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FROM BANKING TO SOVEREIGN STRESS: IMPLICATIONS FOR PUBLIC DEBT

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- The report From Banking to Sovereign Stress: Implications for Public Debt, prepared by IMF staff and completed on December 22, 2014 to brief the Executive Board on January 21, 2015.

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FROM BANKING TO SOVEREIGN STRESS: IMPLICATIONS FOR PUBLIC DEBT

EXECUTIVE SUMMARY

This paper explores how banking sector developments and characteristics influence the propagation of risks from the banking sector to sovereign debt, including how they affect the extent of fiscal costs of banking crises when those occur. It then proposes practices and policies for the fiscal authorities to help manage the risks and enhance crisis preparedness.

Banking sector expansions, especially large ones, can create significant risks for the sovereign. Recessions preceded by a large buildup of banking vulnerabilities—including increasing leverage, expanding balance sheets, and a greater reliance on wholesale external funds—exhibit deeper GDP contractions and longer recovery times, leading to greater deteriorations in the fiscal primary balance and public debt. When banking sector vulnerabilities unravel in banking crises, the risks to the sovereign are further exacerbated by the high fiscal cost of related crisis management policies, particularly bank bailouts.

When a banking crisis occurs, the fiscal costs of dealing with the crisis are influenced by precrisis banking sector characteristics, institutional and regulatory frameworks, as well as crisis resolution policies. Direct fiscal costs of banking crises are higher in countries with larger and more leveraged banking sectors that rely more on external funding. Costs tend to be lower in countries that have strong bank supervision and effective safety nets, including broader deposit insurance schemes.

Other banking sector characteristics further influence risks from banks to the sovereign. Banks' large holdings of domestic sovereign claims amplify the links between banks and the sovereign. While such "home bias" can help reduce borrowing costs and provide fiscal breathing space especially during times of stress, it can also lead to increased accumulation of debt and an eventual rise in sovereign risk. Finally, markets appear to reflect concerns regarding bank-sovereign links: the implied probability of sovereign distress conditional on bank stress is markedly higher in countries with more leveraged banking sectors. Markets' perception of government bailout of banks in turn may also contribute to pernicious bank-sovereign links.

Proposals. Efforts to strengthen financial sector regulation and supervision are the preferred approach to preserve the health of the banking sector and minimize the risk

that taxpayer funds may be exposed to loss due to banks' failures. Policy priorities should include macroprudential measures aimed at reducing excessive procyclicality in banking systems, higher bank loss-absorbing capacities, and effective resolution powers and planning. While several countries have made progress in these areas in light of the recent global financial crisis, fiscal risks from the banking sector are likely to remain. Although the specific policy recommendations to deal with these risks will depend on country-specific circumstances, the main findings of this paper suggest that fiscal authorities should:

- *Have in place an institutional framework that strengthens their ability to identify and monitor risks coming from the banking sector*. In this context, diagnostic analytical tools could be designed to help assess emerging country-specific bank-to-sovereign risks, for example, early warning models or triggers for contingent liabilities analysis.
- *Lean against the wind during banking booms so as to develop fiscal buffers that would allow for appropriately-sized countercyclical policies during downturns*. The adoption of fiscal rules that constrain the spending of unsustainable increases in tax revenue associated with credit booms, including particular reliance on real estate-related sources of revenues, would be beneficial in this regard. More work is needed to further develop such rules.
- *Balance the benefits and risks associated with reliance on domestic banks as a source of public financing*. Excessive reliance on domestic bank financing may lead to distortions, a false sense of debt sustainability, and a deeper bank-sovereign nexus.
- *Consider tax policies that reduce the bias towards debt financing and the attractiveness of leverage*. Reducing banks' debt bias via removing tax incentives to borrow and introducing a Financial Stability Contribution tax could lower banking sector risks and help build fiscal buffers when vulnerabilities increase.

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CONTENTS

I. INTRODUCTION 5
A. Scope 6
B. Findings 7

II. FROM BANKING TO PUBLIC DEBT STRESS 9
A. Macro-Financial and Macro-Fiscal Channels 9
B. Fiscal Costs of Systemic Banking Crises 15

III. THE ROLE OF COUNTRY AND BANKING SYSTEM CHARACTERISTICS 18
A. Precrisis Banking Vulnerabilities and Regulatory Features 18
B. Crisis Management Policies and Practices 21
C. Banks' Home Bias in Sovereign Debt 23
D. Market-Based Measures of Bank-to-Sovereign Contagion 26

IV. GOOD PRACTICES FOR MONITORING, MEASURING, AND REPORTING RISKS FROM THE BANKING SECTOR TO PUBLIC DEBT 28
A. Institutional Framework 29
B. Identifying and Measuring Relevant Risks 30
C. Reporting Risks 32

V. CONCLUSION AND POLICY IMPLICATIONS 33
A. Data and Analysis 39
A. Direct Fiscal Costs 44
A. Sovereign's Borrowing Costs—Panel Analysis 56
A. Data Coverage 66
A. Summary of Results 72

BOXES
1. Policies to Resolve Financial System Stress and Restore Financial Intermediation 36
2. Determinants of Banks' Preference for Domestic Sovereign Claims 37
3. Using Quantitative Frameworks to Value Contingent Liabilities 38

FIGURES

1. Conceptual Framework 7
2. Excessive Leverage, External Borrowing, and Downturns 11
3. Expansions, Recessions, and Recoveries 12
4. Business Cycles Characteristics in Banking Recessions 12
5. Dependence on External Borrowing in Banking Recessions 13
6. Fiscal Dynamics during Business Cycles 14
7. Fiscal Dynamics around Banking Recessions 15
8. Fiscal Costs of Banking Crises 17
9. Direct Fiscal Costs: Size, Leverage and Reliance on External Funds of the Banking Crises 19
10. Increase in Public Debt after Banking Crises 20
11. Direct Fiscal Costs: Quality of Banking Supervision and Deposit Insurance Coverage 21
12. Direct Fiscal Costs: Countries With and Without Guarantees on Banks' Liabilities 22
13. Banks' Home Bias and Public Debt 24
14. Estimated Primary Balance at Lagged Public Debt of 80 percent of GDP 25
15. Public Debt across the Distribution of Home Bias 26

TABLES

1. Fiscal Cost of Banking Crises 16
2. Directional Impact of Various Factors on BSC 27

REFERENCES 80

ANNEXES

I. Macro-Fiscal and Macro-Financial Effects of Banking Sector Characteristics 39
II. Fiscal Cost of Systemic Banking Crises 44
III. Empirical Analysis of Bank's Home Bias in Sovereign Debt 56
IV. Market-Based Measures of Bank to Sovereign Contagion 66
V. Measuring, Monitoring, and Reporting Risk to Public Debt from the Financial Sector—Country Survey on Current Practices 72

I. INTRODUCTION

1. The recent global crisis has highlighted the far-reaching implications of the linkages between banks and the sovereign for public debt sustainability.[1] The economic downturns in advanced economies after 2008 were preceded by significant increases in the leverage, size, and reliance on external funds of banking sectors. In some countries, the associated buildup of vulnerabilities unraveled in full-blown banking crises that contributed to significant increases in public debt, partly as a result of government interventions, including the fiscal cost of bank bail-outs. More generally, public debt increased sharply in many countries after the crisis as banking vulnerabilities aggravated economic downturns, worsened overall fiscal balances, and for some governments, increased the cost of borrowing.

2. These recent events confirm longstanding relationships between banking sector and public debt developments. A large body of empirical work has established how banking sector developments can affect macroeconomic and fiscal outcomes. Systemic banking crises have been associated with significant direct fiscal costs and increases in public debt: the median cost of direct government intervention in the banking sector across a sample of crises over the period 1970–2011 amounted to about 7 percent of GDP. Banking crises have also been associated with increases in public debt beyond direct costs. The median increase in debt when factoring in the indirect fiscal impact of banking stress is about 12 percentage points of GDP (measured over the 4-year period from the precrisis year). In almost a third of the sample, debt increased by more than 20 percentage points of GDP.[2]

3. The linkages between bank risks and public debt are part of a complex bank-sovereign nexus. These linkages result from the key role banks play in intermediating resources necessary for economic activity. Impaired intermediation leads to lower economic growth and, ultimately, weaker fiscal balances: a banking crisis disrupts the supply of credit to the private sector, which in turn tends to reduce consumption and investment. These events increase sovereign risk and further depress economic activity, which can aggravate banking sector stress, creating a downward spiral. In addition, specific linkages arise from, *inter alia,* explicit and implicit public backstops for banks, the sovereign borrowing from banks, banking sector regulatory frameworks which favor the government as a debtor, the use of domestic sovereign debt as bank collateral, and the relationship between the sovereigns' and banks' funding conditions.

[1]See WEO (2010) and GFSR (2010).

[2]Definitions and data on systemic banking crises and on direct fiscal costs rely on the Laeven and Valencia (2013) database, which identifies 147 banking crisis episodes during 1970-2011. Direct fiscal costs are defined as the sum of governments' recapitalization costs and asset purchases, and other country-specific measures (e.g., central bank recapitalization costs and loans to banks) that take place within the two-year period after the onset of the crisis.

A. Scope

4. This paper contributes to ongoing analyses on the impact of banking sector developments and vulnerabilities on public debt. Past studies have looked at how sovereign balance sheet distress can affect the stability of the banking sector, including how financial institutions should treat credit risks related to sovereigns.[3] Recent analysis of the impact of banking sector stress on the sovereign has focused more narrowly on the likelihood of sovereign default after the onset of banking crises.[4] This paper builds on existing work by further exploring some of the underlying linkages from the banking sector to pre- and post-banking crisis macro-fiscal developments, and by revisiting the factors associated with the fiscal cost of banking crises.[5]

5. The analysis in the paper focuses particularly on how the banking sector characteristics and the build-up of vulnerabilities are associated with increasing public debt. The paper first reviews how banking sector developments may affect fiscal risks and debt sustainability during excessive banking expansions and when systemic banking crises occur. It then analyzes how certain country and banking system characteristics help explain the propagation of risks from banks to the sovereign (Figure 1). The paper stresses the role of regulatory and macroprudential policies to preserve the health of the banking sector and contain fiscal risks, and proposes practices and policies for the fiscal authorities to help manage these risks. It is worth noting that the analyses in the paper focus on the impact of banks' vulnerabilities on public debt while taking into account the contribution of feedback loops between the banks and the sovereign, as highlighted in Figure 1. However, nonbank financial sector vulnerabilities and migration of financial risks to the shadow banking system, which in some cases may be more important than banking vulnerabilities, are beyond the scope of this paper.[6]

6. The primary focus of the analysis is on emerging markets and advanced economies, but some of the conclusions may be relevant for many low income countries to help improve crisis preparedness of the fiscal authorities. Banking sectors in low income countries (LICs) tend to be relatively underdeveloped compared to those in emerging markets (EMs) and advanced economies (AEs), and the source of banking sector risks is generally different from the boom-bust episodes typically observed in EMs and AEs. While the specific policy responses of LICs should be adapted according to their banking sector characteristics, the bank-sovereign transmission channels considered in the paper could be relevant especially in countries where financial deepening is taking place.

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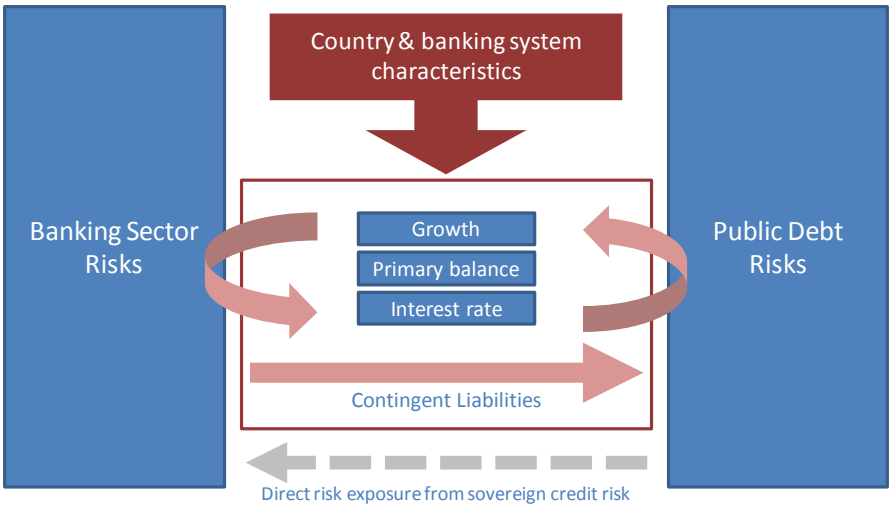
[3]See, for example, Angeloni and Wolff (2012); Bolton and Jeanne (2011); and Davies (2011).

[4]See Laeven and Valencia (2010); Reinhart and Rogoff (2011); Balteanu, Erce, and Fernandez (2012); and Gourinchas and Obstfeld (2012).

[5]This work builds on Demirgüç-Kunt and Detragiache (1998); Hoggarth, Glenn, Reis, and Saporta (2002); Claessens, Klingebiel, and Laeven (2005); and, more recently, Laeven and Valencia (2010); Reinhart and Rogoff (2011); and Balteanu, Erce, and Fernandez (2012).

[6]See IMF (2014d) for a detailed discussion of the shadow banking system.

Figure 1. Conceptual Framework



B. Findings

7. On the effect of banking vulnerabilities on sovereign debt, the paper shows that:

- Rapid bank credit expansions and associated banking sector vulnerabilities can amplify the depth and length of the subsequent recessions, constrain the pace of recovery (growth channel), and exert fiscal pressure (fiscal balance channel), thereby raising sustainability concerns (Section II.A). These macro-fiscal and macro-financial channels are active regardless of whether there is banking stress, but become more significant during banking crises.

- When a banking crisis materializes, the associated fiscal costs are often significant (Section II.B). The tendency for sovereign stress to follow banking crises has been well documented.[7] Banking crises place a significant burden on public finances through the fiscal cost associated with resolving crises (direct channel), and through their overall adverse impact on growth, interest rates, and asset prices (indirect channels).

8. A number of country, institutional, and banking characteristics affect how risks propagate from banks to the sovereign and the magnitude of their fiscal impact:

- Banking sector and institutional characteristics can contribute to shape the bank-sovereign links. A larger banking sector, higher leverage, and greater reliance on wholesale or foreign funding are associated with deeper and longer post-credit boom recessions and larger increases in fiscal deficit and public debt. When systemic banking crises occur, the same vulnerabilities are

[7]The literature has found that banking crises tend to precede currency and sovereign debt crises (e.g., Reinhart and Rogoff (2011); Gourinchas and Obstfeld (2012); and Laeven and Valencia (2013)). These conclusions have been obtained in different samples and under different methodologies and definitions of a crisis. See Claessens, Kose, Laeven, and Valencia (2014) for a collection of analyses on the causes, impact, and consequences of financial crises.

associated with higher direct fiscal costs. However, in a cross-country study, direct fiscal costs tend to be lower in countries where a larger fraction of bank deposits was insured and in countries with better quality of bank supervision. Such government guarantees, however, increase contingent fiscal liabilities (Section III.A).

- Resolution frameworks and crisis management practices affect the economic impact of a crisis and, therefore, its fiscal costs. Evidence suggests that countries that ended up providing guarantees on banks' liabilities after the onset of a crisis typically face higher direct fiscal costs. In general, better containment and resolution policies facilitate a speedy recognition of loan losses and immediate recapitalization and may lead to a faster recovery, and ultimately lower direct and overall fiscal costs (Section III.B).

- Large holdings of government debt by banks—referred to as banks' home bias in sovereign debt—can reinforce the two-way linkages and feedback loops between banks and the sovereign and therefore have important implications for public debt sustainability. Banks' preference for domestic sovereign debt reflects, *inter alia*, the preferential regulatory treatment of government debt, a general preference for local-currency liquid assets, and at times the government's "moral suasion" over banks. High demand for sovereign debt by banks, in turn, has implications for the government's cost of borrowing and its incentive to respond to high levels of public debt (Section III.C).

- Banking sector characteristics also affect the market's pricing of risks to the sovereign due to banks' balance sheet weaknesses. The analysis shows how markets reflect the likelihood of a materialization of contingent liabilities related to contagion from the banks to the sovereign and the ensuing bail-outs. This means that bank-to-sovereign risks are ultimately priced into higher sovereign spreads (Section III.D).

9. Based on its findings, the paper highlights the importance of sound fiscal policies and practices to monitor and mitigate the fiscal risks stemming from the banking sector (Section IV). A survey of member countries regarding their practices in identifying and assessing risks from the financial sector to the sovereign suggests that there may still be insufficient attention to the fiscal risks created by the banking sector. The paper aims to raise awareness among policy makers and improve their readiness to deal with the potentially far-reaching fiscal implications of a buildup of ex-ante vulnerabilities in the banking sector, regardless of the strength of the regulatory framework. It proposes specific practices for fiscal authorities to monitor risks to public finances from the banking sector. In this regard, the paper proposes that staff develop or build on existing analytical tools to help identify emerging bank-to-sovereign risks in the context of the ongoing work to develop broader macro-financial surveillance toolkits. More generally, the paper reinforces calls for fiscal policies, including in the tax area, to mitigate banking booms and build up fiscal buffers in good times, thereby allowing for effective countercyclical policies during downturns and help safeguard fiscal sustainability.

10. The paper recognizes that banking regulatory and supervisory frameworks, including macroprudential and resolution policies, may well be the best tools to safeguard the health of

the banking sector and reduce the associated risks for public debt sustainability. Macroprudential and resolution policies are usefully complemented by appropriate fiscal policies that can reduce incentives to borrow and the scope for adverse feedback between sovereign risk and the financial system (see IMF (2013), "Key Aspects of Macroprudential Policy"). However, given that changes in the regulatory framework typically lag financial market developments and that risks can emerge from new sources, the policy implications in this paper are generally relevant for most existing prudential and regulatory architectures.

II. FROM BANKING TO PUBLIC DEBT STRESS

A. Macro-Financial and Macro-Fiscal Channels

11. Developments in the banking sector can impact debt sustainability by amplifying the depth and length of recessions, constraining the pace of recovery, and exerting strong fiscal pressures. The recent global crisis has shown that a buildup of excessive leverage in the economy, often associated with housing booms and fast credit growth, can lead to public debt sustainability concerns. This section shows that episodes of rapid credit growth can lead to excessive leverage that, when unraveled, can amplify the shocks on the real economy as well as on the sovereign balance sheet.

Banking sector expansions, recessions, and recoveries

12. There is a strong correlation between the extent of ex-ante banking expansions and the ensuing depth of recessions and pace of recoveries (Annex I). While some banking expansions may reflect a healthy deepening of the financial sector, many episodes of rapid credit growth have been associated with the buildup of vulnerabilities through looser lending standards, asset price bubbles, and excessive leverage.[8] Such credit booms have often been followed by recessions and in several cases have unraveled in full-blown banking crises, all inflicting substantial damage to the real economy. Figure 2 shows that, for a sample of advanced and emerging markets, severe recessions tend to be preceded by a significant buildup of leverage, as proxied by the private sector credit-to-GDP and loan-to-deposit ratios, as well as by an increased dependence on external borrowing relative to domestic deposits.[9] While the median leverage increased only minimally during the five years preceding non-severe recessions, such an increase was clearly significant in the case of severe recessions. In severe recessions, both private sector credit-to-GDP and loan-to-

[8]See Dell'Ariccia, Igan, Laeven, and Tong (2012) for evidence and analysis of the linkages between credit booms and banking crises.

[9]The results in this section are based on an analysis of a sample of 31 advanced economies and 29 emerging market economies, over the period 1970–2013. A recession is classified as "severe" when the output contraction from peak to trough (amplitude) *and* the duration (in quarters) from peak to recovery correspond to the top quartile of their distributions. See Annex I for more details on the database and the methodology used to identify recessions. Several studies have documented similar results to those in this section based on a smaller sample of countries (only advanced economies) and annual data. For example, see Claessens, Kose, and Terrones (2009, 2011, and 2012); and Reinhart and Rogoff (2014).

deposit ratios increased by some 25 percentage points.[10]

13. Rapid buildup of leverage in the banking sector is often underpinned by banks' increased reliance on wholesale funds, which can quickly dissipate at the onset of a crisis. Banks with loan-to-deposit ratios greater than 1 must fund their loan portfolio through other sources, including short-term wholesale funds such as interbank loans, commercial paper, wholesale certificates of deposit, repos, and swaps. Some of these sources, particularly those coming from external creditors, tend to be volatile, especially during times of distress. The dissipation of wholesale funds can cause a sudden pullback in banks' lending activity which in turn depresses activity in the real sector. Figure 2 shows that severe recessions are associated with higher loan-to-deposit ratios and potentially greater reliance on external funding. This evidence is consistent with the literature, which shows that reliance on wholesale funding was a major source of bank vulnerabilities during the global financial crisis and that banks that funded themselves with non-deposit and foreign liabilities performed worse during the financial crisis, while their economies also experienced weaker growth outcomes.[11]

14. Indeed, data show that "banking recessions"—recessions preceded by rapid banking sector expansions—tend to be deeper, longer, and followed by slower output recovery than other types of recessions. A banking recession is defined as a recession preceded by a significant banking expansion over 5 years, i.e., where the 5-year cumulative change in private sector credit-to-GDP ratio is above the median of its distribution across emerging and advanced economies.[12] Figure 3 shows that:

- During expansions, real GDP growth paths in the three years before output reaches its peak level are similar for banking and nonbanking recessions, with output expanding in both cases by about 11 percent. Banking-driven growth booms are not necessarily more pronounced than booms driven by nonbanking factors.

- In contrast to expansions, however, the dynamics of output contractions are markedly different between banking and nonbanking recessions. The median banking recession tends to be deeper and lasts longer than other recessions. Emerging markets have historically faced deeper banking recessions than advanced economies.

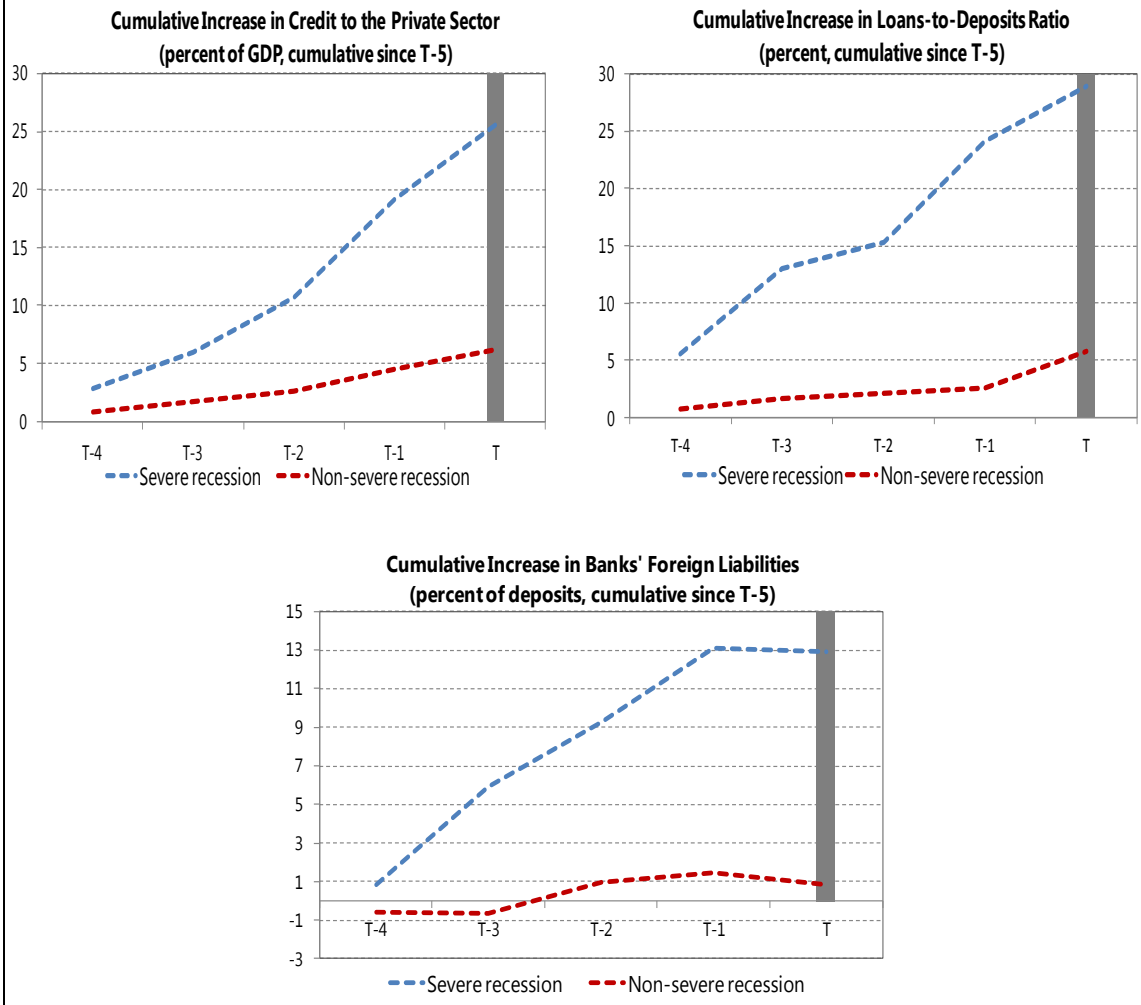
[10]Using an alternative definition of severe recessions (when amplitude or the duration from peak to recovery corresponds to the top quartile of their distributions), both leverage ratios still increased considerably by 15 percentage points.

[11]See, for example, Demirgüç-Kunt and Huizinga (2010); Bologna (2011); Vazquez and Federico (2012); GFSR (October 2012 and 2013); and Berkmen and others (2012).

[12]Such a distribution is conditional on the credit-to-GDP ratio increasing in the past 5 years and being above 10 percent at T-5, as otherwise banking expansions may be related to financial deepening rather than to excessive risk-taking (see Dell'Ariccia and others, 2012 who used a similar cutoff to study credit booms). The median of the 5-year cumulative increase of the credit-to-GDP ratio across emerging and advanced economies is about 10 percent of GDP. See also Abiad and others (2011), and Claessens and others (2011).

