring higher capital levels for systemic institutions, strengthen-

---

<sup>1</sup>State-owned financial institutions may pose additional risks to financial stability that can arise from limited market discipline, poor governance, weak supervision, and an unlevel playing field. These risks require strong oversight (Ratnovski and Narain, 2007).

ing recovery and resolution policies, introducing additional total loss absorbing capacity, and bailing in of private debt holders, all aim at weakening this channel. Nevertheless, these reforms are largely still in an implementation phase and, therefore, cannot be reflected in the following empirical analysis.

## **The Effect of a Weaker Safety Net on Bank Stability**

Measuring the economic magnitude of the safety net channel is difficult. It requires assessing how sovereign distress affects the strength of the safety net and, in turn, how this affects banks' financial health. That said, this section presents evidence that, while short of measuring the quantitative impact of the safety net channel, suggests that the channel is highly relevant in practice.

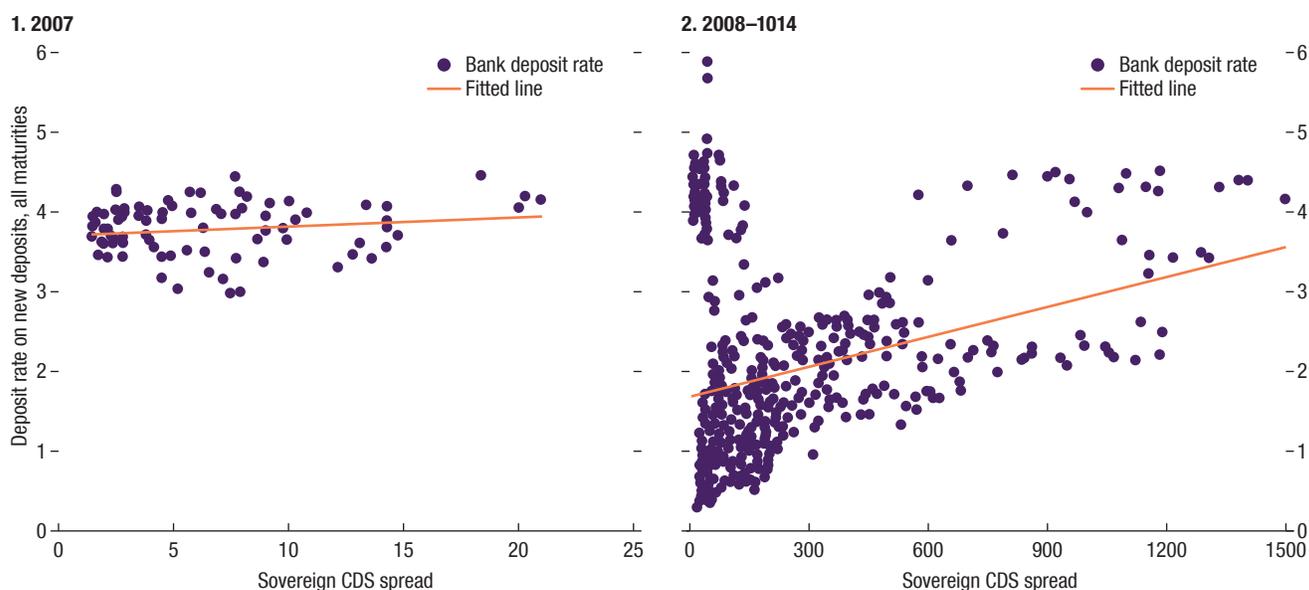
A first piece of evidence comes from the relationship between the rates paid by euro-area banks on new deposits and the CDS spreads of their sovereigns (Figure 3). Before the onset of the euro-area crisis, sovereign CDS spreads were low and they were essentially uncorrelated with bank deposit rates. This suggests that, at low levels of risk, depositors considered banking systems equally safe across euro area countries. Once the crisis erupted, though, a strong positive correlation appeared between deposit rates and sovereign CDS spreads across the euro area (see also Mody and Sandri 2012). Namely, depositors demanded a higher interest rate from banks in countries where the government was perceived to be riskier. This evidence is consistent with the notion that deposit rates increased as government guarantees became less reliable.

Table 8 looks at the relationship highlighted in these plots more formally by regressing the average interest rate on new euro deposits on measures of bank and sovereign stability. Notably, a country's sovereign CDS is a significant determinant of the deposit rate paid by its banks, even after controlling for bank CDS spreads. To the extent that sovereign CDS spreads are an inverse measure of the credibility of government guarantees, this is evidence in favor of the safety net channel.<sup>2</sup> Also, consistent with the safety net channel, the relationship between bank CDS spreads and the deposit rate was stronger in countries with weaker sovereigns and the impact of sovereign CDS spreads on deposit rates was stronger for weaker banks (with weakness measured by the CDS spread).

---

<sup>2</sup>The positive correlation between the rates paid on new deposits and sovereign CDS is robust to controlling for several banking system characteristics (such as domestic sovereign exposure, size, capitalization, and riskiness), interaction terms between these characteristics and sovereign spreads or growth projections for the year ahead, as well as country and year fixed effects.

Figure 3. Deposit Rates and Sovereign CDS Spreads



Sources: Bloomberg; Datastream; and European Central Bank, MFI Interest Rate Statistics.  
 Note: Each data point represents a monthly sovereign's CDS spread and the average interest rate paid by the country's banks on new deposits of all maturities.

Table 8. Bank Deposit Rates, Bank Risk, and Sovereign Risk

	(1)	(2)	(3)	(4)
Sovereign CDS	0.5408*** (0.119)	0.5033*** (0.141)	0.4892*** (0.129)	0.4755*** (0.119)
Bank CDS	0.0777*** (0.020)	0.0700*** (0.017)	20.0238 (0.061)	20.0070 (0.069)
Bank CDS*Sovereign CDS		0.0363 (0.036)		
Bank CDS*Sovereign CDS*2006-07			0.0875** (0.036)	
Bank CDS*Sovereign CDS*2006				20.2136 (0.130)
Bank CDS*Sovereign CDS*2007				0.0888* (0.042)
Bank CDS*Sovereign CDS*2008-09			0.3567** (0.108)	0.3308** (0.108)
Bank CDS*Sovereign CDS*2010-13			20.4159 (0.266)	20.3563 (0.289)
Country FE	Yes	Yes	Yes	Yes
Observations	118	118	118	118
R-squared	0.355	0.360	0.397	0.407

Sources: Bloomberg; Datastream; and European Central Bank, MFI Interest Rate Statistics.  
 Note: The dependent variable is the annualized average deposit rate on new euro deposits of all maturities paid by credit and other institutions (Monetary Financial Institutions (MFI) except money market funds and central banks) to nonfinancial corporations and households. The sample period is 2006-13 on a half-year frequency. "Sovereign CDS" and "Bank CDS" are the average sovereign and bank CDS returns, respectively, over the half-year period. The sample includes eight euro area countries (Austria, France, Germany, Ireland, Italy, the Netherlands, Portugal, Spain).

This relationship can be explored further by focusing on how a bank's stock market value behaves relative to its sovereign CDS, controlling for bank and country characteristics. Again, we use the EBA stress tests releases as an event study. The results (Table 9) show that, when sovereign risk increases, the fall in a bank's stock market value is greater for banks that (1) are highly exposed to government debt, exactly as the sovereign exposure channel would suggest, and (2) have weak balance sheets, as captured through lower capital ratios and higher asset riskiness. This last point is consistent with the safety net channel: it is weak banks, which are most likely to depend on the government backstop in the near future, that are hurt the most when the government's solvency is questioned. Put differently, bank idiosyncratic characteristics become more important when sovereign guarantees are doubtful.

Of course, the previous correlation could also be due to a common shock that simultaneously raises sovereign risk and lowers the country's economic prospects. Insofar as vulnerable banks are more likely to fail in an adverse scenario, such a shock would generate the observed correlation but for different reasons than those outlined here. Including GDP growth projections as a control variable helps with the interpretation of the coefficient of interest as capturing the impact of sovereign risk on banks' values *over and above* what can be explained through deteriorating economic prospects alone.

