INTERNATIONAL MONETARY FUND

December 2014

STAFF GUIDANCE NOTE ON MACROPRUDENTIAL POLICY—DETAILED GUIDANCE ON INSTRUMENTS

IMF staff regularly produces papers proposing new IMF policies, exploring options for reform, or reviewing existing IMF policies and operations. The following document has been released and is included in this package:

- The **Staff Guidance Note on Macroprudential Policy—Detailed Guidance on Instruments**, prepared by IMF staff and completed on November 6, 2014.

This document was issued to the Executive Board for information as a supplement to the Staff Guidance Note on Macroprudential Policy.

The policy of publication of staff reports and other documents allows for the deletion of market-sensitive information.

Electronic copies of IMF Policy Papers
are available to the public from
http://www.imf.org/external/pp/ppindex.aspx

International Monetary Fund
Washington, D.C.

INTERNATIONAL MONETARY FUND

STAFF GUIDANCE NOTE ON MACROPRUDENTIAL POLICY—DETAILED GUIDANCE ON INSTRUMENTS

November 6, 2014

EXECUTIVE SUMMARY

This note is expected to be used as a "handbook" that staff can consult when considering what macroprudential advice may be appropriate for a given constellation of systemic risks. It covers in detail considerations that can guide the staff's policy advice in the use of:

- **Broad-based tools**
- **Household sector tools**
- **Corporate sector tools**
- **Liquidity tools**
- **Structural tools**

Each chapter discusses the transmission and likely effectiveness of these tools in mitigating systemic risks and the set of indicators that can be used in surveillance to assess the need for changes in macroprudential policy settings. Key issues in the staff's advice are discussed in the Staff Guidance Note on Macroprudential Policy.

Because macroprudential policymaking is an area in which knowledge is expanding rapidly, the note largely refrains from providing specific thresholds for the use of macroprudential policy tools, and instead emphasizes the need for an in-depth analysis of country-specific circumstances.

The note also covers issues in the implementation of macroprudential tools. This includes an exploration of the interactions between different tools when used in combination in order to mitigate risks, and the sequencing of tools that may be appropriate in responding to changes in systemic risk.

Each chapter highlights the potential for leakages as activity migrates outside the scope of macroprudential tools, and identifies strategies to address such leakages where available. The potential for leakages should be assessed ex ante and policy advice adjusted accordingly.

This material should not be used mechanically and cannot substitute for an in-depth analysis and engagement with the authorities that is critical to arrive at sound policy recommendations tailored to country circumstances.

Approved By
Jan Brockmeijer and Mary Goodman

Prepared by a staff team led by Erlend Nier and comprising Nicolas Arregui, Chikako Baba, Heedon Kang, and Ivo Krznar (MCM), in collaboration with Gavin Gray, R. Sean Craig, and Nadege Jassaud (SPR), with assistance provided by Jessica Allison and Ricardo Cervantes (MCM).

CONTENTS

BOXES

FIGURES

TABLES

Glossary

ABCP	Asset-backed commercial paper
ABS	Asset backed security
AE	Advanced economy
BCBS	Basel Committee on Banking Supervision
BCR	Basic capital requirements
BIS	Bank for International Settlements
BoE	Bank of England
CCB	Countercyclical capital buffer
CCPs	Central counterparty clearing houses
CDS	Credit default swap
CESEE	Central, Eastern, and Southeastern Europe
CFM	Capital flow management measure
CFR	Core funding ratio
CGFS	Committee on the Global Financial System
CIVs	Collective investment vehicles
CRE	Commercial real estate
DPR	Dynamic loan loss provisioning requirement
DSC	Debt service coverage ratio
DSIB	Domestic-systemically important bank
DSTI	Debt-service-to-income
DTI	Debt-to-income
EME	Emerging market economy
ESRB	European Systemic Risk Board
EU	European Union
FDIC	Federal Deposit Insurance Corporation
FPC	Financial Policy Committee
FSA	Financial Supervisory Authority
FSB	Financial Stability Board
FSOC	Financial Stability Oversight Council
FX	Foreign exchange
HLA	Higher loss absorption
HP	Hodrick-Prescott
HPI	House price index
HQLA	High quality liquid assets
G-SIIs	Global-systemically important insurers
GSIB	Global-systemically important bank
IAIS	International Association for Insurance Supervision
IFRS	International Financial Reporting Standards
IFS	International Financial Statistics
IRB	Internal Ratings Based

ISD	Integrated Surveillance Directive
LCR	Liquidity coverage ratio
LGD	Loss-given-default
LTD	Loan-to-deposit
LTI	Loan-to-income
LTSF	Loan-to-stable funding
LTV	Loan-to-value
MAG	Macroeconomic Assessment Group
MMMF	Money Market Mutual Fund
NAV	Net asset value
NBFIs	Nonbank financial institutions
NPLs	Nonperforming loans
NSFR	Net stable funding ratio
OTC	Over-the-counter
PD	Probability of default
PIR	Price-to-disposable income
PRR	Price-to-rent ratio
ROC	Receiver operating characteristic
RRPs	Recovery and resolution plans
RSF	Required stable funding
RWAs	Risk-weighted assets
SEC	Securities and Exchange Commission
SIFI	Systemically-important financial institution

BROAD-BASED TOOLS[1]

A. Description of the Tools and the Transmission Mechanism[2]

1. Broad-based tools affect all credit exposures of the banking system and can include countercyclical capital buffers (CCBs), leverage ratios, and dynamic loan loss provisioning requirements (DPRs). The capital tools (CCB, leverage ratio and DPR) aim to enhance the resilience of the banking sector to adverse shocks and may also reduce the procyclicality of bank lending. These tools are complementary: the DPR covers losses that are expected to arise over an average economic cycle, while the CCB covers additional "unexpected" losses that arise in times of financial stress. The leverage ratio is intended to complement risk-based capital requirements, including the CCB, by constraining banks' ability to increase the overall size of their exposures relative to their capacity to absorb losses. Some countries have used caps on credit growth as broad-based tools in addition where capital tools may not be available or are ineffective in reducing excessive credit growth.

- **CCB.** The CCB is meant to be built up in "good times," when financial imbalances are growing, in order to help banks withstand losses in times of financial stress. Its main objective is to increase the system's resilience against adverse shocks. The CCB may thereby help reduce the procyclicality of bank lending—in good times, the build-up of additional capital may contain excessively fast growth in credit by increasing the cost of granting new loans. Conversely, when financial conditions tighten the release of the CCB may avoid a credit crunch by helping banks absorb losses and reducing the pressure on them to deleverage so as to meet regulatory capital requirements.

- **Leverage ratio.** The leverage ratio is intended to maintain resilience of the banking system by limiting a bank's total exposure (both on-balance sheet and off-balance sheet) in relation to its equity. In comparison to the CCB, which builds on risk-based capital requirements, this instrument is not risk-weighted. A key benefit of the leverage ratio is that it counteracts a cyclical erosion of risk weighted assets. Moreover, the leverage ratio can provide a simple and transparent backstop to safeguard against model and measurement error in calculation of capital ratios, including the CCB.[3] Therefore, the leverage ratio can play a complementary role in containing the build-up of risks over time.

[1] Prepared by Ivo Krznar (MCM).

[2] For a broader discussion of key issues in the staff's advice on the use of macroprudential policy tools, see the main Staff Guidance Note on Macroprudential Policy.

[3] While the Basel Committee on Banking Supervision (BCBS) (2014) considers the leverage ratio as a back-stop to risk based capital requirements, there are many officials and academics who have argued that the leverage ratio should be given a greater emphasis and act as a front stop rather than backstop (see references in Haldane, 2013).

- **DPR.** The DPR constitutes forward-looking general (or collective) provisions for performing loans—as opposed to specific provisions for incurred losses—which build a "dynamic loan loss reserve" from profits in good times. This pool of provisions can be drawn on to cover realized losses in bad times when specific provisions for impaired loans exceed the average specific provisions over the economic cycle. Like the CCB, it can help restrain credit growth by increasing the cost of new loans.

- **Caps on credit growth.** Some countries[4] have used caps on credit growth as broad-based tools where credit growth is strong and systemic risks are building up fast, and other tools, such as the CCB, DPR or the leverage ratio, either were not available or were not expected to be sufficiently effective in slowing credit growth. While the primary objective of a cap on credit growth is to slow excessive credit, it can in theory also enhance the resilience of the banking sector indirectly by increasing lending standards if banks select better quality borrowers first before they hit the lending cap. Caps on credit growth should not substitute for appropriate policies in other areas. Since such caps are generally applied on a sectoral basis to address specific risks, these are discussed in the chapters on sectoral tools.

2. Staff should be mindful of the potential for leakage of broad-based tools, where provision of credit migrates outside of the scope of application of the tool. While capital tools can increase the resilience of the banking system, their effect on credit can be reduced by the migration of the provision of credit to domestic nonbanks, off-balance sheet vehicles, and foreign financial institutions. Broad-based tools can be more effective in slowing excessive credit growth in bank-based systems or where the scope of regulation allows the extension of these tools to nonbanks, and where the microprudential framework imposes high standards for consolidated supervision. Strategies to address domestic and cross-border leakages of broad-based tools are considered in more detail below.

While the remainder of this note focuses in the main on the CCB, it also further explains the leverage ratio tool, provides basic guidance on how to set up a dynamic provisioning framework, and offers some considerations for caps on credit growth.

3. The main aim of building up the CCB in good times is to increase the total level of capital, thereby increasing resilience to shocks, while in bad times it can cushion losses and reduce pressure to deleverage. A higher CCB can also have an effect on overall credit growth. This effect depends on a range of factors and is expected to be weaker if: (i) banks can substitute voluntary capital with the CCB; (ii) building up capital, either by retaining earnings or by issuing new equity, is easy; (iii) banks can change the structure of assets by increasing exposures with

[4] For example, the Croatian National Bank used a credit cap in 2006 in order to slow down credit growth and subsequently to resolve external imbalances (IMF, 2006). However, Galac (2010) shows that the credit cap did not affect the rate of growth of the total debt of the private sector—the slowdown of the domestic credit growth due to the credit cap was substituted by higher foreign credit growth suggesting that the credit growth cap, while changing the structure of external debt with corporate firms contributing more and banks less, was not effective in resolving the underlying problem of increasing external imbalances.

low risk-weights at the expense of exposures with high risk-weights, thereby lowering overall risk weighted assets but not overall lending; and (iv) if nonfinancial firms can borrow from the non-regulated financial sector. In theory, laying out the details of the framework ex ante may change banks' behavior in expectation of the policy change (expectations channel, see Committee on the Global Financial System (CGFS), 2012 for details).[5]

4. The available evidence suggests that the transmission of the CCB works mainly via higher resilience rather than lower credit growth. Most empirical evidence suggests that lending spreads might increase only between 2 and 20 basis points in response to a one percentage point increase in capital ratios (Macroeconomic Assessment Group (MAG), 2010a; MAG, 2010b), even though some studies suggest larger effects in the short term.[6] On the other hand, a one percentage point rise in capital requirements is estimated to reduce the likelihood of systemic crises by 20–50 percent (though the marginal benefits of higher capital ratios decreases with higher initial capital levels, CGFS, 2012). Nier and Zicchino (2008) find that banks with larger capital buffers are better able to continue lending when faced with loan losses. IMF (2013a) provides additional evidence on stronger effects of capital requirements on credit in bad times.

5. Staff's advice on the CCB should use the guidance of the BCBS as a starting point. The Basel framework stipulates that the CCB should be determined at the national level for all exposures to counterparties in that country. Banks should have to meet the CCB with common equity tier 1 and would otherwise be subject to restrictions on dividend distributions. While the activation and level of the CCB is at national discretion, the framework features mandatory international reciprocity up to levels of 2.5 percent of risk-weighted assets to make the CCB more effective to ensure a level playing field where the CCB applies to both domestic and foreign banks in one jurisdiction.[7]

6. A growing number of countries are implementing a CCB framework, broadly following the BCBS guidance.[8] Table 2 compares the CCB frameworks of five early adopters

[5] Igan and Kang (2011) document the expectations channel for the loan-to-value (LTV) ratios and debt service-to-income ratios (DSTIs). Their findings suggest that tighter limits on loan eligibility criteria, especially on LTV, curb expectations and speculative incentives. There is no empirical evidence of expectations channel related to the CCB given its limited use thus far.

[6] Bridges and others (2014) show that in response to an increase in capital requirements, banks increase capital buffers and reduce credit growth for commercial real estate, other corporates and households secured lending, while credit growth mostly returns to normal within three years. Banks' responses differ depending on bank size, capital buffers held, the business cycle, and the direction of the change in capital requirements. Aiyar and others (2014) suggest that tightening of capital requirements reduces substantially the supply of lending, especially of large banks.

[7] Jurisdictions can impose a CCB higher than 2.5 percent. While reciprocity will be mandatory up to 2.5 percent, it will be voluntary for the CCB higher than 2.5 percent.

[8] The international requirement is that the CCB be phased in gradually from 2016 to 2019. However, some countries are likely to do this early.

(Switzerland, the United Kingdom (U.K.), Peru, Norway, India, and New Zealand).[9] Within these countries, central banks assume a strong role in decisions on implementing the CCB, in cooperation with banking supervisors who enforce these buffers bank–by-bank.

B. Tightening Phase—Indicators

7. Staff is encouraged to use the "credit gap" as a starting point for assessing the build-up of systemic risks and recommending the activation of the CCB, in the context of broader surveillance to assess systemic risks. This indicator was put forward in the BCBS guidance on implementing the CCB as a core reference variable based on analysis by Drehmann and others (2010 and 2011). They found that among potential variables, including credit growth, GDP growth, property prices and banks' profitability, the credit gap is the *single* most powerful indicator of banking crises.

8. An increase in the credit-to-GDP ratio relative to its trend can indicate the need to impose the CCB.[10] In particular, Drehmann and others (2010) show that a credit-to-GDP ratio of ten percentage points or more above trend issues the strongest signal of an impending crisis (in terms of noise to signal ratio). While the initial studies have tested this measure on advanced economies, the recent literature has confirmed its signaling properties for emerging market economies (Drehmann and Tsatsaronis, 2014, European Systemic Risk Board (ESRB), 2014).

9. Calculating the credit gap requires data on the credit-to GDP ratio and estimation of the trend in this ratio. The measure of credit to the private nonfinancial sector should, ideally, be a broad measure comprising all lending by domestic and foreign financial institution as well as debt raised in financial markets.[11] Where data on broad credit are unavailable, staff should try to use national source data to construct a credit measure consistent with the Bank for International Settlements (BIS) definition, or alternatively International Financial Statistics (IFS) data on credit to the nonfinancial private sector.

10. To estimate the trend credit-to-GDP ratio a Hodrick-Prescott (HP) filter can be used. To estimate the gap, a trend must be extracted from the ratio, which involves a number of statistical challenges. The BCBS recommends calculation of a one-sided (backward looking) HP filter using quarterly data and a relatively high smoothing parameter (lambda equal to 400,000

[9] Peru is an exception to this trend. The authorities decided to take a different guide, based on GDP growth, and different rules of activation and deactivation of the CCB, because of its low banking penetration compared with advanced economies. Likewise, India's thresholds of the credit gap are set higher due to a lower stage of financial system development.

[10] The trend value is interpreted as the equilibrium credit-to-GDP ratio.

[11] Staff can use BIS data on broad credit to the private non-financial sector, which are available for 40 advanced and emerging economies. Credit is defined as a sum of credit provided by domestic banks, all other sectors of the economy and non-residents.

instead of 1,600).[12] This is justified by the fact that credit cycles tend to be longer than business cycles. A reliable measure of the credit-to-GDP gap requires a long time series (ten years of quarterly data) to estimate the trend with no breaks in the series.

11. The credit gap is subject to a number of statistical caveats (further discussed in Drehmann and Tsatsaronis, 2014). End-of-sample uncertainty related to trend estimates can be high when using a backward-looking HP filter, as the arrival of new data can affect the estimated trend. Edge and Meisenzahl (2011) find that ex-post revisions to the credit gap in real time are sizable for the United States (U.S.) due to the revision of the estimated trend measured in real time.[13] Gerdrup, Kvinlog and Schaanning (2013) augment historical observations with forecasts of the series. They find that this improves the credit gap's signaling quality for Norway but introduces another source of uncertainty by using forecasts.[14] In addition, the start date chosen for estimating credit gaps can affect the value of the trend substantially (Drehmann and Tsatsaronis, 2014). If the time series of the credit gap is long enough, staff is encouraged to analyze the signals of the credit gap estimated over different sample sizes, by changing the smoothing parameter and by augmenting historical observations with recursive forecasts.

12. A template provided with the guidance note can be used to calculate the HP trend. After adding an add-in file for calculation of the HP filter,[15] staff is required to enter seasonally adjusted nominal GDP (annualized, on a quarterly basis) and the stock of credit. The template calculates the HP trend and a deviation from the trend using a simple one-sided filter.[16] Staff can also analyze the robustness of the credit gap with respect to sample length and the smoothing (lambda) parameter. To address the end-point problem, staff can estimate the HP trend with historical observations of credit and GDP augmented by forecasts of the two variables, as proposed by Gerdrup, Kvinlog and Schaanning (2013).

[12] In addition to a HP filter, which is an univariate filter, Staff might want to consider estimating the credit gap via multivariate filter based on a structural model, as have been done in related work by the Research Department on potential output estimation (see Benes and others, 2010).

[13] The revision is measures as the difference between credit gap estimates using one-sided and two-sided HP filter.

[14] Gerdrup, Kvinlog and Schaanning (2013) show that, applied to Norwegian data, the BCBS proposal results in a buffer of ¼ percent at the end of the second quarter of 2013, while an alternative calculation method based on recursive forecasts yields a buffer of 1¾ percent.

[15] Files HP-filter.xlsm (calculates the HP trend) and HPfilter.xla (HP filter function) should be saved in the same folder. Once the HP-Filter excel file is opened, links and macros in Option, Security warning should be enabled. HP-filter add-in provided with the excel file should be added. In column that calculates the HP trend, in the cell G8, the text in front of HP function should be deleted (the text that is left should look like =hp(F8:F157,E4)). After deleting the text, hold Shift and Ctrl and hit enter to calculate HP trend. The sample can be changed by replacing F157 in the cell G8 with the cell that represent the end of the sample.

[16] The template is not supposed to be used to simulate the hypothetical, historical paths of the CCB. For simulation purposes of the hypothetical paths of the CCB in the past, estimates of the credit gap should be calculated based on one-sided filters.

13. In light of these data and estimation challenges, the credit gap should not be used mechanically and staff should rely on judgment when making recommendations on activation of the CCB. This should be based on in-depth surveillance that draws on a range of indicators. To inform staff's analysis the following indicators might be considered in addition to the credit gap, since they proved to be useful early warning indicators in cross-country studies:

- **Further credit growth measures:** Jorda and others (2010) show that the rate of credit growth is a very useful predictor of financial instability. Bas and others (2012) also find that while it is difficult to tell "bad" from "good" credit booms, bad booms tend to be larger and last longer (roughly half of the booms lasting longer than six years end up in a crisis). IMF (2011a) show that an increase in the credit-to-GDP ratio above three percentage points, year-on-year, could serve as early warning signals one to two years before a financial crisis. Use of this indicator may also help judge whether a trend increase in credit is sustainable.

- **Asset prices deviations from long-term trends:** Borio and Lowe (2002), Borio and Drehmann (2009), and IMF (2011a) show that combinations of credit and asset price deviations from long-term trends are good leading indicators of banking distress. Increases in house prices and real commercial property prices, and their levels relative to income or rent can be valuable indicators of a build-up of imbalances (Gerdrup, Kvinlog and Schaanning, 2013).

- **Market volatility and spreads:** Brunnermeier and Sannikov (2014) provide a rationale for the idea that the financial system is prone to crises even if measured risk is low (the so called volatility paradox). Similarly, Gilchrist and Zakrajsek (2012) and Stein (2014) argue that when the risk premium is low, there is a greater probability of a subsequent upward spike in credit spreads. The risk premium can include the term premium on treasury securities and the credit risk premium on corporate bonds and asset-backed securities, which is the expected excess return on such bonds with credit risk relative to safe treasury securities. The interpretation of low spreads can be difficult, since they can be due both to investor sentiment and to more concrete factors, such as time variation in either the risks facing investors or their tolerance for bearing such risks (Stein, 2014). Nonetheless, Bush and others (2014) argue that spreads can be operationally useful even if the interpretation of low spreads is not clear—if prices of risk are excessively low and funding is therefore cheap, macroprudential policy should take advantage of the ability to take out insurance and lean against the wind.

- **Debt-service ratio:** Drehmann and Juselius (2014) find that in addition to the credit-to-GDP gap, the debt-service ratio, if available, consistently outperforms other measures as an early warning indicator. While the credit-to-GDP gap is the best single indicator at longer horizons (providing early warning three to five years ahead of crises), increases in the debt-service ratio performs as well at shorter horizons (up to two years). However, computation of debt-service ratios is more data intensive and will not be possible for many countries. Another drawback is that they can be driven strongly by the monetary stance, rather than underlying

balance sheet strength, with some of the signaling power driven by tightening of monetary policy conditions ahead of historical banking crises.[17]

- **Leverage:** Leverage on individual loans or at the level of a particular asset class (e.g., LTVs for real estate, margin requirements for over-the-counter (OTC) derivatives etc.), monitored by recording margin requirement or LTV ratios, can provide useful information about the build-up of risks (Geanokoplos and Pedersen, 2011). Average leverage can be complemented with information on the distribution of asset leverage (e.g., distribution of LTV ratios) or the distribution of investor leverage, if available.

- **Wholesale funding:** The composition of banks' liabilities performs well as early warning indicator (Shin, 2013). Since unsustainable credit booms are often funded by noncore funding, the decomposition between core and noncore liabilities can indicate the degree of risk-taking by banks and therefore of the stage of the financial cycle. Gerdrup, Kvinlog and Schaanning (2013) also show that the wholesale funding ratio is useful indicator of a systemic crisis.

- **Current account deficits:** Weak exports and resulting current account deficits are frequently observed before financial crises (Kaminsky and Reinhart, 1999). Jorda and others (2010) show that the correlation between lending booms and current account imbalances has increased in recent decades. Current account deficits are also strongly associated with increases in house prices (Aizenmann and Jinjarak, 2009) and when used jointly predict banking crises well (Barrel and others, 2010; Reinhart and Rogoff, 2009).

14. Staff is encouraged both to analyze the historical dynamics of the indicators for the country and compare the behavior of indicators across countries. Staff could evaluate indicators during previous episodes of financial stress in a country, and compare these experiences with those in peer countries. Staff may also want to evaluate formally the signaling power of selected indicators as early warning indicators of banking crises for the country, or at the regional level. The noise-to-signal ratio, discrete choice models (IMF, 2011a) and the receiver operating characteristic (ROC),[18] as used in Drehmann and Juselius (2014), can be used to assess indicators' signaling properties. However, staff should take into account that past correlations are not necessarily robust indicators of future crises.

[17] While the debt-to-service ratio dominates the credit gap as an early warning indicator at shorter horizon, it is not included in the core indicators for two reasons. First, in comparison to the credit gap the debt-to-service ratio is data intensive, frequently not publicly available and therefore often not easily computable. And second, the ratio may signal crises too late, especially when debt service is held low by low policy rates which can revert.

[18] A receiver operating characteristic curve, is a graphical plot of the fraction of true positives out of the total actual positives versus the fraction of false positives out of the total actual negatives, at various thresholds

Table 1. CCB: List of Core and Additional Indicators

Core indicators

- Credit-to-GDP gap.

Additional indicators

- Change in credit/GDP ratio (m-o-m and y-o-y change);
- Credit growth (m-o-m and y-o-y change), asset price growth (m-o-m and y-o-y change), gaps and levels of house prices-to-income, real commercial property prices;
- Spread and volatility measures (equity volatility, term premium, credit risk premium);
- Debt service ratio;
- Leverage on individual loans or at the asset level (e.g., LTV ratio—an average and a distribution across new loans over a period and existing loans at a given point in time, margin requirements);
- Decomposition between core and noncore liabilities and the wholesale funding ratio (gap and level); and
- Current account deficits.