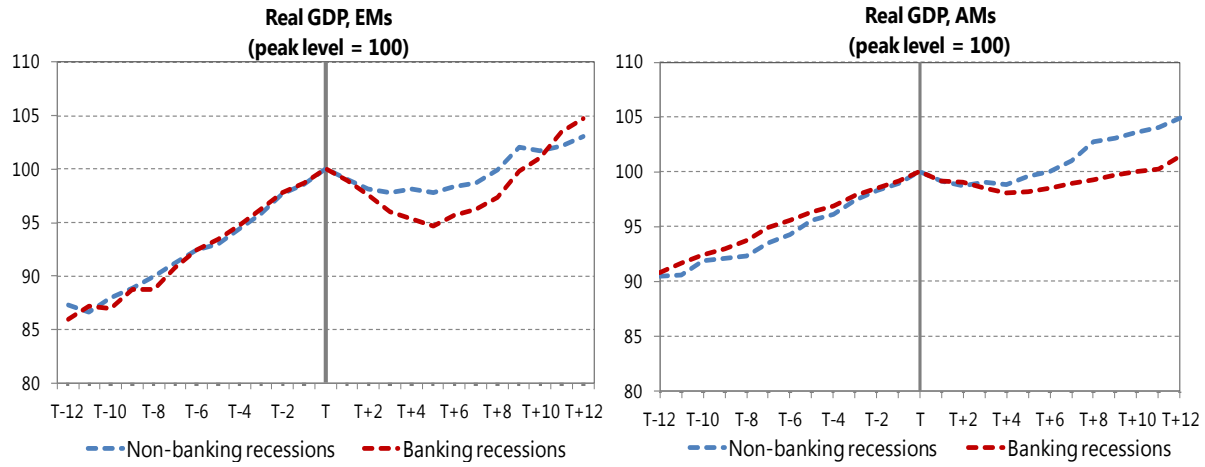
- Recoveries are slower after banking recessions. In particular, regaining the pre-recession output level takes about one more year in banking recessions compared to nonbanking recessions for both advanced and emerging market economies.

Figure 2. Excessive Leverage, External Borrowing, and Downturns



Source: Fund staff estimates.
T (in years) corresponds to the peak output level.
At T, figures show the median change of credit-to-GDP, loans-to-deposits, and banks' foreign liabilities to domestic deposits between T-4 and T.

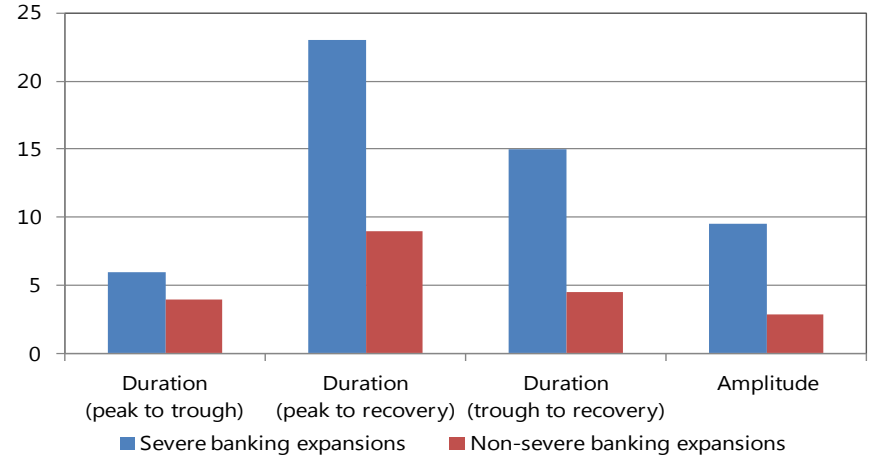
Figure 3. Expansions, Recessions, and Recoveries



Source: Fund staff estimates.
T (in quarters) corresponds to the peak output level, normalized to 100.

15. Furthermore, the greater the preceding banking expansions, the deeper the output contraction and the slower the recovery (Figure 4)**.** A "severe banking expansion" corresponds to the top quartile of the 5-year cumulative change in the private sector credit-to-GDP ratio within the episodes of banking recessions. Although there is no significant difference in terms of the median duration from output peak to trough when recessions are preceded by severe versus non-severe banking expansions, precrisis banking developments do matter for the recovery. The median recovery time (duration from one peak to the time such a level is recovered) for recessions preceded by severe banking recessions is more than twice that for recessions preceded by non-severe banking expansions. The difference in amplitude (the percentage change of real GDP between output peak and trough) further highlights the high economic costs imposed by ex-ante banking sector vulnerabilities. These observations hold for the separate EM and AE samples.

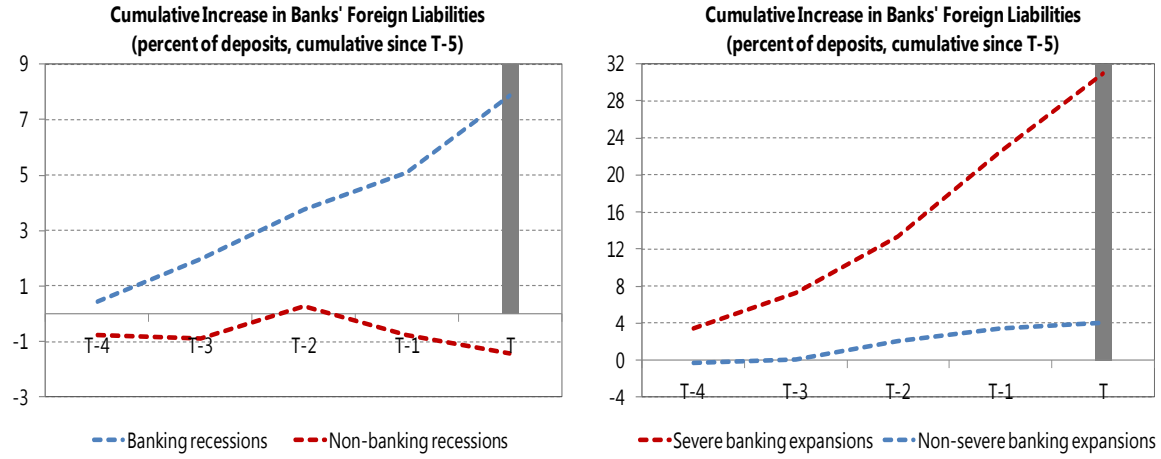
Figure 4. Business Cycles Characteristics in Banking Recessions
(Duration in Quarters, Otherwise in Percent)



Source: Fund staff estimates.

16. The tendency for deeper output contractions and slower recoveries during and after banking recessions is even more marked when the preceding banking expansions involved increased reliance on foreign funding. Large banking expansions often go hand in hand with large reliance on foreign funding (Figure 5). Capital inflows are often welcomed during good times, but their skittishness at times of stress can lead to severe credit crunches and pervasive real effects. While non-banking recessions are not associated with the particular bank funding patterns, banking recessions tend to follow expansions fueled by large increases in banks' external borrowing.

Figure 5. Dependence on External Borrowing in Banking Recessions



Source: Fund staff estimates.

T corresponds to the peak output level.

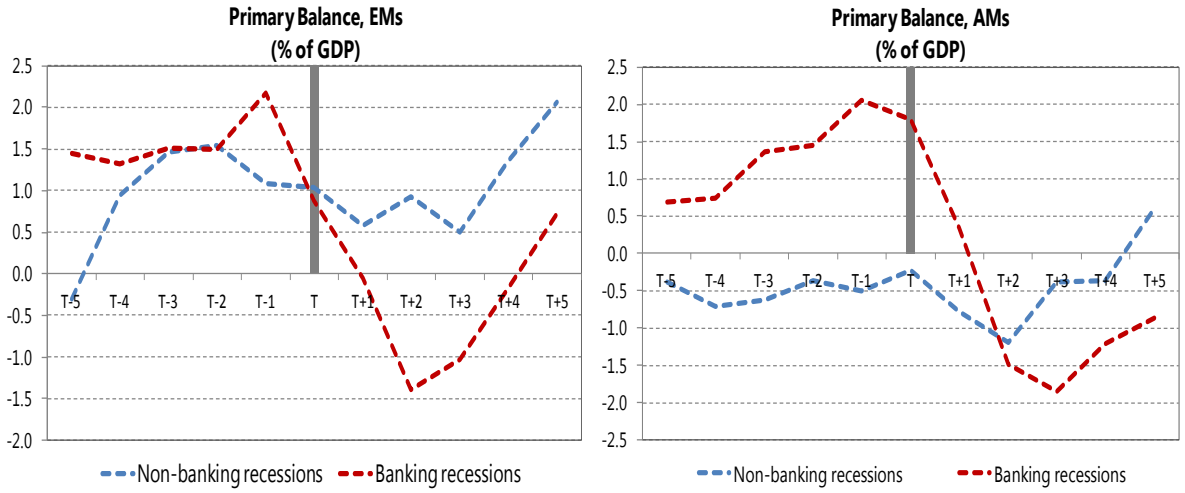
17. The deeper and longer recessions that follow rapid banking expansions arise from the banks' need to quickly deleverage, necessitating a sudden adjustment by the private sector. Looser lending standards and asset price bubbles often accompany rapid banking expansions, leading to excessive leverage and balance sheet weaknesses in the private sector. The high leverage increases the sensitivity of the economy to shocks. Uncertainty in the macro outlook that induces restraint by some sectors of the economy can cause a more widespread slowdown, as debt overhang in the corporate and household sectors imposes a further drag on the economy. Indeed, Abiad and others (2011) find that creditless recoveries tend to be preceded by credit booms and/or banking crises and that those recoveries are weaker and more protracted than recoveries associated with credit expansion.

Banking expansions and fiscal outcomes

18. While banking expansions tend to improve fiscal balances during the boom phase, fiscal pressures tend to be significantly worse during banking recessions. Rapid banking expansions are associated with higher primary balances leading up to the onset of the recession, particularly for advanced economies (Figure 6). Once the downturn begins, however, primary balances deteriorate more quickly in those countries that previously had rapid banking expansions, 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 and stay significantly below levels achieved during the five years prior to the downturn (Figure 6).

Figure 6. Fiscal Dynamics during Business Cycles



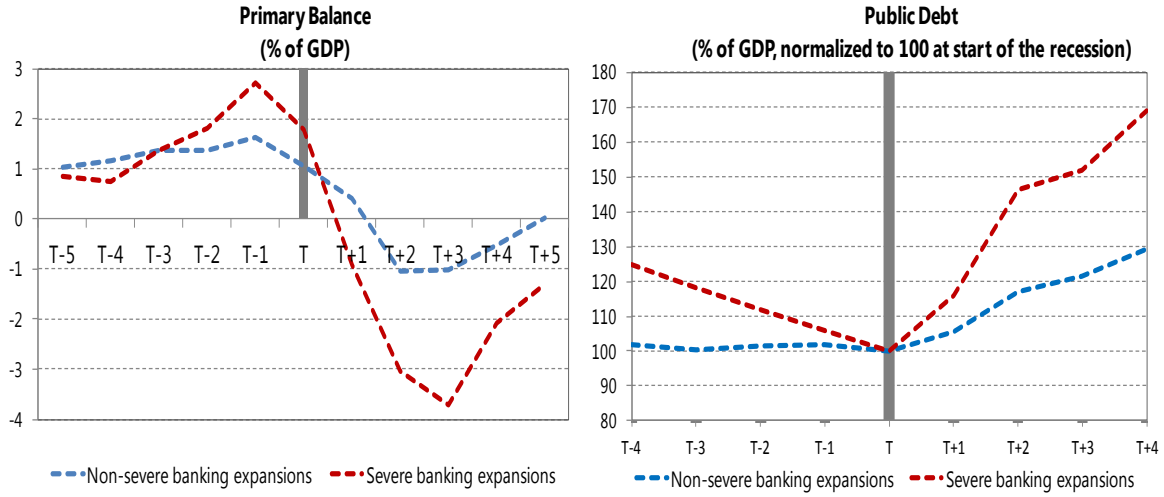
Source: Fund staff estimates.
T (in years) corresponds to the onset of a recession episode.

19. Even though severe banking expansions tend to reduce public debt during booms, fiscal deterioration during the recession more than offsets all previous gains. The positive effects of banking expansions on the primary balance also contribute to decreases in public debt during the boom phase. Figure 7 shows that severe banking expansions are associated with a faster reduction in public debt leading up to the economic downturn. Once the recession hits, however, public debt increases are much more pronounced in countries that had severe banking expansions.

20. The relationship between banking expansions and fiscal outcomes reflects the often mistaken perception that the increase in revenue associated with credit booms is structural. It is generally difficult to assess ex-ante whether revenue increases during a credit boom are indeed structural. If increases in government revenues associated with banking expansions are assumed to be structural, they may lead to increases in government expenditures that are difficult to unwind. The associated loss of fiscal flexibility, coupled with automatic stabilizers and loss of revenues during recessions, reinforces the negative impact of downturns on fiscal balances, placing significant stress on debt sustainability. In fact, several studies have shown that fiscal policies were (with hindsight) imprudent during the expansion phase preceding the global crisis, reflecting excessive expenditure growth as a result of incorrect estimates of the output gap and the underlying fiscal stance.[13]

[13]For example, Schuknecht (2010) notes that "Such measurement problems lead policy makers to decide on an expenditure path that looks broadly reasonable ex ante but proves unsustainably expansionary ex post."

Figure 7. Fiscal Dynamics around Banking Recessions



Source: Fund staff estimates.

B. Fiscal Costs of Systemic Banking Crises

21. Large banking expansions may, at times, turn into systemic banking crises that affect public finances through both direct and indirect channels.[14] The direct channel reflects crisis management responses, where the governments directly support the banking system, typically providing guarantees on bank liabilities to contain liquidity pressures and using a broad range of measures to recapitalize banks and support economic growth (Table 1). These policies carry large costs for governments and contribute to increasing public debt (Figure 8).[15] The indirect channel works through the impact of banking crises on the economy. Crises raise risk premia and disrupt the supply of credit to bank-dependent borrowers, reducing consumption and investment, with negative effects on aggregate demand, growth, and value of assets. These interest rates, growth, asset prices, as well as inflation and exchange rate effects compound to reduce governments' revenue and create pressures on public spending, leading to fiscal sustainability pressures. As a result, banking crises often tend to foreshadow sovereign crises.

[14]Banking crises typically follow large banking expansion; see, for example, Crowe and others, 2011.

[15]The treatment of direct fiscal costs in fiscal accounts varies with the type of government intervention in the banking sector. Direct costs can give rise to public spending (which affects the fiscal balance), pure financial transactions (which have no effect on fiscal balance, but could affect gross debt), or contingent liabilities (with no immediate effect on fiscal accounts). For discussion of the accounting treatment of different crisis management measures, see IMF (2009).

Table 1. Fiscal Cost of Banking Crises

Fiscal Cost	Examples
Direct Fiscal Costs	• Bank recapitalizations • Asset purchases • Calls on government guarantees • Depositor payouts • Central bank recapitilization
Indirect Fiscal Costs	• Revenue effect from lower growth and the decline in asset prices • Expenditure effect from automatic stabilizers • Discretionary fiscal policy (revenue and expenditure) in response to increasing economic slack • Mark effects on borrowing costs • Effects through exchange rate changes

22. A comprehensive indicator of the impact of banking crises on public finances is the change in gross public debt.[16] Public debt captures the overall fiscal costs of banking crises, including direct budgetary costs and indirect costs that materialize through the impact of crises on the real economy, as well as any cost recovery. While changes in public debt are rather imprecise measures of overall fiscal costs of banking crises—in that they capture fluctuations that may not necessarily be attributable to the banking crisis alone—they do help to shed light on the role of precrisis risk factors and policy choices in explaining overall fiscal costs.

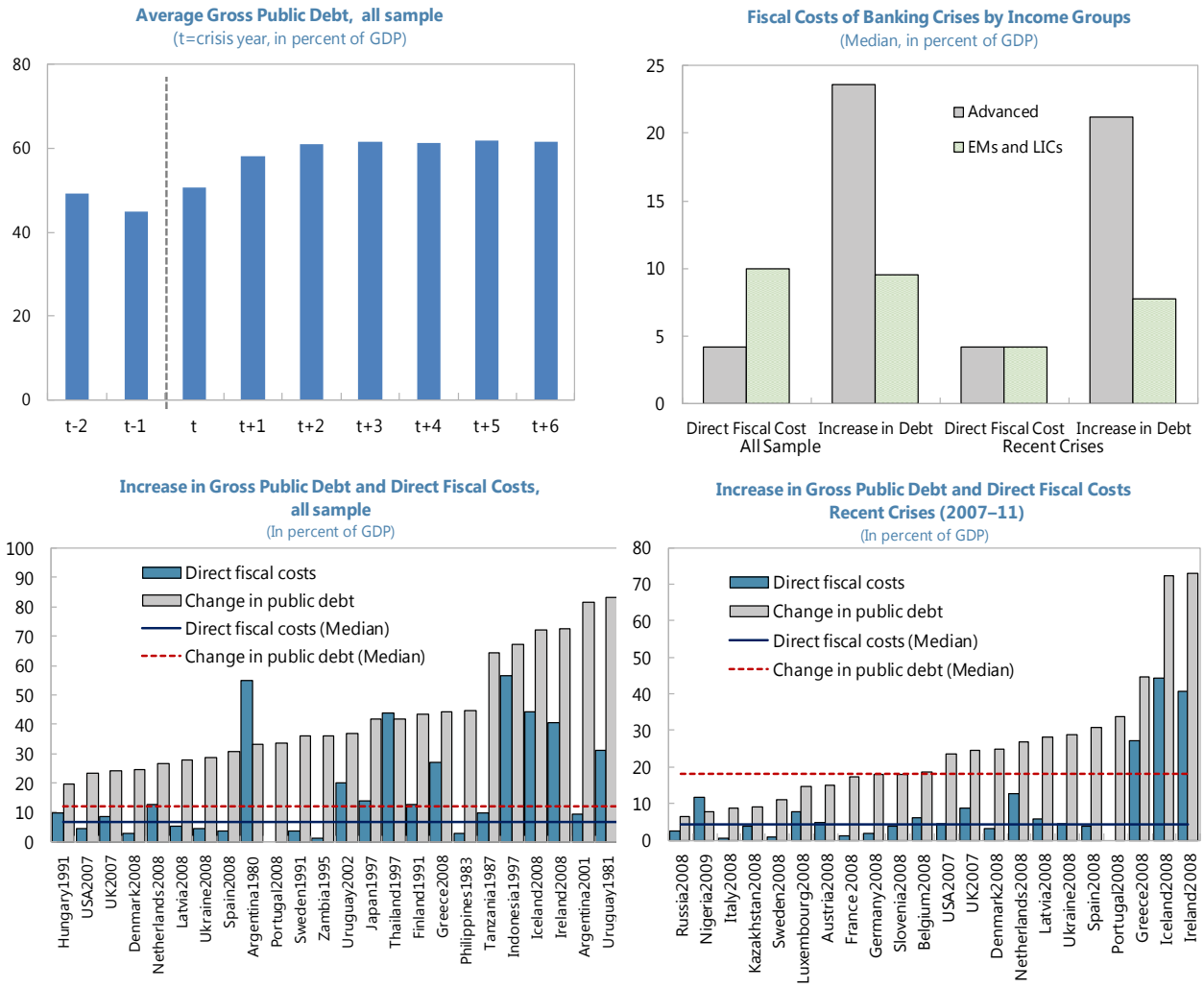
23. Systemic banking crises can carry significant fiscal costs. During 1970–2011, the overall median increase in public debt and direct fiscal costs associated with banking crises were about 12 percent of GDP and 7 percentage points of GDP, respectively. But the costs varied considerably across countries, suggesting important country specific factors at play (Figure 8).

- The increase in public debt was almost twice as large in advanced economies compared to the whole sample, possibly reflecting the larger capacity of these economies to pursue countercyclical fiscal and monetary policies, larger automatic stabilizers, or larger banking systems. Recent crises were no exception. Across a sample of 25 banking crises that started over the period 2007–11 (some of which are still ongoing), mainly involving advanced economies, the median increase in public debt has been around 18 percent of GDP. As the asset recovery rates in some of these countries appear to be particularly high, the impact of direct fiscal costs on public debt was mitigated (see Fiscal Monitor, September 2014).

[16]The focus is on gross public debt because data are more widely available and, unlike net debt, gross debt captures government's financial commitments and obligations toward the banking sector, reflecting the degree of immediate financial stress. Changes in net debt capture government's commitments toward the banking sector net of any asset acquisition. In general, changes in net debt parallel changes in gross debt except when public support to the banking sector is provided using governments' liquid assets, (e.g., cash) and when, over time, the value of acquired assets changes. As a result, in our sample gross and net debt, where available, show similar dynamics around banking crises.

- While direct costs were on average large, they were smaller in advanced economies (about 4.2 percent of GDP) where they only constituted 18 percent of the overall debt increase, albeit with significant cross-country variation within the subset. The experience with the recent wave of crises reinforces these conclusions. These crises, which mainly involved advanced economies, show a similar pattern, with direct fiscal costs (about 4.2 percent of GDP) generally explaining only a limited part of the total increase in public debt recorded around the crisis (about 25 percent).

Figure 8. Fiscal Costs of Banking Crises



Sources: Laeven and Valencia (2013a); Fund staff' calculations.
Note: The bottom left chart shows only crisis episodes in advanced and middle income countries that experienced an increase in gross public debt of 20 percentage points or more. Medians are reported for the entire samples. The bottom right chart excludes crisis episodes that experienced a decrease in gross public debt. Medians are reported for the entire samples.

III. THE ROLE OF COUNTRY AND BANKING SYSTEM CHARACTERISTICS

24. A number of country and banking system characteristics importantly affect the strength of bank to sovereign links and their implications for debt sustainability. Characteristics that are found to affect the overall fiscal impact of banking to sovereign links include: precrisis vulnerabilities in the banking system and the pre-existing regulatory framework; the type of resolution policies used in banking crises; and other features such as home bias, i.e., the share of sovereign debt in banks' total assets. Markets tend to reflect these various characteristics in pricing risks of contagion from banking to sovereign.

A. Precrisis Banking Vulnerabilities and Regulatory Features

25. Empirical evidence suggests that banking vulnerabilities and institutional features matter for fiscal costs emanating from the banking sector. Both bivariate and multivariate analyses show that these factors can help explain cross-country differences in the depth of recessions, the direct fiscal outlays incurred by governments, and the overall increases in public debt.

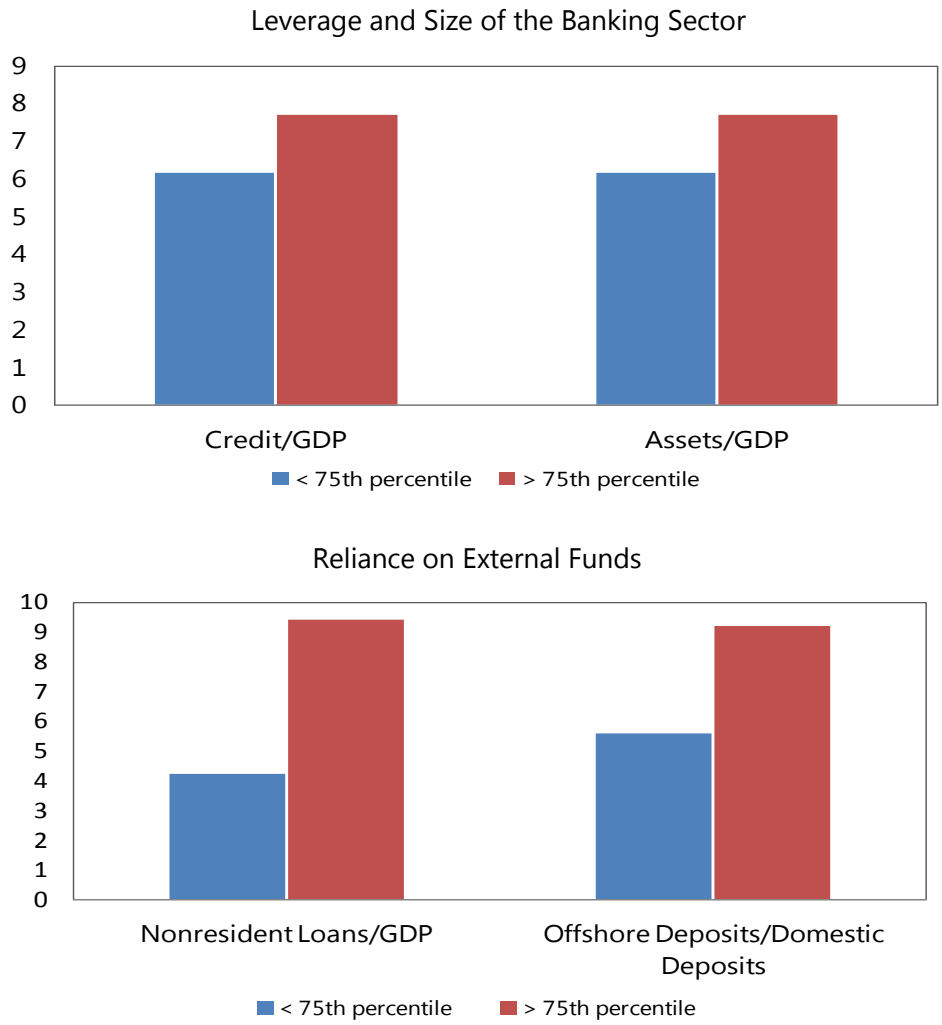
- ***Vulnerabilities in the banking sector and recessions*** (Annex I). Regression analysis shows that banking sector vulnerabilities affect the depth of recessions and duration of output recovery to its pre-recession level. In particular, the increase in banking sector leverage and reliance on wholesale funds (proxied by the credit-to-GDP and loan-to-deposit ratios), the expansion of the size of the banking sector (measured by banking sector assets-to-GDP), and a higher dependence on foreign funding versus domestic deposits contribute to explain the depth of recessions. Other indicators of risk-taking activities (e.g., return to equity, non-interest income, net interest margin, and a measure of insolvency) are also associated with deeper contractions and longer recoveries. In addition, asset diversification and the degree of liability dollarization are negatively and positively associated with deeper recessions and longer recoveries, respectively.