Finally, it is worth asking how the impact of sovereign stress affects banks' activities and the availability of credit. Once again, the recent euro-area crisis provides an interesting testing ground. Between December 2010 and December 2011, following tensions in sovereign debt markets, lending by Italian banks grew by 3 percentage points less than lending by foreign banks in Italy, which were de facto protected by their home country safety net. There was also an interest rate differential on loans between 15 and 20 basis points (Bofondi, Carpinelli, and Sette 2018).<sup>3</sup>

### The Fiscal Cost of the Safety Net

The fiscal costs of banking crises are typically large and subject to substantial variation.<sup>4</sup> This obviously depends on the severity of the crisis, but also on the different policies adopted and the timing of government intervention. Policies designed to contain market panics or freezes, such as guarantees on bank liabilities, might be very effective in restoring market liquidity but entail

---

<sup>3</sup>Less direct evidence is in Correa, Sapriza, and Zlate (2013) and Ivashina, Scharfstein, and Stein (2015).

<sup>4</sup>Following the global financial crisis, important progress was made on initiatives to improve banks' resolution frameworks, protect public resources and avoiding moral hazard. Obviously, the impact of these recent initiatives could not be reflected in the empirical analysis. For a discussion on the stage of implementation of the regulatory reforms, see Financial Stability Board (2017).

**Table 9. Bank Stock Returns and Safety Net**

	(1)	(2)	(3)
Sovereign CDS	0.4201 (0.783)	0.3704 (0.769)	0.5159 (0.913)
Sovereign CDS * Size	20.0232 (0.026)	20.0215 (0.026)	20.0268 (0.031)
Size	0.0004 (0.005)	20.0006 (0.001)	
Sovereign CDS * Domestic sovereign exposure	21.7087*** (0.546)	21.6903*** (0.539)	21.9021*** (0.669)
Domestic sovereign exposure	20.0007 (0.039)	20.0119 (0.020)	
Sovereign CDS * Capital	0.0727*** (0.020)	0.0712*** (0.019)	0.0805*** (0.024)
Capital	0.0041*** (0.001)	0.0027*** (0.001)	
Sovereign CDS * Risk profile	20.0058*** (0.002)	20.0056*** (0.002)	20.0064*** (0.002)
Risk profile	0.0002 (0.000)	20.0001 (0.000)	
Projected growth	0.0168 (0.022)	0.0121 (0.013)	
Projected growth * Size	20.0003 (0.001)	20.0002 (0.000)	
Projected growth * Domestic exposures	20.0114 (0.015)	20.0106 (0.011)	
Projected growth * Capital	20.0011** (0.000)	20.0009** (0.000)	
Projected growth * Risk profile	20.0001 (0.000)	20.0001 (0.000)	
Bank FE	Yes		
Year-month FE	Yes	Yes	
Country FE		Yes	Yes
Bank-year-month FE			Yes
Number of countries	12	12	12
Number of banks	33	33	33
Number of observations	1,404	1,404	1,404
R-squared	0.276	0.272	0.329

Sources: Bankscope; Bloomberg; Datastream; European Banking Authority; IMF, World Economic Outlook; and SNL Financial.

Note: The dependent variable is the bank's stock market return. Regressions are run at the bank-trading day level. The sample includes 33 domestic banks in 12 euro area countries. The data for bank-country pairs are pooled across EBA stress test release periods (between March 2010 and December 2013), where each period includes the day of data release and the subsequent 10 trading days. All variables other than banks' stock market return and sovereign CDS are constant over the 10-day period after release. "Sovereign CDS" is the daily return on a five-year sovereign CDS contract. "Domestic exposure" is the ratio of the bank's domestic sovereign bond holdings to the bank's total assets. "Size" is the natural logarithm of the bank's total assets (in euros). "Risk profile" is the ratio of risk-weighted assets to total assets. "Projected growth" is the one-year-ahead real GDP growth projection as of the World Economic Outlook release date closest to the EBA stress test release date. A constant term is included (coefficient not shown). Standard errors clustered at the bank-sovereign pair level appear in parentheses, where \*\*\* indicates significance at the 1 percent level, \*\* at the 5 percent level, and \* at the 10 percent level.

very small disbursements up front (Laeven and Valencia 2012). In fact, while these interventions create contingent fiscal liabilities, they may require no disbursements at all as long as they are sufficiently credible. In contrast, direct capital injections entail an immediate fiscal cost, although this is partly recovered when the government divests its shareholdings (see Laeven and Valencia 2012, 2013a for examples on recoveries). Notably, both types of policies

require ample fiscal room—the former to guarantee credibility and the latter to allow for the immediate provision of resources.

The timing of the intervention also matters, with speedier resolutions often translating into lower ex-post fiscal costs (Claessens, Kose, and Terrones 2012; Laeven and Valencia 2010). Then, a tradeoff emerges between higher direct fiscal costs (due to measures in support of the financial sector) and indirect costs (encompassing the overall fiscal impact of a crisis).<sup>5</sup> Measures that entail greater direct fiscal costs, such as bank recapitalizations, tend mitigate the negative real effects of banking crises and, hence, potentially their indirect cost (see, for example, Giannetti and Simonov 2013; Laeven and Valencia 2013b).

An analysis of systemic banking crises and the associated recessions from 1970 through 2011 reveals that both direct and indirect costs have been significant (Table 10). Across all countries, the median direct fiscal outlays for the four-year period starting with the first crisis year were 6.8 percent of GDP and over 12 percent of financial system assets.

These numbers, however, vary greatly across countries. In extreme cases, such as in Indonesia during the 1997–2001 Asian financial crisis, direct fiscal costs amounted to more than 50 percent of GDP. Direct costs are generally larger in emerging markets (8.3 percent of GDP) and developing countries (10 percent of GDP) than in advanced economies (4.2 percent of GDP), while the opposite is true for total fiscal costs. One explanation for the difference in direct fiscal costs of banking crises is that advanced economies might be more effective at containing them, even though they have larger financial systems, and/or that crises are more severe in emerging markets. The explanation for the higher total fiscal costs in advanced economies may lie in their greater capacity to pursue countercyclical policy and allow automatic stabilizers to operate (IMF, 2015). This reduces the need for direct intervention with banks, but at the same time raises the indirect fiscal costs of the crisis.

Consistent with this view, during the recent global financial crisis (Figure 4), measures in support of the banking sector contributed significantly to increases in public debt. In extreme cases, such as Iceland and Ireland, direct fiscal outlays amounted to more than 30 percent of GDP (IMF 2016). However, in many cases, direct fiscal costs represented only a relatively small fraction of the overall increase in public debt associated with the crisis.

Besides the fiscal outlays entailed by current policies, the expectation of future outlays (due to contingent liabilities and the potential need for further

---

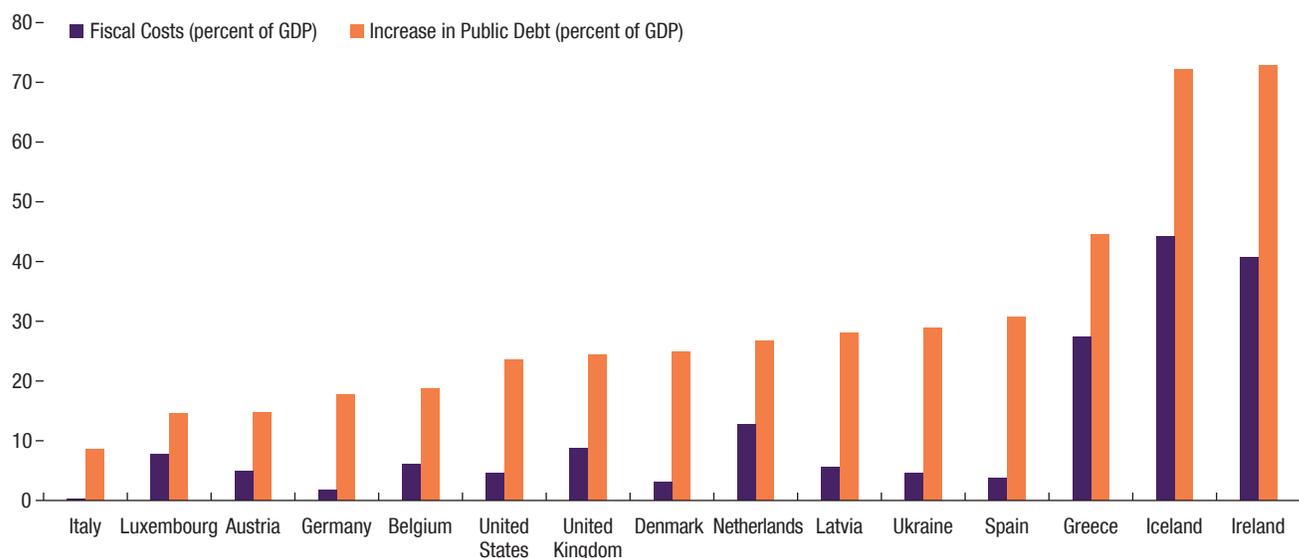
<sup>5</sup>Although this section focuses on the fiscal costs of different policies, the merits of different alternatives should be evaluated based on broad welfare implications.