C. Tightening—Calibration of the Tool

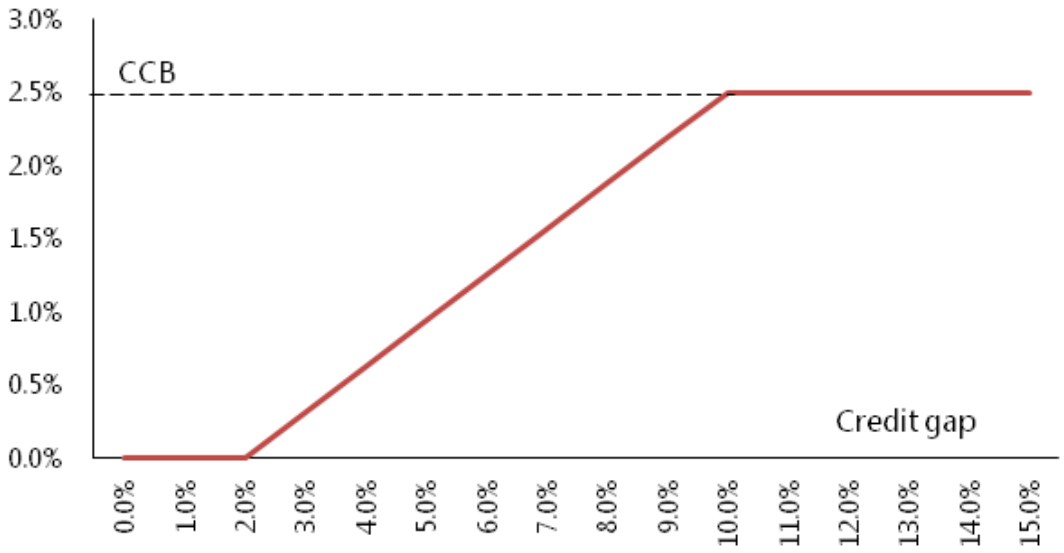
15. To calibrate the CCB, staff should consider the BCBS "buffer guide" formula, using the credit gap as part of an in-depth analysis. This approach starts by considering a two to tem percentage point range for the credit gap. When the credit gap breaches a "lower threshold" of two percent a decision to start increasing the buffer could be taken if the surveillance supports a judgment that systemic risk may be building up; and, when it reaches the "upper threshold" of ten percent, the CCB should be set at 2.5 percent of risk-weighted assets. It can also be set higher based on broader macroprudential considerations (Figure 1). Estimates based on historical banking crises find that these lower and upper thresholds do not vary significantly across jurisdictions (BCBS, 2010; Drehmann and Tsatsaronis, 2014; ESRB, 2014).

16. A lower threshold is needed so that banks can build up capital gradually, sufficiently ahead of a crisis. The lower threshold is identified as a level where there is a material risk of a crisis and thus when the authorities should start to build up capital gradually ahead of a potential crisis. Given that banks typically need notice of one year to start to raise additional capital,[19] the process of building buffers should start at least two to three years prior to a crisis for it to make a difference (BCBS, 2010). Similarly, the pace of accumulation of the CCB need not be linked in a linear fashion to the credit gap but, should be based on judgment of the pace at which systemic risks are rising.

[19] To give banks time to meet the additional buffer, the buffer add-on decision should be preannounced by up to 12 months before it takes effect.

17. Timely activation is critical to avoid procyclicality from a tightening of the CCB. As a financial crisis approaches, GDP growth often falls, while credit keeps rising as borrowers draw on credit lines to keep their operations open, Giese and others (2013). These developments would increase the reading of the credit gap, potentially reducing the reliability of the signal and increasing the risk that activation or tightening comes too late. This might lead to an unintended, additional pro-cyclicality of credit if a continuing increase in the capital buffer leads banks to curtail lending.[20]

Figure 1. The Mapping of the Credit Gap to the Size of the CCB



Source: BCBS.

18. Stress-testing tools can inform judgments on the appropriate level of the CCB. Stress tests can help estimate losses and capital shortfalls under a stress scenario. During a period of stress the market might require additional capital to compensate for uncertainty about the solvency of the banking system. Therefore, the level of the CCB in the activation phase should reflect both the capital shortfall and the extra capital needed to maintain investor's confidence in a downturn, potentially exceeding 2.5 percent of risk-weighted assets.

19. Judgment in setting the buffer is necessary for a number of reasons. While rule-based approaches would better shape expectations and promote accountability, applying some judgment in the setting of the buffer is necessary mainly because of the imperfect nature of the indicators' signal. Communicating buffer decisions and evaluating the buffer's performance is key

[20] Repullo and Saurina (2011) show that in major advanced countries the credit gap is negatively correlated with GDP growth.

to promoting accountability. This would also help banks manage uncertainty about future capital requirements.

20. Staff should take country-specific characteristics into account when recommending how to calibrate the CCB. The CCB should vary with the extent of the build-up of the systemic risk, which may be affected by the level of indebtedness and the degree of economic and financial development. In particular:

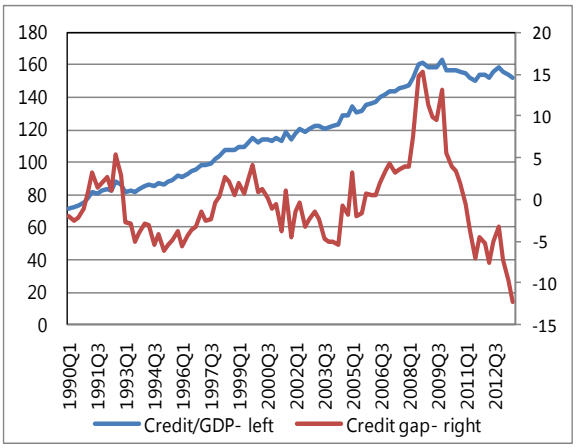
- The CCB should be set higher for an economy where historically high growth of credit resulted in large indebtedness, possibly accompanied by asset price overvaluation. Even when credit growth has slowed and the credit gap is closing, high indebtedness could amplify the financial sector's vulnerability to adverse shocks (see examples of the Netherlands, New Zealand, Sweden and South Africa in Figure 2). Neither current credit growth nor the current credit gap will then adequately capture the elevated level of vulnerability. While the CCB can cushion the negative consequences of high indebtedness, other tools that target the level of debt directly and might support a gradual deleveraging of the private sector (e.g., LTVs, DSTI) should also be used.

- The stage of financial sector development should not, in general, have a major influence on decisions to activate or calibrate the CCB. Even though credit growth can be driven by healthy financial deepening, such gradual financial deepening will be reflected in the trend of the credit-to-GDP ratio (Drehmann and Tsatsaronis, 2014). However, staff need to judge whether high trend growth in credit-to-GDP is associated with systemic risks, since excessive financial deepening (such as following financial liberalization) can result in a crisis (see note on low income countries). Staff is therefore encouraged to analyze factors that will help assess whether credit growth represents healthy financial deepening justified by economic convergence, or whether the sustainable level of credit in the economy is breached (see further note on low-income countries). Staff should also be aware that some countries set different thresholds than those recommended by the BCBS (see India's case; Table 2) on the basis of the stage of economic development, the degree of maturity of financial markets and ongoing structural transformation.

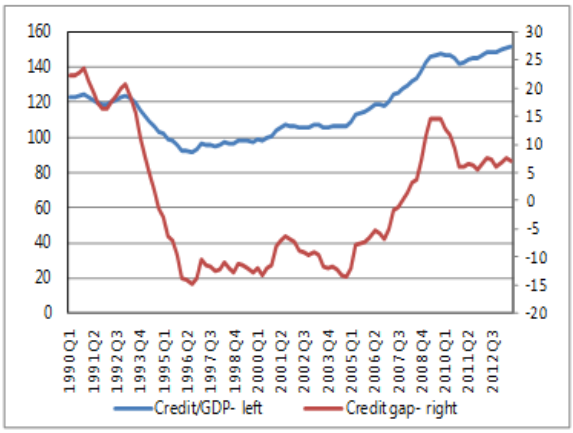
- For economies that are highly concentrated and where GDP growth is highly dependent on a couple of sectors or export markets—resulting in high volatility in both business and credit cycles—it might be difficult to implement a CCB, since this might have to change very frequently. An alternative strategy for such countries would be to set permanently higher capital buffers at a level which would reflect the through-the-cycle losses, and to release them only in periods of severe stress.

Figure 2. Credit/GDP and Credit Gap[21]

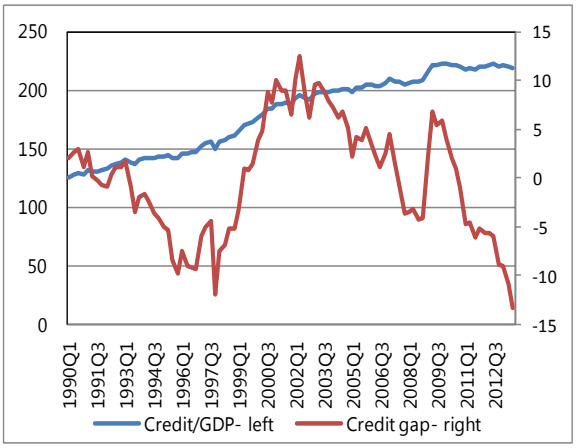
New Zealand



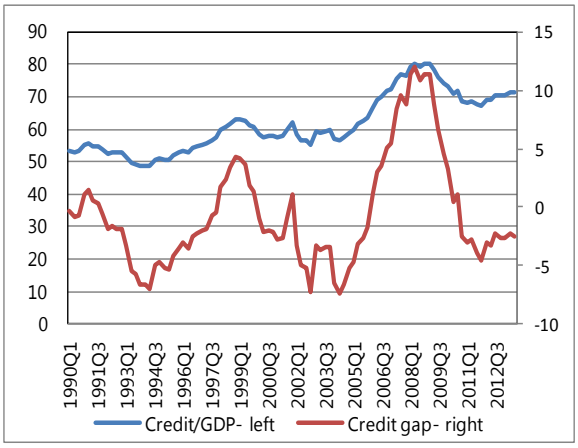
Sweden



Netherlands



South Africa



Sources: BIS, Haver, IMF staff calculations.

D. Release—Indicators

21. The CCB should be released in times of financial stress, in order to absorb losses or reduce the risk of a credit crunch (BCBS, 2010). In a scenario where an increase in systemic risk is followed by incipient financial stress, the CCB should be released promptly so that banks can use the capital that was built-up to absorb losses, reducing the risk of a credit crunch. Moreover, a prompt and full release of the CCB will be necessary to lessen the risk of a credit crunch due to

[21] The starting point for the credit gap calculation is different for different countries due to data availability (1989Q4, 1984Q1 and 1980Q1 for the Netherlands, New Zealand and Sweden, and South Africa, respectively). The credit measure for Netherlands and South Africa is the broadest possible and is taken from the BIS, credit measures for Sweden and New Zealand are taken from national data. The credit measure for Sweden is taken from the Riksbank's Financial Stability Review (2014) defined as monetary financial institutions' lending to the private non-financial sector and the outstanding stock of commercial paper and bonds issued by the Swedish private nonfinancial sector. The credit measure for New Zealand is defined as domestic credit.

regulatory capital requirements otherwise becoming binding. To ensure that banks use their released capital to absorb losses, rather than to pay it to shareholders, dividend distributions should be restricted when the CCB is fully released.

22. The in-depth analysis underpinning the judgment to release the CCB should draw on a different set of indicators than those used in the activation decision. The latter requires leading indicators while the former decision should rely more on near-contemporaneous indicators of banking distress.[22] The following indicators, possibly used in combination, can be useful in signaling the beginning of the release phase:

- **Market-based indicators:** Staff should use high frequency market based indicators that are forward looking to the extent these are available. Some studies have found credit spreads to be the best contemporaneous indicators of banking sector distress, even though they can be noisy and send out false alarms (Drehman and others, 2011). Other studies point to the usefulness of price-based measures of default or distress (Shin, 2013) or "near-coincident" indicators of systemic stress (Arsov and others, 2013). In particular, measures of market volatility in equity and foreign-exchange markets generally shoot up during market stress. Stress indices can be constructed to aggregate across a number of financial market variables (see, e.g., Oet and others, 2012). Staff should encourage the authorities to construct and monitor such indices for crisis detection purposes. However, judgment will play a role as some studies suggest that market-based indicators frequently signal the onset of crises with considerable noise (Drehman and others, 2011).

- **Growth rate of new loans:** During a crisis, the growth rate of new loans typically slows sharply, reflecting current credit conditions and deleveraging, and, thus, can serve as a useful indication in staff's advice on when to release the CCB. Giese and others (2013) note that credit growth variables provide a more timely signal than the gap variable in identifying turning and release points of credit cycles.[23] However, they also note that credit may not slow in a downturn if corporations have undrawn credit lines. Drehmann and others (2011) find that, among macro variables and indicators of banking sector conditions, a sharp slowdown of credit growth is the best indicator for the release phase.[24]

[22] For example, since credit usually lags the business cycle, the credit gap does not work well as an indicator for releasing the buffer, both in terms of timing or intensity (Drehmann and others, 2010; Repullo and Saurina, 2011). IMF (2013b) presents a simulation exercise of the CCB in Spain and Ireland in the period before and during the crisis using the credit/GDP gap as an indicator for the tightening phase and asset prices as indicator for the release phase.

[23] The credit-to-GDP ratio and gap may be slow to decline once crises materialize and, thus, may be less useful as an indicator in this situation. A fall of GDP growth may lead to an increase in the ratio and the stock of loans may not fall immediately because borrowers may have undrawn credit lines available.

[24] They conclude that a drop of credit growth below eight percent is the best indication for the release phase. This happens at the onset of more than 40 percent of crises and such a signal provides very few false alarms.

- **Lending standards:** In addition, leverage on new loans[25] and measures of lending standards from credit conditions surveys[26] can help determine whether a slow-down in credit is due to a contraction of credit supply. Staff should encourage the authorities to collect these data, including through credit conditions surveys, if these are not readily available.

- **Changes in asset quality:** Changes in aggregate banking sector asset quality, such as incipient increases in nonperforming loans (NPLs) and loan-loss provisions (Wolken, 2013) can signal the onset of stress. Where banking sector losses are increasing due to increased default rates, this may call for a release of the buffer, so that it can be used to cover these losses. However, where market-based measures are available that provide more timely measures of incipient stress, these can be preferable.

23. In determining whether to recommend releasing the CCB staff should analyze how such a move might affect financial stability, funding costs and investor confidence. Banks' capital, after the CCB has been released, has to be sufficient to absorb their unexpected future losses. Staff's advice to release the CCB should therefore be informed by an assessment of indicators of capital adequacy (before and after the CCB has been released), including estimates of expected and unexpected losses under stress, market-based indicators of banks' resilience, credit conditions, and the outlook for growth and banks' profitability. If staff judges that banks' ability to absorb future losses is insufficient when the CCB is released, or if funding costs would increase materially due to insufficient capital; then staff should not recommend a release and might, instead, recommend measures to increase the capital level[27] in order to restore market confidence. More generally, when recommending when to release the buffer staff should consider that the release may be ineffective in supporting credit extension if it comes too late and capital constraints have started to reduce the supply of credit to the economy, or that it may provide an additional support to an ongoing boom if it is released too early.

24. If the CCB is used in combination with the DPR, the latter generally should be released first. The DPR is calibrated to cover expected losses and general provisions will often already have been used by banks to cover losses in periods of stress, before the CCB is released by the authorities to cover additional, unexpected, losses. Moreover, releasing the DPR to cover losses is a built-in feature of the regime that does not require an active decision by the authorities. It is therefore likely to have less of an impact on investor confidence than release of the CCB.

[25] Geanokoplos and Pedersen (2011) show that leverage on new loans such as required down-payments on new loans and margin requirements on securities increase sharply during the crisis. Therefore leverage on new loans, if available, should complement credit growth as an indicator whether and when to release the CCB.

[26] Credit conditions survey report the availability of credit, the demand for credit, loan pricing, and default rate on loans. For details, see Bank of England (BoE) credit condition survey.

[27] It is critical to recommend corrective action targeted at dollars of capital and not capital ratios as banks may choose to increase the capital ratio not by raising the numerator (capital) but by reducing the denominator (assets) (Hanson, Kashyap, Stein, 2011).

25. The CCB might also be released in a more benign scenario, where systemic risks dissipate and financial imbalances unwind without financial stress. In that scenario, the CCB can be reduced gradually as surveillance determines that systemic risks have decreased. This assessment can draw on a similar set of indicators that were used for the activation of the CCB.[28]

E. Assessing and Addressing Leakages

26. Staff should be aware of the potential for leakage of capital tools and advise on strategies to address leakages, where this is feasible. Capital tools like the CCB, and the DPR may increase the cost of extending loans and can lead to arbitrage where loans are provided by institutions not covered by the tool. This can include provision of credit by domestic nonbanks, off-balance sheet provision of credit and lending by foreign financial institutions.

27. Domestic leakages of capital tools can be addressed by expanding the perimeter of regulation to nonbanks or by consolidating such activity, when part of a banking group. This would imply imposing capital requirements on domestic nonbanks. For example, in the U.K., the Financial Policy Committee (FPC) monitors the extent to which any leakages reduce its ability to mitigate systemic risks and, if necessary, can make recommendations to the treasury to expand the set of institutions to which these tools apply. When nonbanks are part a domestic banking group, it is also important to ensure that consolidated supervision is effective. All material nonbank subsidiaries and off-balance sheet vehicles that may be used to circumvent capital requirements should be consolidated with the sponsoring bank that is subject to capital tools.[29]

28. Cross-border leakages of capital tools are well-documented empirically, for both advanced and emerging markets. For the U.K., Aiyar and others (2012) found evidence that in response to varying microprudential (Pillar 2) capital requirements in the 1990s and early 2000s, lending by local banks was substituted by lending by foreign bank branches which were not subject to the local capital regime.

[28] However, using credit gap as a trigger for the release of the CCB might be problematic because GDP might fall faster than credit during financial stress so that the ratio declines slowly or even increases. Repullo and Saurina (2011) show that in major advanced countries the credit gap is negatively correlated with the GDP growth. Single-variable indicators, like credit or house prices, might be more useful.

[29] For example, ahead of the crisis, the originators of asset backed securities (ABS) did not report the securitized receivables and the corresponding securities on their own balance sheets. Therefore, the securitized assets did not carry a capital charge. However, the new International Financial Reporting Standards (IFRS) mandates reporting debt securitizations on balance sheet in case not all of the risks are transferred to buyers of the ABS. For example, Canadian banks were required to bring mortgage backed securities back onto their balance sheet following implementation of the IFRS in 2011. Under the old Canadian GAAP, securitization transactions could achieve derecognition and off-balance sheet treatment for various assets such as loans and mortgages where the bank or corporation is considered to have transferred control over the assets. But under IFRS, de-recognition is now more difficult because it is based on whether there has been a substantial transfer of risks and rewards as well as a transfer of control.

29. Cross-border leakages of capital tools can be addressed by reciprocity arrangements, or alternatively greater host control over foreign branches.

- **Reciprocity:** the reciprocity principle is a cornerstone of the BCBS framework for the CCB, where each country authority is responsible for ensuring that the banks they supervise apply the CCB on exposures in the host jurisdiction that has imposed the CCB. This reciprocity arrangement will apply as long as the buffer does not exceed 2.5 percent, above which reciprocity is voluntary or based on further bilateral or regional agreements between country authorities. Internationally active banks with exposures to various countries will have a consolidated CCB that is a weighted average of the CCBs they face in all countries where they have exposures. In this way, jurisdictional reciprocity is meant to preclude incentives to circumvent the CCB, making the CCB more effective and ensuring a level playing field between domestic and foreign banks operating in one jurisdiction. In particular, with reciprocity the branches of foreign banks will be treated in the same way as subsidiaries of foreign banks.[30] However, it remains to be seen how well the reciprocity framework will work in practice.

- **Greater host control:** As noted in IMF (2013a), foreign branches can become "shadow banks" from the point of view of the host authorities, reducing their ability to assess systemic risk and control over their activities that may contribute to systemic risks. Moreover, as pointed out by Shin (2011 and 2012), foreign branches are often the main entities that transmit global financial conditions into the host countries. Some host countries (e.g., Brazil, Mexico, and New Zealand) have a longstanding policy of encouraging or requiring subsidiarization of local business units, thereby subjecting them to direct regulatory control by the host authorities. In some other countries, branches work effectively as entities which face local capital (and liquidity) charges identical to those applied to subsidiaries.[31,32] The staff should therefore consider recommending subsidiarization to contain leakages of macroprudential policies, even though such action has costs for parent institutions (e.g., capital and liquidity are required to be held in and 'ring-fenced' by the host country). In this regard, staff's advice on these measures should be in line with the general principles that

[30] A proposal of Basel III/CRD of Nordic countries and the BoE proposal on macroprudential powers of FPC consider expanding a reciprocity arrangement for capital requirements, including the CCB and risk weights.

[31] For example, Argentina, Bolivia, Brazil, Chile, Ecuador, and Korea (Fiechter and others, 2011). The crisis has set off a trend towards subsidiarization of (retail) banking activities in other jurisdictions. For instance, in the U.K., Prudential Regulation Authority recently published a consultation paper on its approach to supervising international banks which suggests that non-European Union (EU) international banks wishing to conduct retail banking through a branch will find it harder to do so and may be forced to set up a subsidiary.

[32] The U.S. authorities now require all foreign affiliates (branches and subsidiaries) to be organized under a local holding company, so as to permit U.S. resolution action at the group level. And the Reserve Bank of India has also issued guidelines for foreign banks to open subsidiaries in India that would require all foreign branches to be converted into subsidiaries. Fiechter and others (2011) suggests that retail banking lends itself more naturally to a subsidiary structure than wholesale and investment banking. Fiechter and others (2011) also set out the costs and benefits of expansion through branches versus subsidiaries. However, it does not cover the benefits of subsidiarization in addressing leakages of macroprudential action per se.

govern the analysis of spillovers from domestic policies. Staff should discuss with the authorities the full range of spillovers from policies when they may have a significant impact on global stability, consistent with the Integrated Surveillance Directive (ISD). Although members have no obligation to change policies as long they promote their own stability, staff should recommend alternative policy approaches (where available) that attain the same objective at reduced costs to other countries.

F. Leverage Ratio

30. The Basel III framework introduces a minimum leverage ratio to supplement the risk-weighted capital requirements.[33] While such capital requirements require banks to fund their risk weighted exposures—weighted by risk weights that represent the riskiness of the exposures—with at least a minimum amount of capital, the leverage ratio requires banks to fund their total exposures, weighted equally, with at least a minimum amount of capital, set at three percent.[34] The main objective of the leverage ratio is to constrain excess leverage, i.e., to constrain banks' ability to increase the overall size of their exposures relative to their capacity to absorb losses.

31. The main rationale for a leverage ratio is to constrain an increase in leverage over time that is not captured in current prudential risk metrics. The experience ahead of the crisis has been that banks increased leverage to unsustainable multiples, even though risks-weighted requirements were in place. This points to weaknesses of risk-weighted requirements in constraining overall leverage. Risk-weighted asset can erode in "good times" when measured risks are low. They are also subject to "gaming effects" where banks manage risk weights down in order to flatter their capital ratios.

- There is evidence of a secular fall in average risk weights at international banking groups since the mid-1990s, which is consistent with banks managing these weights to increase reported capital ratios (BoE, 2014b, Haldane, 2013). The 2008/09 crisis showed that the fall in average risk weights observed before the crisis did not represent a systematic reduction in risk (BoE, 2014b).

- In calculating risk-weighted assets, banks that use internal ratings-based approaches to calculate risk weighted assets use their own data and models to determine risk inputs like

[33] Implementation of the leverage ratio began on January 1, 2013 with bank-level reporting to national supervisors of the leverage ratio and its components. Public disclosure will be required from January 1, 2015. It is expected that any final adjustments to the definition of the leverage ratio will be completed by 2017 and that the leverage ratio should become a requirement from 2018.