- ***Precrisis vulnerabilities in the banking sector and fiscal costs of banking crises*** (Annex II, and Figures 9 and 10). Direct fiscal costs of banking crises (in percent of GDP) are higher in countries with precrisis banking sectors that are larger (measured by bank assets-to-GDP ratio), more leveraged (proxied by the precrisis credit-to-GDP ratio), and more reliant on external funds (proxied by the ratio of offshore deposits to domestic deposits) and external wholesale funds (measured by the ratio of loans from nonresident banks to GDP).[17] Banks dependent on external wholesale funds are more exposed to changes in market sentiment that can create rollover

[17] Loans from nonresident banks cover loans to the entire domestic economy, including to the banking sector. Over the period 1995–2011, for which data are available, about ¾ of nonresident loans to the domestic economy were in the form of claims on the banking sector.

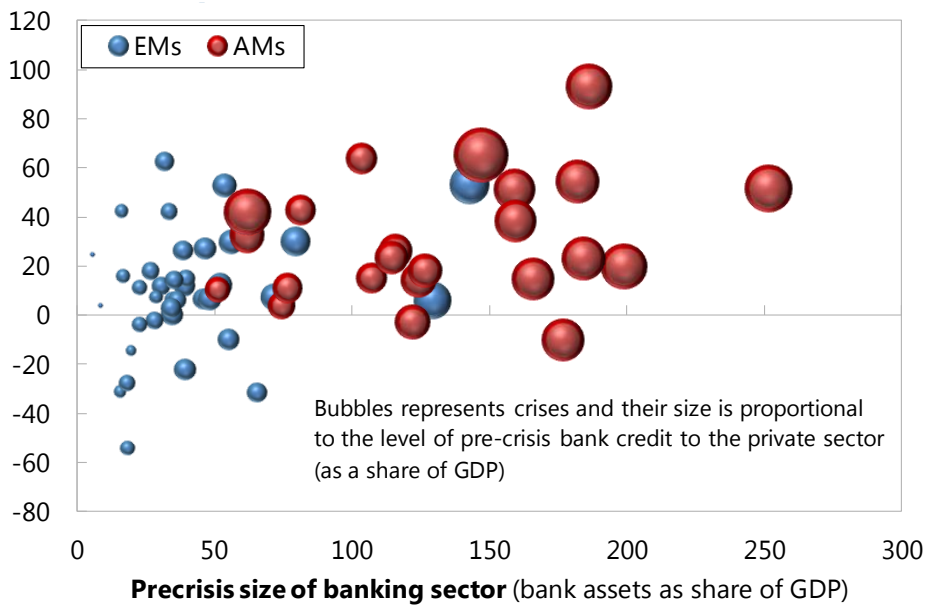
difficulties and possibly solvency concerns that may necessitate government recapitalization to preempt further stress. Overall costs of banking crises (proxied by the change in public debt) are also higher in countries with large and leveraged precrisis banking sectors (Figure 10). These results also hold for the most recent wave of banking crises starting in 2007.

Figure 9. Direct Fiscal Costs: Size, Leverage, and Reliance on External Funds of the Banking Sector, 1980–2011



Sources: Laeven and Valencia (2013a); Beck and Mohseni-Cheraghlou (2012); and Fund staff estimates.
Note: The median of each subsample is shown.

Figure 10. Increase in Public Debt after Banking Crises (percent of GDP)

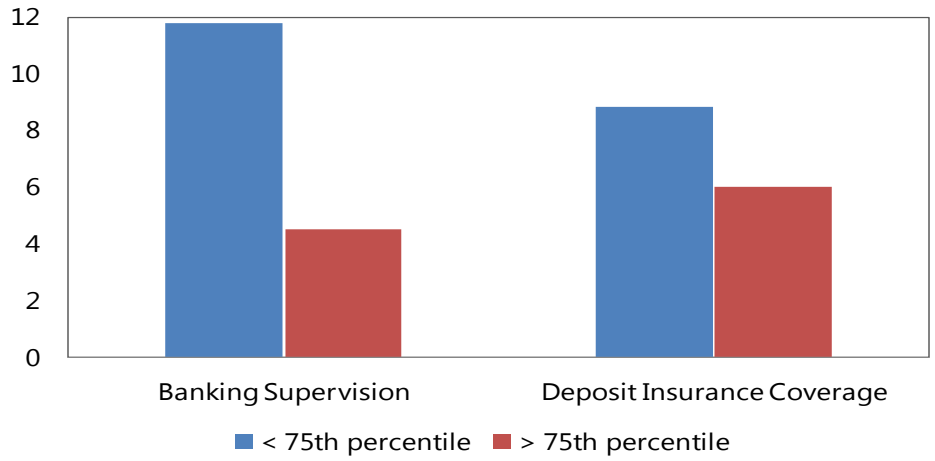


Source: Laeven and Valencia (2013a).
Note: In addition to banking crises, the change in public debt could be affected by other factors, for example, inflation, fiscal adjustment, and sovereign debt restructuring that may explain that in some cases public debt decreases after a banking crises.

- ***Precrisis institutional setting and fiscal costs*** (Figure 11 and Annex II). Direct fiscal costs are lower in countries with better quality of supervision and where the government provides a more generous financial safety nets, such as broader deposit insurance coverage (as proxied by the ratio of insured deposits over per capita GDP).[18] The first result suggests that well-functioning monitoring and regulatory frameworks of the banking sector may help limit the buildup of vulnerabilities and/or contain direct fiscal costs in the event of a crisis. The second result suggests that the presence of broader deposit insurance coverage might reduce the risk of deposit runs and, in this way, help contain the cost of crises. However, it worth noting that some findings in the literature show that countries with broader deposit insurance schemes may be more likely to end up in crises (Demirguc-Kunt and Huizinga, 2004). The net benefit of deposit insurance is therefore ambiguous and the measure of deposit coverage should not be used to inform the optimal design of deposit insurance schemes, which should take into account the moral hazard risks and higher costs associated with high coverage levels.

[18]Abiad and others (2008) define an index of quality of banking supervision. The index consolidates information about adoption of risk-based capital adequacy ratios based on the Basel I capital accord, independence and legal power of banking supervisory agency, institutional coverage of supervision and effectiveness of on-site and off-site examinations of banks.

Figure 11. Direct Fiscal Costs: Quality of Banking Supervision and Deposit Insurance Coverage 1980–2011 (percent of GDP)



Sources: Laeven and Valencia (2013a); Abiad and others (2008); and Fund staff estimates.
Note: The median of each subsample is shown. Higher values of the banking supervision index correspond to higher quality of supervision.

B. Crisis Management Policies and Practices

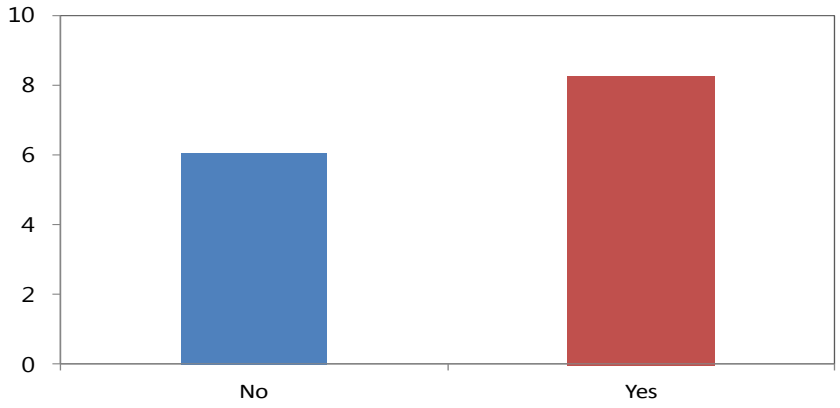
26. Containment and resolution policies matter for direct fiscal costs. Actual fiscal costs of banking crises vary with the particular resolution strategy adopted. A review of past experiences with resolving financial crises shows that proper incentives to repair balance sheets and contain moral hazard (see Box 1) matter for fiscal costs.

- Countries that provide guarantees on banks' liabilities after the onset of the crisis face, on average, higher direct fiscal costs (Figure 12). Hence blanket guarantees may avoid up-front disbursements or issuance of debt but do not necessarily help contain direct fiscal costs over the crisis period. This may be due to reverse causality (more severe crises may force governments to extend broader guarantees), or the fact that blanket guarantees are often not credible or sufficient (due to lack of fiscal space or international reserves in dollarized systems) to contain the crisis, therefore precipitating the guarantees to be called. It may also be that banks have incentives to take higher risks when there is a guarantee on liabilities, again increasing the probability that guarantees are called. Ex-post guarantees may also be seen as a piecemeal solution if not accompanied by a comprehensive strategy to address weaknesses in the failing banks. The lesson appears to be that establishing deposit insurance schemes as a safeguard before a crisis develops may be more effective than issuing new guarantees in the midst of a crisis (although deposit insurance schemes are typically designed to address idiosyncratic bank failures and are not likely be sufficient to address a systemic banking crisis).[19]

[19]The use of guarantees does not appear to be associated with the size of the crisis (possible reverse causality). The result holds when controlling for the size of the crisis, proxied by the peak in NPLs during the crisis period.

- Countries' experiences with resolving financial crises show that imposing losses on bank shareholders and junior debt holders (and creditors further up the hierarchy if systemic consequences can be managed) can significantly reduce the need for taxpayer money to recapitalize financial institutions (Box 1).

Figure 12. Direct Fiscal Costs: Countries With and Without Guarantees on Banks' Liabilities (percent of GDP)



Source: Laeven and Valencia (2013a); and Fund staff estimates.

Note: The median of each subsample is shown.

27. Speedy recognition of loan losses and immediate recapitalization or resolution of failing banks can lead to a faster resolution of crises, and ultimately to lower direct fiscal costs.[20] Experiences from bank resolution cases indicate the value of sound crisis management policies (Box 1). For example, Japan, which experienced a banking crisis in the early 1990s, waited until 1999 to recapitalize its banks through a large-scale government-sponsored preferred stocks program. In the meantime, banks had been delaying the recognition of loan losses, rolling over bad loans into new loans. Many have argued that this evergreening practice eventually increased the fiscal cost.[21] Actions by the central bank also matter. The ability of central banks to respond quickly to liquidity needs can stem banks' liquidity crunches and preempt the need for bank recapitalization down the road. At the same time, providing liquidity to failing banks would simply postpone needed resolution and lead to moral hazard and higher eventual fiscal costs.

28. Overall fiscal costs of banking crises have not necessarily been higher in countries that adopted resolution strategies that increase direct costs, supporting the case for a speedy resolution. For example, while guarantees of bank liabilities are generally associated with higher direct and overall fiscal costs, the correlation is less clear cut for other policy measures such as recapitalization and asset purchases. In these latter cases, short-term measures that had initial direct fiscal costs did not necessarily add to the overall fiscal cost of the crisis. This would suggest that if public support were required to preserve financial stability, early actions to re-establish adequate

[20]See Box 4.1 in the IMF World Economic Outlook (2008b); and Calomiris, Klingebiel, and Laeven (2005).

[21]See, for instance, Hoshi, Kashyap, and Caballero (2013).

functioning of the banking sector, which may entail high upfront costs for governments, can generate sizeable payoffs over time, as improved economic performance and asset recovery help counterbalance the initial fiscal costs. Insofar as creditor bail-in tools are available, those upfront fiscal costs can possibly be reduced further.

29. Since the global financial crisis, progress is being made on a range of crisis management measures with the aim of reducing the burden on public funds in future banking crises. These measures include increased loss absorbency, enhanced supervision, and effective resolution regimes and planning. Recently, the bail-in tool is increasingly becoming a resolution strategy that can minimize recourse to public funds to resolve banking crises (e.g., the EU Bank Recovery and Resolution Directive (BRRD) which mandates creditor bail-in in the event of recapitalization of a failing bank).[22] Some countries have also constrained the ability of the state to assist banks (e.g., the United States and the European Union).

C. Banks' Home Bias in Sovereign Debt

30. The extent of banks' holdings of domestic sovereign debt relative to other assets—banks' "home bias" in sovereign debt—can have important implications for public debt. The share of sovereign debt in banks' total assets has increased significantly since the global crisis, particularly in advanced economies that have seen a rise in public debt in recent years (Figure 13).

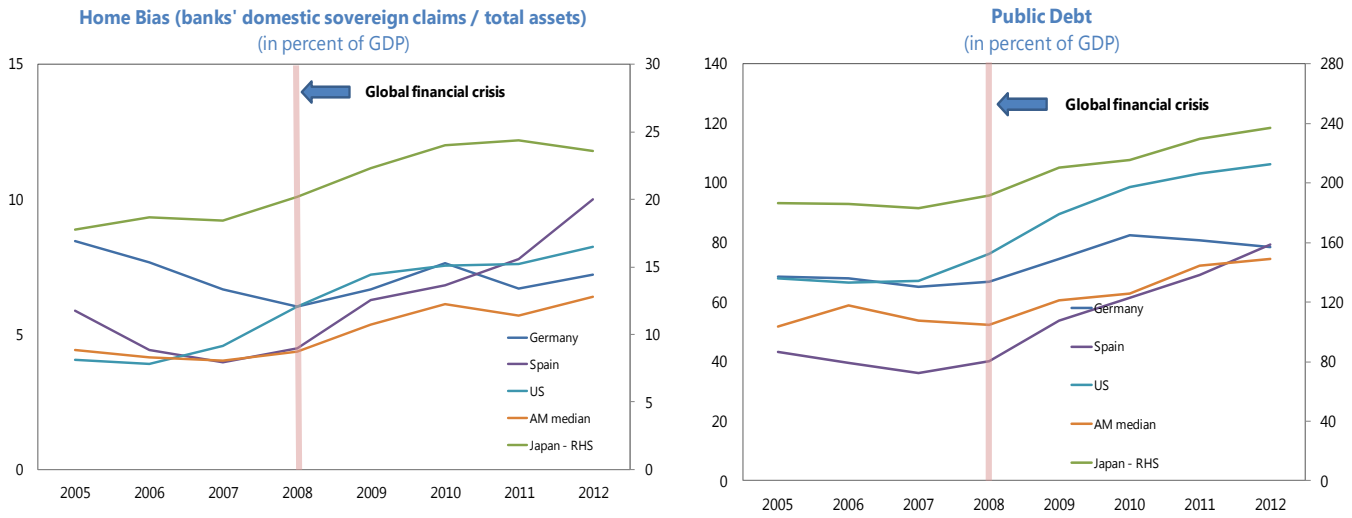
- **Banks' home bias in sovereign debt is one of the key factors contributing to the sovereign-bank nexus.** It is rooted in the preferential treatment of sovereign debt in banking sector regulatory frameworks, the use of sovereign debt as collateral, as well as other factors such as the structural characteristics of the financial sector, the liquidity of sovereign bond markets, the country's savings rate, and government policies, particularly during times of stress (Box 2).

- **The coincidence of high debt and high home bias likely reflects a two-way causality.** On the one hand, governments facing difficulties delivering fiscal adjustment may induce banks through moral suasion to finance the fiscal balances by increasing their holdings of domestic sovereign debt. On the other hand, high demand for domestic sovereign debt by banks likely influences the conduct of discretionary fiscal policy and therefore public debt developments. While acknowledging the presence of both effects, this section aims to substantiate the latter effect, from home bias to fiscal outcomes, through its impact on the sovereign's cost of borrowing.[23]

[22]Bail-in encompasses the power to mandate a restructuring of uninsured and unsecured bank liabilities by writing down their value or converting them into equity. See IMF (2012).

[23]In particular, the empirical panel regression methodology accounts for endogeneity issues between home bias and public debt by using instruments.

Figure 13. Banks' Home Bias and Public Debt



Sources: Arslanalp and Tsuda (2012); IFS; and WEO.

31. Empirical analysis using a sample of AEs and EMs (see Annex III) shows that sovereigns in countries with high home bias generally:[24]

- **Face lower borrowing costs.** The reduced cost of borrowing from higher home bias likely reflects investors' lower expectation of sovereign default because of the anticipated high cost of default. The negative relationship is found to weaken when market sentiment (measured by the VIX) deteriorates, and might even reverse, because increased risk aversion may lead banks to demand higher risk premia to buy sovereign bonds. This is not likely the case for "safe haven" countries, as the increase in risk aversion increases the global demand for their sovereign debt.

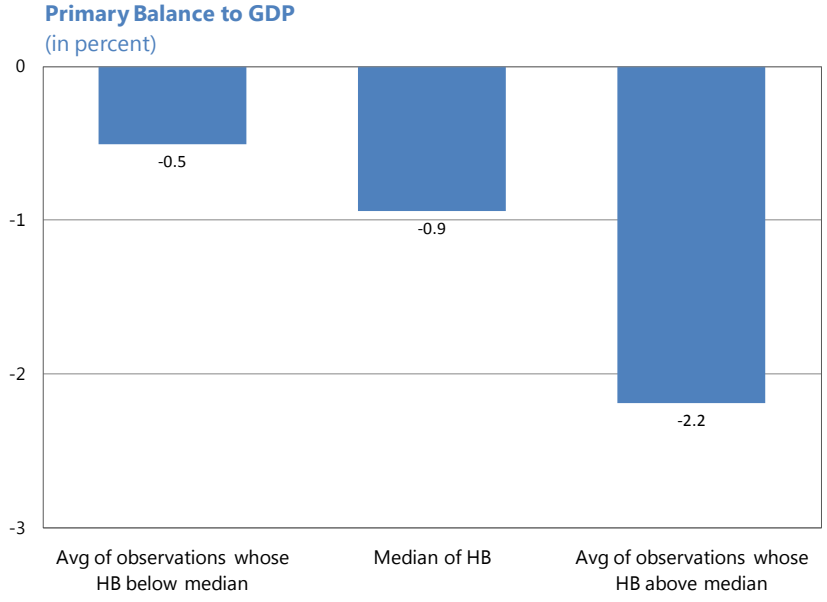
- **Have lower primary fiscal balances.** The average primary balance of countries whose home bias is above the sample median is substantially lower than that of the whole sample for a given level of lagged debt (Figure 14 illustrates this for high debt cases). Because of banks' willingness to absorb domestic sovereign claims and the additional fiscal space created (through lower interest rates), fiscal policy tends to be less responsive to the level of debt, even when debt is high. Reverse causality might play a role in this outcome—a sovereign trying to postpone or avoid implementing difficult fiscal consolidation might resort to moral suasion to convince banks to finance its fiscal deficit.

- **Have higher debt levels and higher debt tolerance.** In 2007, the average public debt level for countries in the top quartile of the distribution of home bias is more than 50 percentage points of GDP higher than for those in the lower quartile. High home bias countries also tend to experience debt difficulties at very elevated debt levels (Figure 15). Sovereigns with higher home

[24]The panel regressions account for a wide range of macro-financial and institutional factors and therefore implicitly capture differences in creditworthiness across countries.

bias seem to be able to tolerate higher levels of debt, partly due to the relatively lower cost of borrowing, before debt sustainability concerns begin to bite.

Figure 14. Estimated Primary Balance at Lagged Public Debt of 80 percent of GDP[1/]

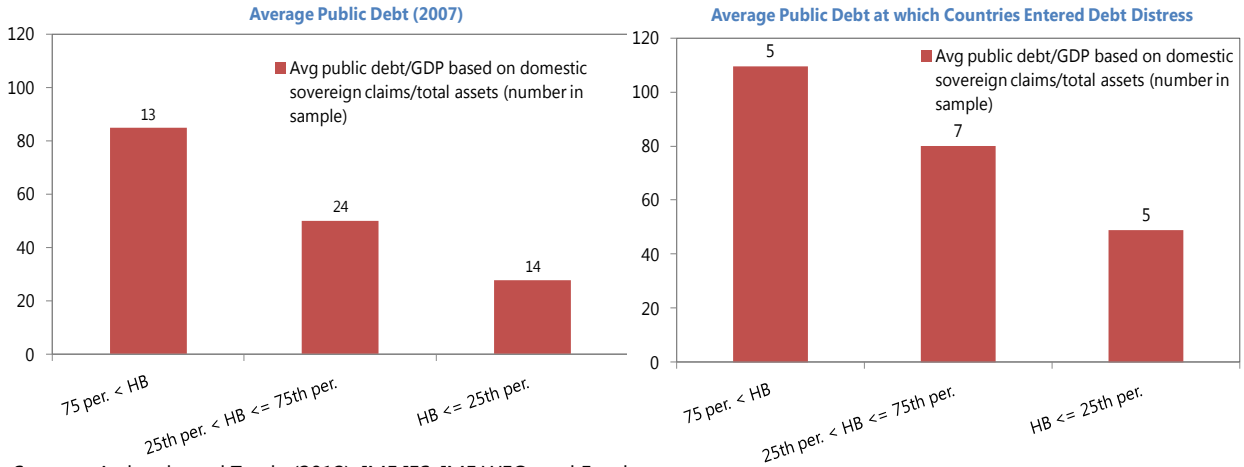


Source: Fund staff estimates.

[1/] Estimates of primary balance response are obtained from estimation of fiscal reaction function with the combined AE/EM sample.

32. Home bias provides fiscal breathing space, but risks creating incentives for countries to postpone problems until debt reaches dangerously high levels. The breathing space is largely the result of the favorable impact of high home bias on rollover risk and interest rates. As such, home bias may be helpful insofar as it allows the government flexibility to weigh the cost and benefit of a fiscal consolidation, especially during recessions. However, to the extent that strong demand by banks for sovereign debt reduces the government's responsiveness to debt accumulation, home bias may not yield better fiscal outcomes. Needless to say, with much of the public debt held domestically, debt stress could have severe and widespread repercussions on the local economy, especially if effective domestic firewalls and crisis management mechanisms are not in place. Moreover, governments' excessive reliance on banks' financing could crowd out domestic private credit, further weakening economic activity and potentially increasing public debt.

Figure 15. Public Debt across the Distribution of Home Bias (2005–07)



Sources: Arslanalp and Tsuda (2012); IMF IFS; IMF WEO; and Fund staff estimates.
Note: Excluding Japan, the average public debt for AEs and EMs is 76 percent of GDP in countries whose home bias falls in the top quartile of the distribution.

D. Market-Based Measures of Bank-to-Sovereign Contagion

33. Markets appear to reflect sovereign-bank linkages in their investment choices and sovereign pricing. As the global financial crisis unfolded, the valuation of sovereign risk was influenced by several factors, including contagion from banks to the sovereign. First, during stress periods, investors reallocated their portfolio towards safer instruments, resulting in a flight to quality. This benefited sovereign securities as an asset class, and introduced a higher degree of differentiation among sovereigns. Second, as the crisis spread and governments stepped in to support troubled financial institutions, probabilities of distress went up across sovereigns (Segoviano and Espinoza, 2014).[25]

34. In addition to macroeconomic variables, banking sector characteristics matter in how markets price risks to the sovereign arising from weaknesses in banks' balance sheets. To isolate the market perception of risks to the sovereign that emanate from banks, Segoviano and Espinoza (2014) derives the probability of sovereign distress conditional on bank stress (bank-to-sovereign contagion or BSC) by using market-based measures of the probability of default of the sovereign and that of individual banks (see Annex IV). The BSC reflects markets' perception of risks from banks to the sovereign that are priced into the cost of borrowing for the sovereign.

35. There is a statistically significant relationship between variation in the BSC on the one hand and banking system characteristics and macroeconomic developments on the other. The

[25]For other approaches related to the quantification of bank-sovereign contagion risk, see "A Guide to IMF Stress Testing-Methods and Models" (Ong, 2014).

focus here is on understanding directional impacts. These are reported in Table 2 and were found to be robust across a range of regression specifications.[26] Results suggest that:

- In general, the higher the ratio of bank loans to GDP and the share of sovereign debt instruments held on banks' balance sheets, the higher the potential contagion from banks to the sovereign. Conversely, the higher banks' capital buffers (the capital-to-asset ratio) and valuations (price-to-book value), the lower the contagion.

- Macroeconomic and fiscal developments also matter for the BSC. For example, variables such as projected GDP growth, the initial fiscal balance position, and underlying weaknesses in the public sector (short-term debt to GDP) are statistically significant in explaining the BSC. Similarly, the price of risk (proxying global risk aversion) is positively related to BSC.

Table 2. Directional Impact of Various Factors on BSC

Banking system characteristics				Macroeconomic developments		Control
Price -to-book value	Bank loans to GDP	Bank Capital to Assets	Govt. bonds held by domestic banks/Assets	Govt. short term debt to GDP	GDP growth projection	Market price of risk
-	+	-	+	+	-	+

Note: Tabulated above are the *signs* of coefficients corresponding to factors found to significantly impact BSC. The dependent variable in the underlying panel regressions captures the probability of a sovereign defaulting conditional on a domestic (median) bank defaulting (i.e., the BSC measure). The reported signs were found to be consistent across regressions pertaining to different country groupings as well as a regression encompassing all groups. The groups included are as follows; 'Core eurozone countries': Austria, Belgium, France, Germany and the Netherlands; 'Eurozone countries under stress during sample period': Greece, Ireland, Portugal, Italy and Spain; and 'Countries outside the eurozone': Sweden, Switzerland, Japan, U.K. and the U.S. Estimation period for the regressions is 2005 Q1 to 2012 Q4.

36. Contributions of banks' characteristics and macro variables to variations in the BSC do differ across time and space:

- Before the Euro area debt crisis erupted, GDP growth projections and banks' capital buffers were important determinants of the Euro area bank-to-sovereign contagion flows. As the crisis played out, however, eurozone countries' fiscal situation became more relevant. For countries in distress, the share of government bonds held by banks proved especially important, while price-to-book values mattered less.

- During the crisis, countries with a combination of sound fiscal fundamentals and safer banks (favorable price-to-book values) fared well. Policy interventions to stem contagion (such as the ECB's public announcement that it stands ready to conduct outright monetary transactions) proved crucial for stressed economies.

[26]Please refer to Annex IV for more details on dataset characteristics, empirical methodology and robustness tests.