**Table 10. Outcomes of Systemic Banking Crises, 1970–2011**

Country	Output loss	Increase in public debt	Direct fiscal costs	
	% GDP	% GDP	% GDP	% financial system assets
All	23.2	12.1	6.8	12.5
Advanced	32.4	23.6	4.2	2.1
Emerging	33.6	9.1	8.3	21.3
Developing	0.7	10.9	10.0	18.3

Source: Laeven and Valencia 2013a.

Note: Numbers shown are medians for the indicated country groups.

**Figure 4. The Fiscal Cost of Systemic Banking Crises**

Source: Laeven and Valencia 2012.

Note: Fiscal costs are defined as the component of gross fiscal outlays related to the restructuring of the financial sector. They include fiscal costs associated with bank recapitalizations but exclude asset purchases and direct liquidity assistance from the treasury. The increase in public debt is measured over  $(T - 1, T + 3)$  where  $T$  is the crisis starting year, generally 2008, except for the United States and United Kingdom, when it is 2007.

For Greece, the figures include the recapitalization package included in the 2012 IMF program, although it had not been fully used as of May 2013.

interventions) can also increase the government's fiscal burden by making it harder to finance its debt. There is evidence of this link from the recent euro-area crisis. For instance, the reaction of euro-area countries' CDS premiums to negative news coming out of Greece was significantly correlated with the exposure of the country's banking system to Greek sovereign debt (Brutti and Sauré 2015). This evidence is consistent with the notion that concerns regarding a country's banking system translated into greater sovereign risk, perhaps anticipating the direct (through guarantees and potential financial-sector support policies) or indirect (through reduced economic activity) fiscal costs of banking troubles. Interestingly, the authors find no evidence of cross-border transmission through exposure to private Greek debt, that is, through interbank lending.

Of course, public interventions in support of banks may also have negative effects ex ante by creating moral hazard. If bank creditors expect to be bailed out, they will choose to exert less effort monitoring banks ex ante, fostering excessive risk taking by banks. Moreover, the expectation of intervention may generate a “collective” moral hazard problem, by which banks decide to take correlated risk exposures because they foresee that a bailout is more likely in a systemic crisis than for isolated failures (for this moral hazard problem at individual banks, see Akerlof and Romer 1993; at the system level, see Schneider and Tornell 2004 and Farhi and Tirole 2012).

## The Macroeconomic Channel

When sovereign risk increases, governments respond with greater fiscal consolidation, that is, by raising taxes or reducing expenditure. Insofar as these measures have a contractionary effect on economic activity, they affect firm revenues and household income negatively. Further, higher sovereign spreads will typically have negative direct effects on economic activity through higher spreads on corporate bonds and wealth effects on household holdings of public bonds. These dynamics tend to increase nonperforming loans and hinder bank profitability, and, potentially, bank stability.

At the same time, there is ample evidence that banking crises hinder economic activity. They disrupt the supply of credit and lead to an inefficient allocation of consumption and investment, as informational asymmetries make it difficult for borrowers to substitute bank loans with other sources of funding (Bernanke 1983; Kiyotaki and Moore 1997; Bernanke and Gertler 1990). In turn, the resulting economic slowdown has a negative impact on fiscal balances.

### Sovereign Crises and Macro Performance

Increases in sovereign risk are often accompanied by fiscal consolidation and greater political instability (Ponticelli and Voth 2012). These have been associated with lower economic growth (Barro 1991; Tornell and Velasco 1992; Alesina and others 1996). This suggests that sovereign risk may have an independent negative impact on economic activity and thus on bank stability (see, for example, Beck, Jakubik, and PiloIU 2013). However, isolating this effect requires additional research.

Measuring this direction of the macroeconomic channel requires assessing the independent effect of sovereign risk on economic activity. While there

is ample research on the determinants and costs of sovereign debt defaults, there is scant evidence on the direct effects of sovereign debt crises on economic growth. A key reason for this is that it is hard to separate cause and effect because debt crises often follow episodes of below-average growth performance. Moreover, even if it were perfectly identified, part of the effect of sovereign risk on economic activity would be attributable to alternative transmission channels, such as the previously discussed bank sovereign exposure channel.

## **The Costs of Banking Crises**

Banking crises are associated with unfavorable economic outcomes. They may result from negative shocks elsewhere in the economy (such as a sharp drop in its terms of trade) or occur simultaneously with a collapse in demand (such as when an asset price bubble bursts). But banking crises also have independent negative effects on the real economy: irrespective of the crisis origin, disruptions in financial intermediation will act as a multiplier and exacerbate the associated economic contraction.

Banking crises disrupt the supply of credit to bank-dependent borrowers, who in turn reduce consumption and investment. Informational asymmetries make it difficult for bank-dependent borrowers to replace loans with other sources of funding. As a result, when banks are forced to curtail lending (for instance, because of their inability to raise external funds; see, for example, Van Den Heuvel 2008; Valencia, forthcoming), borrowers may be forced to reduce consumption and investment, with a consequent drop in aggregate demand (see, for example, Bernanke 1983; Bernanke and Gertler 1990; Brunnermeier and Sannikov 2014; Sandri and Valencia 2013).

Market freezes and panics may give rise to more severe effects (see Claessens and others 2011 for a review of the mechanisms at work during a banking crisis). Depositors can coordinate on a bad equilibrium, forcing a bank into insolvency (Diamond and Dybvig 1983). A similar outcome can arise when changes in margin requirements on bank liabilities trigger runs by wholesale creditors (Krishnamurthy 2010). At the system level, interconnections among banks and other financial institutions can make a system fragile, and thus an idiosyncratic shock can trigger a cascade of bankruptcies throughout the system or across borders (Allen and Gale 2000), including through “fire sale” episodes (Stein 2013). When these interconnections among institutions are not known, each institution adopting risk-averse behavior acts as if the distressed one was closer than it really is, massively exacerbating liquidity hoarding and the credit crunch (Caballero and Krishnamurthy 2008; Caballero and Simsek, 2018).

Empirical evidence supports these predictions. Recessions associated with banking crises tend to be deeper and last longer than “normal” ones (IMF 2009; Jordá, Schularick, and Taylor 2016). For instance, the output decline from peak to trough in recessions associated with a credit crunch tends to be twice as large as in recessions without a credit crunch (Claessens, Kose, and Terrones 2012); average cumulative output losses associated with banking crises are estimated at about 23 percent of GDP (Laeven and Valencia 2013a). There is also growing evidence that recoveries following banking crises tend to be slower than those following “normal recessions” (see Abiad, Dell’Ariccia, and Li 2011).

This is not in itself proof that crises have an exogenous effect on activity; it could be the depth of these recessions that causes banking crises rather than the opposite. However, the fact that sectors that are more intrinsically dependent on external finance suffer more during banking crises suggests that the latter have “real effects” (Dell’Ariccia, Detragiache, and Rajan 2008; Kroszner, Laeven, and Klingebiel 2007). Further proof of an exogenous effect of bank distress on real activity is the cross-border transmission of shocks through banks’ networks of subsidiaries. For instance, the stock market crash in Japan was transmitted to real estate markets in certain US states where Japanese banks’ subsidiaries were active (Klein, Peek, and Rosengren 2002; Peek and Rosengren 1997, 2000). Another example in this regard refers to the losses suffered by US bank holding companies exposed to Iraqi banks, which led to the closure of healthy subsidiaries in the United States and had a significant effect on local county incomes (Ashcraft 2005).