[34] The Basel III leverage ratio is defined as the capital measure (the numerator) divided by the exposure measure (the denominator). The capital measure for the leverage ratio is the Tier 1 capital of the risk-based capital framework taking account of the transitional arrangements. Exposures include on-balance sheet assets, including on-balance sheet collateral for derivatives and securities finance transactions and other off-balance sheet exposures. See BCBS (2014) for details.

probability of default of assets and loss given default (for the advanced approach) of particular exposures. In comparison to the standardized approach, the internal ratings based (IRB) approaches therefore provide flexibility in calculating risk-weighted assets (RWAs). However, this flexibility can also lead to unintended variation in capital ratios. For instance, the BCBS (BCBS, 2013) found that there is variability in the risk weighted assets of U.S., European, and Asian banks even when banks have similar portfolios. Moreover, Tarullo (2014) argues that the combined complexity and opacity of the IRB risk weights create risks of gaming, mistake, and monitoring difficulty. In particular, there is a risk that when capital requirements are increased, banks respond by adjusting risk-weights, in order to avoid increases in capital.[35]

- There is evidence that, while the predictive power of all solvency metrics, leverage or risk-based, is low; leverage ratios perform as well, and in most cases outperform risk-weighted capital measures in predicting bank failure (Haldane, 2013 and references therein).[36]

32. The leverage ratio can be used as a static back-stop or adjusted over time. While the Basel agreement stipulates a minimum requirement, the leverage ratio can in principle be adjusted where the authorities are concerned about heightened risks, thereby building additional resilience against shocks. In this case the leverage ratio would be adjusted flexibly, and perhaps relatively infrequently, to build further resilience over time and as necessary.[37]

33. The leverage ratio can also be used as a structural tool, when a supplementary leverage ratio is applied to a subset of systemically important banking institutions. The supplementary leverage ratio would then come to complement capital surcharges imposed on

[35] For example, when faced with a mandatory floor on risk weights on mortgages in Sweden, major banks increased the risk weights on mortgages in anticipation of the minimum requirement imposed by the Financial Supervisory Authority (FSA) in May 2013. However, simultaneously, the banks appear to have lowered the average risk weighting on corporate lending which improved the average risk weighted capital ratio by about 3½ percentage points (IMF, Sweden 2014 Article IV). In Norway, due to the poor quality of historical data used to estimate probabilities of default and lack of empirical evidence for downturn adjustment for loss-given-default (LGD)-parameters, in 2014 the FSA proposed introducing a minimum standards for both risk inputs in calculation of risk-weighted assets (Norway FSA, 2014).

[36] These results are stronger for large banks using intern risk based approaches to modeling risk weighted assets than for smaller banks typically using standardized approaches (Haldane and Madouros, 2012).

[37] While some jurisdictions are considering using the leverage ratio as a time-varying tool, there is no international agreement on whether the leverage ratio should be used as a static or a dynamic tool. The BoE is considering adjusting the leverage ratio in parallel with the CCB in order to order to preserve the relationship between the risk-weighted and leverage requirements through the cycle. In particular, a concern is that where the CCB is tightened, this might induce institutions to shift from high risk-weighted assets into low risk weighted-assets (such as mortgages) in order to satisfy the higher risk-weighted capital requirement. For this reason the FPC is considering the merits of being able to vary leverage ratios in a countercyclical manner to reduce incentives to readjust risk weights or asset allocation when capital requirement are tightened as well as the criteria that would be used by the FPC when varying the leverage ratio. According to the BoE this could provide a more effective means to curtail unsustainable balance sheet expansion while continuing to guard against model risk (BoE, 2014b).

these institutions, so as to make these financial institutions more resilient against unforeseeable shocks (see the note on structural tools for more details).

34. The leverage ratio should not be used as a standalone tool. It is intended to reinforce and complement capital requirements. Using the leverage ratio together with capital requirements also recognizes the fact that no single capital adequacy metric can capture well all of the risks which they seek to capture or address (see BoE, 2014b, for more details on these risks).

35. The leakages of a leverage ratio are similar to the leakages of other capital tools. They can include provision of credit by domestic nonbanks, off-balance sheet provision of credit and lending by foreign financial institutions. Domestic leakages can be addressed by expanding the perimeter of regulation to nonbanks or by consolidating such activity. Cross-border leakages can be addressed by the Basel III international agreement on a minimum level of the leverage ratio (once this is implemented), or by greater host control over foreign branches, subjecting these entities to the local capital regime.[38]

G. Dynamic Provisioning Requirement[39]

36. The main objective of the DPR is to smooth provisioning costs over the cycle. By gradually building a countercyclical loan loss reserve in good times and then using it to cover losses as they arise in bad times, DPRs smooth provisioning costs over the cycle and thus insulate banks' profit and loss statements in this regard. Jiménez and others (2012) find that dynamic provisioning in Spain helped smooth credit supply cycles and had positive real effects especially in the downturn. In particular, better-provisioned banks partly mitigated the impact of the crisis, by providing credit in greater volumes and at lower cost. Wezel and others (2012) provide an in-depth treatment of the effectiveness of DPR and practical guidance on how to set up a DPR, which is briefly summarized here.

37. There are four main approaches to the DPR: (i) through-the-cycle accumulation; (ii) trigger-based; (iii) expected loss provisioning; and (iv) hybrid. The advice on the choice of the system will primarily depend on the scope and granularity of banking data and the quality of the early warning exercise that can be designed by the authorities or staff.

38. Through the cycle accumulation is the least data-intensive DPR framework. It was introduced by the Bank of Spain in 2000 and adopted by Uruguay in 2001. It is designed to build up general provisions that account for: (i) expected losses in new loans extended in a given period; and (ii) the average provision over the cycle applied to the outstanding stock of loans at the end of that period, after netting off specific provisions incurred during the period.

[38] Note that a reciprocity agreement for the leverage ratio similar to the one for the CCB does not exist.

[39] This appendix is based on Wezel and others, 2012.

39. The framework looks at only three variables: the outstanding amount of loans, the growth rate in loans and specific provisioning. The change in the DPR is the sum of: (i) expected losses in new loans of a similar risk category k, $\alpha^k \Delta C_t^k$; (ii) the average provision over the cycle applied to the outstanding amount of loans, $\beta^k C_t^k$; and (iii) specific provisions incurred during the period SP_t^k.

$$\Delta DPR_t = \sum_{k=1}^{N} \alpha^k \Delta C_t^k + \beta^k C_t^k - SP_t^k$$

- In good times, the loan loss reserves will increase since the difference between the first two components and specific provisions will be positive: specific provisions are very low because NPLs are low. In bad times, the opposite occurs: specific provisions surge, as NPLs increase, and the change in the DPR becomes negative, as the dynamic loan loss reserves are drawn down.

- While the framework does not require any active decisions to tighten or loosen the reserves, it necessitates the calibration of a mapping between new loans, and loans outstanding to the size of the change in general provisions (α^k and β^k respectively). For each risk category of loans, α^k can be calibrated as the estimated average of credit losses (the collective assessment for impairment in a cyclically neutral year) and β^k as the historical average of the specific provisions.

- The parameters are calibrated across different risk categories and can be calibrated separately for each bank. In addition to the formula parameters, there are floor and ceiling values[40] set for the fund of general loan loss provisions, to guarantee a minimum level and avoid excess provisioning, respectively. Banks can use their own models to determine the DPR (subject to supervisory validation) or a set of coefficients are provided to banks by the regulator.

40. Trigger-based systems determine the DPR based on a trigger rule linked to macroeconomic or financial developments. Such a system was first introduced by the Peruvian Superintendence of Banks in 2000, and was adopted by Bolivia in 2008. A DPR[41] is deployed and deactivated following a trigger rule which is tied to different indicators including GDP growth rate (Peru), credit growth, change in provisions, and the ratio of provisions to net interest income or gross financial margin (Colombia). The trigger rule requires estimation of thresholds of indicators that would signal the activation and the release phase of the DPR. In comparison to the through-the-cycle accumulation system where the DPR would be accumulated and released gradually, under a trigger-based system the DPR would be deployed and loosened rapidly. Therefore, the trigger-based system produces higher provisioning costs in the activation phase

[40] The ceiling value is usually calibrated to match the estimate of the expected losses.

[41] The Peruvian framework also consists of a fixed component of general provisions.

and no smoothing of the costs until the buffer is released, at which time the buffer cushions profits much faster. Similarly to the through-the-cycle accumulation system the provisioning rates can be set higher for riskier loans.

41. Expected loss provisioning system requires specific provisions on new loans to reflect through the cycle losses, instead of building dynamic general reserves for expected losses.[42] In this case, each loan starts carrying an individual provision for expected losses from the time it was granted, which would not change throughout the life of the loan. While this approach is much simpler than the first two approaches, it requires access to granular borrower data and reliable techniques for estimating expected losses. In particular, estimation of expected losses requires assumptions for the probability of default (PD) and LGD, usually by type of loan. If PDs and LGD data are unavailable, NPLs can be used to proxy for PDs, and LGDs can be taken from comparable jurisdictions. Periodic recalibration is needed to ensure that provisions are in line with expected losses.

42. Country-specific factors should determine the choice of the DPR framework. In case of a lack of granular data, and where the quality of early warning indicators is poor, the through-the-cycle accumulation system can offer a workable solution. Moreover, if bank-specific data are available, and where there is heterogeneity among banks, the through-the-cycle accumulation system formula based on bank-specific parameters will perform better than an "aggregate system" formula for any of the three approaches. Trigger-based systems ensure that the buffer is released only if systemic risk materializes. Whether this should be a recommended option depends on how reliably the selected set indicators for the activation phase and the release phase work. In light of the weaknesses in using indicators outlined above caution should be advised in recommending this approach, with surveillance assessing how well it is working.

43. Features of the through-the-cycle accumulation system and trigger-based approach can be combined. For example, a hybrid system would be based on the through the cycle accumulation system formula but would add a trigger rule for deactivation based on the set of indicators identified through the same process for deactivation of the CCB framework. In this framework a bank would not be allowed to access its dynamic loan loss reserves unless the indicators signal a downturn. The objective is to ensure that losses are covered by dynamic provisions only in case of systemic risk materialization but this, of course, depends on how well the indicators perform in identifying materializing systemic risk. Surveillance needs to monitor performance so that indicators can be overridden in cases where they fail to identify this.

H. Caps on Credit Growth

44. A few countries have used caps on credit growth when a credit boom gives rise to heightened systemic risk. Broad-based caps on credit growth have been considered where credit growth was strong and systemic risks were building up fast and other tools, such as the

[42] This system was introduced in Mexico and Chile.

CCB, DPR or the leverage ratio, either were not available or not expected to be sufficiently effective in slowing credit growth to sustainable levels. Such a broad-based cap aims in the main to affect the supply of credit by imposing a ceiling on the (quarterly or annual) rate of growth of credit. It can in theory also enhance lending standards if banks decide to pick the best borrowers before they hit the cap.

45. Caps on credit growth should not be used as substitutes for sound macroeconomic policy. Caps on credit growth might be more effective at containing credit booms than capital tools as they directly constrain the supply of credit. However, caps on credit growth should not substitute for warranted adjustments in policies in other areas. Monetary and fiscal policies should remain the first line of defense against macroeconomic distortions and external imbalances. For example, if fiscal and/or monetary policies are too loose, and this results in economic overheating and/or growing current account deficits, the staff should recommend appropriate adjustments in macroeconomic policies rather than endorsing speed limits.

46. Country experiences with broad-based caps on credit growth to address rising systemic risk from unsustainable credit booms vary. In Croatia, a credit growth ceiling of 16 percent was imposed in the period 2003 to 2004. The speed limit was reintroduced in 2007[43] and set as 12 percent and abandoned in 2009 after the outbreak of the crisis slowed credit growth in Croatia. In Turkey, the authorities used moral suasion to target a uniform 25 percent increase on banks' annual loan growth since 2011, adjusted for exchange rate movements, and while this was not a binding cap per se, it was complemented by an increasing range of macroprudential tools. Since credit caps should be expected to be most effective when applied on a sectoral basis to address specific risks, they are discussed further in the chapters on sectoral tools.

[43] The goal of the Croatian National Bank credit cap was to to slow down the credit growth and subsequently to resolve external imbalances (IMF, 2006). However, Galac (2010) shows that the credit cap did not affect the rate of growth of the total debt of the private sector—the slowdown of the domestic credit growth due to the credit cap was substituted by higher foreign credit growth suggesting that the credit growth cap, while changing the structure of external debt with corporate firms contributing more and banks less, was not effective in resolving the underlying problem of increasing external imbalances.

Table 2. CCB Frameworks

	BCBS principles	India	New Zealand	Norway
Date of framework's implementation	**December 2010**	The Draft Report on Implementation of the CCB in India was published for comments in December 2013.	January 2013	October 2013
Authority responsible for the CCB	**The relevant authority to operate the buffer is left to the discretion of each jurisdiction.**	Reserve Bank of India	Under the Memorandum of Understaning from 2013 the Reserve Bank would consult with the Minister of Finance ahead of making the CCB decisions. However, final policy decisions would rest with the Governor of the Reserve Bank. The Bank would account publicly for its assessments and decisions, primarily in its regular six-monthly Financial Stability Reports.	Ministry of Finance based on advice of Norges Bank; a decision on the level of the countercyclical capital buffer is made each quarter; in drawing up the basis for the decision, Norges Bank exchanges relevant information and assessments with Financial Supervisory Authority of Norway.
CCB level	-	Not actived yet.	Not activated yet (will be available from January 2014)	1 percent (decision in December 2013; will be implemented from July 1 2015).
CCB range	**0-2.5 percent of RWAs; a buffer in excess of 2.5% can be also implemented, if this is deemed appropriate. The international reciprocity provisions would not apply to the amount of the buffer in excess of 2.5%. Authorities can release the buffer gradually in situations where credit growth slows and system-wide risks recede in a benign fashion. In other situations, promptly releasing the buffer may be required.**	Linearly from 0 to 2.5 per cent of the RWAs	Expected to vary between 0 and 2.5 percent of RWAs; no formal limit will be set on the maximum size of the buffer	0-2.5 percent of RWAs. The level of the CCB will be changed in increments of 0.25 percentage point or multiples thereof.
Institutions affected by the CCB	**Host authorities would have the right to demand that the CCB be held at the individual legal entity level or consolidated level within their jurisdiction.**	Both the domestic banks and the foreign incorporated banks based on their exposure in India. The CCB shall be maintained on solo basis as well as on consolidated basis in India.	It will initially apply to registered banks but could potentially be extended to other lenders (such as non-bank deposit takers) in the future.	All banks operating in Norway and branches of foreign bank (from 2016; however the supervisory authorities in the home countries of the foreign branches can determine whether the CCB should be applied before 2016)
Notice period (increasing the CCB)	**Up to 12 months.**	4-quarters.	Up to 12 months.	No earlier than 12 months after the decision has been made (in special cases, an earlier entry into force can be decided).
Notice period (decreasing the CCB)	**None**	None	N.A.	None

Table 2. CCB Frameworks (continued)

	BCBS principles	India	New Zealand	Norway
Indicators for increasing the CCB	**The credit gap should serve as a common starting point in guiding decisions on buffer rates, most notably in the build-up phase. Authorities should use other quantitative and qualitative information and explain how they are taken into account in the setting of the CCB. Designated authorities should assess the information contained in the credit-to-GDP gap and any other variables, being mindful of their potential to give misleading signals. In addition, the usefulness of these variables should periodically be reassessed.**	The credit-to-GDP gap, Gross Non-Performing Assets (GNPA) growth, incremental credit-to-deposit ratio for a moving period of three-years, industry outlook assessment index and interest coverage ratio, house price index and credit condition survey. The Reserve Bank of India may apply discretion in terms of use of indicators while activating or adjusting the buffer.	Broad range of financial indicators and other evidence.	Total credit to households and non-financial enterprises -to-GDP ratio, the ratio of house prices to household disposable income, commercial property prices and the wholesale funding ratio (levels and gaps calculated using both one-sided and two-sided, forecast augmented HP filter). The decision relies also on judgement.
Indicators for decreasing the CCB	**Macro variables, including the credit gap may not be ideal indicator variables for signalling the release phase. Indicators such as asset prices, spreads or indicators of banking sector conditions can be used instead.**	The same set of indicators that are used for activating the CCB. However, instead of hard rules-based approach, flexibility in terms of use of judgement and discretion may be provided to the Reserve Bank of India for operating the release phase of the CCB.	When there were clear signs that the credit cycle had peaked.	Market turbulence indicators and loss prospects for the banking sector.
Low and high threshold of indicators behind activation/deactivation of the CCB	**For credit gap 2 and 10 percent respectively.**	Lower threshold is set at the credit gap of 3 percentage points, provided its relationship with GNPA remains significant and the upper threshold is set at 15 percentage points of credit gap-thresholds are higher due to emerging economy issues.	N.A.	Credit gap of 2 and 10 percent respectively. However, the advice on CCB does not rely mechanically on developments in individual indicators.
Reciprocity	**The host authorities take the lead in setting the CCB that would apply to credit exposures held by local entities located in their jurisdiction. They would also be expected to promptly inform their foreign counterparts of buffer decisions so that authorities in other jurisdictions can require their banks to respect them. The home authorities will always be able to require that the banks they supervise maintain higher buffers if they judge the host authorities' buffer to be insufficient.**	The RBI may convey the CCB requirement to the home supervisor of the foreign incorporated banks so that they may ensure that their banks maintain adequate capital under CCB as prescribed by the RBI. If RBI feels that the CCB by host jurisdiction is not reflecting the true risk of the exposures to that jurisdiction, RBI may always prescribe a higher CCB requirement for banks' exposure in that jurisdiction.	The foreign parent of a bank branch that is operating in New Zealand, or an offshore bank lending directly to New Zealand borrowers, may choose to hold the CCB against its New Zealand exposures if it follows the reciprocity provisions envisaged under Basel III.	Norges bank will provide advice on the extent to which Norwegian financial institutions should meet the countercyclical capital buffer requirement for that portion of their activities carried out in another state. In the December decision the Norges bank recommended that the Norwegian buffer rate also apply to that portion of a bank's activities carried out in another state, except if that state's authorities have set their own buffer requirement- the home-country buffer should then apply to exposures in the state concerned.
Detailed information	**http://www.bis.org/publ/bcbs187.htm**	http://www.rbi.org.in/scripts/BS_PressReleaseDisplay.aspx?prid=30097	http://www.rbnz.govt.nz/financial_stability/macro-prudential_policy/5163689.html	http://www.norges-bank.no/en/financial-stability/countercyclical-capital-buffer/

Table 2. CCB Frameworks (continued)

	BCBS principles	Peru	Switzerland	UK
Date of framework's implementation	**December 2010**	July 2011	July 2012. The CCB can be implemented on a broad basis or it can target specific segments of the credit market	September 2012
Authority responsible for the CCB	**The relevant authority to operate the buffer is left to the discretion of each jurisdiction.**	Supervisory Authority of Banks (SBS)	The Swiss National Bank submits a proposal (on the level, whether the CCB needs to be changed and the time that the banks will have to adjust) to the Federal Council which will take the decision on the stance of the buffer. The SNB consults the Swiss Financial Market Authority (FINMA) regarding its view of the situation before deciding whether to issue an official proposal to the Federal Council. FINMA supervises the implementation of the CCB at the individual bank level.	Financial Policy Committee of the Bank of England (as of May 2014)
CCB level	-	Activated in July 2012 ("75 percent CCB")	2 percent of financial institutions' risk-weighted, direct or indirect mortgage-backed positions secured by residential property in Switzerland (decision in February 2013 and January 2014; implemented from September 2013).	Not actived yet.
CCB range	**0-2.5 percent of RWAs; a buffer in excess of 2.5% can be also implemented, if this is deemed appropriate. The international reciprocity provisions would not apply to the amount of the buffer in excess of 2.5%. Authorities can release the buffer gradually in situations where credit growth slows and system-wide risks recede in a benign fashion. In other situations, promptly releasing the buffer may be required.**	Internal methodology where the CCB is equalt to regulatory capital ratio times the increase in the RWA after applying the stress weights provided by the SBS or parameters of expected losses under stress calculated by banks. The CCB does not need to fall within the range proposed by BCBS.	0-2.5 percent of RWAs; the level of the CCB will be set proportionally to the degree of imbalances.	0-2.5 percent of RWAs
Institutions affected by the CCB	**Host authorities would have the right to demand that the CCB be held at the individual legal entity level or consolidated level within their jurisdiction.**	Banks	Swiss banks and subsidiaries of foreign banks in Switzerland. The CCB must be fulfilled at single entity level and at the level of the financial group and financial conglomerate.	All UK incorporated banks, building societies and large investment firms (broker dealers). The CCB will be applied at both the individual entity and consolidated group level. The FPC will monitor the extent to which 'leakages' reduce its ability to mitigate systemic risks and, if necessary, will make recommendations to the Treasury to expand the set of institutions to which the CCB applies.
Notice period (increasing the CCB)	**Up to 12 months.**	Banks need to build 100 percent of the CCB over the next 4 years (in increments of 15 pp) once the rule is activated; banks can request to accumulate up to 75 percent of the CCB; in return they have to commit that at least 50 percent of the net income will not distributed	Between three and 12 months based on an assessment of the severity of imbalances.	Up to 12 months.
Notice period (decreasing the CCB)	**None**	None. 60/40 percent of the CCB can be used after cyclical provisions are exhausted under the 100/75 CCB	None	None

Table 2. CCB Frameworks (concluded)

	BCBS principles	Peru	Switzerland	UK
Indicators for increasing the CCB	**The credit gap should serve as a common starting point in guiding decisions on buffer rates, most notably in the build-up phase. Authorities should use other quantitative and qualitative information and explain how they are taken into account in the setting of the CCB. Designated authorities should assess the information contained in the credit-to-GDP gap and any other variables, being mindful of their potential to give misleading signals. In addition, the usefulness of these variables should periodically be reassessed.**	GDP growth rate	For the sectoral CCB applied to the residential mortgage loans segment, two categories of indicators are used: domestic mortgage volume indicators and domestic residential real estate price indicators. Additional indicators include measures of banks' risk-taking such as interest-rate risk, interest-rate margins, credit-condition indicators and leverage. An in-depth analysis of general economic condition indicators also flow into the decision. When these key indicators depict a homogeneous image of the imbalances building up in the system, the SNB decision will draw heavily on this guidance. When a heterogeneous picture of the situation on the domestic mortgage and real estate market is conveyed by the key indicators, more discretion enters the decision.	Measures of balance sheet stretch (including the credit-to-GDP gap) within the financial system and among borrowers, and measures of terms and conditions in financial markets. The likelihood that the CCB will be adjusted rises if the level of imbalance as measured by the indicators is greater, when the different indicators convey a more homogeneous picture, and when that picture is more consistent with market and supervisory intelligence.
Indicators for decreasing the CCB	**Macro variables, including the credit gap may not be ideal indicator variables for signalling the release phase. Indicators such as asset prices, spreads or indicators of banking sector conditions can be used instead.**	GDP growth rate	In addition to the set of key and additional indicators behind the activation of the CCB, higher-frequency information are monitored on an on-going basis.	Indicators of capital adequacy, including estimates of potential losses under stress, market-based indicators of banks' resilience, credit conditions, and the outlook for growth and banks' profitability.
Low and high threshold of indicators behind activation/deactivation of the CCB	**For credit gap 2 and 10 percent respectively.**	Activation if any of the following ensues: (i) the average yoy GDP growth over the last 30 months goes from a level below 5% to one above this threshold, (ii) The average yoy GDP growth over the last 30 months is already above 5%, and the last 12 months average yoy GDP growth is higher than the value registered one year before by 2 percentage points, (iii) The average yoy GDP growth over the last 30 months is already above 5%, and the rule has been deactivated by at least 18 months by the event described in (ii). Deactivation if any of the following ensues: (i) the average yoy GDP growth over the last 30 months goes from a level above 5% to one below this threshold; (ii) The average yoy GDP growth over the last 12 months is lower than the value registered one year before by 4 percentage points.	The SNB relies on historical evidence and, in particular, on the behavior of the key indicators during build-up phases that were followed by periods of financial instability, in order to assess the degree of imbalances.	Under the EU's draft CRD4/CRR, the FPC will be required to publish a guide broadly along BCBS lines each quarter and explain its decisions on the CCB rate applied to UK exposures with reference to it. The ESRB, tasked with working out details, has yet to issue guidance on precisely how such a guide should be calculated.
Reciprocity	**The host authorities take the lead in setting the CCB that would apply to credit exposures held by local entities located in their jurisdiction. They would also be expected to promptly inform their foreign counterparts of buffer decisions so that authorities in other jurisdictions can require their banks to respect them. The home authorities will always be able to require that the banks they supervise maintain higher buffers if they judge the host authorities' buffer to be insufficient.**	N.A.	N.A.	The FPC will set the CCB rate to be applied to all lending by banks in the United Kingdom, irrespective of the country of origin of the lender. In the same way, other countries will set national CCB rates that will apply to lending by UK banks overseas. The FPC can set CCB rates that are higher than those chosen by the relevant overseas authorities — including where these authorities choose not to activate the CCB at all — when, in its view, the risks to UK financial stability justify such action.
Detailed information	**http://www.bis.org/publ/bcbs187.htm**	http://www.banbif.com.pe/Portals/0/BIFPrincipal/basilea2/articulo_04.pdf.	http://www.snb.ch/en/iabout/finstab/id/finstab_banksector#t3	http://www.bankofengland.co.uk/financialstability/Pages/fpc/coreindicators.aspx

HOUSEHOLD SECTOR TOOLS[44]

A. Description of the Tools and Transmission Mechanisms[45]

47. Sectoral tools, addressing vulnerabilities from excessive credit to the household sector, include increases in sectoral capital requirements (risk weights), LTV, and DSTI. These tools have been used in several countries and a range of empirical studies show that these instruments were effective in addressing systemic risk externalities when used appropriately (Box 1). Since the global financial crisis, these sectoral tools are increasingly being adopted in both emerging market economies (EMEs) and advanced economies (AEs) (Box 5).