IV. GOOD PRACTICES FOR MONITORING, MEASURING, AND REPORTING RISKS FROM THE BANKING SECTOR TO PUBLIC DEBT

37. While previous crisis episodes led to improvements in the management of fiscal risks, the recent global crisis indicates that gaps remain especially in the management of risks stemming from banks. In the wake of the East Asian and other crises, the IMF, the World Bank, and many governments devoted considerable attention to improving the identification, quantification, monitoring, reporting, and mitigation of fiscal risks.[27] Nonetheless, the recent global crisis caught governments, markets, and others unprepared. In particular, the potential impact of financial sector risks on public finances was seldom considered ahead of time, and in many cases, there was insufficient fiscal space to absorb the resulting financial sector contingent liabilities and the deterioration in public finances more generally. The crisis has led to improvements in how fiscal authorities and other relevant authorities (such as the supervisory and resolution authorities) in some countries internalize these risks, and has heightened the degree of scrutiny applied to the health of the financial sector. However, progress has been uneven. In this regard, recommendations in this paper focus on how fiscal authorities can better monitor and assess risks from the banking sector, and be better prepared to conduct countercyclical policies during downturns.

38. A recent survey of emerging and advanced economies indicates that there are still many gaps in managing fiscal risks which may arise from the banking sector.[28] Many countries have frameworks that allow for a regular flow of information across government agencies and regulators on risks from the financial sector. Such information is usually shared through formal and informal mechanisms, including Memorandum of Understandings (MOU) and/or discussions in inter-agency financial stability committees. The survey shows that the ministry of finance is generally represented in such committees, and most often chairs or co-chairs them. However, findings from the survey suggest that there is significant room for improvement in how country authorities assess fiscal risks stemming from the banking sector, and in particular how relevant information on risks is used.

- Risks to public debt from the financial sector are not adequately monitored and assessed prior to their materialization. The assessment of *implicit* contingent liabilities is not always done, even in countries where crisis resolution frameworks allow for government intervention. Oftentimes when such an assessment is done, it is typically under already impending stress.

[27] See, for example, Brixi and Schick (2002); IMF (2006); and IMF (2008a).

[28] The country survey examined current practices of ministries of finance, debt management offices, central banks, banking supervision agencies, and other relevant agencies. For the detailed results of the survey, see Annex V.

- Countries' debt sustainability analyses rarely include a financial sector contingent liabilities stress test (although they generally include several other stress tests including on the cost of borrowing). Even in countries where contingent liabilities are monitored and quantified, these estimates are seldom used to inform public DSA stress tests, possibly because of concerns that this may exacerbate the perception that banks would be bailed out.

39. Good practices entail following a well-established risk management framework that identifies, quantifies (where feasible), monitors, and ultimately mitigates these risks. Recommendations in this section focus on:

- Establishing a sound institutional framework where information about risks from the banking sector is shared and discussed with fiscal authorities;

- Sound practices to regularly monitor banking sector developments to identify and measure relevant risks to public finances. Relevant risks include those related to potential contingent liabilities as well as to other channels through which the banking sector may affect public debt; and

- Reporting of risks to public finances from banks, paying due consideration to the publication of market sensitive information.

A. Institutional Framework

40. In general, institutional arrangements that enhance the capacity of the ministry of finance as well as the other relevant authorities to assess and manage risks to the sovereign from the banking sector are desirable. The global crisis has motivated many countries to pay closer attention to the health of the banking sector and to enhance information sharing and coordination between banking regulators and fiscal authorities. In this regard, good practices include:

- A mechanism for information sharing between the agencies responsible for monitoring the financial sector and the fiscal authorities to help internalize the potential impact of banking sector risks on the sovereign. Such mechanisms should pay due consideration to confidentiality of information and independence of the regulators and supervisors;

- Establishing expertise within the fiscal authorities to generate informed alternative fiscal scenarios and stress scenarios related to rising vulnerabilities in the banking sector to increase awareness of potential threats to fiscal and debt sustainability; and

- Using the inter-agency forum and the analysis of fiscal risks from the banking sector to inform policies to enhance the resolution framework, thereby reducing the risk of recourse to public

support. For example, the authorities could demand higher loss absorption capacity from banks and, if necessary, firm-specific structural measures to reduce fiscal contingent liabilities.[29]

41. These practices are particularly important in countries that have a large or rapidly expanding banking sector and where government intervention is likely to take place in case of banking stress. As noted earlier, a fast expanding banking sector is associated with deeper recessions and more protracted recoveries, and the size of the banking sector is associated with higher direct fiscal costs of banking crises. A highly indebted government should be particularly attentive to the health of the banking sector and the design of the resolution framework because room for additional borrowing to accommodate government intervention is limited. As discussed below, the preferred approach to limiting contingent fiscal risks from the banking sector is to adopt a resolution regime that reduces the likelihood that public funds would be needed in case of bank failures.

42. In countries where the banking sector is highly internationally connected, cross-border cooperation and information sharing in crisis resolution are critical. While important progress has been made on cross-border banking resolution issues, considerable additional work remains to be done in this area in order to limit the impact the resolution of a cross-border banking group can have on the sovereign. This includes (i) strengthening national resolution powers; (ii) agreeing on firm-specific cross-border operational resolution strategies; (iii) agreeing on the definition, size, and location of loss-absorbing buffers across borders; and (iv) enhancing the ability of home and key host authorities of all global systemically important financial institutions (G-SIFIs) to maintain crisis management groups so as to prepare for, manage, and facilitate the resolution of cross-border financial crises affecting G-SIFIs.[30]

B. Identifying and Measuring Relevant Risks

43. While the comprehensive set of relevant indicators for assessing banking sector risks may vary across countries, key indicators appear to be leverage, size, and reliance on external funds. As discussed in this paper, indicators such as increases in the credit-to-GDP ratio, loan-to-deposit ratio, assets-to-GDP ratio, and dependence on foreign funding are associated with increased fiscal risk. This association takes place through a number of channels, including deeper recessions, protracted recoveries, and larger direct banking crisis costs, which in turn lead to higher fiscal costs and, hence, a higher conditional probability of sovereign distress. A good practice in identifying potential vulnerabilities in these variables is to compare their evolution against cross-country benchmarks and country-specific historical performance.[31] If vulnerabilities are detected, corresponding stress tests should be incorporated into the debt sustainability analysis.

[29]See IMF (2014b).

[30]See IMF (2014b).

[31]The Staff Guidance Note for Public Debt Sustainability Analysis in Market Access Countries (IMF, 2013d) proposes benchmarks for (i) the cumulative change in private sector credit-to-GDP ratio over 3 years (15 percent for emerging

(continued)

44. Several techniques can be used to estimate the risks that contingent liabilities create for public finances. The most basic quantification of contingent liabilities is the identification of the face value of the guaranteed liability. Sometimes governments also categorize explicit contingent liabilities according to rough estimates of the probability of being called. With more uncertainty, it is possible to estimate the associated net present values of implicit guarantees using contingent-claims analysis or banks' credit ratings. It is also possible to estimate the expected cost of contingent liabilities as well as the "unexpected cost" or "cost-at-risk"—that is, the greatest cost that the government can expect to face with a given probability (Box 3). Estimates of contingent liabilities should take into account features of the existing crisis resolution framework that may mitigate the associated risks, including whether bail-in options are potentially available.[32]

45. Establishing clear procedures for determining the circumstances under which an in-depth assessment of fiscal risks from contingent liabilities should be conducted would help institutionalize these practices. This would help clarify whether there are important links between the health of the banking sector and public finances that should be monitored on a regular basis.[33] Periodic disclosure, rather than ad hoc disclosure during periods of stress, would also help minimize the potential signaling effect these assessments (see below). As a standing practice, the impact of contingent liabilities on public debt should be estimated anytime a new explicit guarantee of a bank's liability is issued.

46. In this context, an analytical tool could be designed to highlight country-specific emerging bank-to-sovereign risks as part of the Fund's ongoing work to build macro-financial toolkits. The findings in this paper and from other existing tools may have practical use as they provide a cross-country perspective on the indicators that can flag potential risks to public debt that emanate from the banking sector. Existing tools include early warning models and vulnerability exercises, the IMF's Financial Sector Assessment Program, the Guide to IMF Stress Testing, and the Fiscal Transparency Evaluations which assess how the government's potential fiscal exposure to the financial sector is analyzed, disclosed, and managed. A diagnostic tool could be added to analyze bank-to-sovereign risk (e.g., the extent of banking-fiscal linkages and the extent to which the characteristics of the institutional frameworks may help limit the propagation of shocks from the banking sector). Triggers for contingent liabilities analysis could include indicators of leverage, size, holdings of domestic sovereign debt, funding mix, and global risk aversion.

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market economies and 30 percent for advanced economies); and (ii) loan-to-deposit ratio (1.5 for both advanced and emerging market economies).

[32]The European Commission (2012) provides a good example of how to effectively use information provided by the regulators to estimate the extent of exposure of the government to losses in the banking sectors, given a specific regulatory framework. Similarly, the IMF (2013c) Nordic Regional Report provides an illustrative example of how the fiscal costs of cross border spillover risks can be determined while also emphasizing the importance of having a clear resolution framework across borders.

[33]Although these links are not typically made in reports on fiscal/debt sustainability, there is an increasing awareness in this regard (e.g., the assessment of exposure to contingent liabilities from the banking sectors published in the European Commission (2012)).

C. Reporting Risks

47. Governments have been typically reluctant to publicly discuss fiscal risks from the financial sectors. There was a concern that doing so could worsen moral hazard and increase the government's fiscal costs in the event of a crisis. More generally, there was a belief in many economies that the probability of a financial crisis with significant fiscal costs was too small or too speculative to warrant public discussion.

48. While these arguments are understandable, additional elements are at play that warrant consideration:

- **Public discussion of fiscal risks from the banking sector could help build support for reforms to tackle the problem.** As the IMF's Manual on Fiscal Transparency (2007) states, "Fiscal transparency helps to highlight potential risks to the fiscal outlook, resulting in an earlier and smoother fiscal policy response to changing economic conditions, thereby reducing the incidence and severity of crises." The publication of aggregate information on the fiscal risks from the banking sector may increase awareness of the problem within the government and among the public, and help build support for the government's fiscal policy (e.g., its debt target) as well as reforms that reduce fiscal risks, including resolution regimes in line with international best practice. Reports can also demonstrate that the government is aware of and has taken measures to reduce the likelihood that public funds are needed in future bank failures. Routine reporting of these risks as part of a broader discussion of fiscal risks would also help reduce the perception that some bank failure or government intervention may be imminent when financial sector contingent liabilities are discussed.

- **At the same time, such disclosures could have unintended consequences, particularly if no credible measures are taken to limit fiscal risks.** Care should be taken not to create misperceptions that government support would be forthcoming to bail out banks, which could worsen moral hazard, or unhelpfully limit government's intervention options. Published analysis, therefore, should normally be broad-based (not bank-specific), be informed by the published results of banking sector stress tests, and present a range of alternative scenarios, including scenarios that presume no use of public funds to support banks. Furthermore during a period of stress, disclosure of previously nonpublic information about banks' problems could impede banks' efforts to raise funds or, at worst, could trigger a bank run.

49. Currently, most governments do not discuss the fiscal risks associated with supporting the banking sector, though a few are beginning to include some discussion in public reports. Some governments have included cautious discussions of the financial sector in reports on risk (the Philippines' 2012 *Fiscal Risks Statement* and Ireland's *National Risk Assessment* 2014), other budget documents (Italy's 2012 *Economic and Financial Document*), or reports on policies designed to protect public finances from financial crises (e.g., the U.S. Financial Stability Oversight Council's 2014 annual report). In 2012, the European Commission's Fiscal Sustainability Report included a detailed assessment of the potential impact of banking losses on public finances under different regulatory scenarios.

V. CONCLUSION AND POLICY IMPLICATIONS

50. The findings in this paper complement the Fund's ongoing work on macro-financial linkages and provide a basis for policy advice in surveillance work. Developments and vulnerabilities in the banking system can cause severe difficulties for sovereigns. Links from the banking sector to public debt are part of a complex nexus that involves numerous channels of interactions, including many feedback loops. The experience with past and recent financial crises has demonstrated that bank stress can jeopardize fiscal sustainability through both direct and indirect channels, but also that well-designed sovereign interventions may be necessary to prevent the crisis from spinning out of control and undermining fiscal sustainability. While the analysis in this paper primarily focuses on the experiences of EMs and AEs, several policy conclusions are nonetheless relevant for LICs. In particular, the importance of having in place macroprudential policies to safeguard financial stability and the need to monitor fiscal risks that can arise from the banking sector are germane to varying degrees in all economies.

51. Using regulatory policies is the preferred approach to preserving the health of the banking sector, improving the sector's own loss-absorbing capacity and preventing banking crises. The recent wave of financial sector regulatory reforms should help strengthen bank regulation and supervision, increase loss absorbency (as a going concern and in resolution), and lead to more effective resolution regimes. In the wake of the crisis, several countries have prioritized the reform of the regulatory, supervisory, and resolution regimes to reduce the likelihood of crisis and the risk that public funds are used in future banking failures. In addition, resolution mechanisms that rely on bank contributions would also help limit risks to the sovereign especially when adequate funds are built to support bank resolutions without undue recourse to public funds. Further fundamental reforms could be considered to help prevent crises or reduce their cost including possible measures that may emerge from the ongoing review of the regulatory framework that governs banks' economic incentives to hold government debt. The 2014 Triennial Surveillance Review found that in recent years, Fund surveillance has made important progress in assessing risks and aspects of financial sector stability. Looking forward, analysis of financial sector issues could be better linked to fiscal developments and macro performance generally.

52. Adoption of appropriate macroprudential policies would support building buffers that help maintain financial stability. As a complement to macroeconomic policies and micro-prudential supervision, effective macroprudential policies can mitigate procyclical feedback loops between asset prices and credit and strengthen the financial system's capacity to absorb negative shocks.[34] For example, credit-related instruments (e.g., caps on debt-to-income and loan-to-value) could be used to stem credit growth, while capital-related instruments (such as adjustments in the capital requirement and the risk weights of assets, and dynamic provisioning requirements) can provide countercyclical buffers to improve resilience and help curtail excessive growth in leverage. Well-

[34]See Crowe and others (2011); and Lim and others (2011) for analyses; and IMF (2013a) for a detailed discussion on key aspects of macroprudential policy.

coordinated macroprudential policies have the potential to contain risks by taking account of externalities across sub-sectors of the financial system. In this context, a strong institutional framework is essential to ensure that macroprudential policy can work effectively. It needs to ensure the *ability to act* by providing access to relevant information and assigning an appropriate range and reach of macroprudential instruments to the macroprudential authority. Equally important, the framework needs to foster the *willingness to act* and counter biases for inaction or insufficiently timely action by giving a clear mandate to the macroprudential authority. Finally, the framework needs to promote *effective cooperation* in risk assessments and mitigation, in a manner that preserves the autonomy of separate policy functions.[35]

53. Nonetheless, fiscal risks from the banking sector will likely remain and therefore practices should be in place to ensure that adequate early warnings are generated ahead of banking stress. This is particularly important because the structural factors that underlie bank vulnerabilities cannot be adjusted overnight. The paper argues for:

- Putting in place an institutional framework that strengthens the ability of the fiscal authorities to identify and monitor risks from the banking sector, including by ensuring timely access to relevant information and by developing expertise to evaluate the potential impact of banking vulnerabilities on debt sustainability.

- Establishing clear procedures to undertake in-depth analysis of risks from banking sector contingent liabilities. In this context, a diagnostic analytical tool could be designed to highlight country-specific potential emerging bank-to-sovereign risks based on the analytical results in this paper and approaches used in other existing tools.

- Routinely reporting to the public the risks to the sovereign from banks as part of a broader discussion of fiscal risks, taking care not to exacerbate moral hazard. Public discussion of these risks could be informed by banking sector stress tests and the existing regulatory framework including measures to build up buffers within banks (particularly systemically important ones) to limit recourse to public funds in case of stress. The estimated fiscal cost of banking stress should reflect both direct and indirect costs under different scenarios without creating expectations that a particular scenario would prevail or signaling a particular intervention strategy by the government.

54. The analytical results of the paper have broader implications for the conduct of fiscal policy to help contain the impact of banking sector risks when those materialize. While the specific policy recommendations will depend on country circumstances and existing regulatory frameworks, the broad findings of this paper suggest fiscal policy should be conducted in a way that:

[35]See IMF (2014), Staff Guidance Note on Macroprudential Policy.

- Leans against the wind during banking booms to provide buffers that would allow for appropriately-sized countercyclical policies during downturns. The adoption of structural fiscal rules that constrain the spending of unsustainable increases in tax revenue associated with credit and asset price booms would be beneficial. More work is needed to develop structural fiscal targets and rules that take into account factors beyond those reflected in the output gap, for example, credit growth and property and stock price dynamics.

- Balances the benefits and the risks associated with reliance on domestic banks as a source of financing. Under some circumstances, particularly during recessions, high banks' home bias in sovereign debt may provide a welcome relief when other sources of financing may not be available. However, given the distortions it may cause and the likely deepening of the banks/sovereign nexus, it could contribute to excessive accumulation of debt, and an eventual rise in sovereign risk. These tradeoffs should be taken into account by policy makers and debt managers, especially during normal times, by diversifying the government's financing sources.

- Aims to raise revenue in ways that can help reduce banking sector risks and build fiscal buffers as bank vulnerabilities increase. The tax deductibility of interest payments on mortgages and on debt instruments more generally could be limited or eliminated to remove the bias toward debt financing and the attractiveness of leverage, a proven contributing factor to the cost of crises.[36] Reducing the tax advantage of debt would encourage corporations and banks themselves to use less debt and more equity; hence, supporting regulatory efforts to increase banks' equity capital. In light of the adverse externalities associated with excessive debt ratio and related riskiness of individual banks, IMF (2010) proposed a Financial Stability Contribution to internalize such externalities and therefore contain banks' leverage and the size of potential contingent liabilities for the government, and help build up fiscal buffers whenever there is an increase in banking sector vulnerabilities. For countries so wishing, the stability contribution could help finance resolution mechanisms.[37]

[36]De Mooij (2011). See also evidence reported in De Mooij, Keen, and Orihara (2013), pp. 229–52. For further discussion of the advantages and disadvantages of these policies, see IMF (2009).

[37]IMF (2010); Devereux, Johannesen, and Vella (2013).

Box 1. Policies to Resolve Financial System Stress and Restore Financial Intermediation

Well-timed government interventions aimed at financial institutions and borrowers can help restore balance sheets and incentives, mitigate the negative shock of a financial system under stress on the economy, and help to restart productive investment. But in applying these interventions governments frequently face trade-offs. The key challenge is to restore financial intermediation while keeping assistance costs for taxpayers down, avoiding misallocations of capital, and maintaining proper incentives going forward.

Review of past experiences of financial system distress and of the current episode of financial turmoil, suggests the effectiveness and fiscal cost of policy responses depend on four key dimensions:

- First, having a sound framework for assuring financial sector stability helps prevent and contain financial stress. Key elements of this framework include: precrisis sanctions to undercapitalized financial institutions; legal and institutional mechanisms to deal quickly with weak financial institutions, such as special resolution regimes for financial institutions; and effective financial safety nets including deposit insurance and emergency liquidity schemes.
- Second, a swift response may help minimize the impact on the real economy. All too often regulatory capital forbearance and liquidity support have been used to help insolvent financial institutions recover—only to realize that the delay in intervening increases the stress on the financial system and the cost to the real economy. To avoid this, policy makers should force recognition of losses at an early stage and take steps to ensure that financial institutions are adequately capitalized.
- Third, the adverse impact of financial system distress on the real economy may have to be contained through measures that address the debt overhang of firms and households, through debt restructuring programs.
- Fourth, steps should be taken to limit costs and moral hazard implications of these policy responses. Shareholders should be the first to absorb the losses by writing down their equity. In case of large losses, creditors could contribute by restructuring their claims. Mechanisms that link government support (such as preferred stock purchases) to privately raised capital could also help identify those truly worth saving and limit distortions for the future arising from moral hazard.

Policy makers can employ a wide range of measures to contain the crisis and restore the normal functioning of the credit system with a view to rebuild banks' and borrowers' balance sheets. Government recapitalizations have been a key policy instrument in this respect, accounting for most of direct fiscal costs in past banking crises. Recapitalization measures do not directly improve debtor capacity, but aim at quickly improving the capital bases of financial institutions, making it easier for banks to recognize losses and thereby facilitate corporate and household debt restructuring. Government recapitalizations can, however, create moral hazard for shareholders, especially if recapitalizations bail out unviable institutions using taxpayer money. Comparing the preferred bank stock programs adopted in the United States (starting in 1933) and Japan (1998) helps illustrate some of the key issues with recapitalization. While in both cases policymakers used preferred stock purchases to enhance bank capital, this approach appeared to work better in the United States, where appropriate screening and incentives for participants ensured that only banks worth saving and those that managed their risk and capital structure more prudently received taxpayer funds. Moreover, banks receiving assistance were monitored to ensure that they made proper use of public aid. In Japan, by contrast, virtually every bank of significant size received assistance, though the amounts involved were relatively small and the government did not require banks to find private sources of capital. The recapitalization program thus provided a boost to bank capital but did less to foster corporate restructuring or to restart bank lending.

Box 2. Banks' Preference for Domestic Sovereign Claims

A key distinguishing feature of sovereign debt is that it generally enjoys preferential treatment relative to other financial assets in countries' regulatory frameworks. This feature underpins many of the factors that explain changes in banks' holdings of domestic sovereign debt relative to all other assets. The impact of this preferential treatment is likely amplified during economic downturns. In the presence of financial sector vulnerabilities, domestic sovereign debt may become increasingly important as central bank collateral as well as for secured wholesale funding (BIS, 2006). At the same time the supply of public debt may substantially increase during times of stress including as a result of countercyclical fiscal policy. With the quality of other assets deteriorating, domestic banks will continue to absorb sovereign debt to safeguard the health of their balance sheets. In addition, private sector investment opportunities tend to decline during times of stress, further pushing banks towards domestic sovereign debt.

In addition to the favorable treatment of government debt in the regulatory framework, country authorities often take additional policy actions that support banks' increased holding of government debt during times of stress. This could include liquidity extension to banks, and direct purchases of government debt or conditional commitments to purchase government debt by the central bank. While difficult to substantiate empirically, moral suasion is often used to "convince" banks to purchase government bonds, especially in the primary market. Traditionally, home bias in banks' holdings of domestic government debt has been linked to financial repression (see, e.g., Reinhart and Sbrancia (2011) that gives rise to directed lending to the government by captive domestic audiences such as banks and a tighter connection between government and banks.

Cross country variation in home bias could also be explained by factors such as the structural characteristics of the banking sector (e.g., excess liquidity), the type of institutional framework governing the financial sector, political stability, and institutional quality. Countries where the banking sector has a large deposit base (for example because of the limited financial investment options available to households) and relatively limited investment opportunities are likely to have higher home bias. For example, in Japan where the banking sector is very large, corporates tend to rely on the equity market for financing rather than the debt market, limiting the portfolio options for banks.

Determinants of Home Bias 1/

Explanatory Variables	Estimated Coefficients
Bond spread, lagged 2/	**0.129**
Public debt/GDP, lagged	**0.134*** **
Output gap, lagged	**0.036**
Inflation rate, 3-year MA, lagged	**0.542*** **
Institutional quality, lagged 3/	**-0.249*** **
Exchange rate depreciation, lagged	**-0.007**
Credit-to-GDP ratio, lagged	**-0.030*** **
Credit-to-deposit ratio, lagged	**-0.054**
Capital account openness, lagged	**-0.462**
VIX 4/	**0.037** **
Constant	**28.56*** **
Observations	**250**

Note: ***, **, * show significance at 1%, 5%, and 10%.
1/ The fixed effects panel regression is estimated for a sample of 22 advanced and 29 emerging economies during 1999-2012. While the estimation attempts to account for endogeneity and omitted variable bias issues, they cannot be ruled out.
2/ Bond spread is defined as the difference between yields of countries' long-term bonds and those of the U.S. bonds (non-European countries) or those of German bonds (European countries).
3/ For institutional quality, we use ICRG political risk ratings.
4/ VIX is the implied volatility of S&P 500 index options and proxies for global risk aversion.

Using a sample of advanced and emerging market economies, staff's regression analysis confirms the importance of some of the above factors for which data are available. Recognizing that the relationships between home bias and these factors may well reflect a two-way causality, lagged explanatory variables are used in the regression to address potential endogeneity issues. Results show that higher risk aversion measured by the VIX (reflecting increased uncertainty), higher debt-to-GDP ratio, and higher inflation (potentially capturing macroeconomic instability or signs of uncertainty accompanied by increased moral suasion) are associated with higher home bias. In contrast, private sector credit-to-GDP ratio (partly reflecting banks' investment opportunities outside the government), an indicator of institutional quality (capturing government stability and socioeconomic conditions) are significantly negatively related to home bias. Recent studies on the European sovereign-bank nexus find that the supply of government debt and governments' ownership of banks also contribute to home bias in domestic sovereign bonds in the eurozone countries (see De Marco and Macchavelli, 2014.)

Box 3. Using Quantitative Frameworks to Value Contingent Liabilities

Quantification of the contingent liabilities can take different forms, including measurement of: (i) the face value of the guarantee (or maximum loss under the guarantee); (ii) the expected cost of the guarantee (i.e., the mean of the distribution); (iii) the unexpected cost of the guarantee (the maximum loss at a specific confidence interval); and (iv) the estimated market value of the guarantee. Measuring (i) is the least data intensive and is generally used for pricing an explicit guarantee. Measuring (ii) through (iv) require implicitly or explicitly an assessment of the probability of a guarantee being called and typically rely on the use of market or historical data (e.g., estimating the expected cost of a guarantee through loan loss history) or as the use of option pricing models such as the contingent claims analysis (CCA). CCA is a risk-adjusted balance sheet framework where bank assets equal equity plus risky debt (risky debt is default-free value of debt minus the expected loss to creditors of default). See Merton (1974 and 1977), and Gray, Merton, Bodie (2008).