Banking crises are often preceded by periods of strong credit growth (or credit booms). IMF (2015) exploited this empirical regularity to “instrument” banking crises (see Gourinchas and Obstfeld 2012; Jordá, Schularick, and Taylor 2016; Dell’Ariccia and others 2016). The paper explored how recessions preceded by these banking expansions differ from “normal” ones and focused on the indirect fiscal costs associated with lower economic performance. The following paragraphs summarize its findings.

Recessions preceded by rapid banking sector expansions (episodes where the five-year cumulative change in the private sector credit-to-GDP ratio is above the median of its distribution across emerging and advanced economies) tend to be deeper, longer, and followed by slower output recovery than other recessions. Furthermore, the magnitude of the preceding banking expansion is correlated with the depth and duration of the ensuing recession. A banking expansion is defined as “severe” if it belongs to the top quartile of the five-year cumulative change in the private sector credit-to-GDP ratio. The median recovery time (duration from one peak to the time such a level is recovered) for recessions preceded by severe banking expansions is more than

twice that for recessions preceded by nonsevere banking expansions. These observations hold for both emerging markets and advanced economies.

The swings in economic performance associated with credit boom-bust cycles influence fiscal outcomes. Primary balances tend to be higher than normal during banking expansions, particularly for advanced economies. However, once the downturn begins, they also deteriorate more quickly in those countries, possibly raising fiscal sustainability pressures.

Moreover, fiscal sustainability pressures last longer in banking recessions. In the case of nonbanking recessions, it takes four years for the median fiscal deterioration (measured by the deterioration of the primary balance) to be reversed. In contrast, five years after the onset of banking recessions, primary balances continue to be depressed. An examination of debt dynamics yields similar conclusions: rapid banking expansions tend to reduce public debt, but fiscal deterioration during the ensuing recession more than offsets all previous gains (see, for instance, the experience of Spain and Ireland).

## Discussion and Policy Implications

### Discussion

This paper highlights four main findings.

First, there is ample evidence that the sovereign-bank nexus operates through multiple interacting channels. The sovereign exposure channel, the safety net channel, and the macroeconomic channel are all empirically relevant when it comes to explaining the nexus.

Second, banks hold substantial amounts of government debt, and this leaves them vulnerable to episodes of sovereign distress. The analysis directly links the impact of sovereign distress on banks' stability to the proportion of sovereign bonds they hold in their portfolios. As to why banks hold such large amounts of public debt, the evolution and cross-country distribution of sovereign holdings is consistent with the view that banks use public debt to manage liquidity and to support financial activity more broadly. However, there is also some (weak) evidence, at least in the euro area, for the risk-taking and moral suasion motives. In contrast, there is only indirect evidence of how the sovereign exposure channel operates in the other direction—how bank demand influences sovereign yields. Banks represent an important share of sovereign debt markets, holding on average 30 percent of outstanding public debt in advanced economies and 45 percent in emerging markets (Arslanalp and Tsuda 2014).

Third, there is a clear link between the strength of a country's safety net and the financial stability of its banks. The interest rate banks pay on deposits is a function of their sovereign CDS spread. Further, in periods of sovereign distress, this relationship appears more pronounced for banks in more precarious financial positions, which are also those more likely to benefit from the safety net.

The other lane of the safety net channel is also important. Banking crises trigger implicit and explicit government guarantees and ad hoc interventions in the banking system. These have significant impacts on the fiscal accounts. The direct fiscal costs of banking crises between 1970 and 2011 averaged 6.8 percent of GDP, with larger numbers in emerging markets and developing economies.

Fourth, banking crises have an exogenous negative impact on economic activity and this has an additional effect on the fiscal accounts. Pressures on fiscal balances last longer in banking recessions (recessions associated with problems originating in the banking sector) than in standard recessions. More generally, banking crises act as a multiplier of other negative shocks, and the associated increases in public debt are far greater (at least in advanced economies) than those ascribed to direct financial sector support. On average, banking crises are associated with a cumulative output loss of 23 percent of GDP. And, in their wake, public debt increases by about 12 percent of GDP.

It is very difficult to isolate the magnitude of the opposite direction of the macroeconomic channel—from the macro effect of fiscal distress to bank instability. Indeed, because of this identification problem, there is no compelling evidence that fiscal policy has a material impact on bank profitability. But there is strong evidence that sharp fiscal contractions dampen growth, and that bank profitability is procyclical. Therefore, to the extent that increases in sovereign risk lead to subsequent fiscal tightening, one would also expect sovereign stress to have an adverse impact on bank income and capital. However, isolating the independent effect of that stress requires additional research.

For clarity of exposition, each channel of transmission was discussed in isolation. However, these channels operate simultaneously and interact along multiple dimensions, with bilateral feedback between banks and sovereigns (Farhi and Tirole 2014). For instance, assume bank solvency were jeopardized by a financial shock. If such shortfall in solvency triggered a government bailout, it could place government finances under strain, depressing the price of public debt, and compounding the deterioration in bank solvency through their sovereign holdings, and so on. Thus, bank holdings of public debt coupled with government support can generate a multiplier effect on government finances, which increases with the extent of debt held by banks. There is growing evidence of the significance of such “doom loops.” For instance, in the case of the euro area sovereign-debt crisis, sovereign and bank credit risk (as measured in CDS spreads) became more correlated following the announcements of bank bailouts, indicating that the fates of banks and their sovereigns became increasingly intertwined (Acharya, Drechsler, and Schnabl 2014; Fratzscher and Reith 2015).

## Policy Implications

The sovereign-bank nexus is a substantial risk to financial stability. It may act as a powerful transmitter and amplifier of financial stress, exacerbating risks of adverse feedback loops that may precipitate twin crises. Increasing resilience requires reducing the likelihood of severe stress, as well as lowering the potency of the amplification mechanism posed by the nexus. In that regard, the analysis and conclusions developed in the previous sections have important policy implications.

First, the obvious: financial stability requires strong bank and sovereign balance sheets and governance. Financial strength does not break the nexus but reduces its relevance. Larger fiscal buffers and better public-debt management reduce the probability of sovereign-related bank distress. Larger capital buffers and improved regulation and supervision reduce bank risk taking and boost banks' ability to withstand shocks. This additional resilience reduces the likelihood that the safety net is triggered or exploited, and hence the probability of bank-induced sovereign distress.

The importance of large capital and fiscal buffers seems particularly relevant in countries with large banking systems where the bank-to-sovereign linkage is magnified. In these countries, the impact of a banking crisis on the economy and fiscal accounts can be more severe. These circumstances seem to justify larger bank capital buffers to reduce the probability and magnitude of shocks originating in the financial sector and stronger fiscal buffers to absorb eventual crises.

Second, policies aiming to weaken the nexus need to be designed and evaluated from a holistic point of view, since banks and sovereigns are linked through multiple and interacting channels. While such policies can increase resilience and enhance financial stability, measures targeting individual channels may have unintended implications for others, particularly during crises. For instance, placing limits on banks' sovereign bond holdings could strengthen the macroeconomic channel should those limits force the government to undertake a larger fiscal consolidation during a downturn. Similarly, the introduction of rules limiting direct bailouts, even if well-intentioned to save taxpayer money, could increase the indirect fiscal cost of a crisis by worsening its macroeconomic impact to the extent that the lack of an effective alternative resolution results in contractionary contagion and spillover effects. Therefore, policies addressing the sovereign-bank nexus should address and take into account all the relevant channels and recognize that, in practice, the nexus can be weakened but not severed. Policies should be designed acknowledging this constraint. While post-crisis regulatory reforms have enhanced crisis management tools, resolution frameworks, and

the loss-absorption capacity of banks, thereby lowering the potency of the sovereign-bank amplification mechanism, more is needed to weaken further the sovereign-bank nexus.