48. Sectoral capital requirements force lenders to hold extra capital against their exposures to a specific sector to protect against unexpected losses. The sectoral requirements can be imposed on a segment of household loans, such as residential mortgage loans, unsecured consumer loans, or foreign currency loans to unhedged households. They can take the form of either higher risk weights (or LGD floors) or additional capital requirements on such exposures.[46] In response, lenders need to raise more capital, increasing resilience, or reduce risk weighted assets (Figure 3). When tighter capital requirements translate into higher funding costs and lending rates, credit growth may also be restrained (credit supply channel)**.**

49. Limits on LTV ratios cap the size of secured loans relative to the appraised (or transaction) value of a property. While this tool is often applied in mortgage markets, it can also be applied to other secured loans, such as vehicles.[47] LTV limits directly reduce the funding available to borrowers and screen marginal borrowers out of mortgage markets. They can thereby reduce housing demand, lead to a decrease in credit and house price growth and, thus, help contain the procyclical feedback between credit and asset prices (credit demand channel). A tightening of the limits can also lead households to revise down their expectations of future house prices and reduce speculative incentives that play a key role in bubble dynamics (expectation channel). LTV limits bolster borrowers' resilience to house price shocks by increasing the equity in the residential property, and can thus contain both the PD and LGD faced by lenders (resilience channel). By enforcing a minimum down payment, the limits can also reduce borrowers' incentive to default strategically when house prices fall (anti-default channel).

---

[44] Prepared by Heedon Kang (MCM).

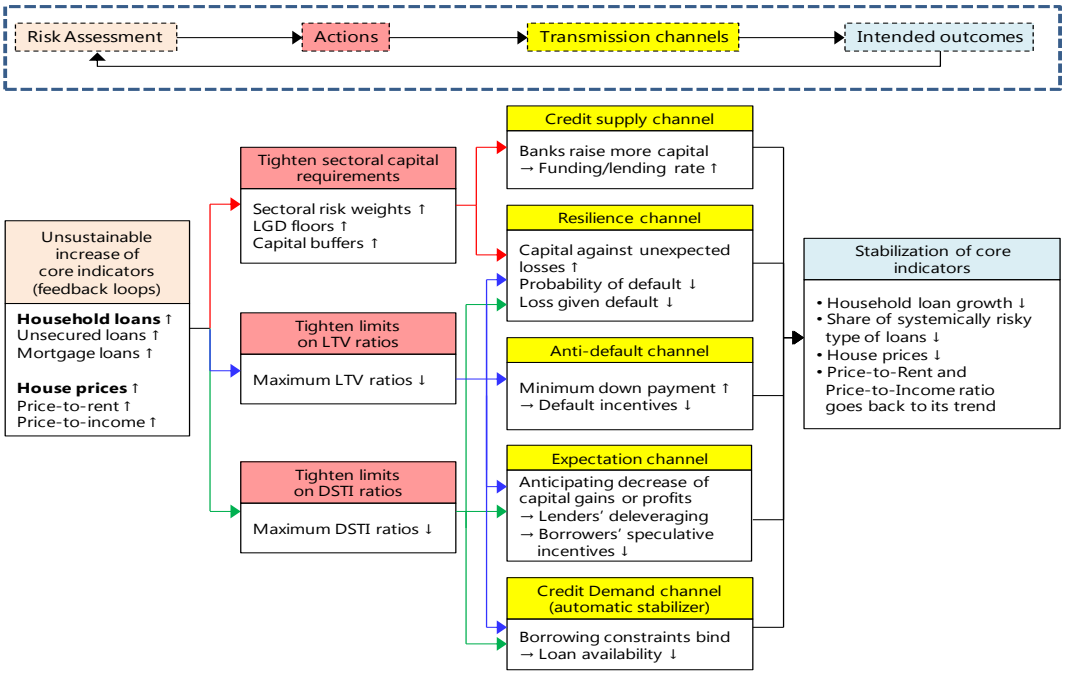
[45] For a broader discussion of key issues in the staff's advice on the use of macroprudential policy tools, see the main Staff Guidance Note on Macroprudential Policy.

[46] Increases in capital requirements should ideally be implemented under "Pillar 1" of the capital framework, thereby ensuring that it applies to all banks equally and is transparent to the market. An implementation under "Pillar 2" can be considered where the legal basis for variations in capital requirements is missing.

[47] Car loans with high LTV ratios became subject to higher risk weights in Argentina (2003) and Brazil (2010), and lower LTV limits were imposed in Hungary (2010). All the arguments on mortgage loans will be applicable to vehicle loans because they are secured loans.

50. Caps on DSTI ratios restrict the size of debt service payments to a fixed share of household incomes, thereby ensuring affordability. A close alternative is a cap on the loan-to-income (LTI) ratio which restricts the size of a loan to a fixed multiple of income.[48] These caps share several transmission channels with a limit on the LTV ratio, i.e., the credit demand, expectation, and resilience channel. However, there are some important differences. First, DSTI caps enhance borrowers' resilience to interest rate and income shocks, so that low DSTI lending is associated with lower delinquency rates and PD. Second, while limits on LTV ratios may become less binding and thus lose effectiveness through some channels with the increase of house prices (Kuttner and Shim, 2013), potentially requiring successive tightening, caps on DSTI ratios become more binding when house prices (and mortgage loans) grow faster than households' disposable income. As a result of this built-in automatic stabilizer feature, DSTI caps can smooth credit booms even without any time-varying element (credit demand channel: automatic stabilizer).

Figure 3. Transmission Mechanism of Three Sectoral Macroprudential Instruments



Source: IMF Staff.

51. Staff should be mindful of the potential for leakage of sectoral tools. Like other capital tools, the sectoral capital requirements aim in part at increasing the cost of extending credit by domestic banks. This can lead to arbitrage where loans are provided by domestic nonbanks, off-balance sheet vehicles, or foreign financial institutions. Therefore, capital tools are more effective at constraining credit in financial systems with few nonbanks, a broad scope of regulated entities, and

[48] Another variation is a cap on the debt-to-income (DTI) ratio that constrains the size of household debt to a fixed multiple of income. Whereas an LTI ratio covers a specific mortgage loan, a DTI ratio captures a broader range of household debts. Since the transmission of LTI, DTI, and DSTI caps are very similar, the remainder focuses on DSTI caps. Differences are pointed out as needed.

an effective consolidated supervision. In contrast, sectoral tools that target customers such as LTV and DSTI limits are in principle less subject to domestic leakage. Such borrower eligibility criteria can be applied to all *products* that are offered by any financial institution within a country and enforced on all regulated institutions by the relevant supervisory agencies, including on foreign branches as necessary. However, such customer regulation may entail other types of leakage, for instance toward unsecured or interest-only loans.

52. This note provides principles and lays out issues for considering advice on when and how to use these tools. It is based on cross-country experiences and evidence from research and policy papers. This guidance can facilitate staff's analysis of vulnerabilities and the development of policy recommendations. However, since the manifestations of systemic risk depend on country characteristics, staff will need to develop customized policy recommendations based on analysis of financial conditions in each country.

Box 1. Effectiveness of Sectoral Macroprudential Instruments

Higher sectoral capital requirements by definition increase resilience via additional buffers, but cross-country evidence of the effects on credit growth varies across countries. BoE (2014c) shows that, in Australia, an increase of risk weights on uninsured 'low-doc' mortgage loans (from 50 to 100 percent) was effective in limiting growth of the low-doc mortgage loans. IMF (2013b) shows that, in Brazil, higher capital requirements on new vehicle loans with high LTV ratios decreased the growth of the targeted segment of consumer loans. However, Crowe and others (2013) suggest that higher capital requirements on particular groups of mortgage loans have failed to stop a credit boom in countries like Bulgaria, Croatia, Estonia, and Ukraine. There are a number of reasons why higher capital requirements may be less effective in containing credit growth. First, when banks hold capital well above the regulatory minimum, lenders may not need to make any change in response to increases in risk weights. Second, when lenders compete intensely for market share, they may internalize the costs of higher capital requirements rather than imposing higher lending rates. This often happens during housing booms when policymakers hope the tool to be most effective.

Limits on LTV and DSTI ratios have been successful in targeting financial accelerator mechanisms that otherwise lead to a positive two-way feedback between credit growth and house price inflation. A number of studies have found that a tightening of LTV and DSTI ratios is associated with a decline in mortgage lending growth, thereby reducing the risk of an emergence of a housing bubble. Lim and others (2011) find that credit growth declines after limits on LTV and DSTI ratios are introduced, and the LTV limits reduce substantially the procyclicality of credit growth. Igan and Kang (2011) show that limits on LTV ratios curb speculative incentives among existing house owners, validating the expectation channel. Crowe and others (2013) confirm the positive association between LTV at origination and subsequent price appreciation using state-level data in the U.S.—a ten percentage point increase in maximum LTV ratio is associated with a 13 percent increase in nominal house prices. Duca and others (2011) estimate that a ten percentage point decrease in LTV ratio of mortgage loans for first-time buyers is associated with a ten percentage point decline in the house price appreciation rate. Krznar and Morsink (2014) finds that four measures to tighten macroprudential instruments (LTVs in particular) in Canada were associated with lower mortgage credit and house price growth. IMF (2011b) finds that lower LTV ratios reduce the transmission of real GDP growth shocks and shocks to population growth to house prices. Kuttner and Shim (2013) find that an incremental tightening in the DSTI ratios is associated with four to seven percentage point deceleration in credit growth over the following year. RBNZ (2014) suggests that a cap on the share of high LTV loans was effective, showing a dramatic fall in the share of mortgages over 80 percent LTV ratio since the introduction in August 2013. Ahuja and Nabar (2011) find that limits on LTV ratios reduced house prices and transaction volumes, albeit with a lag, in Hong Kong SAR,

Box 1. Effectiveness of Sectoral Macroprudential Instruments (concluded)

where monetary policy is constrained as a small open economy with exchange rate pegs.

A growing body of evidence points to the benefit of LTV and DSTI ratios in enhancing resilience and reducing fire-sale dynamics, when the housing market turns. Lee (2012) shows that housing prices in Korea fell from 2008, but the delinquency ratio on household loans remained below one percent well into 2012, and claims that this implies that strict implementation of limits on LTV and DSTI ratios prevented household defaults even as house prices fell, thus reducing financial institutions' losses. Financial Services Authority (2009) finds evidence of a correlation between higher LTV ratios and higher default rates during 2008 in the U.K. Hallissey and others (2014) find that, based on loan-level data in Ireland, the default rate was higher for loans with higher LTV and LTI levels at origination, and that this is relationship is stronger for the loans issued at the peak of the housing boom. They also show a positive relationship between LGD and LTV for loans with an LTV greater than 50 percent, with a sharp increase in the losses of defaulted loans at LTVs greater than 85 percent. Wong and others (2011) present cross-country evidence that, for a given fall in house prices (one percent), the incidence of mortgage default is higher for countries without a LTV ratio limit (1.29 basis points) than for those with such a tool (0.35 basis points). The paper also note that in the wake of the Asian financial crisis, property prices in Hong Kong SAR dropped by more than 40 percent from September 1997 to September 1998, but the mortgage delinquency ratio remained below 1.43 percent, which suggests that limits on LTV ratio reduced the probability of defaults faced by lenders.

B. Tightening—Indicators

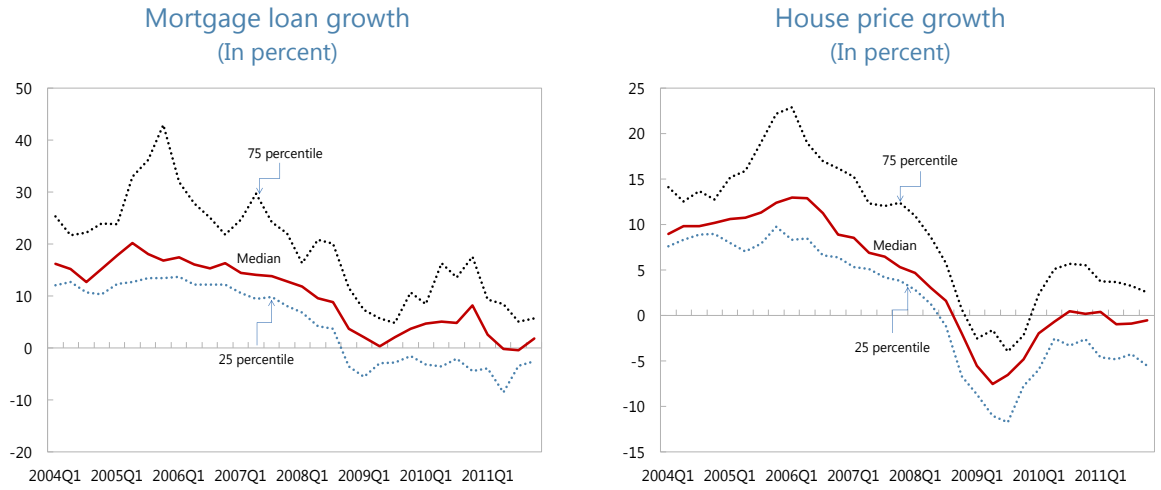
53. An in-depth analysis drawing on a wide range of indicators should inform the need for a policy response (Table 3). This needs to take into account that risks can increase in a specific type of household loans or in loans to a particular group of households. They can accumulate over a long time and materialize precipitously in a crisis. This suggests that the analysis should draw on macrofinancial aggregates, micro-level survey and supervisory data, slow-moving financial balance sheet information and fast-moving market data.

54. Among the indicators, household loan growth and house price growth should be considered as core indicators *jointly* because they together provide powerful signals for policy actions (Figure 4). During the upswing of a credit cycle, rising optimism often leads to loan demand by (risky) households to fund speculative house purchases and causes house price appreciation. This feeds back into further loan growth by easing existing home-owners' budget constraints. As they trade-up into pricier homes, this further fuels house price increases and credit growth. It is very difficult and costly to break this feedback loop once it is set in motion. Indeed, Crowe and others (2013) find empirically that housing booms often coincide with broad-based credit booms (in just over half of the cases in their sample). Almost all the countries with "twin booms" in real estate and credit markets ended up suffering a financial crisis or a severe contraction in GDP.

- **Core credit indicators.** Household (mortgage) loan growth and increases in the share of household loans to total credit should be collected and monitored on a regular basis, preferably monthly. For instance, in countries that had a recent banking crisis the median mortgage loan growth was 12–15 percent for three consecutive years before the global financial crisis, and peaked in the fourth quarter of 2006.

- **Core price indicators.** Staff should monitor three house price indicators: (real) house price growth, house price-to-income and house price-to-rent ratios. IMF (2011a) shows that house prices, on average, tend to rise by 10 to 12 percent up to two years before financial stress emerges. Deviations of house prices from long-term trends have proved useful in predicting financial stress (Borio and Drehmann, 2009). However, given difficulty in estimating equilibrium house prices, house price-to-rent (PRR) and house price-to-income ratio (PIR) are often used as simple measures for an indication of over- or undervaluation of house prices. The rationale is that house prices should rise in line with households' income, because a typical household will want to spend a constant portion of their income on housing; and that rents should be in line with house prices based on simple asset pricing models. A rise in these ratios above their long-term average can indicate that house prices may be exuberant. Igan and Loungani (2012) find from a sample of 55 AEs and EMEs that the larger the overvaluation in terms of the PIR was at end-2006, the larger the drop in house prices during the recent crisis. They also find that a parallel adjustment of the PRR and house prices had been under way in the U.S. by 2009. Staff can use three useful sources for these core price indicators: two IMF sources are the Global Housing Watch and the real estate market module developed by the Research Department, and the third is the BIS cross-country property price statistics.[49]

Figure 4. Mortgage Loans and House Prices around the Global Financial Crisis



Source: IMF staff calculation.

Note: The sample includes 18 countries that have been in a systemic banking crisis (Laeven and Valencia, 2012) and had at least two consecutive quarters of negative nominal house price growth during 2007–11, such as Belgium, Denmark, France, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Luxembourg, the Netherlands, Russia, Slovenia, Spain, Sweden, Ukraine, the U.K., and the U.S.

55. Besides the core indicators, a range of additional indicators are often required for practical policy discussions and recommendations on sectoral macroprudential instruments.

[49] The IMF launched the Global Housing Watch in June 2014 to track developments in housing markets around the world. The real estate market module is updated twice a year (January and June) by the Macro-Financial Unit (RES).

Where this information is already available to the authorities, staff should encourage them to share the relevant data, and where the authorities do not possess the information, staff should encourage them to collect and share it with the staff.

- **Additional credit indicators.** The share of household loans originated by banks and nonbanks and the growth in household loans provided by banks and nonbanks will be useful variables to assess the degree of regulatory arbitrage and to decide how wide the coverage of an instrument should be.

- **Additional price indicators.** House prices often exhibit a distinct spatial pattern in a country, rising in prime regions first and fast, and then spreading out over the rest of the country. House prices by region can be used to assess if a housing boom is country-wide or regional, which may help policymakers to design the details of sectoral macroprudential instruments.

- **Balance sheet indicators.** Both the average and the distribution of LTV ratios across new loans over a period (and existing loans at a certain point in time) should be assessed in order to implement LTV limits in practice. During housing booms, lending standards often appear to be easing in response to a fall in formal measures of risk and with the desire to maintain market share, leading to higher LTV ratios.[50] An increasing average LTV ratio on new loans suggests that more households are exposed to shocks to house prices. When the ratios are high, housing busts are deeper on average (IMF, 2011b). The distribution of LTV ratios can help gauge the impact of several potential values of the cap and decide on the appropriate thresholds in calibration. From lenders' balance sheets, policymakers need data on exposures to households (average risk weights on household loans)[51] and capital buffers above the minimum regulatory requirements in order to calibrate sectoral capital requirements and assess their effectiveness.

- **Affordability indicators.** Both the average DSTI ratio and its distribution across new borrowers over a period (and all borrowers at a certain point in time) should be calculated in order to implement DSTI caps in practice. Loose lending standards often result in higher DSTI ratios. A high and increasing average of DSTI ratios indicates that more borrowers are exposed to shocks to income and interest rates (Wolken, 2013). Not only the distribution of DSTI ratios across new borrowers but also across different income classes, especially low income groups, may give a good indication of increased vulnerability in the financial system. Drehmann and Juselius (2012) suggest that a persistent rise in the DSTI ratio above its 15-year trend provides an early warning of financial stresses around one year in advance. They also suggest that, as a broad rule of thumb, an aggregate DSTI ratio above 20–25 percent reliably signals the risk of a banking crisis in a global sample of countries. In addition, similar to the credit-to-GDP ratio and gap, staff can

[50] Manipulation of valuations can be an issue. Thus, it will be important to require third-party valuation(s) at the time residential mortgage loans are approved.

[51] It can be calculated by dividing risk weighted household loans to the total household loans.

calculate a household LTI ratio and a gap from a long-term trend, the so called household credit gap, which might serve as a potentially useful early warning indicator (Wolken, 2013).[52]

Table 3. LTV and DSTI: List of Core and Additional Indicators

Core indicators

- Household (mortgage) loan growth rate (m-o-m and y-o-y);
- Share of household (mortgage) loans to total credit;
- House price growth rate (real and nominal, m-o-m and y-o-y);
- House price-to-rent ratio (a gap from a long-term trend); and
- House price-to-disposable income ratio (a gap from a long-term trend).

Additional indicators

- House price growth rate by region and types of properties (real and nominal, m-o-m and y-o-y);
- LTV ratio (an average and a distribution across new loans over a period and existing loans at a given point in time);
- DSTI ratio (an average and a distribution across new borrowers (and different income classes) over a period and existing borrowers at a given point in time);
- LTI ratio (an average and a distribution across new borrowers (and different income classes) over a period and existing borrowers at a given point in time);
- Household credit gap (a gap between average LTI ratio and its long-term trend);
- Share of banks' and nonbanks' household loans (changes of the share over time);
- Exposures to household loans (average risk weights on household loans) and capital buffers above the minimum regulatory requirement; and
- Share of foreign-currency denominated loans or interest-only loans.

56. Since the signaling performance of each indicator is imperfect, multiple indicators should be analyzed and supported by judgment on the extent of systemic risk. Different indicators can send opposite signals, and any threshold has a cost in terms of Type I (failure to warn of a crisis) and Type II errors (false alarm).[53] Surveillance of systemic risk building up in the housing

[52] Many authorities calculate and publish the household LTI ratio with household credits and gross disposable income as the numerator and denominator, respectively. For instance, the data for European countries can be found in this link. To the estimate the gap, a trend can be extracted from the ratio by using the HP filter, outlined in the chapter on broad-based tools, taking into account its pitfalls. Staff is encouraged to analyze the signaling properties of the household credit gap estimated over different samples.

[53] Demirguc-Kunt and Detragiache (1999) suggest that if indicators are used as a preliminary screen to determine which cases warrant further analysis, a monitoring framework that tolerates a fair amount of Type II errors will be preferable to one that is likely to miss financial stresses and crises. Arregui and others (2013) note that policy

(continued)

sector should therefore monitor a wide range of indicators. Because of the complex nature of systemic risk there will always be considerable scope for judgment in policy decisions regarding sectoral macroprudential instruments.

57. The case for recommending macroprudential measures is strong when surveillance of several indicators signals elevated systemic risk. For example, IMF (2011a) shows that house prices and mortgage loans together form powerful signals of the build-up of systemic risks, predicting a crisis as early as two to four years in advance. Arregui and others (2013) find that the probability of a crisis increases nonlinearly when both credit and house prices are growing rapidly. Nonetheless, here again, surveillance of the case for action needs to rest on judgment, taking account of all relevant information.

58. A single signal, or mixed signals from multiple indicators, may not be sufficient for action. Surveillance needs to evaluate whether indicators are giving reliable signals and macroprudential measures are the appropriate response. A strong growth of residential mortgage loans without house price growth, for example, may indicate signs of improvement of housing penetration and elastic supply responses to increases in demand, reducing the need for macroprudential intervention. Conversely, house prices may increase rapidly even without strong mortgage loan growth, when a country experiences a temporary or chronic shortage of housing supply. The latter example is one where structural measures to boost the supply of land and housing can be more effective than sectoral macroprudential tools. Nevertheless, since relieving supply constraints can take time, use of macroprudential tools can also be warranted to contain increases in leverage as a result of rising prices.

59. When several indicators show signs of a gradual build-up of risk in the household sector, staff can suggest a gradual policy response. Policymakers should be advised to monitor the development of indicators closely, intensify supervisory scrutiny, and step up communication to inform of the potential for systemic risk. Moreover, the authorities may want to issue supervisory guidance as a prior step to introducing macroprudential measures and should be ready to take further action when these steps are exhausted.

60. Staff should encourage the establishment of the legal and operational basis for sectoral macroprudential tools even when vulnerabilities appear contained. This precaution is needed as risks can build-up rapidly, but implementing new tools takes time. In addition, some sectoral macroprudential tools may require prior political debate, support, and changes in legislation.[54] When the legal and operational basis for the tools has not been established ahead of

mistakes, especially when policy over-reacts to Type II errors (false alarm), could be very costly in principle, but so far, these costs have been estimated to be very modest for the U.S.

[54] For instance, the BoE had been cautious about using limits on LTV and LTI ratios, as the former Governor, Mr. Mervyn King, asserted in an oral evidence that there should be a very clear public decision to be willing to accept the consequences (U.K. Parliament, 2013). When the chancellor of the exchequer of the U.K. announced political support for the use of these tools on June 12, 2014, Mr. Mark Carney, the Governor of the BoE, applauded the decision, stressing that there was an acute need for macroprudential activism and vigilance in the housing market.

time, policymakers may be unable to react in a timely manner to contain risks when they are building up, especially when they have strong distributional impacts, and can therefore be subject to political economy constraints. Prior development of tools, including legislation, can also reduce political interference at the time of deployment of the instruments.