CCA can be used for the estimation of government guarantees including implicit guarantees to the financial sector (see Cebatori, 2008 "Contingent Liabilities: Issues and Practice"). There is strong evidence that implicit and explicit government support for banks reduces banks' borrowing costs and CDS spreads. While bank creditors are the beneficiaries of implicit and explicit government guarantees, equity holders are generally not. CCA uses bank equity market information, together with balance sheet data, to estimate default probabilities and expected losses, as well as guarantee-free credit spread—fair value CDS spread or FVCDS (reported by Moody's Analytics; see for example Gray and Jobst (2013)). The difference between the expected loss associated with the FVCDS and the expected loss from observed bank CDS spread provides an estimate of the market-implied government guarantee, i.e. contingent liability. This approach has been applied to analyze too-important-to-fail contingent liabilities (GFSR April 2014), in FSAPs (e.g., the U.K. and Swedish FSAPs), and in several IMF working papers (e.g., Gray and Jobst 2013; and Gray and others 2013 with applications to the EU).

Credit rating information can also be used to measure contingent liabilities. Credit-rating agencies give banks both an ordinary credit rating and a "stand-alone" rating that depends on the banks' intrinsic financial strength and abstracts from the possibility of government support. The difference in the two credit ratings, combined with information on the relationship between borrowing costs and credit ratings, gives an estimate of the value of the government's implicit guarantee (See for example, GFSR April 2014 Chapter 3).

Other methodologies can provide a "quick estimate" of potential risks from exposure to systemic failure. For example, S&P's Gross Problematic Assets (which includes include overdue loans, restructured assets, foreclosed real estate and other assets recovered in loan workouts, and nonperforming assets sold to special-purpose vehicles) estimates the cost associated to contingent liabilities risks stemming from the financial sector.

Annex I. Macro-Fiscal and Macro-Financial Effects of Banking Sector Characteristics[1]

Banking activities influence economic booms and downturns through their impact on real sector activities. This interaction has fiscal implications due to effects on revenues, expenditures, including automatic stabilizers, and in some cases, government interventions in the banking sector. Economic booms associated with rapid banking expansions are typically followed by deeper and longer recessions, slower recoveries, and greater fiscal sustainability pressures. This annex provides the analysis that underlies the paper's discussion on the macro-fiscal and macro-financial effects of the banking sector on the economy, identifying in particular banking sector characteristics that affect the depth of recessions and length of recoveries.

A. Data and Analysis

1. The analysis uses a dataset of 60 countries—31 advanced economies and 29 emerging markets—to identify periods of expansions and recessions. The data are annual and quarterly (for GDP) and span the period from 1970 to 2013, with the exception of banks' profit and loss (P&L) indicators which are only available since early 1990s. The following table shows the variables and their sources.

Table AI1. Data

Variable	Source
Real GDP	IFS, WEO, OECD
Primary balance/GDP	Mauro and others (2013) and WEO
Public debt/GDP	Mauro and others (2013) and WEO
Banking sector: balance sheet and profit & loss indicators	Global Financial Development database (World Bank)
Banks' foreign liabilities	BIS
Deposit dollarization	Levy-Yeyati (2006) and Chitu (2013)
Other: inflation, real interest rate, openness.	WEO, IFS

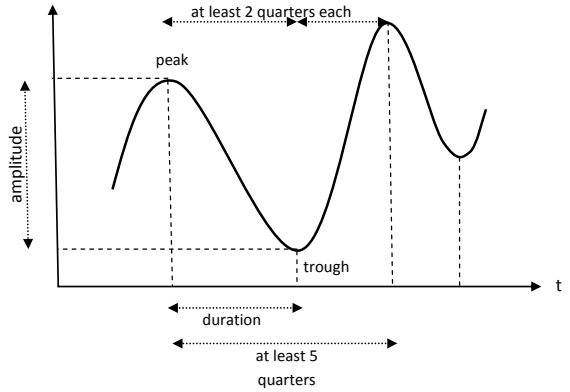
2. Cyclical turning points are identified using the algorithm proposed by Hardigan and Pagan (2002), which finds a series of local maxima and minima that segment the time series into expansions (from through to peak) and recessions (from peak to trough), with the constraint that each phase (expansion or recession) be at least two quarters while the minimum duration of a complete business cycle (from peak to the next peak) be at least five quarters.

3. The main business cycle characteristics during each phase are "duration" and "amplitude." The duration of a recession is the number of quarters between peak and trough. The

[1]Prepared by Cesar Serra and Suchanan Tambunlertchai (both SPR).

amplitude of the recession measures the percentage change of output from peak to trough (Figure AI1). A downturn after a recovery before the economy reaches the prior peak is treated as part of the same business cycle—a "double dip" (Reinhart and Rogoff, 2014). Further, recoveries are defined such that once the economy reaches the prior peak, it continues expanding for at least 2 quarters so that the recovery is not a one-off event.

Figure AI1. Duration and Amplitude of a Recession



Source: Fund staff estimates.

B. Regression Analysis

4. Table AI1 confirms previous results of an association between the extent of ex-ante banking sector characteristics and the ex-post severity of recessions in a multivariate regression setting. The analysis relates the extent of output contraction during recessions (amplitude) and the number of months to regain the pre-recession output peak level (duration) to ex-ante banking sector characteristics, after controlling for macroeconomic variables, including proxies for the fiscal and monetary policy stance prior to the onset of the recession.[2] The amplitude of recessions becomes worse with larger banking sector leverage (measured by the 5-year cumulative change in the credit-to-GDP and loans-to-deposits ratios), increase in banking sector size (measured by the 5-year cumulative change in banking-sector assets to GDP), and dependence to foreign funding (measured by the 5-year cumulative change in the ratio of banks' external borrowing to domestic deposits). Proxies for risk-taking activities such as return on equity (ROE), net interest margin, and non-interest income, [3] as well as measures of inefficiency such as banks' overhead costs are also associated with deeper recessions. Lastly, a more dollarized banking sector, which reflects more vulnerable balance sheets, contributes to amplify downturns.

[2]The average primary balance and average real interest rate during the three years prior to the recession were used as proxies for the fiscal and monetary policy stance during boom times.

[3]Several studies have documented the nexus of these risk-taking proxies and systemic risk. See for example Moshirian, Sahgal, and Zhang (2011); Brunnermeier, Dong, and Palia (2012); and Laeven, Ratnovski, and Tong (2014).

5. Strong capitalization and a more diversified asset base contribute to alleviate the depth of recessions. The solvency z-score which measures the inverse probability of banks' insolvency is negatively associated with the amplitudes of recessions. Similarly, banks' non-core assets to GDP ratio, which reflects diversification, also negatively affects recession amplitudes.

6. Table AI2 shows results that banking sector vulnerabilities preceding a recession affect the prospects of recovery. The findings in this table are consistent with those in Table AI1. In particular, the time to regain the pre-recession output peak level can be explained by the same banking sector characteristics that amplify downturns: leverage, size, dependence on foreign funding, risk-taking proxies, and dollarization.

Table AI1. Recessions and Ex-ante Banking Sector Characteristics

Dependent variable: Amplitude (peak to trough)

VARIABLE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	OLS regression													
Inflation (at peak)	0.0324*	0.0199	0.0228	0.0501**	-0.122	1.006*	0.0712	-0.0416	0.0518	-0.0193	-0.00220	0.271	0.0209	0.00102
	(0.0771)	(0.253)	(0.208)	(0.0424)	(0.151)	(0.0633)	(0.528)	(0.507)	(0.527)	(0.768)	(0.972)	(0.435)	(0.166)	(0.979)
Primary balance (avg, 3y before)	-0.0557	-0.00488	-0.00132	-0.125	-0.191	-0.172	-0.344*	-0.233	-0.279*	-0.252	-0.248	-0.210	0.0195	-0.224*
	(0.583)	(0.961)	(0.987)	(0.297)	(0.182)	(0.362)	(0.0529)	(0.144)	(0.0805)	(0.129)	(0.103)	(0.248)	(0.817)	(0.0736)
Real int rate (avg, 3y before)	-0.0875*	-0.0562	-0.0627	-0.136**	-0.699***	-0.493	-0.613***	-0.615***	-0.637***	-0.512***	-0.430***	-0.584	-0.0579	-0.0514
	(0.0808)	(0.239)	(0.206)	(0.0442)	(0.000126)	(0.177)	(0.000228)	(0.000147)	(0.000222)	(0.000717)	(0.00952)	(0.106)	(0.160)	(0.586)
Openness (at peak)	0.00613	0.00587	0.00790	0.0122**	0.00347	0.00272	0.00174	0.00324	-0.000984	0.00389	0.000412	-0.00290	0.00749	0.00824
	(0.230)	(0.227)	(0.114)	(0.0324)	(0.493)	(0.608)	(0.736)	(0.543)	(0.865)	(0.484)	(0.947)	(0.720)	(0.108)	(0.620)
Leverage (change credit/GDP, 5y before)	0.0636***													
	(0.00106)													
Leverage (change loans/deposits, 5y before)		0.0449*												
		(0.0579)												
Size (diff, 5y and 10y median)			0.0877**											
			(0.0213)											
Dependance (change foreign liabilities/deposits, 5y before)				0.0471***										
				(0.000906)										
Net interest margin (avg, 3y before)					0.686*									
					(0.0507)									
Non-interest income/income (diff, 5y and 10y median)						0.216**								
						(0.0205)								
Non-interest income/income (sd, 10y before)							0.200**							
							(0.0238)							
Overhead/assets (avg, 3y before)								0.364**						
								(0.0273)						
ROE (avg, 3y before)									0.191**					
									(0.0105)					
Solvency (z-score, avg 5y before)										-0.120*				
										(0.0892)				
Bank concentration (avg, 3y before)											-0.0674**			
											(0.0286)			
Foreign ownership (% of assets, at peak)												0.0251		
												(0.359)		
Bank non-core assets/GDP (avg, 3y before)													-0.0962***	
													(0.00230)	
Deposit dollarization (avg, 3y before)														0.103***
														(0.00770)
Constant	3.789***	4.000***	3.859***	4.624***	5.943***	3.595*	6.032***	6.731***	5.177***	9.253***	12.47***	7.586***	5.438***	3.799**
	(2.71e-09)	(1.23e-10)	(1.43e-09)	(2.32e-08)	(3.09e-05)	(0.0985)	(2.67e-05)	(1.15e-05)	(0.000324)	(1.67e-06)	(9.92e-07)	(0.00106)	(0)	(0.0317)
Observations	182	185	190	142	81	50	80	81	81	81	92	52	190	82
R-squared	0.083	0.095	0.041	0.131	0.233	0.235	0.281	0.210	0.259	0.211	0.174	0.198	0.060	0.161

Robust pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table AI2.Recovery and Ex-ante Banking Sector Characteristics

Dependent variable: Duration (peak to recovery, in quarters)

VARIABLE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Poisson regression													
Inflation (at peak)	0.000608	-0.000764	-0.000682	0.00161	-0.0105	0.0394	-0.0209***	-0.0130***	-0.0117**	-0.0172***	-0.00880	-0.0595**	-0.00111	-0.00407
	(0.714)	(0.641)	(0.687)	(0.417)	(0.122)	(0.378)	(0.00772)	(0.00449)	(0.0214)	(8.31e-05)	(0.112)	(0.0316)	(0.480)	(0.323)
Primary balance (avg, 3y before)	-0.00766	0.00464	0.00500	-0.00865	-0.0151	-0.0147	-0.0204	-0.0139	-0.0148	-0.0118	-0.0322	-0.00421	0.00887	-0.0129
	(0.634)	(0.753)	(0.706)	(0.589)	(0.488)	(0.618)	(0.355)	(0.504)	(0.429)	(0.574)	(0.143)	(0.804)	(0.466)	(0.546)
Real int rate (avg, 3y before)	-0.00167	0.00176	0.00161	-0.00452	-0.0726***	-0.123***	-0.0765***	-0.0759***	-0.0804***	-0.0704***	-0.0537***	-0.0801**	0.00276	0.000653
	(0.715)	(0.697)	(0.730)	(0.410)	(5.08e-06)	(0.00700)	(2.23e-07)	(4.30e-07)	(1.59e-09)	(9.02e-06)	(0.000723)	(0.0149)	(0.527)	(0.929)
Openness (at peak)	0.000190	0.000265	0.000401	0.000665	-0.000510	-0.00130	-0.000403	-0.000612	-0.000685	-0.000224	-0.000658	-0.00133	0.000377	0.00142
	(0.761)	(0.699)	(0.553)	(0.369)	(0.481)	(0.165)	(0.606)	(0.407)	(0.375)	(0.767)	(0.373)	(0.139)	(0.576)	(0.445)
Leverage (change credit/GDP, 5y before)	0.00796***													
	(7.46e-06)													
Leverage (change loans/deposits, 5y before)		0.00418**												
		(0.0221)												
Size (diff, 5y and 10y median)			0.0113***											
			(0.000248)											
Dependance (change foreign liabilities/deposits, 5y before)				0.00480***										
				(1.17e-06)										
Net interest margin (avg, 3y before)					-0.0348									
					(0.287)									
Non-interest income/income (diff, 5y and 10y median)						0.0323***								
						(0.00235)								
Non-interest income/income (sd, 10y before)							0.0182*							
							(0.0772)							
Overhead/assets (avg, 3y before)								-0.0373**						
								(0.0378)						
ROE (avg, 3y before)									0.0209***					
									(0.00224)					
Solvency (z-score, avg 5y before)										-0.00837				
										(0.351)				
Bank concentration (avg, 3y before)											-0.00300			
											(0.365)			
Foreign ownership (% of assets, at peak)												0.00408		
												(0.116)		
Bank non-core assets/GDP (avg, 3y before)													-0.00988	
													(0.143)	
Deposit dollarization (avg, 3y before)														0.00860**
														(0.0155)
Constant	2.294***	2.318***	2.308***	2.402***	2.862***	2.778***	2.644***	2.881***	2.468***	2.858***	3.005***	3.042***	2.479***	2.184***
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Observations	182	185	190	142	81	50	80	81	81	81	92	52	190	82

Robust pval in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Annex II. Fiscal Cost of Systemic Banking Crises[1]

This annex presents cross-country econometric evidence relating the fiscal costs of systemic banking crises to a variety of precrisis macroeconomic and banking sector financial variables, countries' institutional frameworks, and governments' responses to crises (Section III.D). It provides evidence on both direct fiscal costs and overall fiscal costs of systemic banking crises.

A. Direct Fiscal Costs

1. Governments that provide financial support to banks during systemic banking crises incur a variety of direct fiscal costs. Costs arise from recapitalization and asset purchase operations as well as from country-specific measures, such as recapitalizations by central banks and loans to banks (Laeven and Valencia, 2013a).[2]

2. It is generally accepted that direct fiscal costs from governments' interventions in the banking sector during crises are closely related to:

- *Precrisis size and vulnerabilities of the banking sector*. Large banking sectors and highly leveraged banks and non-financial sector make banks more prone to financial stress and, in the case of a banking crisis, increase the cost of government's intervention (Kalemli-Ozcan and others, 2012; Allen and Gale, 2003; Hoggarth and others, 2002; IMF, 2003; IMF, 2011).

- *Countries' institutional framework*. The design and degree of development of the institutional setting affect the probability of having a banking crisis, as well as the size of public intervention if a crisis materializes (Demirguc-Kunt and Detragiache, 1998; and Claessens and others, 2005). Moreover, weaker institutions lead to less efficient crisis management policies and higher fiscal costs once crises occur (Claessens and others, 2005).

- *Crisis management policy responses.* Different policy tools have different immediate costs and, in some cases, policies that have low or no immediate costs (e.g., guarantees on financial institutions' liabilities, forbearance from prudential regulations) may postpone or even increase future costs as banks take over additional risks (Honohan and Klingebiel, 2003; and Claessens and others, 2005).

- *Macroeconomic conditions*. Credit booms and asset bubbles typically precede banking crises, inflate growth and improve fiscal performance, possibly leading to macroeconomic imbalances. The larger the precrisis imbalances, the larger are the possible fiscal costs of a crisis (IADB, 2005; and Laeven and Valencia, 2008).

[1]Prepared by Nicolas End and Mariusz Jarmuzek (both FAD).

[2]Definitions and data on systemic banking crises and direct fiscal costs rely on Laeven and Valencia (2013).

3. In absence of a structural model, we estimate a reduced-form equation that accounts for precrisis banking sector characteristics and countries' institutional framework along with a set of policy response variables, and controls for precrisis macroeconomic conditions:

$$DFC_i = \alpha_0 + \sum_{k=1}^{3} \alpha_{1,k} MV_{k,i} + \sum_{k=1}^{2} \alpha_{2,k} IS_{k,i} + \sum_{k=1}^{5} \alpha_{3,k} FV_{k,i} + \sum_{k=1}^{2} \alpha_{4,k} PR_{k,i} + \varepsilon_i \qquad (1)$$

where direct fiscal costs (DFC_i) of crisis episode i are a function of a set of precrisis macro variables (MV_k), such as per capita income, public debt to GDP ratio, and current account balance, institutional features (IS_k), selected financial characteristics of the banking sector (FV_k) and policy responses (PR_k).

4. We estimate the reduced-form equation for a set of 65 crisis episodes spanning the period 1980–2011 and involving 56 countries, both high- and middle-income economies.[3] Financial variables are derived from Beck and Mohseni-Cheraghlou (2012) and policy response variables (Table AII1a–b of this Annex) from Laeven and Valencia (2013a). Despite the broader coverage compared to previous studies, the absence of a structural model suggests that results should be interpreted with caution, as they may not necessarily reflect causal links. A further complicating factor is the possibility of reverse causality because actual costs often depend upon the particular resolution strategy adopted, which is difficult to establish ex ante (see robustness checks below).

5. Cross-country regression analysis identifies important correlations between direct fiscal costs of banking crises and countries' precrisis banking sector and institutional features, and policy responses.

- Higher fiscal costs of systemic banking crisis are associated with larger and more leveraged precrisis domestic banking sectors (as measured by the ratio of banks' assets to GDP and the bank credit to the private sector over GDP,[4] Table AII2). Higher fiscal costs are also associated with banking sectors relying more on external funding (as measured by the ratio of offshore deposits to domestic deposits and by the loans from nonresident bank to GDP). This latter result signals that banks' precrisis funding mix may matter for the fiscal cost of crises. Although we do not find the loan-to-deposit ratio (a measure of banks' leverage) to contribute to fiscal costs, it may matter for overall fiscal costs (see next section)
- Better quality of banking supervision before the crisis is associated with lower fiscal costs of crises. In addition, a broader deposit insurance coverage (measured by the ratio of insured deposits over per capita GDP) is associated with lower fiscal costs (Table AII2, equations 1–5). Looking at governments' policies, bank guarantees, generally used during the initial containment phase, imply no initial costs but are actually associated with higher direct fiscal costs over the crisis period (Table AII3). There is also some evidence that forbearance

[3]High- and middle-income economies are defined according to the World Bank classification as of September 2014. They may include some PRGT (Poverty Reduction and Growth Trust) eligible countries.

[4]The bank credit to the private sector over GDP can also be read as nonfinancial sector leverage.

practices, often used during crises, are associated with higher fiscal costs (significant coefficients at 11–15 percent level, depending on the model specification).

6. Regression results hold under a number of robustness checks. Specifically, we run robustness checks to account for:

- *Size of the crisis shock and bail-in option*. We extended our basic model to include the peak in the non-performing loan (NPL) ratio during the crisis, as a measure of the size of problems in the banking sector, and a dummy variable indicating whether losses were inflicted to depositors. Results remain broadly unchanged, with only the size of the banking sector becoming less significant.

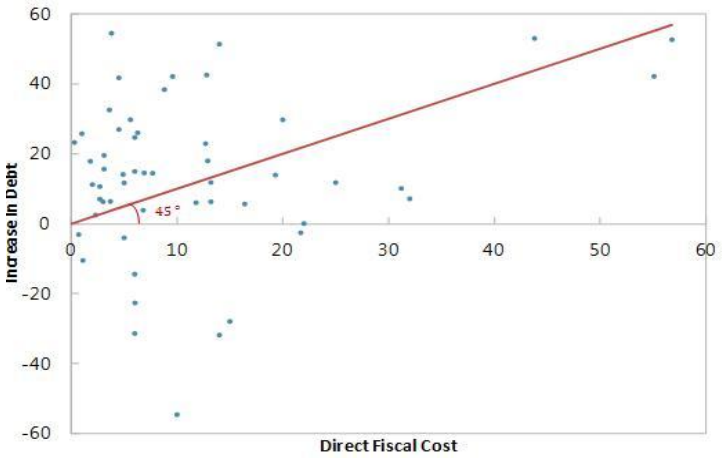
- *Potential endogeneity and reverse causality issues*. We estimate our basic equation (1) using GMM and including as instruments for policy responses the creditor rights variable constructed by Djankov (2008) and time dummy variables (Honohan and Klingebiel, 2003). Results from the basic regressions continue to hold, alleviating somewhat the likelihood of reverse causality problems in the interpretation of the findings.

B. Overall Fiscal Costs

7. A more comprehensive, though admittedly imperfect, indicator of the overall impact of banking crises on public finances is the change in public debt-to-GDP ratios.[5] Changes in public debt ratios cover the direct fiscal costs of banking crises, as well as indirect costs that crises have on the budget through their impact on GDP growth (e.g., via revenue and other automatic stabilizers) and governments' financing costs (Figure AII1). In addition, changes in overall debt capture costs that materialize over time (e.g., calls on guarantees, losses on governments banking sector assets) and governments' ability to recover part of the initial outlays. Despite these advantages, changes in public debt are admittedly an imprecise measure of overall fiscal costs of banking crises in that they capture debt that is not necessarily attributable, directly or indirectly, to banking crises.

[5]We focus on gross public debt because data are more widely available than net debt or net worth, and gross debt better captures government's short-term exposure to financial stress.

Figure AII1. Direct and Total Fiscal Costs of Banking Crises



Source: Fund staff estimates.

8. Analyzing changes in public debt sheds light on the role of banking sector features and institutions as well as policy response for the overall costs of banking crises. To investigate these relations, we estimate a reduced-form model broadly based on the standard debt-flow equation. In our basic model, changes in public debt ratios depend on the precrisis debt ratio level (D_0) and on changes in the primary fiscal balance over the crisis period (ΔPB). In addition, debt dynamics depend on GDP growth and real interest rates, which we assume are affected by precrisis banking sector characteristics (FV_k), institutional variables (IS_k), and policy responses (PV_k). Hence, our basic linear regression is:

$$OFC_i = \beta_0 + \beta_1 D_{0,i} + \beta_2 \Delta PB_i + \sum_k \beta_{3,k} FV_{k,i} + \sum_k \beta_{4,k} IS_{k,i} + \sum_k \beta_{5,k} PV_{k,i} + \eta_i \quad (2)$$

where OFC_i denotes overall fiscal costs (or changes in the debt ratio) in crisis episode i, computed as the change in public debt ratio over five years, i.e. between the precrisis debt level and the value observed at the fourth year after the beginning of the crisis.

9. As for direct fiscal costs, regressions analysis suggests that overall fiscal costs of banking crises are higher when countries enter crises with larger and more leveraged banking sectors (as measured by the asset to GDP ratio and the credit to the private sector to GDP ratio respectively; Table AII4). Contrary to the analysis of direct fiscal costs, overall costs are also higher in countries with banks the loans to deposit ratio is higher, another indicator of banking sector leverage and funding mix (together with the ratio of offshore deposits to domestic deposits and the loans from non-resident bank to GDP). However, when controlling for the quality of banking supervision, indicators of banking sector funding mix appear to be less relevant for overall fiscal costs. This result suggests that when the banking supervisor manages to keep banks under control, banks' funding mix is not as important for overall fiscal costs, while problems can still potentially stem from the size sector and private sector debt overhang and for direct costs. When looking at policy responses, only

bank guarantees are unequivocally associated with higher overall costs (Table AII5). On the other hand, asset purchases and bank recapitalizations—policies that may have a higher upfront cost—are not significantly correlated to an increase in public debt. This latter result suggests that not all the crisis management policies that have high initial costs turn to be costly over time.[6]

10. Regression results hold under a number of robustness checks. We run robustness checks to account for:

- *Alternative timeframes in regression variables.* Results remain unchanged when varying the time span to calculate the change in public debt to 4 and 6 years. However, the shorter the time span, the smaller the coefficients, suggesting that some costs materialize only after a few years from the beginning of the crisis. Similarly, altering the timeframe of precrisis variables (different lags or precrisis averages rather than lagged values) does not alter much the main results. One interesting exception is that the financial sector leverage variable loose significance when averages are taken instead of the one-year lag, which probably indicates a strong build-up of leverage just before the triggering of the crisis.[7]

- *The size of the crisis shock and bail-in options*. We introduce in the regression the peak in the NPL ratio during the crisis as a measure of the size of the shock, as well as a dummy variable indicating whether losses were inflicted to depositors. Results remain broadly similar compared to the benchmark regressions and neither depositor loss nor NPL variables appear statistically significant.

- *The size of the crisis shock and bail-in options*. We introduce in the regression the peak in the NPL ratio during the crisis as a measure of the size of the shock, as well as a dummy variable indicating whether losses were inflicted to depositors. Results remain broadly similar compared to the benchmark regressions and neither depositor loss nor NPL variables appear statistically significant.

- *Endogeneity and reverse causality issues*. We re-estimate the basic equation (2) by the generalized method of moments and using as instruments for policy responses the creditor rights variable constructed by Djankov (2008) and time dummy variables (Honohan and Klingebiel, 2003). Results suggest that guarantees remain significant and, in some specifications, asset purchases and bank recapitalization dummies gain significance.

[6]This could also be a result of endogeneity issues (see robustness checks).

[7]To confirm this intuition, we examine, in addition to averages, cumulative changes prior to the crisis. Most variables become far less significant in variation than they were in levels, once again except for financial leverage.