### Sovereign Exposure Channel

Turning to specific channels, the sovereign exposure channel can be weakened through measures that reduce excessive holdings of sovereign debt and the domestic sovereign bias. The key role played by sovereign debt in financial markets means that, in practice, banks need to hold some level of such exposures and that policies should recognize this role. Calibration of measures that restrict such exposures should therefore consider the benefits and costs of smaller holdings of sovereign debt. The focus of regulation should be on excessive holdings incentivized by favorable prudential treatment and financial repression. Virtually all countries assign a zero risk weight to domestic sovereign exposures denominated and funded in their own currency and exempt them from concentration limits. Such treatment incentivizes holdings of sovereign debt over other assets, strengthening the nexus and distorting the allocation of assets in the economy. It also creates a captive market for sovereign debt that may discourage prudent fiscal behavior.

One policy option would be to fully align the regulatory framework with the risks posed by sovereign exposures and eliminate the regulatory incentive to hold sovereign paper.<sup>1</sup> This option would include the establishment of positive, risk-sensitive capital requirements and strict concentration limits. But it presents the operational challenge of establishing good proxies for sovereign debt risk and, more critically, may make the system more procyclical.<sup>2</sup> Risk-sensitive risk weights would lead to an increase in capital requirements during sovereign distress, encouraging banks to reduce their exposures. Therefore, the currently observed debt-stabilizing behavior of banks could be significantly reduced or even reversed.

Additionally, the interplay of risk-sensitive capital requirements and liquidity requirements could contribute to a broader reduction in the credit supply to the private sector. If an episode of sovereign distress increases capital requirements but banks, due to the need to maintain minimum holdings of high-quality liquid assets, cannot reduce their sovereign debt holdings, there

---

<sup>1</sup>See Basel Committee on Banking Supervision (2017) for a discussion on alternatives for the regulatory treatment of sovereign exposures.

<sup>2</sup>In principle, similar procyclicality concerns are also relevant for other assets<sup>3</sup> by banks. Nevertheless, the practical implementation of the capital regulation makes these concerns less relevant. Non-sovereign portfolios are more diversified and the proportion of exposures that are externally rated is relatively low, resulting in more stable risk weights. Further, internal-ratings approaches for capital requirements contain several features aiming to mitigate procyclicality.

might be a need to reduce other credit exposures. The sovereign exposure channel would be weaker and the macroeconomic channel stronger. Further, given the positive aspects of banks' holdings of sovereign bonds, the benefits of a weaker bond-holding channel need to be compared against the costs (Cœuré 2016).

A preferable approach would be to impose a positive but time-invariant (through-the-cycle) risk weight for domestic sovereign exposures and an appropriately calibrated framework that increases capital requirements according to sovereign concentration on banks' balance sheets. A through-the-cycle risk weight should be calibrated with the aim to reduce the current regulatory incentive for banks to invest excessively in domestic sovereign bonds. A through-the-cycle risk weight would not fully align capital requirements with the underlying risks during the down period of the economic cycle. While this would limit the potential weakening of the bond-holding channel, such an approach would avoid a regulatory-induced procyclicality.<sup>4</sup> A through-the-cycle risk weight would provide an approach representing substantial progress in relation to the current framework that largely exempts domestic sovereign exposures from risk weighting, and thus merits further consideration.<sup>5</sup>

That said, through-the-cycle risk weights would reduce the current regulatory distortion but would not on their own discourage the current strong home bias on sovereign exposures. Strict concentration limits could address this issue but, particularly if globally harmonized, are likely to generate negative effects because banks' need to hold sovereign bonds for liquidity management and the broad operation of the financial system can vary substantially from country to country according to market characteristics, business models, and availability of alternative safe assets. Capital surcharges reflecting concentrations of sovereign holdings are more flexible and can discourage the home bias without substantial negative effects if appropriately calibrated. The surcharges would also incentivize banks to hold a more diverse pool of liquid assets, which would further contribute to financial stability. More consideration of a concentration surcharge is thus also advocated.<sup>6</sup>

---

<sup>4</sup>Concerns about procyclicality and the possibility of unintended strengthening of the macroeconomic channel are mainly related to exposures to domestic sovereign debt. Because the nexus with foreign sovereigns tends to be substantially less relevant, the regulatory treatment of exposures to foreign sovereign debt should maintain the current risk-sensitive prudential treatment and strong concentration limits.

<sup>5</sup>The main shortcoming of a through-the-cycle risk weight is that, in principle, it could potentially encourage holdings of the riskiest sovereign paper. Nevertheless, this risk is substantially mitigated by the fact that the flat risk weight would apply only to domestic sovereign exposures denominated and funded in domestic currency. Foreign sovereign exposures and domestic exposures denominated in foreign currency could continue to be subject to risk-sensitive capital requirements, minimizing the risk of adverse selection. The regulatory treatment in monetary unions, such as the euro area, would require additional considerations.

<sup>6</sup>Veron (2017) provides a proposal to link capital charges to sovereign risk concentration.

Replacing domestic sovereign exposures in bank portfolios with securities backed by a pool of assets diversified across countries would also help. This would automatically spread default risk across borders, reducing banks' exposure to idiosyncratic sovereign risk and weaken the sovereign-bank nexus. For the euro area, where fiscal stabilization policies are predominantly national in nature, the creation of euro-area-wide sovereign-bond-backed securities would have the potential of enhancing private risk sharing across borders (see, for example, Brunnermeier and others 2011).

Three final observations: First, banks' exposures to central banks are usually of a different nature than exposures to governments. Considering the mechanisms and operationalization of monetary policy, and provided that there are strong governance arrangements for its implementation, it also seems justifiable to consider a more lenient regulatory treatment for exposures to central banks (as opposed to exposures to central governments) denominated in domestic currency to avoid the possibility of hindering such mechanisms. Second, it is important to notice that the current regulatory definition of sovereign exposures is broad and high-level, frequently encompassing exposures such as loans to subnational governments and to public sector entities. Such exposures do not play the same role in financial markets that central government bonds do; for example, their importance for liquidity and balance sheet management, collateral, and monetary policy is substantially lower. Therefore, the reasons that support a beneficial regulatory treatment for sovereign bonds do not apply to such instruments. Third, additional transparency and disclosure could foster market discipline, thus helping to reduce excessive sovereign holdings. Therefore, requirements breaking down the disclosure of sovereign exposures by jurisdictions, currency denomination, and account classification as well as their regulatory treatment should be sought by standards-setters.<sup>7</sup>

### Safety Net Channel

The safety net channel can be weakened by restricting and reducing the need for government guarantees on banks and introducing private loss-sharing arrangements in bank resolution. Following the financial crisis, important policy initiatives have been introduced aiming at ending too-big-to-fail and reducing the need for bailouts. Systemically important banks are now subject to tighter loss absorbency and supervisory requirements, which are meant to reflect externalities associated with their potential failure. Further, the introduction and upgrading of resolution regimes, to provide authorities with a broad range of resolution tools for dealing with banking sector distress, seeks to enable the orderly resolution of banks. In particular, the new minimum

---

<sup>7</sup>See Basel Committee on Banking Supervision (2017) for a potential Pillar 3 template for sovereign exposures.

requirement for liabilities (or loss-absorbing capacity) that should be readily available for bail-in within resolution is meant to support the orderly resolution of global systemically important banks without recourse to public funds by making bail-in resolution strategies feasible and credible.<sup>8</sup>

The effective implementation of these policies is key for weakening the nexus. From an ex-ante perspective, policies should seek to minimize moral hazard. These include bail-in<sup>9</sup> policies that impose losses on agents with greater ability and incentives to monitor bank risk taking such as shareholders and uninsured debtholders (see, for instance, Zhou and others 2012). The enhanced market discipline could also limit excessive undercapitalized and concentrated exposures, possibly weakening the sovereign exposure channel. From an ex-post perspective, these policies directly weaken the safety net channel by limiting the recourse to public funds. Further, to the extent that improved bank resolution frameworks facilitate a speedy resolution of bank distress, help preserve bank value, and minimize spillover effects, they weaken the macroeconomic channel.