61. Surveillance of housing risks also needs to take into account country-specific circumstances. In some countries, the legal underpinnings of mortgage contracts, such as full recourse for the lender, deter households' incentives to default strategically.[55] Lenders' rights to seize assets beyond collateral or to have a quick out-of-court transfer of the title of collateral can reduce probability of default and the need for macroprudential instruments.[56] If strong housing demand and house price growth are financed directly by foreign cash inflows (bypassing domestic credit intermediation), it can be difficult to contain house price growth using sectoral macroprudential tools. In such cases, a higher stamp duty or capital gains tax may have a role to play, as in Hong Kong SAR and Singapore.[57]

C. Design and Selection: Use of Multiple and Tailor-Made Tools

62. Combining different sectoral tools can help lessen the shortcomings of any single tool and enable policymakers to use several transmission channels at the same time, thereby promoting effectiveness of policy responses.

- Limits on LTV and DSTI ratios can complement each other in dampening the cyclicality of mortgage loan demand. They also can enhance resilience to house price shocks and to income and interest rate shocks, respectively. In addition, DSTI caps enhance the effectiveness of LTV limits in addressing excessive credit growth by restricting the use of unsecured loans to attain the minimum down payment.[58]

- Higher capital requirements reduce banks' exposure to risky segment(s) of household loans and increase resilience. After the global financial crisis, many countries started to use a mix of these sectoral measures (e.g., Norway, Israel, India, and Hong Kong SAR). In some cases, their design was also interlinked (e.g., sectoral capital requirements on higher LTV loans) (see Box 5).

[55] In many countries, such as Australia, France, and the Netherlands, mortgage lenders have full recourse against borrowers who default on their loans. In Brazil, a chattel mortgage (full recourse) is a security over other collateral held by a lender, giving the lender recourse against the collateral in the event of default by a borrower.

[56] Ghent and Kudlyak (2010) empirically find with U.S. state-level data that recourse decreases the probability of default when there is a substantial likelihood that a borrower has negative home equity.

[57] IMF (2012a) shows the stamp duty in Singapore was effective at reducing demand from foreigners, who were outside of LTV and DSTI regulatory perimeters, as evidenced by the sharp drop in foreign buyers' share of private residential properties in the first quarter of 2012.

[58] Hallissey and others (2014) find that in Ireland, although there is a strong positive relationship between the LTV and LTI ratio at origination in general, there is a large variation of LTI ratios for loans with high LTV ratios (80–90 percent). They argue that, since a large proportion of risky lending is in this LTV region, a combination of both tools is required to promote effectiveness.

- When interest rates are kept low to support the real economy, this lowers DSTI ratios, which could lead to risk taking and excessive increases in leverage. In this case, policymakers can impose stressed DSTI caps instead where lenders must pass an affordability test based on a higher, "stressed" interest rate. For example, in Hong Kong SAR this test assumed a 300 basis point interest rate hike.[59] They can also introduce caps on LTI ratios in tandem with caps on LTV and/or DSTI ratios (e.g., Norway and the U.K.). By definition, caps on LTI ratios can restrict the size of secured loans to a fixed multiple of household incomes, thereby containing the build-up of excessive leverage.

63. Tool can be targeted at the riskier segments of household loans, while seeking to minimize distortions. Sectoral capital requirements are imposed on lenders' balance sheets are generally less distortionary, since they tend to work through the price of credit. However, they are often less effective in constraining excessive credit growth than tools that work on the demand side, such as caps on LTV and DSTI ratios. A drawback of these caps, however, is that they may disproportionately affect first-time home buyers and low-income households. Facing these trade-offs, policymakers can tailor the measures.

- **Differentiated limits by borrowers.** In Israel and Singapore, lower LTV limits for those with more than one outstanding mortgage loan are applied to target speculators without affecting first-time home buyers.

- **Differentiated limits by regions.** Tailored limits on LTV and/or DSTI ratios may be used to focus on a particular region where house price appreciation is deemed risky. The Malaysian authorities apply lower LTV limits for luxury properties, and Korean authorities apply different LTV and DSTI caps if the associated property is located in a speculative zone.[60]

- **Caps on lenders' exposures.** LTV limits can screen out borrowers with little equity but good debt service capacity. Caps on lenders exposure to particular types of borrowers, such as caps on the exposure to high LTV ratio loans (as introduced in New Zealand) or a cap on the share of lenders' exposure to high LTI ratio loans (as introduced in the U.K.), can strike a balance, since they do not prohibit, but only constrain the provision of such credit.

64. The more targeted a measure, the more efficient its effect, but the more information is required for its effective enforcement. For instance, detailed information is needed on individual household income, mortgage loans, and house prices—preferably at a regional level. In addition,

[59] The Hong Kong Monetary Authority imposed stressed DSTI caps, based on 300 basis points interest rate hike. The stressed DSTI caps are 50 (60) percent for loans to borrowers with (without) outstanding mortgage loans, while base DSTI caps are 40 (50) percent.

[60] A region is designated as a 'speculative' zone if the following two criteria are satisfied: (a) monthly nominal house price index (HPI) rose more than 1.3 times nation-wide inflation rate (CPI) in the previous month, and (b) either a previous two-month average of the regional HPI growth rate (y-o-y) was 1.3 times higher than the two-month average of the nation-wide HPI growth rate (y-o-y), or the twelve-month average of the regional HPI growth rate (y-o-y) was higher than the twelve-month average of the nation-wide HPI growth rate (y-o-y) in the last three years.

credit registers will be needed to provide information on pre-existing secured and unsecured loans, enabling the LTV and DSTI ratios to be accurately computed.[61]

65. Sectoral macroprudential tools can target systemically important household loan products, such as interest-only and foreign exchange loans. Country experiences suggest that exposures of household sectors to disruptive risks, including sharp changes in interest rates and exchange rates, tend to increase in the run-up to crises as lending standards fall and the terms of financial contracts change. The increased prevalence ahead of the crisis of interest-only and adjustable-rate mortgage loans (e.g., in the U.S.) and of foreign currency denominated or indexed mortgage loans (e.g., in Central, Eastern, and Southeastern Europe (CESEE)) are prominent examples (Box 2).[62]

66. Staff and the authorities should examine risks from such products, and develop measures to target them. This can include imposing tighter LTV and DSTI limits or risk weights for interest-only or foreign currency loans (e.g., as in Poland). Furthermore, policymakers can adopt additional measures if necessary. For example, Canada and Israel implemented limits on amortization periods and exposure caps on variable-rate loans, respectively, to reduce risks from borrower exposures to rising interest rates. In Israel, the variable-rate component of mortgage loans is limited to a third of the loans since May 2011. Hungary imposed a ban on foreign currency denominated mortgage loans (August 2010–May 2011).

67. Staff should also bear in mind that sectoral tools can create unintended consequences. For instance, tighter restrictions on high LTV and DSTI ratio loans can lead borrowers towards riskier forms of loans. This should be dealt with by adjusting existing measures, changing their design in appropriate ways, or complementing existing tools with further well-designed measures.

- First, responding to limits on LTV ratios, lenders may choose to offer unsecured loans to compensate for lower credit availability against the collateral value. Sveriges Riksbank (2012) shows that the use of unsecured loans indeed increased following the introduction of limits on LTV ratio (85 percent), although from low levels.

- Second, where DSTI limits are in place, this can give rise to increased prevalence of interest-only mortgage loans. This issue led to these loans to be disallowed (Singapore) or subjected to tighter regulation (Korea and Netherlands). However, appropriate design is important. Crowe

[61] In most countries with official LTV limits, the size of a mortgage loan or the sum of mortgage loans (if multiple) cannot be above a specified percentage of the appraised value of a property. An underwriter collects information related to the property from both the borrower and credit bureau(s) and runs a credit analysis in order to access the eligibility prior to the granting of a loan. In this process, the underwriter will examine if there are other senior loans that are attached to the property and calculate the loanable amount given the limits.

[62] From 2003 to 2007, there was a sudden switch from fixed-rate mortgage loans to adjustable-rate mortgage loans in the Alt-A and subprime mortgage markets of the U.S., increasing borrowers' interest rate risk exposure (Sengupta, 2010).

and others (2013) provide an example that, in Korea, tighter LTV limits for interest-only bullet loans with less than three years of maturity spurred a boom in the same type of loans originated with maturity of three years and one day.

- Third, more generally, a longer amortization period can be a way to avoid tighter DSTI restrictions. To fill this loophole, in Canada, the allowable maximum amortization period has been reduced for insured mortgage loans from 40 to 35 years in 2008, 35 to 30 years in 2011, and 30 to 25 years in 2012, which is equivalent to tightening DSTI caps (TD Economics, 2012).

Box 2. Systemic Risk from FX Mortgage Lending: CESEE Experience

Ahead of the global financial crisis, FX lending in CESEE and Latin America increased markedly (IMF, 2013a)**.** Interest rates on foreign exchange (FX) loans were much lower than those in domestic currency, which strongly incentivized households to borrow in FX without factoring in depreciation risks. For instance, the share of FX household loans in total household loans in Hungary reached around 60 percent in 2008 up from around five percent in 2004; Romania and Poland reached a similarly high share of FX mortgage loans.

Large unhedged FX exposures are significant sources of systemic risk, and can create negative externalities. At the outbreak of the crisis, some countries in the CESEE experienced a sudden stop and large currency depreciation. FX loans posed systemic risk due to the declining repayment ability of unhedged borrowers, increasing the probability of default and generating large losses in the banking system. Lending standards were tightened, the supply of new loans evaporated, and house prices fell sharply. The house price fall depleted the balance sheets of borrowers and lenders even further and intensified the downward spiral. Between 2008 and 2013 the Hungarian forint depreciated by 65 percent against the Swiss franc and 25 percent against the euro increasing the cost of servicing FX loans. Households experienced a further increase of their debt burdens as banks increased interest rates on Swiss franc and euro-denominated loans. NPLs on FX household loans (mostly in Swiss francs and euros) rose from less than 1 percent to around 21 percent and NPLs on domestic currency household loans went up from 1 percent to 13 percent through 2013.

Across CESEE countries, policymakers addressed the risks from FX loans in various ways. In Serbia, a 50 percent risk weight was applied to local currency mortgage loans, 75 percent to FX mortgage loans to unhedged borrowers and 125 percent to other FX loans to unhedged borrowers in 2008.[1] In Poland, higher risk-weights on FX mortgages were introduced in 2008, and stricter caps on DSTI ratios were imposed on FX mortgage loans in 2010. These measures were tightened in late 2011 through amending the so-called "Recommendation S." Hungary imposed maximum limits on LTV and DSTI ratios on new FX mortgage loans in June 2010, and banned FX mortgage lending altogether in August 2010. The ban was lifted under very tight credit conditions in mid-2011. Romania tightened caps on DSTI ratios for households in 2008–09, and applied differentiated LTV limits by currency.

1/ When Serbia moved to Basel II in 2012, the National Bank of Serbia adjusted risk weights to the following: 35 percent for all mortgage loans and 100 percent for almost all other loans including nonmortgage loans to households irrespective of the FX mismatch.

68. Sectoral macroprudential tools can also be imposed on unsecured household loans. Because lenders take a greater loss given default on unsecured lending, these loans are generally associated with higher interest rates than secured ones. Historically, a proliferation of unsecured consumer loans has resulted in systemic financial risk in a number of cases. Where risks are assessed

as high, increases in unsecured lending can be contained by sectoral tools, such as higher risk weights, DSTI limits, or exposure caps (Box 3).

Box 3. Macroprudential Instruments on Unsecured Household Loans

Sectoral macroprudential tools can be imposed on unsecured household loans. Unsecured loans, such as personal signature loan and credit card loan, can be acquired by households without collateral. Because lenders take a greater loss given default, the loans are generally associated with higher interest rates than secured ones. Historically, a proliferation of unsecured household loans has resulted in systemic financial risk in a number of cases. The credit card crises in Korea (2002–03) and in Mexico (2008) provide good examples. On the other hand, when limits on LTV ratios are imposed only on mortgage loans, lenders may top up with additional unsecured lending above the regulated level in order to circumvent the measures, reducing their effectiveness.

Staff and the authorities can use similar core and additional indicators as recommended for secured loans. They need to monitor the growth rate of unsecured loans, the share of unsecured loans to total household loans, and DSTI ratios on unsecured loans.

Where risks are assessed as high, increases in unsecured lending can be contained by sectoral tools, such as higher risk weights, DSTI limits, or exposure caps. In several countries, e.g., Brazil (2010), Korea (2002), Mexico (2011), and Russia (2013), higher risk weights or (loan loss provisioning) were applied to unsecured loans. In the United Arab Emirates (2011) and Canada (2012), caps on DSTI ratios were imposed on a borrower's total outstanding household debt rather than on mortgage loans only. In August 2005, the Romanian authorities introduced a maximum DSTI ratio of 40 percent covering the sum of all household loans in addition to the monthly maximum DSTI ratio of 30 and 35 percent on consumer credit and mortgage loans. Recently, the Turkish authorities introduced and tightened several tools on credit card debts, such as through higher risk weights on longer-term installments of credit cards (e.g., risk weights on credit card loans with over 12 month installments were raised from 200 to 250 percent), higher monthly minimum payment requirements, and caps on credit limits for new credit card holders (200 percent of monthly income in the first year and 400 percent in the following years).

69. 'Demand-side' sectoral tools can be complemented with housing supply measures.[63] Places with elastic housing supply have fewer and shorter bubbles with smaller price increases (Glaeser, Gyourko, and Saiz, 2008). Craig and Hua (2011) find that land supply is the second most important factor driving long-run residential property price movements in Hong Kong SAR, following real GDP per capita. Policymakers often focus on demand-side instruments, since supply-side measures operate at a greater lag and are not easily reversed. But, as long as mismatches between housing supply and demand remain, the effectiveness of demand-focused instruments can face limitations since they will be subject to strong incentives for circumvention. This issue has arisen in a number of countries, including Israel, Hong Kong, and Sweden, and staff may consider the scope for measures to relieve supply constraints to be taken alongside macroprudential tools.

[63] Housing supply can be increased by streamlining construction licensing procedures, changing tax policy on undeveloped land, and easing planning and zoning restrictions. For instance, the latter can be done by removing constraints on brownfield developments.

70. Removing fiscal distortions can help reduce systemic vulnerability in housing markets. Favorable tax incentives for owner-occupied housing (e.g., mortgage interest deductibility) can make households more vulnerable to economic and financial downturns, as they are encouraged to leverage against housing assets, to invest in non-housing assets or finance immediate consumption. Therefore, where this is viewed as contributing to a buildup of systemic risk staff should recommend phasing out mortgage interest relief, as has been done in the U.K. and the Netherlands (for interest-only loans) and was recently recommended in Sweden and Switzerland.

71. Active use of fiscal measures (such as stamp duties) can also contribute to reducing risks. Stamp duties and capital gains taxes can be used to cool down sharply rising house prices (e.g., Hong Kong SAR and Singapore). These can be useful especially when house price increases are in part due to capital inflows that bypass domestic intermediation, but which can still increase the systemic risk of a property price correction for the domestic system. IMF (2012a) shows that the stamp duty in Singapore was effective at reducing demand from foreigners, who were outside the LTV and DSTI regulatory perimeter, and stabilizing housing prices, as evidenced by the sharp drop in foreign buyers' share of private residential properties in the first quarter of 2012.[64] However, the timing of these measures is important and their effective use will often require close coordination between the macroprudential and fiscal authorities.

D. Tightening: Gradualism

72. Policymakers should take a gradual approach when they tighten sectoral macroprudential instruments. This can help overcome uncertainty over the strength of transmission of policy actions, reduce the burden on lenders and borrowers, and enhance the strength of the expectation channel. In sequence, less distortionary sectoral capital requirements may be tightened as a first defense to build additional buffers (e.g., risk weights on residential mortgage loans from 50 to a higher number, such as 100).[65] Tightening of limits on LTV and/or DSTI ratios can follow if the first defense proves insufficient to meet the policy objectives. For instance, if the existing caps on the LTV and DSTI ratio are 80 percent and 40 percent respectively, they can be tightened further, as necessary (See Figure 5 for LTV and DSTI ratio ranges across countries).[66, 67] As

[64] In Singapore, an additional buyer's stamp duty on residential property purchases was imposed on top of the existing three percent buyer's stamp duty in December 2011, at the rate of ten percent for foreigners and corporate entities, three percent for permanent residents buying the second or subsequent property, three percent for Singapore citizens buying their third or subsequent property. In January 2013, the duty rate was raised again: Foreigners and corporate entities are subject to fifteen percent, and permanent residents purchasing their second and subsequent properties and Singaporeans purchasing their third and subsequent properties have to pay ten percent of the duty. Permanent residents purchasing their first property and Singaporeans purchasing their second residential property are subject to five and seven percent of stamp duty, respectively. Because of differentiated tax rates on the basis of residency, the buyer's stamp duty rates in Singapore can be considered as a capital flow management measure.

[65] Under Basel II's standard approach, risk weights for residential mortgage loans are 50 percent.

[66] Observed maximum LTV ratios are below 80 percent in more than half of 51 sample countries, and Crowe and others (2013) show that a typical mortgage loan carries a LTV ratio of 71 percent across a global sample of countries.

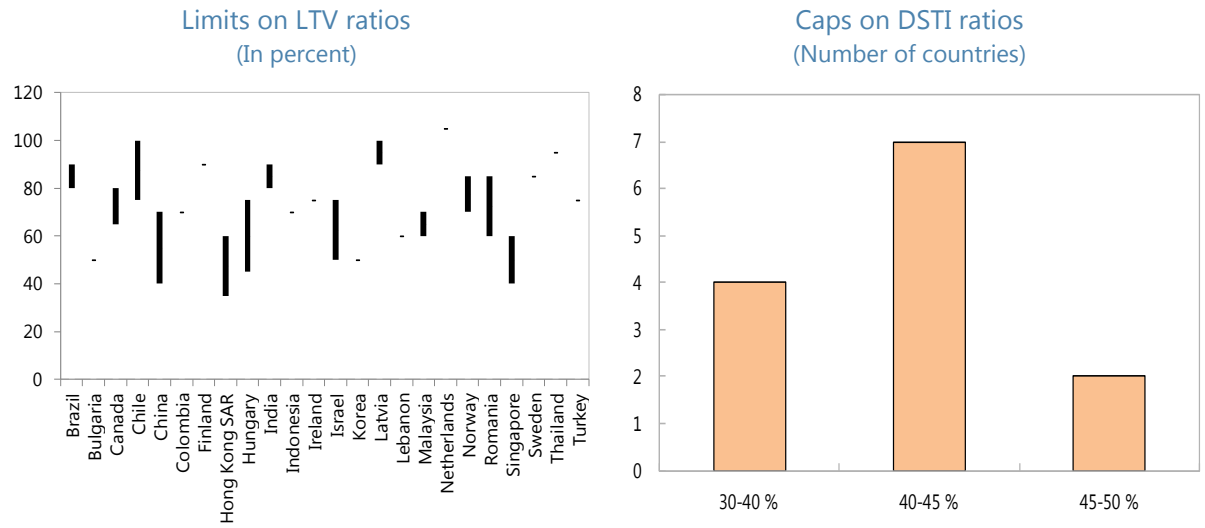
mentioned above, DSTI caps can smooth housing booms even without any time-varying element, because the measure has a built-in automatic stabilizer: the caps become more binding when house prices and mortgage loans increase faster than households' disposable income.

73. Limits on LTV and DSTI ratios should always be imposed on the flow of new household loans, while sectoral capital requirements can be applied either to the outstanding stock of exposures or to new lending. If the main objective is to enhance lenders' resilience, sectoral capital requirements can be applied to the whole stock of exposures to households. But, if new household loans are judged as riskier than the average existing household loans and the objective is to contain the growth of these loans, sectoral capital requirements can be applied only on loans granted after a specific point in time. The drawback of this approach is that it may be cumbersome to keep track of different sectoral capital requirements (on the stock and the new flow). On the other hand, this reduces adjustment costs for lenders, allowing a tighter calibration with a greater effect on lenders' incentives to lend (BoE, 2014c). By contrast, LTV and DSTI measures should always be imposed on new loans. If authorities sought to impose them on the stock and apply them over the lifetime of the loan, a fall in house prices or disposable income would force some existing high-LTV and high-DSTI borrowers to provide more collateral or repay part of their loans, precipitating the distress the measures seek to protect against. (Note that observed LTV on existing loans will likely diminish over time as the outstanding loans are amortized, thus becoming less risky with time, except in cases of sharp property price declines).[68]

[67] Most countries with caps on DSTI ratios have imposed 40–45 percent as the limit (seven out of 13 countries), and four countries restrict it to be below 35 percent.

[68] A tightening of limits on LTV and DSTI ratios can also be applied to refinancing of mortgage loans without this putting undue pressures on borrowers where most loans are at least partially amortizing. When house prices increase and the principal of a loan is paid down over an amortization period, ceteris paribus, LTV and DSTI ratios on a loan balance that is refinanced will fall over time. Thus, gradual tightening of measures need not bring about significant adjustment costs to most refinancing borrowers. The U.K. authorities will include refinanced loans with an increase in principal when they calculate a cap on the share of lenders' exposure to high LTI ratio loans (BoE, 2014a), and the Canadian authorities tightened LTV limits on refinanced mortgages three times (95→90→85→80 percent) during 2010–12 (Krznar and Morsink, 2014).

Figure 5. Limits on LTV and DSTI Ratios and Number of Countries at Each Range



Source: IMF staff calculation.

74. Policymakers should communicate their actions clearly and carefully. They need to explain the source of systemic risk, which sectoral macroprudential instruments are chosen, how the instruments are expected to mitigate the risk, and which further action(s) may follow should the effects fall short. In general, such communication would enhance the effectiveness of instruments via the expectation channel. However, ex-ante communication may also invite frontloading of activity and lobbying. The problem of frontloading can be particularly challenging when instruments are applied to the flow of new credit (ESRB, 2014; BoE, 2014c).[69] On the other hand, when sectoral capital requirements target the stock of lenders' exposures, they may require significant adjustment, and may therefore need to be announced well ahead of the planned enforcement date.

75. Once tools are put in place, their effects should be monitored closely and settings adjusted as needed. Additional analytical techniques can be used, such as stress tests, to examine whether the tools have brought about the desired effects on resilience of the financial system (Wong and others, 2014).

E. Loosening Housing Measures

76. Housing busts often result in banking crises and severe recessions (IMF, 2011b)**.** Reinhart and Rogoff (2009) find that the majority of banking crises in advanced and emerging market economies were associated with housing busts. Claessens, Kose, and Terrones (2011) show that recessions linked to financial stresses are much deeper and longer than regular ones: a typical credit and house price downturn episode corresponds to about six to seven percent decline in

[69] For LTV constraints, the effect can be mitigated where the constraint applies to refinancing, or typical maturities are short, so that borrowers expect to have to refinance their loans at tighter future ratios. In these cases an announcement of a plan to reduce LTV ratios can lead borrowers to internalize the future constraint.

economic activity for 18 quarters, while a typical decline in output is only about 2.5 percent and lasts for four quarters.

77. These developments can be driven by feedback loops between falls in credit and house prices. A housing bust can result in a broad credit crunch that puts further downward pressure on house prices. Externalities arise, analogous to boom periods, but work in reverse: lenders and borrowers do not internalize the social cost of their actions, such as strategic defaults, foreclosures, and fire sales, which can create negative externalities beyond the parties involved in financial contracts (IMF, 2011b; Geanakopolos, 2009; and Shleifer and Vishny, 2011). When house prices fall, existing homeowners' equity erodes, preventing them from refinancing at prevailing LTV ratios or moving house, and putting negative pressure on transactions and house prices. When these borrowers are "under water," they may also choose to default strategically on their mortgage depending on the legal regime. Following defaults, lenders will foreclose on and sell related properties, again depressing prices. These developments are often exacerbated when lenders tighten lending standards for new loans or refinancing, thereby reducing demand for properties. Lower asset prices can further weaken the balance sheets of borrowers and lenders, and banks may be forced to sell their assets at fire-sale prices and shrink credit provision to the economy at large.

78. Macroprudential tools can be loosened to contain these feedback loops (Figure 6). A relaxation of sectoral macroprudential tools can be used to target various links of the feedback loops.

- Loosening sectoral capital requirements can alleviate pressure on the balance sheets of lenders, attenuating their desire to deleverage or to cut back on credit provision (link 1).