Table AII1(a). Systemic Banking Crises

Argentina	1980, 1989, 1995, 2001	Korea	1997
Austria	2008	Latvia	1995, 2008
Belgium	2008	Lithuania	1995
Bolivia	1994	Luxembourg	2008
Brazil	1990, 1994	Malaysia	1997
Bulgaria	1996	Mexico	1994
Chile	1981	Mongolia	2008
Colombia	1982, 1998	Netherlands	2008
Côte d'Ivoire	1988	Nicaragua	2000
Croatia	1998	Nigeria	2009
Czech Republic	1996	Norway	1991
Denmark	2008	Paraguay	1995
Dominican Rep	2003	Philippines	1997
Ecuador	1998	Portugal	2008
Estonia	1992	Russia	1998, 2008
Finland	1991	Slovenia	2008
France	2008	Spain	2008
Germany	2008	Sri Lanka	1989
Ghana	1982	Sweden	1991, 2008
Greece	2008	Switzerland	2008
Hungary	2008	Thailand	1997
Iceland	2008	Turkey	2000
Indonesia	1997	Ukraine	1998, 2008
Ireland	2008	United Kingdom	2007
Italy	2008	United States	2007
Jamaica	1996	Uruguay	2002
Japan	1997	Venezuela	1994
Kazakhstan	2008	Vietnam	1997

Source: Laeven and Valencia (2013a).

Table AII1(b). Data Description and Sources

Name	Description	Source
Direct Fiscal Costs	Direct fiscal costs as a share of GDP	Laeven & Valencia (2012)
Income Per Capita	GDP per capita	WEO
Public Debt	Public debt as a share of GDP	Abbas et al. (2010) spliced with general government gross debt/GDP from Paolo et al (2013)
Current Account Balance	Current account balance as a share of GDP	WEO
Banking Sector Supervision	Banking sector supervision index	Abiad et al. (2008)
Deposit Insurance Coverage	Deposit insurance coverage as a share of GDP per capita	Laeven & Valencia (2012)
Peak NPLs	Peak non-performing loans as a share of total loans	Laeven & Valencia (2012)
Financial Sector Leverage	Private credit by deposit money banks as a share of demand, time and saving deposits in deposit money banks.	Beck & Mohseni-Cheraghlou (2012)
Size of Financial Sector	Claims on domestic real nonfinancial sector by deposit money banks as a share of GDP	Beck & Mohseni-Cheraghlou (2012)
Non-Financial Sector Leverage	Private credit by deposit money banks as a share of GDP	Beck & Mohseni-Cheraghlou (2012)
Interconnectedness 1	Offshore bank loans (amount outstanding) as a share of GDP	Beck & Mohseni-Cheraghlou (2012)
Interconnectedness 2	Offshore bank deposits relative as a share of domestic deposits	Beck & Mohseni-Cheraghlou (2012)

Source: Laeven and Valencia (2013a).

Table AII2. Direct Fiscal Costs, Precrisis Banking Sector and Institutional Variable

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Income Per Papita (t-1)	-0.00300	-0.00291	0.000124	-0.000202	-0.00138	-0.00343	-0.00307	-0.0000442	-0.00190	-0.00214
	[0.00179]	[0.00181]	[0.00157]	[0.00205]	[0.00209]	{0.00229]	[0.00224]	[0.00206]	[0.00217]	[0.00241]
Public Debt/GDP (t-1)	-0.00369	-0.00495	-0.00412	-0.00713	-0.00441	-0.00109	-0.00196	-0.00384	-0.00574	-0.00591
	[0.00529]	[0.00527]	[0.00367]	[0.00776]	[0.00374]	[0.00517]	[0.00505]	[0.00358]	[0.00691]	[0.00349]
Current Account/GDP (t-1)	-0.0287	-0.0325	-0.0475*	-0.0516*	-0.0448	-0.0437	-0.0474*	-0.0616**	-0.0674**	-0.0558*
	[0.0263]	[0.0263]	[0.0283]	[0.0295]	[0.0298]	[0.0276]	[0.0274]	[0.0292]	[0.0255]	[0.0281]
Banking Supervision Index	**-0.443*** **	**-0.428*** **	**-0.403*** **	**-0.545** **	**-0.615*** **	**-0.320** **	**-0.315***	**-0.342***	**-0.410** **	**-0.520*** **
	[0.125]	[0.120]	[0.132]	[0.202]	[0.177]	[0.157]	[0.160]	[0.172]	[0.199]	[0.179]
Deposit Insurance Coverage *(Covered Deposits/GDP Per Capita, t-1)*						**-0.00186*** [1]**	**-0.00191*** [1]**	**-0.00242*** [1]**	**-0.00348*** [1]**	**-0.00279*** [1]**
						[0.000899]	[0.000906]	[0.000921]	[0.00125]	[0.00132]
Non-Financial Sector Leverage *(Private Credit/GDP, t-1)*	**0.00871** **					**0.00771***				
	[0.00376]					[0.00452]				
Size of Financial Sector *(Assets/GDP, t-1)*		**0.00771** **					0.00649			
		[0.00320]					[0.00430]			
Financial Sector Leverage *(Loans/Deposits, t-1)*			**-0.00139**					-0.00161		
			[0.00133]					[0.00143]		
Interconnectedness *(Offshore Deposits/Domestic Deposits, t-1)*				**0.0230** **					**0.0295*** **	
				[0.0110]					[0.00971]	
Interconnectedness *(Non-Resident Loans/GDP, t-1)*					**0.00704** **					**0.00666***
					[0.00338]					[0.00348]
Constant	2.504***	2.515***	2.857***	2.911***	3.068***	2.457***	2.479***	3.042***	3.141***	3.385***
	[0.341]	[0.339]	[0.351]	[0.534]	[0.340]	[0.385]	[0.398]	[0.466]	[0.490]	[0.416]
Observations	53	53	53	36	37	46	46	46	34	35
R Squared	0.309	0.304	0.270	0.396	0.403	0.373	0.361	0.364	0.554	0.519
F Statistic	5.566	5.559	3.672	6.960	6.861	4.549	4.474	4.743	7.250	6.082
Prob > F	0.000417	0.000421	0.00692	0.000202	0.000205	0.00138	0.00155	0.00103	0.000110	0.000360

Source: Fund staff estimates.

Notes: Standard errors in brackets. The symbols ***, **, and * indicate statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively. Dependent variable is the log of direct fiscal costs in percent of GDP. Estimated coefficients reflect a log-linear relationship; hence, a unit increase in the independent variable is associated to a $(e^{coeff} - 1) \times 100$ percent change in the dependent variable.

Table AII3. Direct Fiscal Costs, Precrisis Banking Sector and Institutional Variable

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Income Per Capita (t-1)	-0.00320*	-0.00312*	-0.001	-0.001	-0.002	-0.003	-0.003	0.000	0.001	0.000
	[0.00178]	[0.00180]	[0.00153]	[0.00213]	[0.00210]	[0.00181]	[0.00180]	[0.00145]	[0.00222]	[0.00222]
Public Debt/GDP (t-1)	-0.004	-0.005	-0.005	-0.006	-0.005	-0.003	-0.004	-0.001	-0.0126*	-0.004
	[0.00540]	[0.00543]	[0.00358]	[0.00780]	[0.00356]	[0.00422]	[0.00421]	[0.00365]	[0.00639]	[0.00442]
Current Account/GDP (t-1)	-0.028	-0.031	-0.043	-0.0499*	-0.041	0.022	0.004	-0.018	0.030	-0.028
	[0.0255]	[0.0258]	[0.0274]	[0.0267]	[0.0280]	[0.0539]	[0.0544]	[0.0533]	[0.0675]	[0.0622]
Banking Supervision Index	**-0.461****	**-0.448****	**-0.479****	**-0.582****	**-0.665****	-0.145	-0.121	-0.159	-0.472	-0.396
	[0.128]	[0.124]	[0.132]	[0.203]	[0.170]	[0.177]	[0.172]	[0.205]	[0.315]	[0.377]
Non-Financial Sector Leverage	**0.00726***					**0.00853***				
(Private Credit/GDP, t-1)	[0.00395]					[0.00323]				
Size of Financial Sector		**0.00636***					**0.00664***			
(Assets/GDP, t-1)		[0.00336]					[0.00268]			
Financial Sector Leverage			-0.001					0.000		
(Loans/Deposits, t-1)			[0.00141]					[0.00187]		
Interconnectedness				**0.0288****					0.003	
(Offshore Deposits/Domestic Deposits, t-1)				[0.0103]					[0.0122]	
Interconnectedness					**0.00753***					0.005
(Non-Resident Loans/GDP, t-1)					[0.00278]					[0.00459]
Bank Guarantee (Dummy)	0.380	0.388	**0.625****	**0.743****	**0.615***					
	[0.310]	[0.307]	[0.271]	[0.355]	[0.346]					
Forbearance (Dummy)						0.568	0.581	0.530	0.205	0.116
						[0.339]	[0.349]	[0.358]	[0.482]	[0.431]
Constant	2.452***	2.461***	2.763***	2.533***	2.860***	2.175***	2.162***	2.220***	3.549***	2.998***
	[0.347]	[0.345]	[0.346]	[0.498]	[0.315]	[0.424]	[0.432]	[0.467]	[0.796]	[0.573]
Observations	53	53	53	36	37	35	35	35	18	19
R Squared	0.328	0.324	0.326	0.46	0.45	0.318	0.298	0.169	0.322	0.268
F Statistic	6.662	6.652	6.581	5.165	7.595	2.41	2.65	1.433	2.188	1.415
Prob > F	0.000	0.000	0.000	0.001	0.000	0.053	0.037	0.237	0.123	0.286

Source: Fund staff estimates.

Notes: Standard errors in brackets. The symbols ***, **, and * indicate statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively. Dependent variable is the log of direct fiscal costs in percent of GDP. Estimated coefficients reflect a log-linear relationship; hence, a unit increase in the independent variable is associated to a $(e^{coeff} - 1) \times 100$ percent change in the dependent variable.

Table AII4. Overall Fiscal Costs, Precrisis Banking Sector and Institutional Variables

	Basic Model					With Institutional Variables				
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Public Debt/GDP (t-1)	-0.113	-0.119	-0.216*	0.083	-0.199	-0.051	-0.058	-0.246*	0.088	-0.222
	[0.109]	[0.113]	[0.128]	[0.103]	[0.161]	[0.126]	[0.122]	[0.133]	[0.111]	[0.139]
Change in Primary Balance (t, t+3)	-0.905***	-0.972***	-1.046***	-1.073***	-1.011***	-1.190***	-1.252***	-1.120***	-1.301***	-0.992***
	[0.217]	[0.205]	[0.198]	[0.180]	[0.199]	[0.233]	[0.214]	[0.255]	[0.227]	[0.324]
Non-Financial Sector Leverage	**0.113****					**0.148****				
(Private Credit/GDP, t-1)	[0.053]					[0.061]				
Size of Financial Sector		**0.095***					**0.136****			
(Assets/GDP, t-1)		[0.056]					[0.060]			
Financial Sector Leverage			**0.049*****					0.005		
(Loans/Deposits, t-1)			[0.013]					[0.058]		
Interconnectedness				0.092					0.179	
(Offshore Deposits/Domestic Deposits, t-1)				[0.171]					[0.226]	
Interconnectedness					-0.002					0.070
(Non-Resident Loans/GDP, t-1)					[0.011]					[0.064]
Banking Supervision Index						**-6.596***	**-6.256***	0.171	-4.419	-1.158
						[3.530]	[3.563]	[3.478]	[3.921]	[4.020]
Deposit Insurance Coverage						0.031	0.031	0.031	0.014	0.041
(Covered Deposits/GDP Per Capita, t-1)						[0.022]	[0.022]	[0.024]	[0.030]	[0.030]
Constant	13.813**	15.225***	19.121***	14.661**	27.165***	13.387*	13.402*	20.267**	17.039	18.878
	[5.485]	[5.400]	[6.264]	[7.152]	[7.900]	[6.832]	[7.011]	[9.003]	[12.771]	[11.877]
Observations	53	53	53	38	40	44	44	44	34	35
R Squared	0.479	0.457	0.472	0.480	0.432	0.549	0.545	0.514	0.578	0.544
F Statistic	19.53	18.74	17.71	15.24	11.38	15.49	15.18	8.80	31.47	15.20
Prob > F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Source: Fund staff estimates.

Notes: Standard errors in brackets. The symbols ***, **, and * indicate statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table AII5. Overall Fiscal Costs and Policy Responses

	Basic Model					With Institutional Variables				
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Public Debt/GDP (t-1)	-0.113	-0.119	-0.216*	0.083	-0.199	-0.051	-0.058	-0.246*	0.088	-0.222
	[0.109]	[0.113]	[0.128]	[0.103]	[0.161]	[0.126]	[0.122]	[0.133]	[0.111]	[0.139]
Change in Primary Balance (t, t+3)	-0.905***	-0.972***	-1.046***	-1.073***	-1.011***	-1.190***	-1.252***	-1.120***	-1.301***	-0.992***
	[0.217]	[0.205]	[0.198]	[0.180]	[0.199]	[0.233]	[0.214]	[0.255]	[0.227]	[0.324]
Non-Financial Sector Leverage	**0.113****					**0.148****				
(Private Credit/GDP, t-1)	[0.053]					[0.061]				
Size of Financial Sector		**0.095***					**0.136****			
(Assets/GDP, t-1)		[0.056]					[0.060]			
Financial Sector Leverage			**0.049*****					0.005		
(Loans/Deposits, t-1)			[0.013]					[0.058]		
Interconnectedness				0.092					0.179	
(Offshore Deposits/Domestic Deposits, t-1)				[0.171]					[0.226]	
Interconnectedness					-0.002					0.070
(Non-Resident Loans/GDP, t-1)					[0.011]					[0.064]
Banking Supervision Index						**-6.596***	**-6.256***	0.171	-4.419	-1.158
						[3.530]	[3.563]	[3.478]	[3.921]	[4.020]
Deposit Insurance Coverage						0.031	0.031	0.031	0.014	0.041
(Covered Deposits/GDP Per Capita, t-1)						[0.022]	[0.022]	[0.024]	[0.030]	[0.030]
Constant	13.813**	15.225***	19.121***	14.661**	27.165***	13.387*	13.402*	20.267**	17.039	18.878
	[5.485]	[5.400]	[6.264]	[7.152]	[7.900]	[6.832]	[7.011]	[9.003]	[12.771]	[11.877]
Observations	53	53	53	38	40	44	44	44	34	35
R Squared	0.479	0.457	0.472	0.480	0.432	0.549	0.545	0.514	0.578	0.544
F Statistic	19.53	18.74	17.71	15.24	11.38	15.49	15.18	8.80	31.47	15.20
Prob > F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Source: Fund staff estimates.
Notes: Standard errors in brackets. The symbols ***, **, and * indicate statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table AII6. Overall Fiscal Costs and Policy Responses

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Public Debt/GDP (t-1)	-0.124	-0.110	-0.109	-0.124	-0.116	-0.113	-0.258**	-0.218	-0.192	0.052	-0.232
	[0.106]	[0.113]	[0.111]	[0.106]	[0.116]	[0.114]	[0.127]	[0.133]	[0.115]	[0.104]	[0.161]
Change in Primary Balance (t, t+3)	-0.879***	-0.899***	-0.901***	-0.930***	-0.965***	-0.967***	-0.904***	-1.033***	-1.010***	-0.952***	-0.889***
	[0.203]	[0.221]	[0.219]	[0.183]	[0.206]	[0.206]	[0.192]	[0.199]	[0.199]	[0.162]	[0.202]
Non-Financial Sector Leverage	0.072	**0.111***	**0.106***								
(Private Credit/GDP, t-1)	[0.064]	[0.055]	[0.056]								
Size of Financial Sector				0.044	0.094	0.086					
(Assets/GDP, t-1)				[0.058]	[0.056]	[0.058]					
Financial Sector Leverage							**0.037****	**0.052*****	**0.045*****		
(Loans/Deposits, t-1)							[0.017]	[0.014]	[0.015]		
Interconnectedness										0.120	
(Offshore Deposits/Domestic Deposits, t-1)										[0.174]	
Interconnectedness											-0.007
(Non-Resident Loans/GDP, t-1)											[0.010]
Bank Guarantee (Dummy)	9.223			**11.224***			**12.532****			**11.993***	**13.260***
	[7.017]			[6.656]			[6.140]			[7.078]	[7.469]
Asset Purchases (Dummy)		3.629			3.782			4.002			
		[5.457]			[5.561]			[6.116]			
Bank Recapitalization (Dummy)			4.644			5.525			11.670		
			[7.842]			[7.854]			[8.451]		
Constant	12.529**	12.097**	10.292	13.546**	13.426**	11.032	15.968**	16.912**	8.969	7.757	20.291**
	[5.755]	[5.494]	[8.100]	[5.730]	[5.539]	[8.034]	[6.447]	[7.167]	[8.919]	[6.226]	[8.159]
Observations	53	53	53	53	53	53	53	53	53	38	40
R Squared	0.499	0.484	0.483	0.487	0.463	0.463	0.512	0.477	0.495	0.524	0.473
F Statistic	17.03	16.39	15.14	16.98	16.16	14.61	16.24	15.27	14.44	14.91	10.01
Prob > F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Source: Fund staff estimates.

Notes: Standard errors in brackets. The symbols ***, **, and * indicate statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Annex III. Empirical Analysis of Bank's Home Bias in Sovereign Debt[1]

This annex analyzes in more technical details the role of home bias in debt sustainability by examining the relationship between home bias and (A) borrowing costs of sovereigns, (B) the fiscal primary balance of sovereigns, (C) the level of public debt, and (D) the level of debt at which sovereigns enter debt distress. Asonuma, Bakhache and Hesse (2015) provide further details including on robustness tests.

1. Throughout the annex, we focus on the home bias indicator that reflects the banks' holding of domestic sovereigns claims in banks' total assets as in Acharya and Steffen (2013). This allows for the widest country coverage in the sample (22 advanced economies (AEs) and 29 emerging markets (EMs)) and longer coverage of time horizon (1999–2012) in annual frequency.[2] In the home bias indicator, the numerator comprises banks' holdings of domestic sovereign claims, while the denominator consists of banks' total assets which include banks' holdings of domestic sovereign claims as well as their claims on nonresidents, central bank and other sectors (all based on the IMF IFS).[3]

2. The macro variables in the regression analysis follow the academic literature on borrowing costs, fiscal reaction function, and debt accumulation. In line with Ghosh and others (2011), control variables for the fiscal reaction function include lagged public debt level, output gap, fiscal expenditure gap, and trade openness. Following Ardagna and others (2007), conventional determinants of bond yields/spreads include lagged debt level, GDP growth, and inflation. The VIX is used as a proxy for global risk aversion of investors. Table AIII1 provides an overview of the data sources.

A. Sovereign's Borrowing Costs—Panel Analysis

3. We assess the impact of home bias on sovereigns' borrowing costs in AEs and EMs based on a panel regression approach. We use a two-step generalized method of moment (GMM) estimation with housing price and lagged credit-to-GDP ratio as instruments for home bias to deal with potential endogeneity issues. The housing price variable is appropriate as an instrument because it is correlated with banks' home bias but not with bond yields or spreads. The lagged

[1]Prepared by Tamon Asonuma and Heiko Hesse (both SPR).

[2]AEs include Australia, Austria, Belgium, Canada, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Korea, Luxembourg, Netherlands, Portugal, Slovenia, Spain, Sweden, and the United States. In addition, EM countries include Antigua and Barbuda, Argentina, Belize, Brazil, Bulgaria, Chile, Ecuador, Estonia, Egypt, Hungary, Indonesia, Jamaica, Jordan, Latvia, Lebanon, Lithuania, Malaysia, Mexico, Pakistan, Peru, Philippines, Poland, Romania, Russia, Saint Kitts and Nevis, Thailand, Turkey, Ukraine, and Venezuela.

[3]For the six countries Australia, Canada, New Zealand, Norway, Switzerland, and the U.K. we complement the above numerator definition with domestic banks' holding of domestic sovereign claims based on Arslanalp and Tsuda (2012).

credit-to-GDP variable is predetermined, and thus uncorrelated with bond yields or spreads, but affects banks' portfolio allocation.

Table AIII1. Details and Sources of Macroeconomic Variables

Variable	Description	Frequency	Source
Dependent variables			
Long-term bond yields	In percent	Annual, Monthly	IMF's World Economic Outlook (WEO) / IFS
EMBI stripped spreads	In percent	Annual, Monthly	Bloomberg
Debt-to-GDP	In percent	Annual	WEO database
Primary balance to GDP ratio	In percent	Annual	WEO database
Explanatory variables			
Lagged debt to GDP ratio	In percent	Annual	WEO database
GDP growth rate	In percent	Annual	WEO database
Inflation rates	Three year lagged moving average CPI inflation	Annual	Staff calculations based on WEO database
Exchange rate depreciation	In percent	Annual	Staff calculations based on WEO database
Institutional quality index	Smaller (larger) values indicating higher (lower) political risk.	Annual	International Country Risk Guide (ICRG) dataset.
Credit to GDP ratio	In percent	Annual	IFS database
Capital account openness	Higher indices indicating a high degree of capital account openness	Annual	Chinn and Ito (2006)
VIX	Chicago Board Options Exchange Market Volatility Index	Annual, Monthly	Bloomberg
U.S. long-term bond yields	In percent	Annual	WEO database
Output gap	Difference between actual and potential (calculated using the Hodrick-Prescott filter real GDP)	Annual	Staff calculations based on WEO database
Government expenditure Gap	Difference between actual and potential (calculated using the Hodrick-Prescott filter real GDP)	Annual	Staff calculations based on WEO database
Trade openness	Sum of exports and imports to GDP (in percent)	Annual	Staff calculations based on WEO database
Oil price	Log of (trend) oil price applied to oil exporters only.	Annual	Staff calculations based on WEO database

4. Model specification to determine spreads follows Ardagna and others (2007):

$$r_{i,t} = \beta_1 b_{i,t-1} + \gamma_0 (hb_{i,t} - \overline{hb}_t) + \gamma_1 ((hb_{i,t} - \overline{hb}_t) * b_{i,t-1}) + \gamma_2 ((hb_{i,t} - \overline{hb}_t) * VIX_t) + x_{i,t}\delta + y_t\phi + \varepsilon_{it} \quad (1)$$

Where

$r_{i,t}$ captures long-term bond yields or spreads of country i at t,[4]
$b_{i,t}$ is the level of public debt of country i at t,
$hb_{i,t}$ is the home bias for country at t,
$\overline{hb}_t$ is the sample average of home bias at time t,
VIX_t is a proxy for global risk aversion at time t,
and $x_{i,t}$ is a vector of macroeconomic variables.

The first lagged debt term reflects the effect of existing debt on borrowing costs; the second term the direct influence of home bias, and the third and fourth terms how home bias interacts with debt and global risk aversion. To account for the fraction of home bias observations close to zero, which biases the effects of the interacted terms, the home bias variable is entered as a deviation from its sample median to account for cross-country variations in the level of home bias.

5. Findings suggest that for AEs with moderate to high debt levels, borrowing costs generally decline as home bias increases in normal times (Figure AIII1 (A)).[5] Lower spreads with high home bias reflect reduced expectation of default whenever domestic banks own a sizable portion of domestic sovereign claims, perhaps because of the anticipated high cost of default. Panel regression results (3rd column of Table AIII2) show that bond spreads are negatively influenced by the interaction of home bias and debt but positively affected by the interaction of home bias and VIX. The former effect dominates during normal times leading to a decrease in spreads with higher home bias when the debt level is above 50 percent of GDP. Figure AIII1(A) shows that the higher the debt level and the higher the spread, the greater the marginal benefit of home bias on sovereign borrowing cost.

6. However, during crisis periods when risk aversion rises, the negative impact of home bias on spreads diminishes and may turn positive (Figure AIII1 (B)). For example when VIX is 80 points above the sample mean and debt is relatively low (60 percent of GDP), the interaction of home bias and VIX could surpass the interaction of home bias and debt. The intuition is that during periods of increased risk aversion, banks demand higher risk premia while continuing to hold more domestic sovereign claims. There could also be the possibility (e.g., in countries with a high share of

[4]For AEs, we use bond spreads against the German bonds for European countries and the U.S. bonds for non-European countries since we are interested in how borrowing costs for sovereigns deviate from those of "risk-free" bonds, i.e., the German or US bonds. For EMs, we use sovereign bond yields.

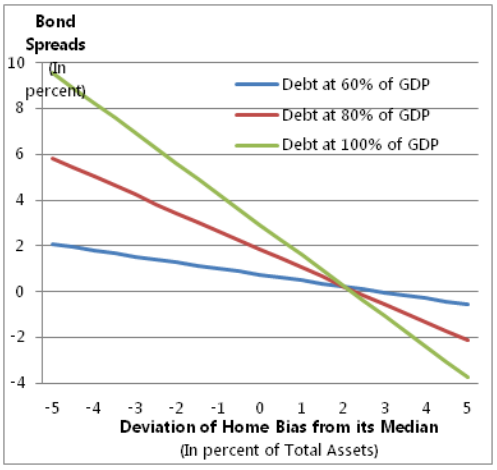
[5]Throughout our analysis, normal time denotes a time when risk aversion proxied by the VIX is at or below its sample mean (22.7 point), a "crisis period" occurs when the VIX, is substantially higher than its sample mean, say 80 points above sample mean.

foreign sovereign debt holdings) that a sharp increase in the VIX could lead to an endogenous increase in home bias (e.g., via moral suasion), which influences the cost of sovereign borrowing.

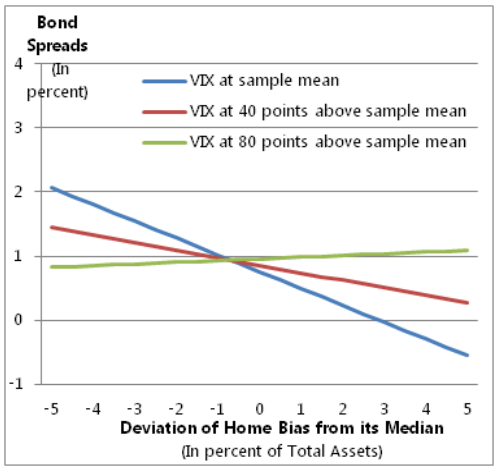
7. In EMs, home bias is also negatively associated with bond yields. However, home bias seems to have a milder impact on EMs' cost of borrowing as seen in the flatter lines in Figure AIII2 (A) and the 5th column of Table AIII2. On the contrary, market sentiments play a bigger role in EMs. In particular, for debt level of 60 percent of GDP the impact of home bias on borrowing cost becomes positive when VIX is slightly above its mean (Figure AIII2(B)).