That said, resolution regimes will still need constrained flexibility to allow temporary public sector's support in times of severe contagion risk. This may be necessary to mitigate the high impact of system-wide distress and ensure the continuity of credit provision.<sup>10</sup> If limits to government action impair the ability to restructure and resolve weak banks and prevent the speedy resolution of systemic crises, they could end up reinforcing weak-bank/weak-sovereign linkages (Claessens and others 2012). In that context, ongoing efforts to end too-big-to-fail go in the right direction, but given the tradeoff between costs that may arise from the macroeconomic channel and the safety net channel of the nexus, it is key that reforms are implemented fully and on a timely basis. In particular, reforms should focus on introducing robust early intervention powers, effective resolution toolkits and adequate loss-absorbing capacity, effective arrangements for cross-border cooperation, and credible recovery and resolution plans.

### **Cross-Border Integration**

Large internationally active banks with substantial cross-border operations provide an international dimension to the sovereign-bank nexus. In theory, the domestic nexus would be weakened if banks operated across countries with fully diversified balance sheets and were protected by a supranational

---

<sup>8</sup>The standard is known as total loss-absorbing capacity (TLAC). It was agreed on by the Financial Stability Board in November 2015 and applies to global systemically important banks.

<sup>9</sup>This paper uses the term “bail-in” generically, referring to arrangements that allow loss absorbency by private creditors. These arrangements can have a statutory, contractual, or structural nature.

<sup>10</sup>See Dell’Ariccia and others (2018) for a discussion on trade-off in bank resolution.

safety net, including appropriate coordination arrangements for liquidity support. In practice, however, such integrated safety net and arrangements are unlikely to be politically feasible. Therefore, while internationally diversified banks may be better able to withstand shocks to their home country, weakening the domestic macro and sovereign exposure channels, they are also likely to grow much larger, strengthening the safety net channel since (paraphrasing Mervyn King's oft-quoted line) global banks remain national in death. It follows that the sign of the relationship between cross-border financial integration and the strength of the nexus is in general ambiguous.

The practical and political challenges to the introduction of effective cross-border cooperation arrangements have led to changes in the structure of international banks. To curb and better control potential recovery and resolution costs, a number of jurisdictions are introducing requirements for the creation of intermediate holding companies that, in practice, mandate international banks to create local subsidiaries that can operate and be resolved independently from the rest of the group. Such policies can facilitate resolution and arrangements for liquidity support but, *de facto*, will tend to reinforce the link between the health of subsidiaries of international banks and their sovereign host and might fragment cross-border banking flows.

If full integration across a set of countries could be accomplished, the domestic nexus could be substantially weakened across all channels. Take, for instance, the euro area, where the sovereign-bank nexus resulted in a Gordian knot between sovereigns and banks. A full banking union, one that included an integrated safety net with centralized deposit insurance and lender of last resort functions, would significantly weaken the nexus. This would complement the already centralized banking supervision and resolution frameworks. Under such a framework, additional measures could contribute to limit banks' dependence on national economies. The monetary union and supra-national arrangements would eliminate the need for banks to hold bonds from specific countries to manage liquidity and avoid foreign exchange risk. That would allow prudential rules to effectively limit the concentration of exposure to individual sovereigns, although not necessarily to the whole euro area sovereign debt stock, weakening the sovereign exposure channel without compromising the bond-holding liquidity function. Measures aimed at facilitating cross-border banking integration, including the physical presence of banks abroad, would help weaken the macro channel, while the integrated safety net rather than domestic arrangements would apply.

### Box 1. Regulatory Treatment of Sovereign Exposures

Sovereign exposures are treated more favorably than other asset classes in the current regulatory framework, encouraging banks to hold sovereign bonds. This box summarizes the main elements of this regulations.<sup>1</sup>

**Capital:** The Basel risk-weighted capital framework prescribes minimum capital requirements for sovereign exposures<sup>2</sup> related to the underlying credit risk.

Under the standardized approach, sovereign exposures are risk-weighted according to their external ratings on an increasing scale as reported in the table below. However, at national discretion, a lower weight may be applied to domestic sovereign debt, provided it is denominated and funded in domestic currency. This discretion is widely applied. All Basel Committee member jurisdictions apply a zero risk weight to domestic sovereign debt in domestic currency. This exemption is extended across the European Union. For euro area banks, this implies a zero risk weight on any euro-denominated government debt within the euro area. Moreover, the Capital Requirements Regulation provides for a transitional period, to be phased out in 2020, during which a zero risk weight is applied to sovereign exposures denominated and funded in the currency of any member state.

#### Risk Weights for Sovereign Exposures in the Standardized Approach (Percent)

Credit rating	AAA to AA–	A+ to A–	BBB+ to BBB–	BB+ to B–	Below B–	Unrated
Risk weight	0	20	50	100	150	100

Source: Basel Committee on Banking Supervision.

Under the internal-ratings-based approach, banks are permitted to use their own models to estimate default probabilities and loss-given-default, using a granular rating scale to assess the credit of individual sovereigns. In this case, sovereign debt is exempt from the 3-basis-point floor under the default probability prescribed for private issuers with broadly similar

<sup>1</sup>Sources: *BIS Quarterly Review*, December 2013; European Systemic Risk Board (2015); Basel Committee on Banking Supervision (BCBS) International Convergence of Capital Measurement and Capital Standards, June 2006; BCBS: Basel III: Liquidity Coverage Ratio and liquidity risk monitoring tools, January 2013; BCBS Supervisory framework for measuring and controlling large exposures, April 2014; BCBS Basel III Leverage ratio Framework and disclosure requirements, June 2014; BCBS Minimum capital requirements for market risk, January 2016; BCBS Interest rate risk in the banking book, April 2016; EBA Pillar 2 Roadmap, European Banking Authority, April 2017.

<sup>2</sup>Sovereign exposures are defined as exposures to central governments, central banks, international organizations, certain multilateral development banks, and, subject to national discretion, certain nongovernmental public sector entities.

**Box 1. Regulatory Treatment of Sovereign Exposures (continued)**

characteristics. In practice, the risk weights applied to domestic sovereign debt under this approach are often close to zero.

In addition, some jurisdictions (such as the EU) perform stress tests of banks that include shocks to sovereign exposures. The results from these stress tests may guide supervisory actions concerning additional (Pillar 2) capital requirements.

**Credit risk mitigation:** The Basel framework permits a national discretion to apply a zero haircut for repo-style transactions where the collateral is a sovereign security with core market participants.

**Revised market risk framework:** Under the standardized approach, a national discretion is permitted, enabling jurisdictions to apply a preferential default risk charge for sovereign exposures denominated and funded in domestic currency. Under the internal-ratings-based approach, sovereign exposures should be included in models.

**Interest rate risk:** Sovereign debt is exposed to significant interest rate risk. There is no Pillar 1 charge for such risks; rather, following consultation the Committee decided in 2016 to enhance the Pillar 2 approach.

**Large exposures:** There is currently no large exposure or concentration limit applied to sovereign exposure. In particular, sovereign debt is explicitly exempt from the large exposure requirement that limits exposures to any single counterparty or group of connected counterparties to 25 percent of eligible capital.

**Leverage ratio:** Sovereign exposures are included in total assets in the leverage ratio calculations. But the leverage ratio is not a binding constraint for most banks and, thus, does not de facto restrict sovereign exposures.

**Liquidity standards:** Under the liquidity coverage ratio, no limits or haircuts are applied to sovereign exposures, which are defined as high-quality liquid assets (those assigned a zero percent risk weight under the standardized approach).<sup>3</sup>

---

<sup>3</sup>These include both sovereign bonds assigned a zero percent risk weight according to the credit weighting, and under national discretion.