- A relaxation of LTV limits loosens constraints for existing borrowers and might help boost refinancing activity and transactions. When a greater share of existing borrowers is able to refinance their mortgage loans, this can also reduce strategic default incentives in housing markets where that is a factor (link 2). Some potential new homebuyers who would face binding budget constraints under previous limits may also become eligible for new mortgage loans, thus potentially increasing transaction volumes (link 3).

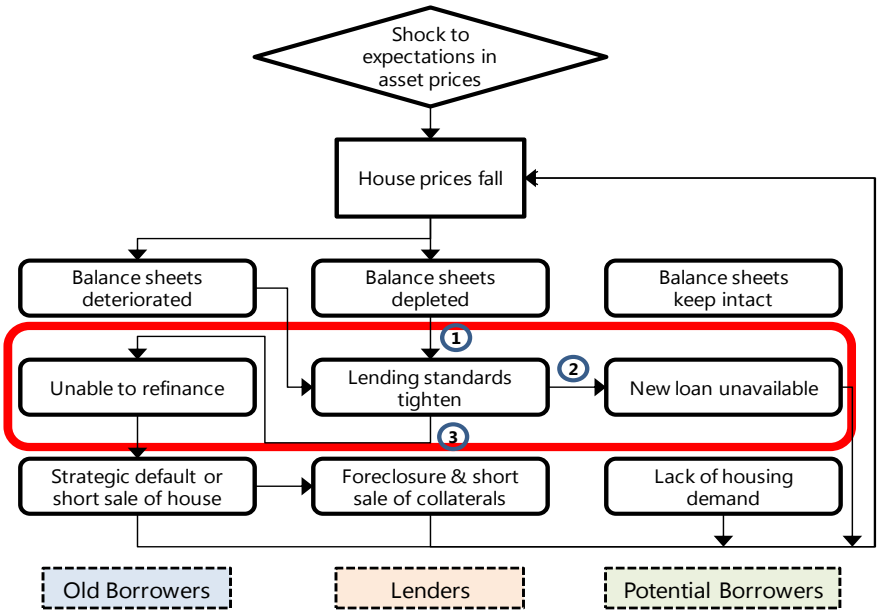
- If DSTI caps have been tightened beyond prudential minima during the boom phase, a loosening of the DSTI cap can make more potential homebuyers eligible for new mortgage loans, drawing these borrowers into the housing market and thus bolstering housing demand (link 3). However, an existing DSTI cap may also become less binding when house prices and the size of mortgage loans decrease faster than disposable income, so that some effect can be expected even without time-varying elements.

A relaxation of these tools may have limited effects when it is "pushing on a string." It may be harder to spur credit supply in downturns than to restrain it in upturns. Potential borrowers may be reluctant to enter the housing market while prices are still falling. Even if policymakers loosen sectoral instruments, lenders may be reluctant to provide credit due to increased risk aversion or capital considerations and may apply more stringent lending standards than the regulatory

thresholds. Where extra buffers were built up in good times, the relaxation could be more effective during the downturn.

79. A loosening of sectoral tools can potentially be effective, although the evidence so far is based on a very limited sample of events. IMF (2013a) assesses whether the effect of sectoral macroprudential instruments are symmetric or asymmetric in a cross-country panel. The study finds that the size of the effects on credit from a tightening and from a loosening are similar in magnitude, even though the effect of a tightening of LTV limits on house prices appears somewhat stronger than that of a loosening. Similarly, Igan and Kang (2011) show that the response of house prices was less visible when LTV and DSTI caps were loosened in Korea, but that a loosening and tightening of DSTI limits had symmetric impacts on mortgage loans. However, for both studies, the number of tightening events is far greater than that of loosening events (Box 4). This is a key limitation for the empirical analysis to date, since few instances of loosening will reduce the power of any test. Therefore, the results of the available research need to be interpreted with caution.

Figure 6. Where to Break Feedback Loops with Relaxation of Sectoral Tools



Source: IMF.

80. Several indicators that inform the tightening phase can also be used for decisions to relax. This includes notably the growth rate of new loans and changes in house prices. In addition, some fast-moving indicators can be useful for release decisions, e.g., transaction volumes, spreads on household loans and credit default swap (CDS) spreads of financial institutions.[70]

[70] High-frequency and market-based indicators may detect the materialization of financial stresses and can help prepare policymakers to respond to the stresses several months in advance (Blancher and others, 2013).

- **House prices.** A fall in house prices can be a useful early warning indicator of stress in housing markets. In an analysis conducted for this guidance note, we find for a sample of 54 countries that house prices started to decline about a year (sometimes three quarters) ahead of 60 percent of the banking crises in our sample.[71] Drehmann and Juselius (2013) also show that house price growth turns negative approximately a year before a crisis. However, a downturn of house prices alone may not be sufficient for the loosening of sectoral tools.

- **Credit growth.** A fall in house prices accompanied by a sharp decline in mortgage loan growth can be a strong indication that feedback mechanisms have started, which would justify the relaxation of macroprudential tools. Prior to the global financial crisis, the growth rate of mortgage loans started to decline from the fourth quarter of 2006. The median growth rate across eighteen crisis countries dropped from 15.4 percent to 10 percent at end-2007, and fell further to 3.7 percent by end-2008.[72] Giese and others (2014) note that the credit growth rate provides a more timely signal than gap variables in identifying turning and release points of credit cycles and sectoral tools, respectively.[73] Staff should also be aware that the stock of total household loans may not fall as much at the beginning of crises because households draw down existing credit lines. Thus, it will be useful to monitor changes of both types of loan origination.

- **Other market prices.** As Shin (2013) stresses, spreads on household loans, CDS spreads of financial institutions, and stock prices may be good early warning indicators of stresses, indicating the need for a loosening of sectoral tools, since the spreads tend to increase and stock prices decrease rapidly when financial conditions tighten during a downturn.

- **Resilience of lenders.** Information on lenders' resilience is also useful when deciding to loosen sectoral capital requirements. If lenders' balance sheets are resilient, their funding spreads would remain low and stock prices not fall markedly upon the relaxation of capital requirements.

81. There is merit in taking a sequential approach when loosening sectoral instruments, but successive decisions may need to be taken more rapidly than ones in tightening phases. There are arguments for loosening sectoral capital requirements first, to boost credit and help lenders absorb losses, and to loosen LTV and DSTI ratios only as needed and again in steps, moving away gradually from the calibration adopted in the boom phase. However, in a severe downturn, authorities may need to loosen these instruments simultaneously to break the vicious feedback

[71] Data sources for banking crises and real house prices are Laeven and Valencia (2012) and the real estate market module, respectively.

[72] The crisis countries include Austria, Belgium, Denmark, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Luxembourg, Netherlands, Portugal, Russia, Slovenia, Spain, Sweden, Switzerland, Ukraine, the U.K., and the U.S.

[73] Credit-to-GDP ratios and gaps may be slow to decline once crises materialize. A fall of GDP growth may lead to an increase in the ratio and the stock of household loans may not fall immediately because they may have undrawn credit lines available.

decisively, since relaxation of the latter tools can have more powerful effects on credit growth and in supporting prices.

82. The relaxation needs to respect prudential minima that can guarantee an appropriate degree of resilience against future shocks. If a large additional buffer has been built up during the tightening phases, this can be released safely to avoid a credit crunch without unduly jeopardizing lenders' resilience. However, the relaxation should not go beyond levels that are considered safe through downturn conditions, which thereby serve as a permanent floor.

83. Staff should encourage the authorities to define a maximum LTV and a maximum DSTI ratio that is considered safe in downturn conditions (perhaps not higher than 85 percent and 45 percent, respectively). This can then provide policy space for a tightening of these measures, as risks are building up, and for a relaxation in periods of stress. Policymakers should also communicate the idea that a tightening can be followed by a relaxation, so that market participants do not take an adverse view of relaxation of prudential measures during a downturn (CGFS, 2012).

84. Sectoral macroprudential tools should not be used to manage aggregate demand (IMF, 2013d)**.** When negative shocks cause an economic downturn without this resulting in adverse financial feedback effects, other countercyclical tools (monetary and/or fiscal policies) should be used to manage aggregate demand, thereby keeping macroprudential tools focused on systemic financial stability. Assigning macroprudential policies a primary role in managing aggregate demand is likely to overburden them, with the key risk that policymakers overestimate what they can achieve and underestimate the distortions that are created by their overactive use.

Box 4. Experiences of Relaxation of Macroprudential Instruments

Cross-country experiences suggest that loosening events tend to occur from 2008, when there was financial stress in many countries as a result of the global financial crisis. Out of 35 instances of relaxation of macroprudential instruments on mortgage loans since 2001, more than half occurred after the recent crisis. For instance, limits on LTV ratios were loosened in China, Denmark, Iceland, Korea, Latvia, Luxemburg, Serbia, and Thailand, and caps on DSTI ratios were relaxed three times in Korea (2008, 2010, and 2012).

Number of Macroprudential Measures–Tightening or Loosening (2008–13)

	Tightening	Loosening
Capital requirements	19 (39)	7 (12)
Limits on LTV ratios	54 (76)	9 (19)
Caps on DSTI ratios	14 (26)	3 (4)
Total	87 (141)	19 (35)

Note: Data in Kuttner and Shim (2013) and Lim and others (2013) are combined by IMF staff. Table shows tightening and loosening of three sectoral tools over 2008–13 and 2001–13 (in parenthesis).

F. Addressing Leakages

85. Policymakers need to monitor vigilantly if credit provision moves toward nonbank entities or foreign entities, and should expand the regulatory perimeter if necessary. If sectoral

tools apply only to the domestic banking sector, this can lead to increased provision of credit by foreign banks or domestic nonbanks, and increase incentives for domestic banks to move their loan supply to affiliated nonbanks.

86. Sectoral capital requirements can be circumvented through a move to foreign banks that provide credit either directly across the border or through their local branches (e.g., Bulgaria and Serbia). Direct cross-border credit is less likely for household (mortgage) loans, since foreign banks are often at a disadvantage in appraising local retail credits, and in collecting and realizing local collateral. Subsidiaries of foreign institutions will in general be subject to local capital requirements. The main issue is therefore the provision of credit by local branches that may be outside of the scope of domestic capital requirements. Greater host control over foreign branches or reciprocity arrangements can be considered to address this, as discussed further the main paper and the chapter on broad-based tools.

87. Tools that constrain the availability of bank credit to households, such as LTV and DSTI limits can be subject to domestic leakage, that is, the migration of provision of credit to domestic nonbanks. In principle, however, such borrower eligibility criteria can be applied to all *products* that are offered by any financial institution within a country and enforced on all regulated institutions by the relevant supervisory agencies, including on foreign branches as necessary (BoE, 2011).

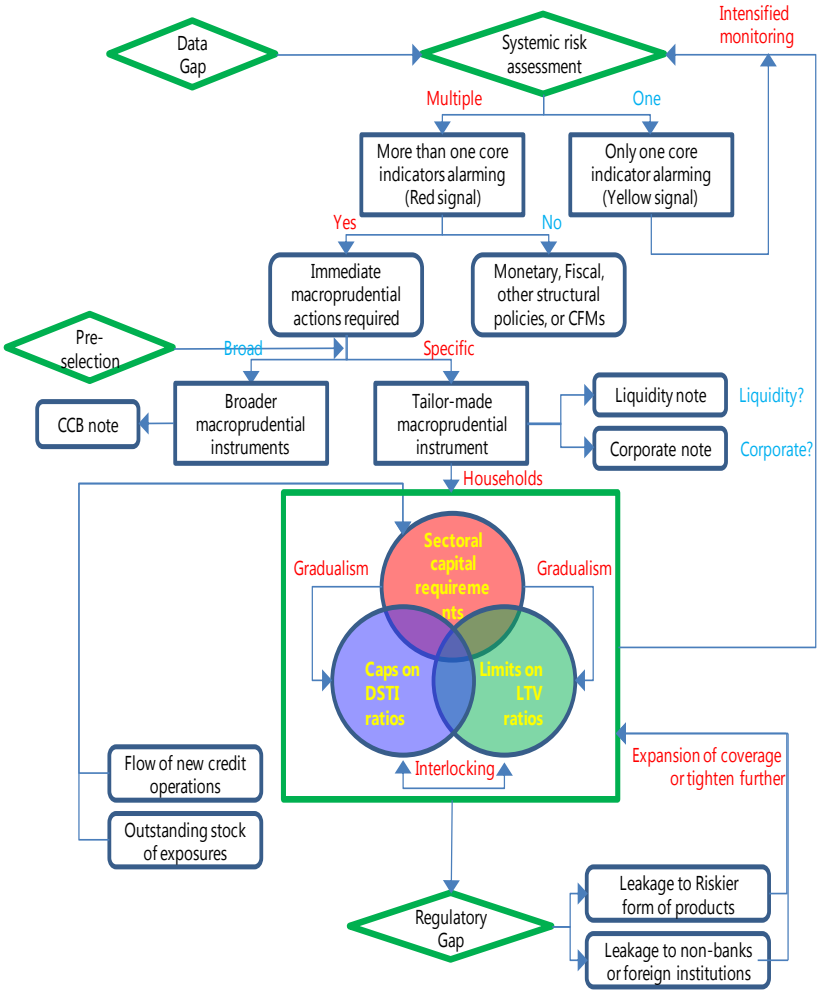
88. Where there are separate regulators for nonbank institutions, this may require the cooperation of these agencies, but can otherwise be straightforward. An example is Korea where LTV ratios have, since 2009 been applied to lending by nonbank financial institution that are under the purview of the single regulatory agency. Extending the tools to un-regulated entities may require a prior step of expanding the licensing regime to such institutions.

89. Finally, arbitrage can occur where government-provided insurance and securitization programs co-exist with private label securitization. For example, in the U.S., LTV limits on conforming mortgages for GSE securitizations coexisted with an increase in private label securitizations where the average LTV ratio was often much higher in the run-up to the crisis. A similar trend was observed in Canada over the pre-crisis period. To address this issue, staff should recommend the same standards for both private and public entities that securitize and/or guarantee mortgage backed securities. For instance, in Canada in 2008, the authorities mandated private mortgage insurers to follow the eligibility rules the government sets for the government owned mortgage insurer.

Figure 7. Operational Steps of Sectoral Macroprudential Instruments

Five Steps	Key Questions
Systemic Risk Assessment & Data Gaps	Do authorities have well-functioning systemic risk assessment mechanism?
	How many core indicators are alarming? All or just one?
Selection of MaPP tools	Are macroprudential instruments the only option? Aren't other policies more suitable?
	Is systemic risk from the entire financial system or a specific sector (households, corporate, or liquidity)?
	Which tools should be used? In which sequence?
Calibration of MaPP tools	Should authorities use tools separately or together?
	Should a tool be imposed on a flow of new credits or an outstanding stock of exposures?
Regulatory Gaps	Is there any leakage? Where is it?

Decision Making Process



Source: IMF staff.

Box 5. Experiences with Sectoral Macroprudential Instruments

Several countries used limits on LTV and DSTI ratios to discourage the growth of mortgage loans; for example, Hong Kong has operated a LTV cap since the early 1990s and introduced a DSTI cap in 1997; in Korea, LTV limits were introduced in 2002, followed by DSTI limits in 2005. Since the global financial crisis, many AEs and EMEs, such as Hungary, Norway (LTI), and Singapore, have adopted these instruments. Until now, eleven AEs and 14 EMEs have implemented LTV ratio limits. Seven AEs and eight EMEs adopted caps on DSTI ratios, which complemented the LTV ratio limits in all countries except two.

Use of Sectoral Macroprudential Instruments

	Advanced Economies	Emerging Market Economies	Total
Sectoral Capital Requirements	Australia (2004), Hong Kong SAR (2013), Ireland (2001), Israel (2010), Korea (2002), Norway (1998), Spain (2008), Switzerland (2013)	Argentina (2004), Brazil (2010), Bulgaria (2004), Croatia (2006), Estonia (2006), India (2004), Malaysia (2005), Nigeria (2013), Peru (2012), Poland (2007), Russia (2011), Serbia (2006), Thailand (2009), Turkey (2008), Uruguay (2006)	23
Limits on LTV ratio	Canada (2007), Finland (2010), Hong Kong SAR (1991), Ireland (2001), Israel (2012), Korea (2002), Netherlands (2011), Norway (2010), Singapore (2010), Sweden (2010), New Zealand (2013)	Brazil (2013), Bulgaria (2004), Chile (2009), China (2001), Colombia (1999), Hungary (2010), India (2010), Indonesia (2012), Latvia (2007), Lebanon (2008), Malaysia (2010), Romania (2004), Thailand (2003), Turkey (2011)	25
Caps on DSTI ratio (including LTI caps)	Canada (2008), Hong Kong SAR (1997), Korea (2005), Netherland (2007), Norway (2010, LTI), Singapore (2013), United Kingdom (2014, LTI)	China (2004), Colombia (1999), Hungary (2010), Latvia (2007), Malaysia (2011), Poland (2010), Romania (2004), Thailand (2004)	15

Source: IMF staff calculation.
Note: Parentheses show the time when a country started to introduce currently imposed measures since 1990.

These tools are often used individually, but also applied in tandem. Interlocking use of different tools can help overcome the shortcomings of any single tool and enable policymakers to use several different transmission channels, thereby promoting the effectiveness. However, it may increase regulatory burden.

Number of Countries with Sectoral Macroprudential Tools

	Sectoral Capital Requirements	Limits on LTV Ratio	Caps on DSTI Ratio	Limits on LTV and DSTI ratios	At least One tool	More than two tools	All three tools
Number of Countries (Total = 46)	23 (50 percent)	25 (54)	15 (33)	13 (28)	38 (83)	20 (43)	5 (11)

Source: IMF staff calculation.
Note: Numbers in parenthesis shows the proportion of countries with a specific instrument among the sample.

CORPORATE SECTOR TOOLS[74]

90. Staff should consider targeted macroprudential instruments in their advice when systemic risks stem from exposures to corporate sector.[75] Macroprudential instruments applied to all exposures of the banking sector (e.g., CCB, provisioning requirements) will also affect exposures to corporate sector. However, staff should recommend more targeted tools if exposures to the corporate sector pose heightened risk. Potential tools include: increases in risk weights on corporate exposures,[76] limits on the growth of credit to the corporate sector, as well as LTVs and caps on the debt-service coverage (DSC) ratio specifically for exposures to commercial real estate.

- **Tools affecting broad corporate credit.** If systemic risk arises from strong growth in credit to the corporate sector, an increase in sectoral capital requirements applied to corporate exposures can be useful. They can take the form of higher risk weights (or LGD floors) or additional capital requirements on such exposures.[77] Higher risk weights will increase the resilience of banks to an excessive increase in broad corporate credit. Moreover, the increase can affect funding costs and increase lending rates for corporate credit. If capital tools are not expected to have sufficiently strong effects in containing systemic risk from rapid credit growth to the corporate sector, consideration can also be given to caps on the growth of such credit.

- **Tools to address foreign exchange risks.** Systemic risks stemming from particularly risky forms of corporate credit, such as foreign currency credit, can be addressed by targeted risk weights and exposure caps for such credit. Risk weights will build a buffer against heightened credit risks for banks from lending in FX and will affect the supply of credit indirectly, whereas caps on the growth of FX exposures can more directly curtail the supply of such credit. Risk weights can also be used in combination with a limit on credit growth.

- **Tools to address risks from commercial real estate.** Commercial real estate (CRE) is a form of credit where homogeneity across corporate borrowers allows implementation of LTV and DSC ratios in addition to risk weights and speed limits. The CRE credit market is characterized by similar collateral where investors are involved in similar business activities, and often with substantial use of leverage. Moreover, risks from CRE markets are similar to those arising in residential real estate markets. Therefore, tools that are used to deal with risks from real estate markets can be extended to address risks in CRE markets. Limits on LTV ratios impose a cap on

[74] Prepared by Ivo Krznar (MCM)

[75] Some countries have implemented macroprudential measures targeted at corporate exposures. These include measures on commercial real estate exposures (e.g., LTV ratio—Hong Kong SAR, Turkey; risk weights—India), dynamic provisioning for commercial loans (Colombia), stamp duty (Hong Kong SAR, Singapore) and foreign currency lending limits (Turkey). See Table 7 for details.

[76] While it is conceivable that countercyclical capital buffer and dynamic provisioning requirement be applied to corporate exposures, these capital tools should be primarily applied on total credit exposures.

[77] Increases in capital requirements should ideally be implemented under "Pillar 1" of the capital framework, thereby ensuring that it applies to all banks equally and is transparent to the market. An implementation under "Pillar 2" can be considered where the legal basis for variations in capital requirements is missing.

the size of a commercial real estate loan relative to the appraised value of the property and enforce a minimum down payment. Caps on the DSC ratio require the size of net operating income to be larger than a fixed multiple of debt service payments, thereby increasing the resilience of borrowers and banks to shocks in asset prices or rental income. These limits can also affect the demand for CRE credit, in turn containing a property price boom financed by credit.

91. Staff should be mindful of the potential for leakage of corporate sectoral tools. This can arise when corporate borrowers substitute domestic bank credit with borrowing from unregulated financial institutions or in capital markets (domestic leakages) or borrowing from abroad (cross-border leakages). As discussed in more detail below, containing such leakages is particularly challenging since corporate borrowers have more easy access to alternative sources of credit, especially in countries where capital markets are well-developed.

A. Tools that Target Broad Corporate Credit

92. Excessive corporate borrowing can give rise to vulnerabilities of the banking sector to shocks to the corporate sector. Rapid lending growth to corporations can result in excessive increases in the leverage of the corporate sector, exposing the banking sector to increases in the risk of corporate defaults in the event of funding stresses or demand shocks. This, in turn, can lead to a larger increase in losses in the banking sector, reducing its capital and capacity to lend, which may amplify the impact of the initial shock, and possibly result in a financial crisis. While corporate sector credit played less of a role in the global financial crisis, Box 6 highlights the key role of corporate sector leverage in the East Asia financial crisis in the late 1990s.

Box 6. Corporate Credit Risk in the Asian Crisis

Corporate sector leverage was at the center stage of the Asia financial crisis in the late 1990s. High growth rates of corporate lending (by both local and foreign banks) that resulted in high levels of short-term and un-hedged corporate borrowing was one of the key elements behind the systemic financial crises in some Asian countries (Indonesia, South Korea, Malaysia, Thailand; see Stone (2000) or Corsetti and others (1998) in 1998.[1]

The buildup of vulnerabilities of the banking sector to corporate sector shocks was rooted in many factors. These included: (i) financial liberalization in combination with weak supervision; (ii) underdeveloped nonbank capital markets that concentrated credit risks within the banking sector; (iii) interventionist government policies that often directed credit toward favored corporate sectors; (iv) capital inflows that financed corporate credit; and (v) fixed exchange rates that lulled corporations and banks into false sense of security regarding the costs of external debt servicing.

The crisis was triggered by a sudden reversal of capital inflows which hit countries with high levels of corporate debt the hardest. A reversal of capital inflows was amplified into a systemic crisis largely by corporate sector balance sheet channels. Rapid depreciation increased foreign debt servicing costs of heavily indebted and un-hedged firms. Higher policy rates aimed at stemming devaluation squeezed corporate cash flows. Corporate defaults hit banks through higher NPLs and lower capitalization, which curtailed lending and exacerbated the downturn.

1/ Corporate leverage before the crisis (1996) in Thailand was close to 250 percent, Korea 350 percent, Indonesia close to 200 percent and Malaysia around 120 percent. (Claessens and others, 1998)

Instruments and transmission mechanism

93. Instruments to address systemic risks stemming from broad corporate exposures include risk weights for corporate exposures and caps on credit growth or concentration limits.

- Risk weights can be recommended to deal with risks from broad or specific corporate exposures. Risk weights will, in general, help the banking system withstand corporate credit losses by building capital buffers (direct effect). These instruments may also increase the costs of credit and slow down the growth of corporate credit, thereby reducing concentration of corporate exposures on bank balance sheets. For banks using the Basel IRB approach in calculating RWAs, a higher risk weight can be implemented either by a risk weight floor (as for banks using the standardized approach) or by LGD floors in the IRB formula.

- A cap on the growth rate of the flow of new credit or a cap on the share of new corporate credit in total new credit can be considered when capital requirements are not expected to be sufficiently effective in containing systemic risk from rapidly growing credit to the corporate sector. While the main effect of a cap is to slow the supply of credit, caps on credit growth might enhance the resilience of the banking sector indirectly, by increasing lending standards if banks shun the more risky clients in favor of less risky borrowers to meet the limit.