Figure AIII1. Home Bias and Bond Spreads in AEs

(A) "Normal Times"[1]



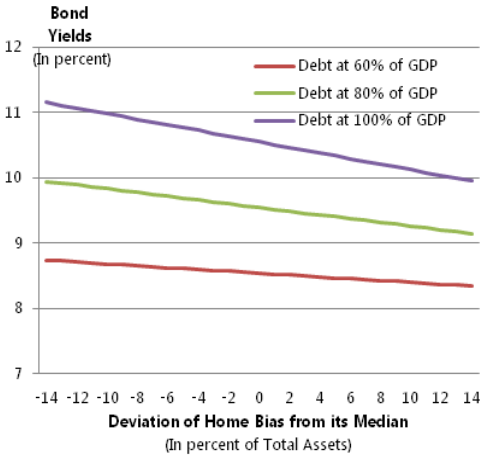
(B) "Increased risk aversion" Period[2]



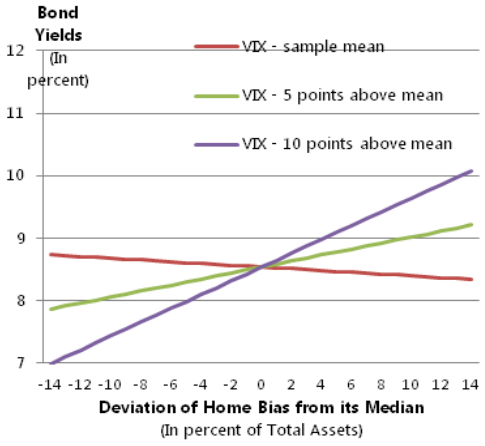
Sources: IMF WEO; and Fund staff estimates.
[1]VIX is fixed at sample mean (22.7 point).
[2]Debt is fixed at 60 percent of GDP.

Figure AIII2. Home Bias and Sovereigns Yields in the Domestic Market in EMs

(A) "Normal Times"[1]



(B) "Increased risk aversion" Period[2]



Sources: IMF WEO, and Fund staff estimates.
[1]VIX is fixed at sample mean (18.5 point).
[2]Debt is fixed at 60 percent of GDP.

B. Primary Balance Adjustments

8. This section considers whether the primary fiscal balance tends to adjust less to debt level in countries with high home bias. Our model specification closely follows Ghosh and others (2011) and includes squared and cubic terms of lagged debt to capture inflexion points in the fiscal reaction function. We use a two-step GMM estimation to deal with potential endogeneity issues.[6] At very low debt levels, there is little (or even a negative) relationship between lagged debt and the primary balance. As debt increases, the primary balance rises but the responsiveness eventually begins to weaken, and then decreases at high levels of debt.

$$pb_{i,t} = \beta_1 b_{i,t-1} + \beta_2 b_{i,t-1}^2 + \beta_3 b_{i,t-1}^3 + \gamma_0 (hb_{i,t} - \overline{hb}_t) + \gamma_1 ((hb_{i,t} - \overline{hb}_t) * b_{i,t-1} + x_{i,t}\delta + \varepsilon_{it} \quad \text{-- (2)}$$

where $pb_{i,t}$ is the primary balance at time t,

$b_{i,t-1}$, $b_{i,t-1}^2$, $b_{i,t-1}^3$ are linear, quadratic, and cubic terms of lagged public debt at t,

$hb_{i,t}$, $\overline{hb}_t$, and $x_{i,t}$ are defined as before.

9. We find that fiscal policy is less responsive to lagged public debt in AEs and EMs with higher home bias.[7] As shown in the panel regression results (2nd column of Table AIII3), the primary balance is negatively affected by home bias. Given domestic banks' interest in domestic sovereign claims, sovereigns might be less willing to do fiscal consolidation, ceteris paribus. Here, however, while the endogeneity issue is addressed through the use of instruments, reverse causality may still be an issue.

C. Public Debt

10. We analyze whether home bias contributes to a high public debt level in AEs and EMs possibly through reduced borrowing costs. Our model specifications are as follows and also use the two step GMM estimation

$$b_{i,t} = \gamma_1 hb_{i,t} + x_{i,t}\delta + \varepsilon_{it} \quad \text{--- (3)}$$

$$b_{i,t} = \gamma_2 hb_{i,t-1} + x_{i,t}\delta + \varepsilon_{it} \quad \text{--- (4)}$$

where the variables are defined as before.

[6]The fixed effects estimation accounts for significant variations in primary balance adjustments across countries.

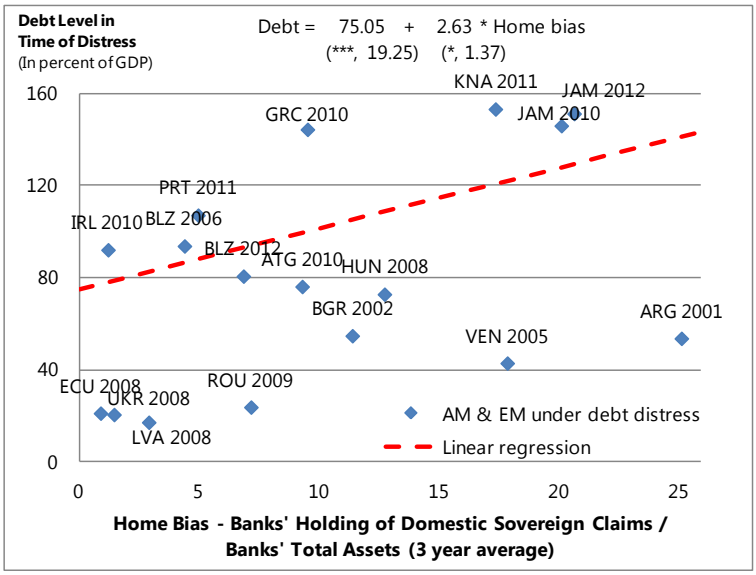
[7]Due to a limited sample for EMs, we use the regression based on the combined sample of AE and EM.

11. An increase in home bias in AEs and EMs is associated with a high public debt level.[8] Panel regression results indicate that home bias has concurrent effects on the level of debt (2nd and 4th columns of Table AIII4). Moreover, the subsequent debt level is significantly influenced by home bias due to its persistent feature (3rd and 5th columns of Table AIII4). Reverse causality may be playing a part in this result because rise in public debt might lead sovereigns to use moral suasion to ensure new debt can be placed with domestic banks, increasing the home bias indicator.

D. Debt under Distress

12. AEs and EMs with high home bias tend to experience debt difficulties at a higher level of public debt (Figure AIII3). This finding is based on an event study analysis using a sample of 17 episodes of debt difficulties based on the methodology of Baldacci and others (2011) and Cruces and Trebesch (2013).[9]

Figure AIII3. Debt Distress and Home Bias



Sources: Baldacci; and others (2001), and Cruces and Trebesch (2013).

[8]For the combined sample of AE and EM, we introduce a dummy variable for AE.

[9]Baldacci and others (2011) define debt distress events for AEs as (1) Default: a sovereign not current on its debt obligations (Standard and Poor definition); (2) Restructuring and rescheduling: any operation which alters the original terms of the debtor-creditor contract; (3) IMF financing: in excess of 100 percent of quota; or (4) Inflation: greater than 35 percent per annum. For EMs, debt distress events are defined as: (1) Default: arrears on principal or interest payments to commercial or official creditors; (2) Restructuring and rescheduling: any operation which alters the original terms of the debtor-creditor contract; or (3) IMF financing: addressing liquidity issues associated with sovereign debt distress.

Robustness Tests

13. Our main findings broadly hold in robustness checks. For instance, dropping outliers such as Greece and Japan from the country sample does not change the empirical results. The findings are also robust in quantile regression methodologies as well as when using a different home bias measure, namely holding of domestic sovereign debt as a share of holdings of all sovereign debt). Other studies (e.g., Arslanalp and Poghosyan, 2014; and Andritzky, 2012) have shown that home bias proxied by the holding of domestic sovereign debt as a share of total public debt is associated with lower spreads. This result is not inconsistent with our results as it reflects the diversification angle, not necessarily banks' preference for domestic sovereign debt.

Table AIII2. Regression of Bond Spreads—AE and EM Samples

Dependent variable: **Bond Spreads/ Yields 1/**	(1) AM: HB HB/Debt	(2)AM: Baseline - HB. HB/Debt, HB/VIX	(3) EM: HB, HB/VIX	(4) EM Baseline—HB, HB/debt, HB/VIX
	IV pooled estimation	IV pooled estimation	IV pooled	IV pooled
β_1 (Public debt/GDP, lagged)	0.055*** (0.013)	0.054*** (0.013)	0.046*** (0.010)	0.050*** (0.015)
β_1 (Public debt/GDP, square, lagged)	-	-		
γ_0 (Deviation of home bias from median)	1.361*** (0.493)	1.255** (0.515)	-0.223** (0.088)	-0.202** (0.088)
γ_1 (Deviation of home bias from median * Public debt/GDP, level, lagged)	-0.027*** (0.009)	-0.027*** (0.012)	-	-0.0007 (0.002)
γ_2 (Deviation of home bias from median * VIX)	-	0.004 (0.012)	0.012*** (0.0035)	0.012*** (0.0036)
δ_1 (GDP growth rate)	-0.045*** (0.012)	-0.045*** (0.016)	-0.258*** (0.063)	-0.264*** (0.066)
δ_2 (Inflation rate, 3-year MA)	-0.089 (0.101)	-0.087 (0.101)	0.201* (0.102)	0.202* (0.105)
δ_3 (Institutional quality)	-0.046*** (0.012)	-0.045*** (0.012)		
δ_4 (Exchange rate depreciation)	-0.009* (0.005)	-0.009* (0.005)	-0.0012 (0.021)	-0.002 (0.021)
δ_5 (Capital Account Openness)			0.054 (0.214)	0.068 (0.217)
δ_6 (Credit-to-GDP ratio)	0.009** (0.004)	0.009** (0.004)	0.0028 (0.015)	0.0028 (0.015)
ϕ_1 (VIX)	0.011* (0.006)	0.007 (0.016)	0.057** (0.026)	0.055** (0.026)
ϕ_1 (U.S. long-term bonds)			0.977*** (0.313)	0.960*** (0.313)
Adj. R-squared	0.252	0.253	0.747	0.742
Sample of years	1999–2012	1999–2012	1999–2012	1999–2012
Sample of observations	313	313	113	113
Root MSE	0.681	0.682	1.574	1.578

Note: ***, **, * show significance at 1%, 5%, and 10%. Error term assumed to follow an AR(1) process.
1/ For AEs, bond spreads is defined as difference between yields of countries' long-term bonds and those of the U.S. bonds (non-European countries) or those of German bonds (European countries). For EMs, local currency bond yields (long-term) are used.

Table AIII3. Regression of the Fiscal Reaction Function—AE & EM

Dependent variable: **Primary balance to GDP ratio**	**(1) HB indicator—constant**	(2) HB indicator—constant/linear	(3) HB indicator—linear interactive	(4) HB indicator—quadratic interactive	(5) HB indicator—cubic interactive
β_1 (Public debt/GDP, lagged)	**-0.143***	-0.130	-0.150*	-0.151*	-0.148*
	(0.084)	(0.083)	(0.085)	(0.086)	(0.085)
β_2 (Public debt/GDP, square, lagged)	**0.00166****	0.0014*	0.00179**	0.00181**	0.0018**
	(0.0007)	(0.00075)	(0.00074)	(0.00074)	(0.00072)
β_3 (Public debt/GDP, cubic, lagged)	**-0.0000048****	-0.0000044**	-0.0000052***	-0.0000051***	-0.0000047**
	(0.0000020)	(0.0000020)	(0.0000020)	(0.0000020)	(0.0000019)
γ_0 (Deviation of HB from median)	**-0.096****	-0.169*	-	-	-
	(0.050)	(0.092)			
γ_1 (Deviation of HB from median * Public debt/GDP, lagged)	**-**	0.00096	-0.00024	-	-
		(0.00099)	(0.00046)		
γ_2 (Deviation of HB from median * Public debt/GDP, square, lagged)	**-**	-	-	-0.0000023	-
				(0.0000031)	
γ_3 (Deviation of HB from median * Public debt/GDP, cubic, lagged)	**-**	-	-	-	-0.000000022
					(0.000000019)
δ_1 (Output gap)	**0.151*****	0.140***	0.155***	0.157***	0.158***
	(0.050)	(0.050)	(0.052)	(0.052)	(0.052)
δ_2 (Government expenditure gap)	**-0.065****	-0.060**	-0.062**	-0.062**	-0.062***
	(0.028)	(0.027)	(0.029)	(0.028)	(0.028)
δ_3 (Trade openness)	**0.070*****	0.072***	0.071***	0.070***	0.070***
	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)
δ_4 (Inflation rate, lagged)	**-5.869**	-7.372	-7.124	-7.013	-6.879
	(7.790)	(7.793)	(7.881)	(7.800)	(7.730)
δ_5 (Oil price, lagged)	**-12.734*****	-13.118***	-12.491***	-12.404***	-12.305***
	(3.887)	(3.834)	(4.002)	(4.020)	(4.018)
δ_6 (Capital account openness)	**0.060**	-0.009	0.105	0.124	0.148
	(0.346)	(0.348)	(0.344)	(0.347)	(0.348)
δ_7 (Credit-to-GDP ratio)	**-0.067*****	-0.067***	-0.068***	-0.068***	-0.068***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Adj. R-squared	**0.424**	0.434	0.418	0.417	0.417
Sample of years	**1999–2012**	1999–2012	1999–2012	1999–2012	1999–2012
Sample of observations	**453**	453	453	453	453
Sample of countries	**45**	45	45	45	45
Root MSE	**2.423**	2.417	2.433	2.432	2.423
Transformed DW	**1.670**	1.664	1.680	1.682	1.685

Note:***, **, * show significance at 1%, 5%, and 10%. Country-specific fixed effect included, and error term assumed to follow an AR(1) process. All specifications are regressed by two-step GMM fixed effects estimation.

Table AIII4. Regression of the Public Debt/GDP—AE, EM, AE & EM

	(A) AM		(B) EM		(C) AM & EM	
Dependent variable: **Public debt to GDP ratio**	**(1) IV pooled regression**	(2) Least Square—pooled regression	**(1) IV pooled estimation**	(2) Least Square—pooled regression	(1) IV pooled regression	**(2) Least Square—pooled regression**
γ_1 (Home bias)	**2.307** (1.127)**	-	**1.104*** (0.392)**	-	0.420 (0.518)	**-**
γ_1 (Home bias, lagged)		3.753*** (0.520)		1.919*** (0.157)		**2.529*** (0.242)**
δ_1 (Output gap)	**-1.742*** (0.669)**	-2.342*** (0.666)	**-0.913*** (0.320)**	-0.863*** (0.318)	-1.356*** (0.458)	**-0.907*** (0.307)**
δ_2 (Government expenditure gap)	**-1.095 (1.146)**	-0.414 (1.166)	**-0.132 (0.165)**	0.043 (0.120)	-0.427 (0.264)	**0.188 (0.160)**
δ_3 (Trade openness)	**-0.074* (0.045)**	-0.137*** (0.047)	**-0.082 (0.070)**	0.287*** (0.064)	-0.131*** (0.041)	**-0.052*** (0.032)**
δ_4 (Inflation rate, 3-year MA)	**-4.318** (1.901)**	-10.604*** (1.870)	**0.093*** (0.028)**	0.032*** (0.023)	0.172*** (0.041)	**0.087*** (0.032)**
δ_5 (Oil price, lagged)	**-**	-	**-5.186*** (1.145)**	-1.655** (0.774)	-4.502*** (1.414)	**-1.018 (0.782)**
δ_6 (Capital account restriction)	**18.223*** (3.036)**	13.179*** (2.618)	**-4.301*** (1.073)**	4.430*** (0.977)	-4.502*** (1.414)	**7.821*** (1.251)**
δ_7 (Credit-to-GDP ratio)	**0.087 (0.068)**	0.197*** (0.042)	**-0.111 (0.126)**	-0.207** (0.092)	4.712** (2.051)	**0.181*** (0.049)**
δ_8 (Institutional quality)	**-1.243** (0.484)**	-0.857** (0.406)	**-0.225 (0.350)**	-0.567 (0.774)	-1.094*** (0.393)	**-0.865*** (0.279)**
Constant	**118.25** (46.961)**	96.480*** (34.614)	**56.22 (36.016)**	44.079*** (27.290)	121.442*** (34.916)	**63.275*** (20.937)**
Dummy variable for AM	**-**	-	**-**	-	37.076*** (7.891)	**23.936*** (6.174)**
Sample period	**1999–2012**	1999–2012	**1999–2012**	1999–2012	1999–2012	**1999–2012**
Adj. R-squared	**0.420**	0.635	**0.879**	0.588	0.387	**0.493**
Sample of observations	**202**	207	**70**	184	272	**391**
Sample of countries	**19**	20	**9**	18	28	**38**
Root MSE	**21.654**	24.392	**11.084**	21.892	23.68	**27.388**
Wald chi-squared	**210.73**	-	**2227.36**	-	352.74	**-**

Note:***, **, * show significance at 1%, 5%, and 10%. Estimation including capital adequacy ratio is also examined, but due to availability of data on capital adequacy ratio, sample period and observation are limited to 2008–10 and 75. Thus, we do not report the results in the table.

Annex IV. Market-Based Measures of Bank to Sovereign Contagion[1]

The aim of this Annex is to identify the possible determinants of bank to sovereign contagion (BSC) across countries and over time. The empirical analysis is carried out via a panel regression approach which model's BSC as a function of macroeconomic, financial and fiscal fundamentals.

A. Data Coverage

1. The data are at quarterly frequency over the sample period 2005 Q1–2012 Q4 and organized according to three groupings:[2]

(i) **Eurozone countries under stress during the sample period:** Greece, Ireland, Italy, Spain and Portugal.

(ii) **Other eurozone countries:** Austria, Belgium, France, Germany and the Netherlands.

(iii) **Countries outside the eurozone:** Sweden, Switzerland, Japan, the U.K. and the U.S.

B. Construction of the BSC Measure

2. BSC is measured as the probability of the sovereign defaulting conditional on a median domestic banking default. For each country, the top 5 banks in terms of asset size were included as of end-2012. Specifically, this conditional probability is constructed using the following method:

1. For each country in the sample, the (marginal) probability of default of the sovereign *A*, and the (marginal) probabilities of default of all the banks (*B, C*, etc.) listed for that country (and for which data was available) were extracted from the individual CDS spreads of the country and its banks.[3]

2. The joint probability of default of *A, B,* (for instance), *P(A, B)*, is obtained using the CIMDO methodology developed by Segoviano (2006). This methodology is used to

[1]Prepared by Sheheryar Malik and Miguel Segoviano (both MCM).

[2]As explained in Section III.D, estimations were carried out in order to account for characteristics specific to individual groups.

[3]CDS spreads are widely used to generate risk-neutral probabilities of default. These probabilities of default are estimated by dividing the level of the Credit Default Swap (CDS) by its recovery rate; see Luo (2005). The recovery rate is taken to be 40 percent, consistent with what is typically assumed in the literature for the case of advanced economies. It should be the noted that altering this value in the range of 25%–50% had little impact on the results of the regression analysis which follow.

estimate the multivariate empirical distribution (CIMDO-distribution) that characterizes the probabilities of distress of banks and the sovereign under analysis and their distress dependence. The joint probability of distress of the entire group of sovereign and banks and all the pair-wise combinations of sovereign-banks within this group, i.e., *P(A, B), P(A, C), P(B, C),* etc. are estimated from the CIMDO distribution.

3. Finally, the conditional probability of default *P(A/B)* is obtained by using the Bayes' law: $P(A/B) = P(A, A_B) / P(B)$. For each set of bank-to-sovereign contagion probabilities {*P(A/B), P(A/C),P(A/D)*…}, only the *median* value is kept as the dependent variable.

3. Alternative specifications for BSC were considered. In addition to defining BSC in terms of the probability of default of the sovereign conditional on the median bank defaulting, equally weighted as well as (bank specific) probability weighted approaches were also considered.[4] The information provided by the dynamics of the contagion indicator remained broadly similar. Weighting based on the relative size of each bank within a country's total banking sector was found to be infeasible. This was due to lack of availability of consistent balance sheet data for all banks and across all countries in our sample.

C. Explanatory Variables

4. Variation in the risk of bank to sovereign contagion (BSC) is hypothesized to be explained by macroeconomic and financial characteristics of the sovereign and the banking system. Relevant factors capturing these characteristics and reasons for their inclusion are described below.

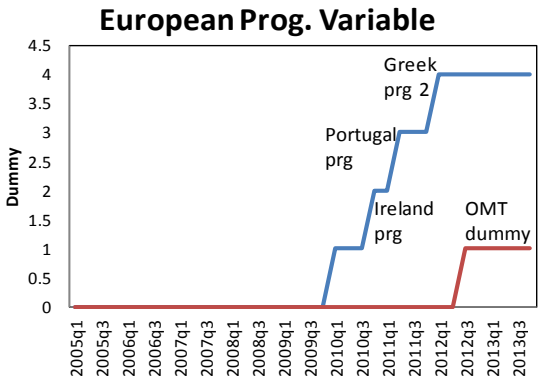
5. Macroeconomic and fiscal developments: Growth prospects are expected to reduce the probability of contagion. This motivates the inclusion of *GDP growth forecast*. A high stock of short-term public debt is likely to increase the probability of default of the sovereign. Dependence of the sovereign on domestic banks' financing is also likely to increase funding risk for the sovereign if a bank defaults. *Short-term public debt/GDP* and *government bonds held by domestic banks* (as a share of banks' assets) as measures of the extent fiscal stress and dependency on the banking sector are hence included.

- **Banking sector characteristics:** Large banks balance sheets and high leverage are likely to increase losses to the sovereign in the event of a bank default. Thus *bank loans/GDP* and the *banking sector capital to asset ratio* to investigate the effect of leverage and buffers are included. Valuation prospects in the banking sector are expected to influence the probability of contagion. This motivates the inclusion of *price to book value* of banks.

[4]Probability weighting refers to weighting by the unconditional probability of bank default.

- **Control variables:** Three control variables are also included.[5] In order to control for the intensification of the euro debt crisis by including a dummy, step, variable that takes the value 1 after the first Greek Program was approved (2010 Q1). This variable is assumed to increase with the series of 'eurozone countries under stress during sample period'; labeled *EZProg*. A dummy variable labeled *OMT* is also added. This takes a value 1 on and after 2010 Q3 to capture the European announcements that the ECB would do 'whatever it takes' to protect the euro; see Figure AIV1. A variable capturing global market price of risk (*MkrPr*) is also included.[6] CDS spreads, similar to any other market risk indicator, are in fact asset prices that depend on the price of risk (i.e. the cost of insurance against a distress event) as well as idiosyncratic news on the actual probability of default of a specific firm or sovereign. Therefore, it is necessary to control for the price of risk in order to be able to use CDS spreads to compute probabilities of default.

Figure AIV1. Dummy Variables



D. Baseline Regression Specification

6. Empirical analysis is carried out in a panel regression setting. The equation to be estimated takes the form:

$$P_{it} = \beta_1 X_{1,it} + \ldots + \beta_n X_{n,it} + \gamma_1 MkrPr_t + \gamma_2 EZProg_t + \gamma_3 OMT_t + \alpha_i + \varepsilon_{it} \quad \text{-- (1)}$$

Here index *i* relates to country and *t* denotes time and P_{it} denotes the BSC measure. The set of *n* explanatory variables are denoted by $[X_{1,it}, \ldots, X_{n,it}]$.

[5]Earlier papers in the literature on contagion to sovereigns (De Santis, 2012; Caceres and others, 2010) have identified international spillovers and developments in other crisis countries as key factors explaining sovereign spreads. Since the focus here is on domestic characteristics, that channel is not investigated here.

[6]Please see Espinoza and Segoviano (2011); and Segoviano and Espinoza (2014) for a detailed description on the construction of this variable. In summary, *MkrPr* captures the market price of risk under distress and is constructed as the expectation of the market price of risk when it exceeds a certain threshold. The threshold is computed from two moments: the variance of the market price of risk and its mean.

7. The estimated coefficients corresponding to the different factors were found to be statistically significant with plausible signs/directional impact. Results provided in Table AIV1, column 1 correspond to the baseline model. This model is estimated with fixed effects α_i (i.e., country-specific dummies) given the Breusch-Pagan test rejected the homogeneity assumption of no-country specific effects (column 2). In addition, the Hausman test rejected the random effect model (column 3). In addition, the baseline model estimates a group-specific slope coefficient for the *price to book value* since it was found that the relationship between this variable and BSC could be very different for the three groups of countries. Moreover, differentiating the effect of the *price to book value* by group was found to be critical to ensure that the residuals (ε_{it}) of the model are well behaved.

E. Alternative Regression Specifications and Robustness

8. Cross-sectional and temporal differences across groups of countries are further investigated. This entails considering alternative specifications for equation 1. Results for these are reported in Table AIV1 and are commented upon in turn below.

- An alternative to the baseline specification is to include time dummies to control for common factors, i.e. for any potential factor affecting all countries similarly. Results pertaining to this exercise are reported in column 4. All the coefficients have the expected sign (as in Column 1) except for the price to book value for non-eurozone countries.

- Columns 5–7 present results where some characteristics are allowed to vary by country group. Column 5 corresponds to a model where the slope coefficient for the growth forecast is estimated separately for the different country groups. Growth forecast does not seem to significantly affect the BSC for those countries under stress (group 2). It is conjectured that this is probably because all these countries already suffer from a high level of contagion and poor growth forecasts (data heterogeneity is reduced significantly when looking at subsamples). The coefficient on growth forecast for the non-eurozone countries is similar to that for the whole sample. The coefficients for the other variables are robust to this modification of equation 1. Column 6 shows that the volume of government bonds held domestically is most important for the stress countries. The variable is not significant for the core eurozone countries and for countries outside the eurozone. Similarly, short-term debt appears to be less important for countries outside the eurozone.

- In columns 8–11, the effect of different sub-periods (pre- and post- the first Greek program) are investigated. All the factors in the baseline portion of these specifications are estimated with the correct sign. It is further revealed that growth outlook and buffers in the banking sector would have been much more relevant precrisis. Results suggest that since the crisis broke, the dependence of government financing on domestic banks and the stock of short-term debt have become more important.