## References

- Abiad, A., G. Dell’Ariccia, and B. Li. 2011. “Creditless Recoveries.” IMF Working Paper 11/58, International Monetary Fund, Washington, DC.
- Acharya, V., Y. Amihud, and S. Bharath. 2013. “Liquidity Risk of Corporate Bond Returns: Conditional Approach.” *Journal of Financial Economics* 110 (2): 358–86.
- Acharya, V., I. Drechsler, and P. Schnabl. 2014. “A Pyrrhic Victory? Bank Bailouts and Sovereign Credit Risk.” *Journal of Finance* 69 (6): 2689–739.
- Acharya, V., T. Eisert, C. Eufinger, and C. Hirsch. 2018. “Real Effects of the Sovereign Debt Crisis in Europe: Evidence from Syndicated Loans.” *Review of Financial Studies* 31 (8): 2855–896.
- Acharya, V., and S. Steffen. 2015. “The Greatest Carry Trade Ever? Understanding Eurozone Bank Risks.” *Journal of Financial Economics* 15 (2): 215–36.
- Akerlof, G., and P. Romer. 1993. “Looting: The Economic Underworld of Bankruptcy for Profit.” *Brookings Papers on Economic Activity* 24 (2): 1–74.
- Alesina, A., S. Ozler, N. Roubini, and P. Swagel. 1996. “Political Instability and Economic Growth.” *Journal of Economic Growth* 1: 189–211.
- Allen, F., and D. Gale. 2000. “Financial Contagion,” *Journal of Political Economy*, Vol. 108:1, pp. 1–33.
- Angeletos, G., F. Collard, H. Dellas, and B. Diba. 2013. “Optimal Public Debt Management and Liquidity Provision.” NBER Working Paper 18800, National Bureau of Economic Research, Cambridge, MA.
- Angelini, P., G. Grande, and F. Panetta. 2014. “The Negative Feedback Loop between Banks and Sovereigns.” Occasional Paper No. 213, Banca d’Italia, Rome, Italy.

- Arslanalp, S., and T. Tsuda. 2014. "Tracking Global Demand for Advanced Economy Sovereign Debt." *IMF Economic Review* 64, 430–64.
- Ashcraft, A. 2005. "Are Banks Really Special? New Evidence from the FDIC-Induced Failure of Healthy Banks." *American Economic Review* 95 (5): 1712–30.
- Barro, R. 1991. "Economic Growth in a Cross Section of Countries." *Quarterly Journal of Economics* 106 (2): 407–44.
- Basel Committee on Banking Supervision. 2017. "The Regulatory Treatment of Sovereign Exposures." Discussion Paper, Bank for International Settlements, Basel, December.
- Baskaya, S., and S. Kalemli-Ozcan. 2016. "Sovereign Risk and Bank Lending: Evidence from 1999 Turkish Earthquake." NBER Working Paper 22335, National Bureau of Economic Research, Cambridge, MA.
- Battistini, N., M. Pagano, and S. Simonelli. 2014. "Systemic Risk, Sovereign Yields and Bank Exposures in the Euro Crisis." *Economic Policy* 29 (78): 203–51.
- Beck, R., P. Jakubik, and A. PiloIU. 2013. "Non-Performing Loans: What Matters in Addition to the Economic Cycle?" ECB Working Paper 1515, European Central Bank, Frankfurt.
- Becker, B., and V. Ivashina. 2018. "Financial Repression in the European Sovereign Debt Crisis." *Review of Finance* 22 (1), 83–115.
- Bernanke, B. 1983. "Nonmonetary Effects of the Financial Crisis in the Propagation of the Great Depression." *American Economic Review* 73 (3): 257–76.
- , and M. Gertler. 1990. "Financial Fragility and Economic Performance." *Quarterly Journal of Economics* 105 (1): 87–114.
- Bocola, L. 2016. "The Pass-Through of Sovereign Risk." *Journal of Political Economy*. 124 (4): 879–926.
- Bofondi, M., L. Carpinelli, and E. Sette. 2018. "Credit Supply during a Sovereign Debt Crisis." *Journal of the European Economic Association* 16 (3): 696–729.
- Bolton, P., and O. Jeanne. 2011. "Sovereign Default Risk and Bank Fragility in Financially Integrated Economies." *IMF Economic Review* 59 (2): 162–94.
- Bottero, M., S. Lenzu, and F. Mezzanotti. 2014. "The Real Effects of Credit Supply Shocks: Evidence from the Sovereign Market." Unpublished, University of Chicago, Department of Economics, Chicago.

- Broner, F., A. Erce, A. Martin, and J. Ventura. 2014. "Sovereign Debt Markets in Turbulent Times: Creditor Discrimination and Crowding-Out Effects." *Journal of Monetary Economics* 61: 114–42.
- Brunnermeier, Markus, Luis Garicano, Philip Lane, Marco Pagano, Ricardo Reis, Tano Santos, Stijn van Nieuwerburgh, and Dimitri Vayanos. 2011. "European Safe Bonds: ESBies." Unpublished, Princeton University, Princeton, NJ.
- , and L. Pedersen. 2009. "Market Liquidity and Funding Liquidity." *Review of Financial Studies* 22: 2201–238.
- , and Y. Sannikov. 2014. "A Macroeconomic Model with a Financial Sector." *American Economic Review* 104: 379–421.
- Brutti, F. 2011. "Sovereign Defaults and Liquidity Crises." *Journal of International Economics* 84 (1): 65–72.
- , and P. Sauré. 2015. "Transmission of Sovereign Risk in the Euro Crisis." *Journal of International Economics* 97 (2): 231–48.
- Caballero, R. and A. Krishnamurthy. 2008. "Collective Risk Management in a Flight to Quality Episode." *Journal of Finance*, Vol. 63(5), pp. 2195–2230.
- Caballero, R. and A. Simsek (2017), "A Risk-Centric Model of Demand Recessions and Macroprudential Policy." MIT mimeo.
- Chari, V., A. Dovis, and P. Kehoe. 2014. "On the Optimality of Financial Repression." Unpublished, University College London.
- Claessens, S., M. Ayhan Kose, and M. Terrones. 2012. "How Do Business and Financial Cycles Interact?" *Journal of International Economics* 87 (1): 178–90.
- Claessens, S., C. Pazarbasioglu, L. Laeven, M. Dobler, F. Valencia, O. Nedelcsu, and K. Seal. 2011. "Crisis Management and Resolution: Early Lessons from the Financial Crisis." IMF Staff Discussion Note 11/05, International Monetary Fund, Washington, DC.
- Cœuré, Benoît. 2016. "Sovereign Debt in the Euro Area: Too Safe or Too Risky?" Keynote address at Harvard University's Minda de Gunzburg Center for European Studies, Cambridge, MA, November 3.
- Correa, R., H. Sapriza, and A. Zlate. 2013. "Liquidity Shocks, Dollar Funding Costs, and the Bank Lending Channel during the European Sovereign Crisis." FRB International Finance Discussion Paper 1059, Board of Governors of the Federal Reserve System, Washington, DC.
- Cruces, J., and C. Trebesch. 2013. "Sovereign Defaults: The Price of Haircuts." *American Economic Journal: Macroeconomics* 5 (3): 85–117

- Dell’Ariccia, G., E. Detragiache, and R. Rajan. 2008. “The Real Effect of Banking Crises.” *Journal of Financial Intermediation* 17 (1): 89–112.
- , D. Igan, L. Laeven, and H. Tong. 2016. “Credit Booms and Macroeconomic Stability.” *Economic Policy* 31 (86): 301–55.
- , M. S. Martinez Peria, D. Igan, E. Awadzi, M. Dobler, and D. Sandri. 2018. “Trade-Offs in Bank Resolution,” IMF Staff Discussion Note 18/02, International Monetary Fund, Washington, DC.
- , and L. Ratvnoski. 2013. “Bailouts and Systemic Insurance.” IMF Working Paper 13/233, International Monetary Fund, Washington, DC.
- Diamond, D., and P. Dybvig. 1983. “Bank Runs, Deposit Insurance, and Liquidity.” *Journal of Political Economy* 91 (3): 401–19.
- European Systemic Risk Board (ESRB). 2015. “Report on the Regulatory Treatment of Sovereign Exposures.” March.
- Farhi, E., and J. Tirole. 2012. “Collective Moral Hazard, Maturity Mismatch and Systemic Bailouts.” *American Economic Review* 102 (1): 60–93.
- . 2014. “Deadly Embrace: Sovereign and Financial Balance Sheets Doom Loops.” Working Paper 164191, Harvard University OpenScholar.
- Financial Stability Board. 2017. “Implementation and Effects of the G20 Financial Regulatory Reform: Third Annual Report.” Bank for International Settlements, Basel, July.
- Fratzscher, M., and M. Rieth. 2015. “Monetary Policy, Bank Bailouts and the Sovereign-Bank Risk Nexus in the Euro Area.” DIW Berlin Discussion Paper 1448, German Institute for Economic Research, Berlin.
- Friewald, N., R. Jankowitsch, and M. Subrahmanyam. 2012. “Illiquidity or Credit Deterioration: A Study of Liquidity in the US Corporate Bond Market during Financial Crises.” *Journal of Financial Economics* 105 (1): 18–36.
- Gennaioli, N., A. Martin, and S. Rossi. 2014a. “Banks, Government Bonds, and Default: What Do the Data Say?” IMF Working Paper 14/120, International Monetary Fund, Washington, DC.
- . 2014b. “Sovereign Default, Domestic Banks, and Financial Institutions.” *Journal of Finance* 69 (2): 819–66.
- Giannetti, M., and A. Simonov. 2013. “On the Real Effects of Bank Bailouts: Micro Evidence from Japan.” *American Economic Journal: Macroeconomics* 5 (1): 135–67.
- Gourinchas, P., and M. Obstfeld. 2012. “Stories of the Twentieth Century for the Twenty-First.” *American Economic Journal: Macroeconomics* 4 (1): 226–65.