94. The effectiveness of these tools depends on a range of factors. While risk weights will make the regulated financial institutions more resilient to a shock from the corporate sector, the evidence on the strength of the effects of a variation of risk weights on credit growth is mixed.[78] As explained in the main guidance note, the effects can be greater when issuing new shares and generating retained earnings is difficult and/or aggressive tightening forces intermediaries to cut lending. However, risk weights and caps on credit growth are prone to leakages, as discussed at the end of this section.

Tightening corporate sector tools

95. The judgment on the need for activation and tightening of tools can draw on both bank and corporate balance sheets indicators (Table 4).

- **Core indicators.** Increases in the share of corporate credit in total credit can signal the need for targeted tools directed at the corporate sector instead of or in addition to broad-based tools. This should be confirmed by analysis of the share and corporate credit growth. This would

[78] See also the discussion of broad-based capital tools. For instance, Bridges and others (2014) show for the U.K. that in response to an increase in capital requirements, banks increase capital buffers and reduce credit growth for CRE, other corporates and households secured lending, while credit growth mostly returns to normal within three years. Banks' responses differ depending on bank size, capital buffers held, the business cycle, and the direction of the change in capital requirements. However, other country experiences to date do not point to strong effects on credit growth.

confirm, for example, that increases in the share are driven by increases in corporate credit and not by lower total credit growth.

- **Additional indicators.** A range of additional indicators can help gauge whether rapid increase in corporate credit is indeed excessive, i.e., whether corporate credit is expanding for the "wrong" reasons. For example, growing leverage on new loans or for the sector as a whole, increases in the debt-service ratio (level of debt service as a share of operating surplus[79] or total pre-tax profit income) as well as the distribution of these ratios and the gap of the ratios can indicate deteriorating lending standards and rising operating leverage, signalling that risks are building up in the corporate sector. Moreover, the corporate ratio of credit to operating surplus and its growth rate and the corporate credit gap (defined as the difference between the corporate credit share and its trend) might serve as early warning indicators.[80] If granular data on income statements and balance sheets of corporate firms are available staff might want to analyze the Altman z-score[81] and its components (working capital over total assets, retained earnings over total assets, earnings before interest and taxes over total assets, market value of equity over book value of total liabilities, sales over total assets) that predict the probability that firms will default. Staff should make use of the IMF early warning exercises which also analyze corporate default probabilities and the Corporate Vulnerability Utility developed by the IMF's Research Department which includes indicators of the balance sheets and risks of corporate sectors (e.g., leverage, profits, growth opportunities, default risks) for more than 70 countries.

96. Staff is encouraged to analyze the historical dynamics of the indicators, and to compare their behaviour across countries. If possible, staff should evaluate the signaling power of selected indicators based on historical experience of these variables at the country or regional level as early warning indicators of banking crises, but should keep in mind that the nature of crises changes over time. The selection of indicators for such exercises will crucially depend on data availability.[82]

[79] Operating surplus should be taken as a denominator instead of GDP as it corresponds to a "business" component of value added and GDP and serves as an additional indicator that measures the ability to repay debt.

[80] To the estimate the gap, trend should be extracted from the ratio by using the HP filter with relatively high smoothing parameters (lambda equal to 400,000 instead of 1,600 for quarterly data). Staff should be cautious owing to the "end-point" problem and is encouraged to analyze the signaling properties of the credit gap estimated over different sample size, by changing the smoothing parameter and by augmenting historical observations with recursive forecasts.

[81] The Altman z-score is a linear combination of four or five common business ratios, weighted by coefficients. The coefficients are estimated by identifying a set of firms which had declared bankruptcy and then collecting a matched sample of firms which had survived, with matching by industry and approximate size.

[82] Empirical tools like event studies, signaling approaches that use the noise-to-signal ratio and discrete choice models (IMF, 2011a) could be used to identifying a set of robust indicators of systemic risk related to excessive corporate credit. The noise-to-signal ratio and the ROC should be used to assess indicators' signaling power.

Table 4. Corporate Sector Tools: List of Core and Additional Indicators

Core indicators

The share of corporate credit in total credit (flow and stock, level and growth rate) in combination with the growth rate of corporate credit.

Additional indicators

- Leverage on new and old loans;
- Debt service ratio (level of debt service as a share of operating surplus, distribution of the ratio and gap of the ratio);
- Corporate credit/operating surplus (share and growth rate);
- Corporate credit gap; and
- Lending standards.

97. Staff should rely on judgment and not use the indicators mechanically when recommending when and how much to tighten measures. This is especially important since empirical analysis of the signaling power of the core and additional indicators is not currently available at the global level.[83] Activating the tools should be considered when different indicators convey a homogeneous picture and when the degree of deviations or speed of growth of many indicators is large. A gradual, step-wise approach to the tightening is recommended given the uncertainty surrounding the tool's impact and possible erroneous signals of the selected indicators. Estimates of losses using stress tests of the banks' resilience to corporate losses could be used to calibrate the risk weights—the tools should be set so that the resulting buffer is sufficient for absorbing future unexpected losses related to corporate sector loans.[84]

98. Staff should consider the following principles when recommending the tools:

- **Data requirements.** In case the data on selected indicators are missing staff should encourage the authorities to start collecting or improve their collection of the data from the corporate sector. Complete and timely flow of funds accounts with detailed information on the composition of corporate sector's assets and liabilities such as information on foreign versus domestic assets and liabilities, short-term versus long-term assets and liabilities, liquid versus illiquid assets, bank versus nonbank liabilities, debt versus non-debt source of finance can enhance monitoring of the corporate sector, especially where visibility can also be gained into the distribution of these variables across sectors or firms.

[83] In case empirical methods can be used, threshold values of the identified indicators should define the range of each indicator's values at which either buffer instrument should be deployed when broader judgment indicates the need for action. The threshold for the activation should be set to balance the trade-off between timely detection of systemic risks and false alarms i.e., to minimize the noise-to-signal ratio.

[84] Corporate losses should be calculated as a product of probability of default, loss-given-defaults and exposure to corporate sector.

- **Sequencing.** Tools that build buffers and affect the supply of credit via higher lending rates should be used first. A cap on loan growth may be relatively more distortive and it is reasonable to first reach for tools that affect the price of rather than the quantity of lending. Moreover, a cap on loan growth has little direct impact on the resilience of the banking system to corporate sector shocks and building this resilience early is important.

- **Implementation.** Risk weights can be applied to the total (stock of) domestic corporate exposures or the flow of new exposures. The latter can be preferable when the riskiness of new loans is judged higher than that of the stock. In comparison to risk weights imposed on the stock of exposures, risk weights applied to new exposures can be set at a much higher level.

- **Notice period.** When risk weights are applied on the stock of exposures, the decision to increase the risk weights should be preannounced well before it takes effect. In general, no notice period is needed for implementation of measures that target the flow of (new) credit.

- **Additional consideration on calibration of risk weights.** The capital required by higher risk weights should also reflect: (i) the potential capital shortfall and extra capital needed to maintain investor's confidence during stress periods, so that a loosening of the tools may be effective; (ii) the uncertainty surrounding the estimation of corporate credit losses; (iii) the level of corporate indebtedness.[85]

Release phase of macroprudential tools

99. The set of indicators appropriate for the release phase will depend on how the imbalances materialize. When imbalances giving rise to systemic risk recede gradually, this will be reflected in the same set of indicators that are used for the tightening phase. In this case, the release should be gradual. In case imbalances result in a crisis, a sharp fall in the growth rate of new corporate loans and market-based financial indicators would likely signal the need for a more prompt release.[86] In particular, a large drop in the growth rate of new loans and/or spikes in CDS spreads on corporate bonds and/or risk premia on corporate debt can signal an imminent materialization of systemic risk in the corporate sector. If market-based indicators are not available, measures of an incipient increase in corporate losses, bankruptcy, nonperforming corporate loans, or tightening of lending conditions should be taken into account when recommending the release of the tools. Judgment will play a role in deciding when to loosen the instruments since credit indicators might not be timely, whereas high-frequency indicators might be noisy and tend to generate many false positive signals of crises.

[85] The instruments should be set higher for an economy that is highly indebted. Even with low corporate credit growth, high level of indebtedness could amplify the vulnerability of the economy and the financial sector to other shocks to the economy.

[86] The speed limit could be reduced to ensure that credit is not constrained due to the regulatory requirement. However, reducing speed limits in a crisis likely would do little to support the continued flow of credit since they might not be binding during a stress period and lenders likely would want to pull back.

100. In recommending whether or not to reduce the risk weights it is important to consider how such a decision might affect funding costs and investor confidence. Staff's advice to reduce risk weights should therefore be informed by an assessment of capital adequacy (before and after the release), including estimates of expected and unexpected losses under stress, and market-based indicators of banks' resilience. In any case, the risk weight should not be loosened beyond the micro-prudential limits.

Addressing leakages

101. Staff should be mindful of the potential for circumvention of macroprudential tools. This can arise when corporate borrowers substitute domestic bank credit for borrowing from unregulated financial institutions or in markets (domestic leakages) or borrowing from abroad (cross-border leakages). These issues are particularly challenging since corporate borrowers have more easy access to alternative sources of credit, especially when capital markets are well-developed. Leakage can then allow a build-up of corporate sector leverage due to extension of credit by nonbanks that increases the risk of default of borrowers *including* on banks' existing credit exposures to corporations. Sectoral tools, such as higher capital requirements, can still increase the banking system's resilience to the risk of default, thereby containing systemic risk, but may not be able on their own to contain the build-up of vulnerabilities in the corporate sector.

102. Domestic leakages can be addressed by expanding the regulatory perimeter of the tools to unregulated entities or requirements to consolidate such activity, as discussed for the in the note on broad-based tools. However, market based funding (such as bond issuance by corporate firms) is difficult to curtail, and there may then need to be an even greater emphasis on increasing risk weights, so as to build additional resilience to shocks in the banking sector, and to increase resilience also of important nonbank classes of intermediaries (see further note on structural tools).

103. Addressing cross-border leakages is also challenging since the tools do not initially apply either to foreign branches or to the direct provision of credit from across the border. Strategies to address these leakages include reciprocity arrangements, and greater host control, as discussed in the note on the tools targeted at broad credit exposures, but also targeted capital flow management measures (CFMs) and fiscal policy. Since these measures are costly to implement, policymakers should be encouraged to obtain full information about how much companies are borrowing abroad and the nature of such funding. Closing such information gaps should be first step to reducing the cross-border leakages.

- **Reciprocity.** Reciprocity for risk weights is currently not subject to international agreements. However, a proposal for the implementation of Basel III/CRD in the Nordic countries and the BoE proposals on macroprudential powers of the FPC both consider expanding reciprocity arrangements to risk weights, in addition to CCB.

- **Greater host control.** If stability risks warrant, foreign affiliates can be encouraged or required to be established as subsidiaries rather than a branch to ensure that they can be subject to

capital regulation, including higher risk weights or caps on credit growth. This is further discussed in the note on broad-based tools.

- **Targeted CFMs**. In general, corporate borrowing from abroad via corporate debt securities can pose challenges (see for an example India in Box 7). When recommending CFMs, close attention needs to be given to the choice and design of such measures to best meet the goals of efficiency and effectiveness, in line with established principles (IMF, 2012b and 2013e). In particular, emphasis should be placed not so much on the volume of inflows, but on lengthening the maturity of corporate debt issuance and reducing reliance on FX securities.

- **Fiscal policy.** As an alternative or in addition to other measures, increased taxation of corporate sector profits and measures that correct the tax bias in favor of corporate debt should be recommended to reduce the demand for corporate credit.

B. Tools that Target Foreign Exchange Loans

104. Foreign exchange loans can present an important specific vulnerability associated with corporate loans. While FX or FX-linked loans often carry lower interest rates, inducing corporate firms to borrow in FX, they can significantly increase credit risk for borrowers without a natural hedge. In case of a sharp depreciation of the domestic currency, un-hedged borrowers may become unable to service their FX loans. This will increase NPLs of banks and reduce their capital, in turn reducing their capacity to lend and aggravating the effects of the initial shock. Risks for the banking sector can be exacerbated if FX induced credit risk is accompanied by increased roll-over risk and maturity mismatch when FX loans (bank assets) are financed by short-term FX borrowing from abroad. Then, a deterioration in investor sentiment can result in both increased credit risks and liquidity strains for local banks engaged in foreign currency lending. A build-up of FX credit also adversely affects domestic monetary policy transmission, as the central bank cannot influence the cost of FX debt. At the same time, the exchange rate channel of monetary policy transmission would pose risks to the economy since a depreciation can expose the vulnerability of the corporate sector to increases in the cost of servicing FX loans.

105. There is evidence that capital inflows in some new member states of the European Union (EU) fuelled corporate FX lending ahead of the global financial crisis. While in many new EU member countries it was households who were borrowing in FX, Bulgaria and Slovakia were two countries where corporate firms were more inclined to borrow in FX than households (Rosenberg and Tirpak, 2008). The share of FX corporate loans in total loans increased by around 20 percent in Slovakia and around 25 percent in Bulgaria over the period 2000 to 2007.[87] Experience from other EU countries where FX loans to households increased rapidly before the crisis shows how higher debt services ratios of un-hedged borrowers due to depreciation of local currency translates into

[87] The share of FX household loans increased by less than 5 percent in Slovakia and by around 20 percent in Bulgaria over the same period.

higher losses of the banking system (for Hungary see in ESRB, 2012a). See also Box 6 for the experience in the East Asian crisis.

106. Tools that can be recommended to address risks stemming from FX credit extension include risk weights and limits on FX exposures. Ideally, these tools should be applied to FX exposures of un-hedged corporate borrowers only since FX-induced credit risk does not arise for hedged borrowers. However, when this is difficult for supervisors to enforce loan-by-loan, consideration can be given to measures that apply to both hedged and un-hedged corporations. In this case, both tools may naturally lead to a shift away from lending to un-hedged borrowers, since lending in FX becomes more costly for the banks. However, a tight calibration of both tools can result in hedged borrowers being unable to obtain an FX loan, resulting in efficiency losses. The availability of data on firms that have a natural hedge, as well as on open currency positions and the robustness of swap markets, is important to assess these trade-offs.

107. The recommendation on the two tools should be combined with advice to strengthen data availability and supervisory capacity. Better data and supervisory capacity to restrict lending practices can enable the enforcement of better targeted tools, reducing efficiency losses. There is a need also for strong conduct of business requirements, such as requirements on financial institutions to provide borrowers with sufficient information to make well-informed and prudent decisions regarding the risks involved in foreign currency borrowing.[88]

108. Macroprudential instruments should address systemic risks stemming from excessive FX credit growth, but will be insufficient to address widespread dollarization. The objective of risk weights and speed limits applied to FX corporate exposures is foremost to address systemic risks arising from increases in FX loans. Thus, the aim of the instruments is to prevent FX loans from becoming prevalent and resulting in systemic risk. However, they may not suffice to reduce or eliminate a structurally high level of FX corporate loans.

109. Other structural tools, beyond macroprudential tools, might be recommended if dollarization is widespread. While dollarization on both the asset and liabilities side of a banking sector carries the same risks mentioned above it can be a structural issue. Achieving de-dollarization is difficult in practice and requires a multi-pronged and well-sequenced approach. Sound macroeconomic policy frameworks, including sustainable fiscal and credible monetary policy are a key precondition for de-dollarization. Financial markets in domestic currency should be built by, for example, the public sector shifting from borrowing in FX to borrowing in the domestic currency. Tightly calibrated macroprudential tools, including limits on net open positions, differentiated and/or marginal reserve requirement across currencies, requiring reserves in terms of foreign liquid assets, might then also be appropriate in order to de-dollarize the banking system. In addition, a levy can be introduced on the interest paid on foreign loans to encourage a gradual substitution of

[88] See ESRB (2011) for details of microprudential measures implemented by EU countries to deal with risks coming from FX credit market.

foreign loans by domestic loans. See Galac (2012) on de-dollarization and references therein for recent examples of measures taken by the authorities in order to de-dollarize their banking systems.

Description and transmission mechanism

110. Higher risk weights are a key tool to address excessive growth in FX corporate borrowing. Higher risk weights targeted at FX corporate exposures will not only build a buffer for unexpected FX losses but are likely also to reduce the share of FX corporate exposures by increasing the relative cost of funding of the FX credit. As set out above, a calibration to unhedged borrowers only is preferable in achieving these benefits at reduced cost to efficiency.

111. Exposure caps can complement risk weights in addressing excessive growth in FX corporate borrowing. Exposure caps on FX credit can be designed as a cap on the growth rate of FX credit or on the share of the new FX credit to total new corporate credit. A cap on the (stock of) FX credit in the (stock of) total corporate credit presents an additional option. These measures can also enhance the resilience of the banking sector indirectly by increasing lending standards if banks prioritize lending to better borrowers when lending caps bind. This will, however, depend on how risk averse banks are.

Tightening phase—macroprudential tools targeting FX exposures

112. Indicators should be primarily focused on FX credit markets. Core indicators should include measures of FX-based credit. Additional indicators that staff should analyze are related to financial conditions of the corporate sector firms that take FX loans (Table 5).

- **Core indicators.** Increases in the share of FX corporate credit in total corporate (and total) credit and the growth rate of this credit are primary indicators, if possible broken down by companies that have and do not have a natural hedge. Evaluation of the growth rate of FX corporate credit should complement the analysis of the share to gauge whether the shares' dynamics is attributed to rapid FX credit growth or slower non-FX corporate exposure growth. In addition, the growth rate of the FX corporate credit/GDP and FX corporate credit gap defined as the difference between corporate credit and its trend might signal potentially excessive FX lending.

- **Additional indicators.** Credit-based core indicators should be combined with additional indicators to gauge whether rapid increase in corporate credit is indeed excessive. Growing leverage (on new and old loans) and debt-service ratios, and deteriorating lending standards over time of firms involved in FX lending can indicate that risks are building up.

Table 5. Tools to Address FX Risks in the Corporate Sector: List of Core and Additional Indicators

Core indicators

- The share of corporate FX credit in total corporate credit (flow and stock, level and growth rate) in combination with the growth rate of corporate FX credit for un-hedged borrowers;
- Corporate FX credit/GDP (share and growth rate); and
- Corporate FX credit gap.

Additional indicators

- Leverage on new and old loans of un-hedged borrowers;
- Debt service ratio (level of debt service as a share of operating surplus, distribution of the ratio and gap of the ratio) of un-hedged borrowers; and
- Lending standards for un-hedged borrowers.

113. An in-depth analysis drawing on indicators should inform staff's advice on activating the risk weights and exposure caps. Staff should make sure that the relevant information is available, including importantly information on the fraction of hedged borrowers. If possible given available data, staff might develop a mapping between the indicators and the activation of the speed limit and their calibration. This should be done based on historical experience of indicators, or through cross-country comparisons.

- **Risk weights:** Risk weights can be applied to the total (stock of) FX corporate exposures, or on new loans only. In comparison to risk weights imposed on the stock of exposures, risk weights applied to new exposures can be set at a much higher level and can be brought in immediately. For measures applied to the stock, gradual, subsequent increases of risk weights are recommended. Estimates of losses using, for example, stress tests of the banks' resilience to FX corporate losses could be used to calibrate the risk weights—the tools should be set so that the resulting buffer is sufficient for absorbing future unexpected losses related to corporate sector FX loans.

- **Exposure caps:** Since macroprudential authority should be concerned with growing FX corporate exposure (relative to growth of total exposure), caps could be imposed on the growth rate of new FX loans or on the share of new FX corporate credit growth in new total corporate credit. With appropriate sanctions for breaching the limit, these caps should have larger impact on FX lending than risk weights since they can more directly manage the growth rate of FX credit.

Release phase: macroprudential tools targeting FX exposures

114. The decision to lower risk weights should depend on the extent of FX corporate loans and whether risks resulted in a crisis. If risks have not materialized but vulnerabilities related to FX corporate loans persist due to widespread dollarization i.e., due to the extent of FX loans, any measure taken as part of an overall strategy to de-dollarize the banking system should not be released, as these measures are regarded as structural measures. However, even in a dollarized banking system if a crisis materializes, the risk weights could be released to cover FX loans losses. Reducing the risk weights can be used to soften a credit crunch, but this needs also ensure the resilience of the system to future shocks and respect microprudential standards.

115. Reducing exposure caps might not be necessary as they might not be binding during the stress period. By contrast, keeping them in place can be useful when this might helps deter currency speculation by local banks. This is because the growth rate of FX credit is a function both of the volume of FX loans and its value, which increases when the domestic currency depreciates. Therefore, keeping a cap even during the stress period can be useful to deter banks from speculating against the domestic currency (Kraft and Galac, 2011).

116. Market-based financial indicators and credit flow-based indicators can be taken into account when deciding whether to lower the risk weights. A depreciation of the domestic currency can bring about a materialization of credit risk on FX exposures, since it will put pressure on corporates' ability to repay their FX debt. A sharp depreciation should therefore be used as the main indicator for the relaxation of increases in risk weights. Moreover, spikes in CDS spreads on bonds of corporate firms, and the risk premium on corporate debt might signal imminent materialization of systemic risk in the corporate sector. A fall in measures of corporate earnings, and increases in bankruptcy rates, nonperforming FX corporate loans and tightening lending standards could be also taken into account when recommending the release of the tools.

Leakages

117. Cross-border leakages are acute for risk weights and caps imposed on FX corporate credit. While risk weights and exposure caps will enhance the resilience of the banking sector (directly and indirectly), they will be subject to the same leakages associated with tools to address corporate sector risks generally (Box 7). Faced with higher costs of credit (due to higher risk weights) or constraints on credit provision (due to exposure caps), firms might look for foreign sources of credit, thereby circumventing the macroprudential tools.[89] Moreover, banks may start to offer FX-linked loans when these are not subject to the exposure cap; even as these would represent the same credit risk as FX loans (see an example of Turkey in Box 7). Alternatively, banks might grant an FX loan and sell it, avoiding it being counted towards the exposure cap (see the example of Romania in ESRB, 2012a).

[89] However, the tools might be partially effective as only large, publicly traded firms will have access to foreign capital or credit markets.

Box 7. Experiences With Tools to Address Corporate/FX Leverage

The Croatian National Bank implemented a wide range of macroprudential measures to increase resilience of the banking sector and manage credit growth during the boom of the 2000s. The main macroprudential measures included: (i) higher risk weights on banks' total FX loans (as well as those in domestic currency indexed to foreign currency) granted to un-hedged clients; (ii) introduction of FX liquidity minimum; and (iii) credit growth (speed) limits which were subsequently linked to banks' capital adequacy and the growth rate of core deposits.[1] To deal with large capital inflows into the banking sector that fueled the credit growth, macroprudential measures were complemented with marginal reserve requirement on increases in banks' foreign liabilities.

Direct cross-border lending growth to nonfinancial firms accelerated with tightening of local macroprudential policies. The macroprudential measures contributed to stronger resilience of the banking sector, both in terms of higher capital and liquidity as well as indirectly via slower credit growth. In combination with capital controls, the measures also reduced reliance on foreign wholesale funding and lowered banks' leverage by changing the structure of funding in favor of equity. However, with tighter measures banks' foreign borrowing from parent banks was replaced by corporate firms' direct foreign borrowing from the same creditors. In particular, banks with parent banks abroad referred clients to the parent bank, with all of the screening and paperwork carried out in Croatia, but the final contracts and funding, at least formally, coming from the headquarters outside of Croatia. This leakage of macroprudential polices was never fully closed.

Leakages associated with a ban on FX loans by local banks in Turkey forced the authorities to revoke the ban. Turkish authorities prohibited local banks from providing FX loans to households and un-hedged firms due to foreign currency-induced credit risk.[2] To evade this restriction, Turkish banks lent in foreign currency to un-hedged firms through their offshore branches or by issuing FX-indexed loans onshore. The former, however, resulted in an increase in external debt and contributed to an increase in the country risk premium. To reverse the dynamics of external debt the authorities permitted onshore lending in FX to un-hedged firms in 2009.[3,4] This has shifted the composition of external debt away from corporate firms and created an appetite for the domestic companies to use FX loans from local financial institutions.

India has been actively managing external borrowing by nonbank corporations. In addition to an overall ceiling, individual limits and maturity limitations, corporate external borrowing is subject to maturity-dependent all-in-cost ceilings, which limit the interest rate at which Indian corporations can raise the funds abroad. By changing the all-in-cost ceilings, the Reserve Bank of India can influence the external indebtedness of the corporate sector even without adjusting the limits on credit volumes or maturity. All-in-cost ceilings on three-year to five-year loans have varied between 150 and 300 basis points over six months LIBOR from 2004 through end-2008. After the suspension of the ceiling during 2009 in response to the global financial crisis, the all-in-cost ceilings were re-introduced in January 2010. While the evidence for the effectiveness of these policies in restraining credit growth is weak (Habermeier and others, 2011), Singh (2007) finds that this policy framework achieved a balanced maturity profile.