9. Robustness to endogeneity bias was considered. In order to account for possible endogeneity bias, regressions specifications with lagged (by one period) explanatory variables were also estimated. Importantly, the sign, magnitude and significance of these variables remained unaltered.[7]

[7]From an intuitive standpoint, endogeneity is less of a concern in this analysis given the Left Hand Side (LHS) variable is a contagion measure and contagion is a low probability event. It is thus difficult to justify why it would quantitatively affect the growth forecast, the size of bank loans, of capital, the stock of short term government debt, or even the share of domestic debt.

Table AIV1. Estimation Results

VARIABLES	(1) Panel Fixed effects (FE)	(2) Pooled OLS	(3) Panel random effects	(4) Panel FE time dummies	(5) Panel FE by group	(6) Panel FE by group	(7) Panel FE by group	(8) Panel FE by period	(9) Panel FE by period	(10) Panel FE by period	(11) Panel FE by period
Growth forecast	-0.112***	-0.362***	-0.112***	-0.164***		-0.105***	-0.0706**		-0.141***	-0.159***	-0.163***
	[-3.474]	[-12.16]	[-3.658]	[-4.382]		[-3.368]	[-2.332]		[-4.147]	[-4.969]	[-4.805]
Price to Book Value for Banks * I(group=1)	-1.886***	-1.257***	-1.886***	-0.438***	-1.734***	-1.874***	-1.616***	-1.728***	-1.792***	-1.758***	-1.714***
	[-11.32]	[-9.517]	[-12.56]	[-3.624]	[-10.29]	[-11.18]	[-10.16]	[-9.902]	[-10.82]	[-10.83]	[-10.31]
Price to Book Value for Banks * I(group=2)	-0.815***	-0.671***	-0.815***	-0.139	-1.036***	-0.822***	-0.648***	-0.805***	-0.722***	-0.669***	-0.679***
	[-6.107]	[-6.610]	[-7.070]	[-1.645]	[-5.592]	[-5.942]	[-5.131]	[-5.987]	[-5.478]	[-5.228]	[-5.207]
Price to Book Value for Banks * I(group=3)	-0.546***	-0.687***	-0.546***	0.731***	-0.476***	-0.682***	-0.770***	-0.358**	-0.489***	-0.348**	-0.394***
	[-4.144]	[-6.328]	[-4.451]	[5.716]	[-3.573]	[-4.940]	[-6.212]	[-2.410]	[-3.757]	[-2.437]	[-2.892]
Bank loans/GDP	1.849***	0.0529	1.849***	1.357***	1.926***	1.664***	1.897***	1.730***	1.878***	1.664***	1.869***
	[6.457]	[0.491]	[6.768]	[6.360]	[6.628]	[5.902]	[6.795]	[5.909]	[6.831]	[6.108]	[6.880]
Banks capital/Assets	-6.364*	13.22***	-6.364*	-5.319**	-7.145*	-12.04***	-13.05***	-7.892**	-3.236		-2.19
	[-1.760]	[6.231]	[-1.784]	[-2.108]	[-1.960]	[-2.993]	[-3.346]	[-2.151]	[-0.878]		[-0.600]
Govt. bonds held by dom. banks/Assets	8.847***	2.605	8.847***	6.170***	7.608***		11.86***	8.222***		8.687***	6.295***
	[3.853]	[1.121]	[3.375]	[3.253]	[3.183]		[4.904]	[3.525]		[3.986]	[2.700]
Gvt. Short-Term Debt/GDP	2.833***	-0.248	2.833***	2.060***	2.885***	3.209***		2.684***	2.638***	2.660***	
	[7.853]	[-0.873]	[7.678]	[8.254]	[7.666]	[7.752]		[7.345]	[7.432]	[7.628]	
Mkt. Price of risk	17.80***	21.07***	17.80***		16.24***	16.63***	19.70***	17.70***	17.82***	19.52***	18.87***
	[8.023]	[7.412]	[8.086]		[7.271]	[7.265]	[9.180]	[7.852]	[7.943]	[8.566]	[8.350]
European programs variable	0.334***	0.606***	0.334***		0.350***	0.325***	0.279***	0.342***	0.277***	0.227***	0.232***
	[8.429]	[12.98]	[7.819]		[8.905]	[8.163]	[6.978]	[8.631]	[6.983]	[5.915]	[5.903]
OMT dummy	-0.501***	-0.904***	-0.501***		-0.539***	-0.485***	-0.397***	-0.424***	-0.456***	-0.379***	-0.399***
	[-4.052]	[-5.950]	[-3.414]		[-4.339]	[-3.991]	[-3.268]	[-3.391]	[-3.791]	[-3.029]	[-3.363]
Growth forecast * I(group=1)					-0.230***						
					[-5.403]						
Growth forecast * I(group=2)					0.0229						
					[0.478]						
Growth forecast * I(group=3)					-0.190***						
					[-3.870]						
Govt. bonds held by dom. banks/Assets * I(group=1)						-9.521					
						[-1.366]					
Govt. bonds held by dom. banks/Assets * I(group=2)						15.24***					
						[5.481]					
Govt. bonds held by dom. banks/Assets * I(group=3)						-2.055					
						[-0.434]					
Gvt. Short-Term Debt/GDP * I(group=1)							7.425***				
							[6.782]				
Gvt. Short-Term Debt/GDP * I(group=2)							4.706***				
							[10.04]				
Gvt. Short-Term Debt/GDP * I(group=3)							1.156***				
							[2.931]				
Growth forecast * I(time<2010q1)								-0.178***			
								[-4.102]			
Growth forecast * I(time>2010q1)								-0.0222			
								[-0.587]			
Govt. bonds held by dom. banks/Assets * I(time<2010q1)									4.338		
									[1.577]		
Govt. bonds held by dom. banks/Assets * I(time>2010q1)									8.956***		
									[3.902]		
Banks capital/Assets * I(time<2010q1)										-13.10***	
										[-3.295]	
Banks capital/Assets * I(time>2010q1)										-4.593	
										[-1.316]	
Gvt. Short-Term Debt/GDP * I(time<2010q1)											1.938***
											[4.983]
Gvt. Short-Term Debt/GDP * I(time>2010q1)											2.617***
											[7.465]
R-squared	0.911	0.816	0.904	0.957	0.914	0.914	0.919	0.913	0.914	0.915	0.917
Im-Pesara-Shin p-value	0.0082	0.0279		0.0085	0.00789	0.00995	0.000781	0.00543	0.00385	0.00277	0.00168
Phillips-Perron L* p-value	0.00405	0.0169		0.0304	0.00174	0.00376	0.000901	0.00315	0.0022	0.00208	0.0012
Number of countryid			15								
Breusch-Pagan p-value			0								
Hausman test p-value			0								

Robust t-statistics in brackets
*** p<0.01, ** p<0.05, * p<0.1

Notes: The dependent variable in the underlying panel regressions captures the probability of a sovereign defaulting conditional on a domestic (median) bank defaulting, i.e., the BSC measure. The groups included in the estimation samples above are as follows. (Group 1) 'Core eurozone countries': Austria, Belgium, France, Germany and the Netherlands. (Group 2) 'Eurozone countries under stress during the sample period: Greece, Ireland, Italy, Spain and Portugal. (Group 3) 'Countries outside the eurozone: Sweden, Switzerland, Japan, the U.K. and the U.S. Estimation period for these regressions is 2005 Q1 to 2012 Q4.

Annex V. Measuring, Monitoring, and Reporting Risk to Public Debt from the Financial Sector—Country Survey on Current Practices[1]

This annex presents the findings of a survey of 117 market access countries of their practices in identifying, monitoring, and reporting risks to public debt stemming from the financial sector. The survey fielded in the fall of 2013 to ministries of finance, debt management offices, banking supervision agencies, and other relevant agencies. It covered: (i) the institutional framework under which the relevant risks are identified, monitored, and reported; (ii) the tools used to measure and monitor such risks; and (iii) whether and how such risks inform the design of fiscal policy and debt management.

A. Summary of Results

1. For the 43 countries that responded to the survey the main results suggest: [2]

- Countries operate within frameworks that generally allow for a regular flow of information about risks from the financial sector across government agencies and regulators.
- Measuring risks to public debt from the financial sector is not adequately done prior to the materialization of risks. Assessing implicit contingent liabilities is not common, and is typically only done under special circumstances. A large portion of countries with crisis resolution frameworks allowing for government intervention do not monitor implicit contingent liabilities despite having relatively large or leveraged banking sectors.
- While governments seem to have adequate access to information about risks from the financial sector, the link to public finances (in particular public debt) is rare even in countries with high public debt, large and leveraged banking sectors, or with history of banking crises.

B. Institutional Framework

Framework for Information Sharing

2. The survey results suggest that governments operate within institutional frameworks that allow for regular flow of information between government entities and regulators (Table AV2).[3] In particular, about 90 percent of respondents indicated that information about financial

[1]Prepared by Karina Garcia (SPR).

[2]See Table AV1 for details on the response rate, and Table AV2 for the response summary for the yes/no questions. Table AV3 provides the full set of questions in the survey.

[3]For the purpose of this annex, the government refers to the ministry of finance and/or relevant ministries responsible for monitoring fiscal and public debt sustainability.

sector risks is shared with the government, with almost 80 percent indicating this is done on a regular basis. In 63 percent of respondents, information is shared through formal channels, such as MOUs. In addition, about 80 percent of respondents have in place inter-agency financial stability committees (FSC) dedicated to discuss financial sector risks. Government participation in these committees (either through the ministry of finance or other relevant ministry) seems to be the norm (in 90 percent of respondents) and in the few countries where the government is not represented, formal and regular channels of information sharing are in place. In 49 percent of respondents, such committee is either chaired or co-chaired by the ministry of finance or relevant government agency.

3. Information sharing is common across countries irrespective of banking sector characteristics or debt levels.[4, 5] The majority of countries with large or leveraged banking sectors or with a history of banking crises have in place an FSC. The government chairing of the FSC is more common in countries with history of banking crises, while the use of MoUs for sharing information is more common in countries with highly leveraged banking sectors.

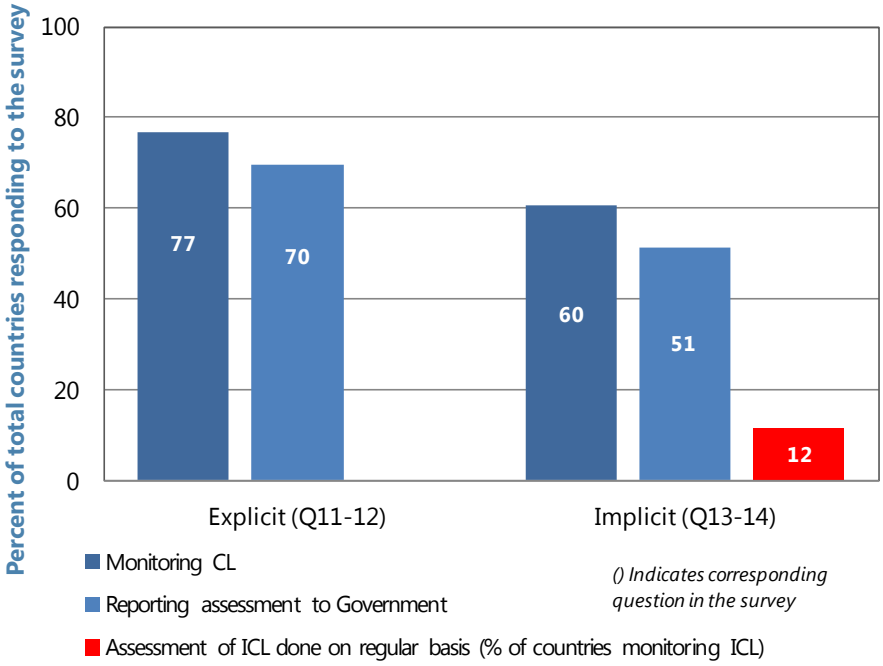
Framework for Monitoring and Assessing Contingent Liabilities

4. While there is generally adequate attention to contingent liabilities from explicit guarantees, systematic attention to implicit contingent liabilities is lacking (Figure AV1). A significant share of respondents (77 percent) has institutions in charge of regular monitoring and quantification of explicit contingent liabilities. This information is reported to the ministry of finance in almost all cases. While 60 percent of respondents (26 countries) indicated that the same is done for implicit contingent liabilities, a follow-up survey of these countries found that only 12 percent (3 countries) actually do this on a regular basis, while 35 percent (9 countries) indicated this is done only under special circumstances, for example when stress occurs. The remaining countries did not respond to the follow-up.

[4]The size of the banking sector is measured by the ratio of assets to GDP. A bank is considered large if this ratio falls in the top quartile of the distribution of a sample of advanced and emerging market countries. Leverage is assessed by either the credit- to-GDP or loan-to-deposit ratio. Countries are assessed to have a relatively leveraged banking sector if either of these indicators falls within the top quartile of their respective distribution.

[5]A country is considered to have a history of banking crises if it had one in the past 10 years according to the latest database on banking crises from Leaven and Valencia (June 2012).

Figure AV1. Assessment of Contingent Liabilities from the Financial Sector



5. Many countries where the government has an explicit role in crisis resolution frameworks do not assess implicit contingent liabilities. The presence of a crisis resolution framework establishing clear procedures and roles for each relevant entity in the face of a banking crisis is prevalent in 74 percent of respondents (32 countries). More than 60 percent of the countries where this framework is in place (20 countries) indicated that government intervention of the type that could create a liability on the sovereign is explicitly foreseen. In about 40 percent of these group (8 countries), practices for monitoring and quantifying implicit contingent liabilities are not in place. Of the latter countries, five have large banking sectors, six have leveraged banking sectors, three have high public debt,[6] and two have a history of banking crises.

C. Tools for Identifying, Measuring, and Monitoring Risks from the Financial Sector to the Government

6. The assessment of the financial sector health is done through various risk indicators. This includes credit-to-GDP, banks assets to GDP, leverage ratios, and other financial stability indices. Such indicators are used to inform reports on the overall health of the financial sector, which are often shared with the government.

7. About two thirds of respondents use the above mentioned indicators to inform discussions with the government on potential risks to their balance sheets from the financial

[6]A high or low debt burden is guided by indicative benchmarks for public debt to GDP ratios derived in the DSA for market access countries (50 percent for EMs and 60 percent for AEs).

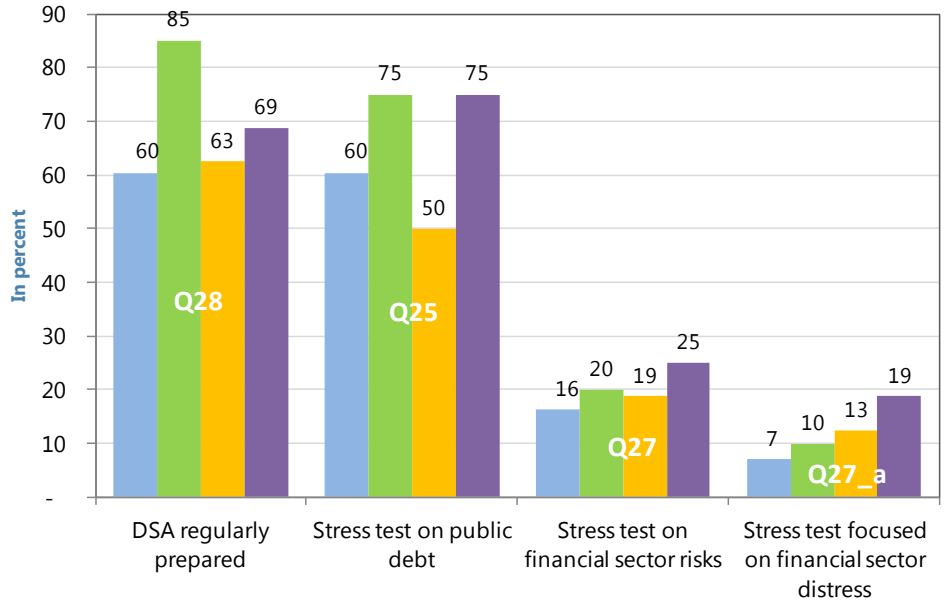
sector (Q20). However, as elaborated in the next section, the explicit link to fiscal and debt sustainability is lacking. More than one third of the countries where such discussions do not take place had large and leveraged banking sectors (5 out 14 countries). All of these countries also indicated that, the ministry of finance does not conduct its own analysis of financial sector risks.

D. Assessing Risks to Fiscal and Public Debt Sustainability[7]

8. Debt or fiscal sustainability analyses, while not widespread, are done in the majority of countries, but rarely include an assessment of risks from financial sector contingent liabilities (Figure AV2).

- About 60 percent of respondents conduct a public debt sustainability analysis (DSA),[8] and in a large share of these (22 out of 26 countries doing DSAs) the DSA results are used to inform government's policies. However, only 40 percent of respondents indicated the DSA is published. The practice of doing DSAs is more prevalent in countries with high public debt.

Figure AV2. Public DSA and Stress Test



Q refers to the corresponding question in the survey

[7]This section of the survey focused exclusively on the preparation of debt sustainability analysis. However, some respondents also included the preparation of fiscal sustainability reports as part of their answers.

[8]The DSA discussed in this section refers to an assessment of the evolution of public debt under a baseline scenario and under different macroeconomic and financial alternative scenarios and/or stress tests.

- About 60 percent of respondents indicated that stress testing of public debt is a common practice, with the vast majority focused on macroeconomic shocks. Stress testing of public debt is relatively more common among countries with high public debt and/or a history of banking crisis (about 75 percent of each group). However, financial sector stress testing is significantly less common, and typically done as shocks to the government cost of borrowing. Even less common is the assessment of the impact of financial sector contingent liabilities on debt even in countries where government intervention is explicitly foreseen in crisis resolution frameworks.

9. While the majority indicated that public debt strategies pay due regard to risks from the financial sector, few hold cash buffers to prepare for potential financial sector contingent liabilities. The practice of holding cash buffers is common across debt managers to help smooth expenditure cycles. In addition, about 16 percent of total respondents (7 countries) indicated that estimates of appropriate cash buffers also takes into consideration estimates of potential financing needs to cover (partially or fully) a materialization of financial sector risks.

Table AV1. Response Rate to Practices Survey on Risks to Public Debt from the Financial Sector 1/

Dept.	Sent	Received	Percentage of responses
AFR	9	1	11.1%
APD	14	5	35.7%
EUR	44	29	65.9%
MCD	22	4	18.2%
WHD	28	4	14.3%
Total	**117**	**43**	**36.8%**

1/ The survey was sent on August 7, 2013 to 117 market access countries across all regions (9 in Africa, 22 in Middle East and Central Asia, 28 in Western Hemisphere, 14 in Asia and the Pacific, and 44 in Europe). The response rate as of October 2013 was 37 percent. The majority of responses came from advanced economies.

Table AV2. Summary of Survey Responses

	Summary of the response to the Yes/No questions	Yes	No	N/A	Total	Yes	No	N/A	Total
		Number of respondents				Percent of respondents			
Q3.	Is information on financial sector risks shared with the agency responsible for monitoring fiscal and public debt sustainability?	39	3	1	43	91	7	2	100
Q5.	Is information sharing specified formally in a memorandum of understanding (MoU) between participating agencies?	27	15	1	43	63	35	2	100
Q7.	Are there inter-agency financial stability committees (formal or informal) dedicated to discussing financial sector risks?	35	7	1	43	81	16	2	100
Q11	Monitoring of **explicit** contingent liabilities. Are there agency (agencies) responsible for recording, quantifying and reporting financial sector contingent liabilities associated with explicit guarantees to the sector?	33	10	0	43	77	23	0	100
Q12.	Is the above analysis communicated to the ministry of finance?	30	4	9	43	70	9	21	100
Q13	Monitoring of **implicit** contingent liabilities. Are there agency (agencies) responsible for quantifying and reporting potential financial sector contingent liabilities associated with implicit guarantees (i.e. potential fiscal cost of bailing out financial institutions in the event of a crisis)?	26	17	0	43	60	40	0	100
Q13_a	Follow up: how often is this assessment conducted? (regular basis or under special circumstances). Share responding "regular basis"	3	9	14	26	12	35	54	100
Q14.	Is the above analysis communicated to the ministry of finance?	22	7	14	43	51	16	33	100
Q15.	In the event of a financial crisis, is there a crisis resolution mechanism in place delineating each agency's responsibilities in this process?	32	8	3	43	74	19	7	100
Q16.	Is government intervention in banks (of the type that can create a liability on the sovereign) foreseen in this framework?	20	14	9	43	47	33	21	100
Q18.	Are the above indicators used to inform reports on the health of the financial system?	40	1	2	43	93	2	5	100
Q20.	Are the above indicators used to inform discussions with the government on potential risks from the financial sector for its budget or balance sheet?	29	10	4	43	67	23	9	100
Q22.	Does the ministry of finance do its own analysis of financial sector risk?	19	20	4	43	44	47	9	100
Q24.	Does the ministry of finance uses analyses conducted by other agencies on financial sector risks?	33	4	6	43	77	9	14	100
Q25.	Are stress tests on the evolution of public debt done?	26	16	1	43	60	37	2	100
Q27.	Are there any specific stress tests to assess the impact of financial sector risks on public debt?	7	35	1	43	16	81	2	100
Q28.	a) Is a DSA regularly prepared (e.g., annually)?	26	16	1	43	60	37	2	100
Q29.	Is it published?	17	9	17	43	40	21	40	100
Q30-Q31.	Which agency is responsible for the production of the DSA? Do other agencies contribute to the production of the DSA?	15	11	17	43	35	26	40	100
Q34.	Do the structure and conditions of the financial sector affect the design of the public debt management strategy?	34	8	1	43	79	19	2	100
Q36.	Does the debt manager hold a cash buffer?	31	11	1	43	72	26	2	100
Q37.	Does the debt manager hold a cash buffer explicitly to cover (partially or fully) the materialization of financial sector risks (even if this practice is not publicly disclosed)?	7	34	2	43	16	79	5	100

Table AV3. Survey to Country Authorities

I. Institutional framework

This section aims to understand the institutional framework under which financial sector risks —and their potential impact on public finances and public debt—are identified, measured, monitored, and reported.

Responsible agencies

1. List the agencies responsible for identifying, measuring and monitoring financial sector risks.
2. Indicate the respective responsibility of each agency.

Information sharing between agencies

3. Is information on financial sector risks shared with the agency responsible for monitoring fiscal and public debt sustainability?
4. a) Is this information sharing done on a regular ongoing basis or only under special circumstances (e.g., involving potential systemic risks arising from the financial sector)?

   b) Please specify these circumstances.
5. Is information sharing specified formally in a memorandum of understanding (MoU) between participating agencies?
6. Please indicate the participating agencies covered by the MoU.
7. Are there inter-agency financial stability committees (formal or informal) dedicated to discussing financial sector risks?
8. Which agencies participate in the financial stability committee?
9. Which agency chairs the financial stability committee?
10. What powers do the financial stability committees have (e.g., decision power vs. advisory role)?

Division of responsibilities for identifying, recording, and quantifying financial sector contingent liabilities that could potentially be transferred to the government balance sheet

11. Which agency (agencies) is (are) responsible for recording, quantifying and reporting financial sector contingent liabilities associated with **explicit** guarantees to the sector?
12. Is this analysis communicated to the ministry of finance?
13. Which agency (agencies) is (are) responsible for quantifying and reporting potential financial sector contingent liabilities associated with **implicit** guarantees (i.e. potential fiscal cost of bailing out financial institutions in the event of a crisis)?
14. Is this analysis communicated to the ministry of finance?
15. In the event of a financial crisis, is there a crisis resolution mechanism in place delineating each agency's responsibilities in this process?
16. Is government intervention in banks (of the type that can create a liability on the sovereign) foreseen in this framework?

Table AV3. Survey to Country Authorities (Concluded)

II. Tools For Identifying, Measuring and Monitoring Risks From the Financial Sector to the Government Balance Sheet

Identifying and monitoring risks from the financial sector

17. Please list the main indicators used to monitor and/or assess vulnerabilities in the financial sector (e.g., credit to GDP, leverage ratios, etc).
18. Are the above indicators used to inform reports on the health of the financial system?
19. Please indicate which reports and whether they are published.
20. Are the above indicators used to inform discussions with the government on potential risks from the financial sector for its budget or balance sheet?
21. Please indicate the channel through which this is discussed.
22. Does the ministry of finance do its own analysis of financial sector risk?
23. Please indicate what types of analysis are being conducted.
24. Does the ministry of finance uses analyses conducted by other agencies on financial sector risks?

III. Assessing Risk to Fiscal and Public Debt Sustainability

Under this section a distinction between public debt sustainability analysis (DSA) and public debt portfolio analysis should be borne in mind. The former refers to an assessment of the evolution of public debt under a baseline scenario and under different macroeconomic and financial alternative scenarios and/or stress tests; the latter focuses on an assessment of the risks to the profile of public debt and the cost of funding of the public borrowing strategy.

Stress testing and public debt sustainability

25. Are stress tests on the evolution of public debt done?
26. What kinds of stress tests are conducted?
27. Are there any specific stress tests to assess the impact of financial sector risks on public debt?

Debt sustainability analysis (DSA) and its use

28. a) Is a DSA regularly prepared (e.g., annually)?

    b) Please indicate its periodicity.
29. Is it published?
30. Which agency is responsible for the production of the DSA?
31. Do other agencies contribute to the production of the DSA?
32. Please indicate what the inputs from these other agencies are.
33. How are DSA results used and to what extent do the results inform fiscal, debt, and macro prudential policies?

Public debt portfolio analysis and financial sector risks

34. Do the structure and conditions of the financial sector affect the design of the public debt management strategy?
35. Please explain the main financial sector factors that influence public debt management (e.g. regulatory requirements, liquidity conditions, concentration and liquid asset ratios, capacity of absorb government debt, etc.).
36. Does the debt manager hold a cash buffer?
37. Does the debt manager hold a cash buffer explicitly to cover (partially or fully) the materialization of financial sector risks (even if this practice is not publicly disclosed)?
38. What factors guide how much cash should be held to prepare for the potential materialization of these financial sector risks?

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