- Grigorian, D., and V. Manole. 2017. "Sovereign Risk and Deposit Dynamics: Evidence from Europe." *Applied Economics* 49 (29): 2851–60.
- He, Z., and A. Krishnamurthy. 2012. "A Model of Capital and Crises." *Review of Economic Studies* 79: 735–77.
- Holmstrom, B., and J. Tirole. 1998. "Private and Public Supply of Liquidity." *Journal of Political Economy* 106 (1): 1–40.
- International Monetary Fund (IMF). 2009. "From Recession to Recovery: How Soon and How Strong?" In *World Economic Outlook*, April, 103–38. Washington, DC.
- . 2015. "From Banking to Sovereign Stress: Implications for Public Debt." IMF Policy Paper, Washington, DC.
- . 2016. "Iceland: Staff Report for the 2016 Article IV Consultation." Washington, DC.
- . 2017. "Strengthening Liquidity Management Frameworks in Support of Stability and Growth in the GCC." IMF Policy Paper, Washington, DC.
- Ivashina, V., D. Scharfstein, and J. Stein. 2015. "Dollar Funding and the Lending Behavior of Global Banks." *Quarterly Journal of Economics* 130 (3): 1241–1281 .
- Jordà, O., M. Schularick, and A. Taylor. 2016. "Sovereigns versus Banks: Credit, Crises, and Consequences." *Journal of the European Economic Association* 14 (1): 45–79.
- Kiyotaki, N., and J. Moore. 1997. "Credit Cycles." *Journal of Political Economy* 105 (2): 211–48.
- Klein, M., J. Peek, and E. Rosengren. 2002. "Troubled Banks, Impaired Foreign Direct Investment: The Role of Relative Access to Credit." *American Economic Review* 92 (3): 664–82.
- Krishnamurthy, A. 2010. "How Debt Markets Have Malfunctioned in the Crisis." *Journal of Economic Perspectives* 24 (1): 3–28.
- , and A. Vissing-Jorgensen. 2012. "Aggregate Demand for Treasury Debt." *Journal of Political Economy* 120 (2): 237–67.
- Kroszner, R., L. Laeven, and D. Klingebiel. 2007. "Banking Crises, Financial Dependence, and Growth." *Journal of Financial Economics* 84 (1): 187–228.
- Laeven, L., and F. Valencia. 2010. "Resolution of Banking Crises; The Good, the Bad, and the Ugly." IMF Working Paper 10/146, International Monetary Fund, Washington, DC.

- . 2012. “The Use of Blanket Guarantees in Banking Crises.” *Journal of International Money and Finance* 31 (5): 1220–48.
- . 2013a. “Systemic Banking Crises Database.” *IMF Economic Review* 61 (2): 225–70.
- . 2013b. “The Real Effects of Financial Sector Interventions during Crises.” *Journal of Money, Credit and Banking* 45 (1): 147–77.
- Lanotte, M., G. Manzelli, A. M. Rinaldi, M. Taboga, and P. Tommasino. 2016. “Easier Said Than Done? Reforming the Prudential Treatment of Banks’ Sovereign Exposures.” Occasional Paper No. 326, Banca d’Italia, Rome, Italy.
- Levine, R. 2005. “Finance and Growth: Theory and Evidence.” *Handbook of Economic Growth* 1, Part A: 865–934.
- Livshits, I., and K. Schoors. 2009. “Sovereign Default and Banking.” Unpublished, University of Western Ontario.
- Mody, Ashoka, and Damiano Sandri. 2012. “The Eurozone Crisis: How Banks and Sovereigns Came to be Joined at the Hip.” *Economic Policy* 27 (70): 199–230.
- Nakaso, H. 2013. “Financial Markets without a Risk-Free Sovereign.” BIS Paper, Bank for International Settlements, Basel, July.
- Ongena, S., A. Popov, and N. van Horen. 2016. “The Invisible Hand of the Government: Moral Suasion during the European Sovereign Debt Crisis.” CEPR Discussion Paper 11153, Center for Economic Policy and Research, Washington, DC.
- Peek, J., and E. Rosengren. 1997. “The International Transmission of Financial Shocks: The Case of Japan.” *American Economic Review* 87 (4): 495–505.
- . 2000. “Collateral Damage: Effects of the Japanese Banking Crisis on Real Activity in the United States.” *American Economic Review* 90 (1): 30–45.
- . 2014. “The Role of Banks in the Transmission of Monetary Policy.” In *The Oxford Handbook of Banking*, edited by Allen N. Berger, Philip Molyneux, and John O. S. Wilson, Oxford University Press, Oxford, UK.
- Ponticelli, J., and J. Voth. 2012. “Austerity and Anarchy: Budget Cuts and Social Unrest in Europe, 1919–2008.” CEPR Discussion Paper 8513, Center for Economic Policy and Research, Washington, DC.
- Popov, A., and N. van Horen. 2015. “Exporting Sovereign Stress: Evidence from Syndicated Bank Lending during the Euro Area Sovereign Debt Crisis.” *Review of Finance* 19 (5): 1825–66.

- Ratnovski, L., and A. Narain. 2007. "Public Financial Institutions in Developed Countries—Organization and Oversight." IMF Working Paper 07/277, International Monetary Fund, Washington, DC.
- Reinhart, C. M. 2012. "The Return of Financial Repression." CEPR Discussion Paper 8947, Center for Economic Policy and Research, Washington, DC.
- , and B. Sbrancia. 2015. "The Liquidation of Government Debt." *Economic Policy* 30 (82): 291–333.
- Sandri, D., and F. Valencia. 2013. "Financial Crises and Recapitalizations." *Journal of Money, Credit, and Banking*, Vol. 45, pp. 59–86.
- Schneider, M., and A. Tornell. 2004. "Balance Sheet Effects, Bailout Guarantees and Financial Crises." *Review of Economic Studies* 71 (3): 883–913.
- Stein, J. 2013. "The Fire-Sales Problem and Securities Financing Transactions." Speech delivered at the Federal Reserve Bank of Chicago and International Monetary Fund Conference, Chicago, November 7.
- Tornell, A., and A. Velasco. 1992. "The Tragedy of the Commons and Economic Growth: Why Does Capital Flow from Poor to Rich Countries?" *Journal of Political Economy* 100 (6): 1208–31.
- Van den Heuvel, S. 2008. "The Welfare Cost of Bank Capital Requirements." *Journal of Monetary Economics* 55 (2): 298–320.
- Van Nieuwerburgh, S., and L. Veldkamp. 2009. "Information Immobility and the Home Bias Puzzle." *Journal of Finance* 64, 1187–215.
- Veron, N. 2017. "Sovereign Concentration Charges: A New Regime for Banks' Sovereign Exposures." Study provided at the request of the Economic and Monetary Affairs Committee of the European Parliament, European Parliament Directorate-General for Internal Policies: Economic Governance Support Unit, Brussels.
- Zhou, J., V. Rutledge, W. Bossu, M. Dobler, N. Jassaud, and M. Moore. 2012. "From Bail-Out to Bail-In: Mandatory Debt Restructuring of Systemic Financial Institutions." IMF Staff Discussion Note 12/03, International Monetary Fund, Washington, DC.