1/ See Kraft and Galac (2011) for details.
2/ Decree No. 32 on the Protection of the Value of Turkish Currency.
3/ This is conditional on the loan being for at least one year and for a minimum of US$5 million, or without any condition on maturity or amount if adequately collateralized by FX deposits in a domestic bank branch or FX denominated bonds issued or guaranteed by an Organization for Economic Cooperation and Development (OECD) country government or central bank.
4/ In addition to partially permitting the FX credits to un-hedged firms, amendments to Decree No. 32 from 2009 prohibited households from taking out FX indexed credits from neither local nor foreign lenders.

118. The prospect for leakages and their consequences should be considered up front. In Turkey a ban on credit to un-hedged borrowers (see the example of Turkey in Box 7) was accompanied by cross-border leakages and was ultimately revoked since made it more challenging to monitor the foreign indebtedness of corporate firms, and to determine the extent to which the corporate borrowers were hedged or not. Strategies to deal with the leakages could include reciprocity arrangements for risk weights, greater host control, targeted CFMs, and fiscal policy. For example, changes in the corporate tax code that penalize FX borrowing relative to borrowing in the domestic currency could reduce the incentive for corporations to borrow in FX and could be designed to exclude those firms that can demonstrate a natural hedge.

C. Tools that Target Commercial Real Estate Exposure

119. CRE booms and busts have played an important role in many financial crises (Box 8). Most notably, the U.S and the U.K. financial crises in the late 1980s, the crisis in Nordic countries in the early 1990s, some of the East Asian crises in the latter part of 1990, as well as the recent Irish and U.K. crises in 2008 were accompanied by booms and busts in the real estate sector.[90] While all these crises were associated with both residential and commercial booms, busts in CRE market created larger losses in many of these crises, given higher default rates and higher volatility of commercial property prices.[91] Robust commercial property price growth ahead of the crises spurred a boom in CRE credit growth, while rent increases lagged behind, eventually squeezing income yields and resulting in the bust. The disorderly correction in property prices and defaults led to a deterioration of banks' CRE asset quality and higher NPLs, an erosion of capital and subsequent lower capacity to lend. Moreover, a misalignment of property prices from their fundamental values distorted the efficient allocation of resources, resulting in over-investment in CRE.

Instruments and transmission mechanism

120. In addition to risk weights and exposure caps, excessive CRE lending can be addressed by macroprudential tools that affect lending conditions. LTV and DSC ratio constraints address risks stemming from CRE market by reducing the risk of default and affecting the demand for credit (see Table 7 for examples of countries that have been using LTVs and DSCs to deal with risks from commercial real estate sector). While LTVs and DSCs cannot easily be imposed on broad corporate exposures because of the heterogeneity of corporate sector firms and their activities, they can target risks stemming from CRE lending where corporate borrowers are involved in very similar businesses and use similar collateral.

[90] CRE booms and busts have preceded banking crisis in developed countries (ECB, 2000; Davis, 1995) and emerging market economies (Collyns and Senhadji, 2002; Davis, 1999, Renaud and others, 2001).

[91] Households can cope with short period of financial stress by using income from different sources to cover interest payment. By contrast, an investor in CRE might default as soon as the building is left vacant. In fact, commercial defaults are often associated with a maturity default in which the borrower is unable to borrow a large enough sum to pay of an expiring loan.

121. LTVs and DSCIs work by imposing constraints on the borrower's balance sheet. Limits on LTV ratios impose a cap on the size of a commercial real estate loan relative to the appraised value of a property and enforce a minimum down payment. Floors on the DSC ratios require net operating income to be a fixed multiple (higher than one) of the size of debt service payments, ensuring that the property has the necessary cash flow to cover the loan payment.[92] Lower LTVs and higher DSCs directly reduce demand for credit by limiting the market to new borrowers that satisfy the lending conditions. This will, in turn, contain a property price boom if it is financed by credit. An announcement of a tightening of the limits can also affect corporations' expectations of future commercial real prices if credible and large enough, and reduce speculative incentives that play a key role in bubble dynamics.[93] Lower LTVs and higher DSCs can have a secondary benefit of reducing riskiness of the commercial real estate loan market and therefore enhance the resilience of the banking sector indirectly by increasing the quality of corporate credit.

Box 8. Examples of Commercial Real Estate Booms and Busts

During 2003–06, there was a large increase in commercial property prices in Ireland accompanied by rapid CRE credit growth. Increases in property prices were not accompanied by large increases in rent, squeezing income yields. At the peak of the boom in 2006, CRE credit was growing by more than 60 percent (up from below ten percent in 2003) outperforming most countries' CRE growth rates (Woods, 2007). CRE lending accounted for about 25 percent of total lending to the private sector (up from around 10 percent in 2003) and 60 percent of total lending to private nonfinancial corporations (up from around 40 percent in 2003). At least half of all CRE projects were pre-let or pre-sold. Since 2008, Ireland has experienced a severe financial crisis with significant economic adjustment that has led to the rapid unwinding of domestic imbalances, including in CRE markets. Real commercial property prices have fallen more than 70 percent since their peak in 2007.

During the 1980s the CRE boom in Nordic countries was largely due to financial liberalization. Deregulation increased competition within the banking sector in Norway, Sweden, and Finland, which in turn resulted in loosened standards in a bid to gain market share. Pent-up demand for credit and tax changes biased towards borrowing led to asset and credit booms and concentration of credit risk in the property market. For example, office property prices in Sweden increased more than four fold in the 1980s (Woods, 2007). Adverse macroeconomic developments in the late 1980s, in combination with tax reforms and monetary tightening, ended the boom in the Nordic Countries in the early 1990s. Lower income growth and declining property prices created significant losses for the banking sector. In Norway, NPLs on CRE assets doubled between 1988 and 1992. In Sweden, 75 percent of NPLs in 1991 were due to CRE exposures with banks requiring government guarantees and financial support to offset their losses. In Finland, almost 50 percent of CRE loans had to be booked as NPLs or written off by 1993.

[92] DSCs can be complemented with a minimum capitalization rate which is a rate of return on a real estate investment property based on the expected income that the property will generate. It is calculated by dividing the income the property will generate (after fixed costs and variable costs) by the total value of the property.

[93] At the same time, the announcement can trigger a temporary increase in non-speculative lending as the borrowers will try to lock-in higher LTVs before they are implemented. This highlights the need for the announcement to be close to the implementation of the measures.

Box 8. Examples of Commercial Real Estate Booms and Busts (concluded)

Tax changes and deregulation of the financial sector were the main factors behind the commercial real estate boom in the early 1980s in the U.S. The demand for commercial real estate projects boomed after the Economic Recovery Tax Act of 1981 included several provisions and changed depreciation rules for commercial real estate that improved the rate of return on commercial real estate (Federal Deposit Insurance Corporation (FDIC), 2000). Real estate financing by commercial banks and other institutions grew to meet the demand. Total real estate loans increased sharply in the 1980s, from approximately 18 to over 27 percent of total assets, whereas total consumer loans were stable around 10 percent, and total commercial and industrial loans declined, dropping from approximately 20 percent to 17 percent of total assets (reference). At the same time banks weakened their underwriting standards on commercial loan contracts partly as a consequence of tougher competition and deregulation of the financial sector.

Many factors led to the bust of the commercial real estate market in the U.S. The Tax Reform Act of 1986 removed some of the provisions in order to dampen the demand for commercial real estate investments (FDIC, 2000). The closing of hundreds of insolvent thrift institutions by the Resolution Trust Corporation starting in 1989 dried up an important source of financing for real estate ventures. New risk-based capital standards increased capital levels for commercial real estate loans and helped reduce the supply of new loans at that time. The recession of 1990–91 hit the demand for commercial space, credit quality for outstanding real estate loans and in turn the origination of new commercial real estate, and underwriting standards tightened. Compared with surviving banks, banks that subsequently failed in the 1980s had higher ratios of commercial real estate loans to total assets and commercial real estate loans to total real estate loans. In 1993, commercial real estate loans of banks that subsequently failed constituted approximately 30 percent of total assets. **Commercial property prices bust caused a "small banks" crisis in the late-1980/the early-1990s in the U.K.** High growth of small banks in the late 1980s supported the economic boom and increasing asset prices, including residential and commercial real estate prices. A large increase in CRE loans by these banks led to a severely concentrated loan book. The boom came to an end in the early-1990s following a monetary policy tightening and a recession. A correction in CRE prices by 27 percent and a 14 percent decline in residential home prices (peak to trough) were accompanied by large losses of small banks that were heavily exposed to property-related credit. During the crisis, 25 banks failed and many more got into severe financial difficulty (Logan, 2000). It was also necessary for the BoE to extend liquidity to a few small banks to prevent a widespread loss of confidence in the banking sector.

Rapid increase in CRE price in the U.K over the period 2000 to 2007 accompanied by a rapid build-up in debt tied to investments in commercial property exacerbated the U.K, financial crisis in 2007. Over the period 2000 to 2007, CRE property prices increased by around 50 percent whereas CRE lending by banks tripled (from around 7 percent of GDP to around 20 percent of GDP; see Benford and Burrows, 2013). By the end of 2007, CRE loans accounted for more than a third of the stock of lending to UK private nonfinancial companies by local banks. As the crisis unfolded, CRE prices fell sharply and were almost halved from their 2007 peak by end-2012. Around 6 percent of the U.K. banks' stock of CRE debt written off between 2008 and 2012.

Tightening phase—indicators

122. Cross-country experience of crises accompanied by CRE booms and busts point to credit-based and price-based measures as core indicators to inform a decision when to tighten macroprudential tools (Table 6). Staff should also look at or encourage the authorities to gather data on additional indicators that might support decision-making. If a country has experienced a CRE bust in the past, empirical methods can be used to evaluate the historical

signaling performance of selected indicators and map them into the decision on when to tighten the limits.

- **Core indicators.** The share of CRE loans in total credit (both stock and flow) and increases in those shares should be used as primary indicators of potential risks stemming from CRE lending. The shares should be complemented with the growth rate of CRE credit and price-based measures (commercial property price growth and commercial property price to operating surplus; CRE property prices relative to rental rates and vacancy rate, income yields;[94] levels and gaps) in assessing the build-up of systemic risks in CRE market.[95] Moreover, the CRE credit/GDP ratio[96] and its growth rate and the CRE credit gap (defined as the difference between the share of CRE credit and its trend) might serve as potentially powerful early warning indicator.

- **Additional indicators.** Falling average DSC ratios (net operating income over debt service payments, level or gap), increasing average LTV ratios (on updated commercial property prices and commercial property prices at origination) together with increasing CRE credit growth might signal that loans are granted to riskier clients. Data on the distribution of DSC and LTVs ratios will provide more granular information on the share of riskier clients. Historically, weaker underwriting standards for CRE, and falling income yields proved to be an early warning signal of a CRE crisis.

Tightening phase—calibration

123. The advice on calibrating the risk weights and exposure caps on CRE exposures should follow the same principles presented in the previous sections. The risk weights can be applied to the total CRE corporate exposures or on new CRE loans. Exposure caps should be imposed on the share of new CRE credit in new total corporate credit or on the CRE credit growth rate. Activating or tightening the tools should be considered when different indicators convey a homogeneous picture and when the degree of deviations or speed of growth of many indicators is larger.[97]

124. While LTVs and DSCs on CRE exposures are similar to tools applied to residential real estate there are some important differences in their implementation. Riskier properties (such as hotels) should typically have higher DSCs and lower LTVs than more stable operating properties

[94] Property prices increase without a corresponding increase in rents or a decline in vacancy rates might suggest that speculative motives are driving the CRE market. Rising property prices and low growth in rental values will reduce income yield.

[95] Growth in credit for CRE often supports commercial property price inflation. Davis and Zhu (2004) find a strong link between commercial property prices and CRE lending using cross-country empirical analysis on a sample of 17 developed countries that experienced a banking crises linked to property losses.

[96] Alternatively, operating surplus could be used instead of GDP as the denominator.

[97] In case indicators were selected using empirical methods, threshold values of the identified indicators should define the range of each indicator's values at which either instrument should be deployed when broader judgment indicates the need for action. The threshold for the activation should be set to balance the trade-off between timely detection of systemic risks and false alarms i.e., to minimize the noise-to-signal ratio.

such as apartment buildings. The appraisal is usually done by assessing the potential income generated by the property, and less frequently by assessing costs of building/purchase price of a property. This income approach amounts to estimating the discounted present value of potential net operating income, assuming a certain rent collected, level of occupancy and an estimate of operating expenses. Given the higher risks of CRE in comparison to the residential market, more stringent loan covenants, guarantees and some pre-selling proportion of the project are often required on CRE exposures.[98]

Table 6. Tools to Address CRE Risks: List of Core and Additional Indicators

Core indicators

- The share of CRE credit in total corporate credit (flow and stock, level and growth rate) in combination with the growth rate of corporate CRE credit and CRE prices (commercial property price growth and commercial property price to operating surplus, CRE property prices relative to rental rates and vacancy rates, income yields; levels and gaps);
- CRE credit/GDP (or CRE credit/operating surplus) and its growth rate; and
- CRE credit gap.

Additional indicators

- Average DSC ratios (net operating income over debt service payments);
- Average LTV ratios (on updated commercial property prices and commercial property prices at origination);
- Distributions of DSC and LTVs; and
- Underwriting standards for CRE.

125. When systemic risks are rising, LTV and DSC ratios can be recommended in addition to and in combination with risk weights and exposure caps. Increased risk weights might be applied first as their impact will be less constraining. The design of risk weights can also take account of LTVs and DSCs. For example, higher risk weights can be assigned to CRE exposures with higher LTVs and/or lower DSCs. Similarly, exposure caps can be designed based on LTV and DSCs. For example, there can be a cap on exposures with high LTVs and/or low DSCs (analogous to the design of exposure caps on high LTV loans in New Zealand, or the cap on high LTI loans in the U.K.).

126. A cautious approach to the calibration of LTV and DSC measures may be recommended. Calibration of the LTVs and DSCs limits should be supported by data on the distribution of LTV and DSC ratios across borrowers based on updated commercial property prices

[98] This is because: (i) investors in CRE are usually highly leveraged; (ii) investors have greater incentive to default on the project if property prices fall before the project is completed and monitoring and appraisal of CRE projects by banks might be difficult and costly; (iii) usually the lenders' only recourse is to the property and not to the borrower, and (iv) CRE loans are usually non-amortizing, interest only loans.

and on commercial property prices at the loan origination date. While risk weights can be applied on both the stock and the flow of loans, limits on LTV and DSC ratios should only be imposed on the flow of new loans. Staff should be guided by the gradual approach to overall macroprudential policy given uncertainty surrounding the impact of these tools on the banking sector and the real economy. For instance, a sharp change in LTV and DSC limits could interrupt the ability to refinance existing properties given that CRE loans are usually non-amortizing.

Loosening of macroprudential tools targeting CRE

127. A range of indicators can be used to assess the extent of stress in commercial property markets. In a crisis, the extent of distress in the CRE sector can be assessed based on the decline in CRE lending, falling CRE prices and market-based financial indicators like CDS spreads on corporate firms involved in CRE, risk premium on debt of firms involved in CRE, spreads on CRE loans and prices of securities backed by CRE loans. If these are not available, incipient increases in nonperforming commercial real estate loans, and default rates of CRE loans, as well a slowing in commercial property transactions can be analyzed. However, judgment will play a key role in deciding when to consider loosening measures, since high-frequency indicators are noisy and tend to signal many false realizations of crises.

128. Staff's advice to loosen measures should be informed by assessing indicators of future capital adequacy (trying to map looser lending standards to banks' capacity to absorb larger losses) including estimates of expected and unexpected losses under stress, market-based indicators of banks' resilience and credit conditions, and the outlook for growth and banks' profitability. If uncertainly about their effect is large, staff can recommend that the measures should not be changed until risks recede.

129. If LTV and DSC limits are used in addition to risk weights, risk weights should be relaxed first. In a downturn, risk weights could be reduced first to help alleviate the risk of credit crunch, potentially followed by a relaxation of LTVs and DSCs. In case investors' confidence does not allow any reduction of capital, LTV and DSC limits might be gradually adjusted.

130. If markets allow, the loosening LTV and DSC limits should generally be gradual whether or not imbalances in the CRE market dissipate or end up in a crisis. The loosening should take place gradually because of uncertainty surrounding the effect of looser lending standards on ultimate credit losses and the capital position of the banking sector. In a downturn, if limits are binding increasing them will expand the number of eligible corporate borrowers thereby increasing the demand for credit. However, a trade-off arises as looser lending standards allow riskier borrowers to run up higher credit losses. Large increases/decrease in LTVs/DSCs might then be procyclical and result in higher credit losses in the future by allowing riskier borrowers to borrow more (and "gamble for a resurrection").[99] Moreover, increases in LTVs might not be effective in

[99] See footnote 102 for description of characteristics of CRE lending that may drive such behavior.

smoothing credit growth as lenders usually tighten the required down payments in a crisis (i.e., banks endogenously tighten LTVs, offsetting the easing).

Leakages

131. Staff should be aware of domestic leakages where CRE lending might migrate to domestic nonbank financial institutions (NBFIs). As argued before, in this case, expanding the regulatory perimeter to institutions unaffected by macroprudential policy can be recommended. Where there are separate regulators for nonbank institutions, this may require the cooperation of these agencies, but can otherwise be straightforward. In the case of un-regulated entities, staff should encourage the authorities to expand the regulatory perimeter by enlarging a licensing regime to capture all financial institutions that provide the targeted service.

132. Macroprudential tools applied to CRE lending can be associated with the same cross-border leakages mentioned in the previous section. Risk weights and exposure caps can be circumvented by foreign borrowing or borrowing from entities or markets that are not initially affected by macroprudential regulation. Cross-border leakages from LTVs or DSC ratios can also be expected to the extent that borrowers have access to foreign credit or credit provided by local branches outside of the purview of the macroprudential tools. This may be mitigated to some extent when it is difficult for foreign banks without a local operation to verify the credit quality of local CRE borrowers. The same strategies used in seeking to address cross-border leakages for corporate borrowing more generally can be used for CRE.

Table 7. Use of Tools to Address Risks Stemming from Corporate Sector

	LTV	Risk weights	Dynamic provisioning	Stamp duty	Foreign currency lending limits
Colombia			Discretionary dynamic provisioning was introduced in Jul 2007. Rules based (from April 2010), institution specific, dynamic (individual) provisioning for commerical loan was introduced based on 4 indicators (change in provisions, provisions over interest income, provisions over margin, credit growth) used for activation and depletion with thresholds set by the authorities; If the four indicators are met for 3 consecutive months, the entity will enter the depletion phase, it is institution specific		
Hong Kong	LTV ratio on commercial real estate mortgage loans assessed based on the net worth of a mortgage applicant reduced to 50 percent (Nov 2010), 40 percent (July 2011), 30 percent (Sept 2012)				
India		Risk weights on exposures to commercial real estate was tightened from 100 percent to 125 percent (Jul 2005) and further to 150 percent (April 2006) but reduced to 100 percent in Nov 2008			
Korea					Bank foreign-currency loans to non-financial corporates (for domestic use) were banned (July 2010).
Singapore	The LTV ratio was set to 50% on housing loans for property purchases who are not individuals (Jan 2011)			Buyer's stamp duty (10 percent) was imposed on corporate entities buying any residential property	
Turkey	LTV ratio on commercial real estate mortgage loans was limited to 50 percent (Jan 2011)				Foreign curreny loans were banned (Jun 2009). Corporations were still allowed to borrow in foreign currency provided the maturity of the loan is more than a year and the amount financed is more than 5 million US dollars.

LIQUIDITY TOOLS[100]

A. Tools and Transmissions[101]

133. Liquidity tools aim to mitigate systemic liquidity risks. As banks increase reliance on noncore funding, such as short-term, wholesale or foreign currency funding to fund illiquid assets, the system becomes exposed to funding and market liquidity shocks. As the global financial crisis demonstrated, such vulnerabilities can impair banks' ability to obtain funding and refinancing in stressed times, and can trigger abrupt deleveraging and fire sales with system-wide repercussions (IMF, 2010b; Covitz and others, 2009; Kapadia and others, 2012). Liquidity instruments improve resilience to shocks over time and within the system by reducing the exposure to vulnerable non-core funding. Moreover, tightening liquidity tools to address systemic liquidity risk can also have a side-effect of slowing credit growth.

134. International discussions on liquidity tools are ongoing, and efforts to define global standards for liquidity risk management are underway. In 2008, the BCBS issued a guideline on principles for sound liquidity risk management. To complement the principles, the BCBS is in the process of negotiating the calibration of two minimum standards, the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR), under Basel III to ensure sufficient liquidity to withstand a range of stress events and encourage long-term funding. However, their international implementation among the participating jurisdictions will only take place over the medium-term (Box 9).

Box 9. Basel III Liquidity Tools

The LCR aims to promote short-term resilience of a bank's liquidity risk profile by ensuring that it has sufficient High Quality Liquid Assets (HQLA) to survive a significant stress scenario for one month. The ratio is defined as a stock of unencumbered HQLA divided by the total net cash outflows over the next 30 calender days, with draw-downs on liabilities assumed to mimic those over a stressed period. The total net cash outflow is defined as the total expected cash outflow, which is calculated from the outstanding balances of liabilities and off-balance sheet commitments with certain assumptions on run-off and draw-down rates, minus the total expected cash inflow, which is calculated from the outstanding balances of contractual receivables. The minimum requirement for LCR starts from 60 percent in January 2015, and rises by 10 percentage points each year to reach 100 percent from January 2019 onwards.

The NSFR aims to reduce funding risk over a longer time horizon by requiring banks to fund their activities with sufficiently stable sources of funding. The ratio is defined as the amount of available stable funding (ASF) divided by the amount of required stable funding (RSF). The ASF is a weighted sum of capital and liabilities with maturity over one year, such as long-term liabilities and non-maturity deposits by retail and SME customers, where more stable liabilities receive higher weights. The RSF is a weighted sum of assets and off-balance sheet activity based on the liquidity characteristics and residual maturities, where higher weights are assigned to long-term and encumbered assets and nonbank customer loans. The BCBS intends to set the minimum requirement of 100 percent on an ongoing basis from January 2018.

[100] Prepared by Chikako Baba (MCM).

[101] For a broader discussion of key issues in the staff's advice on the use of macroprudential policy tools, see the main Staff Guidance Note on Macroprudential Policy.

135. A variety of liquidity tools are available to promote a more sound funding profile and to improve the resilience to shocks overtime, but experience with some tools is limited. Instruments can be designed as price-based levies (charges, fees, taxes, etc.) or as quantity-based limits on balance sheet ratios.[102] Their specific design can be tailored to the objective at hand. For example, they can be differentiated by types of liabilities (e.g., by currency, or maturity); they can be applied to stocks or flows; and their stringency can be adjusted along financial cycles to tackle systemic risks that may be rising due to the evolution of banks' (and other intermediaries') funding structures. [103]

- **Liquidity buffer requirements** ensure that banks hold enough liquid assets to cover outflows during a stressed period for a few weeks. Examples include setting a minimum requirement for the LCR or more simply a liquid asset ratio that requires banks to hold a certain amount of liquid assets as a fraction of all short-term funding. Banks meet these requirements by increasing their holdings of liquid assets or decreasing short-term liabilities, thereby contributing to greater resilience to liquidity shocks.

- **Stable funding requirements** ensure that banks hold stable liabilities to fund their illiquid assets (such as loans). Examples include the NSFR, a core funding ratio (CFR), a cap on the loan-to-deposit (LTD) ratio, a cap on the loan-to-stable funding (LTSF) ratio, and limits on maturity mismatches between assets and liabilities. As stable funding grows slowly over time, the requirements can work counter-cyclically. Given uncertainties in the NSFR definition and complexity in its calculation, the practical experience so far is confined to simpler measures, like LTD ratios. Further discussion of the NSRF is contained in Gobat and others (2014).

- **Liquidity charges** impose a levy on non-core funding, and were first proposed by the IMF (2010a). These levies can be differentiated by maturity or by currency, and the proceeds can flow into the general budget or accumulate at a dedicated contingency fund that is available to provide liquidity support in times of stress. In the latter case, they can be viewed as an insurance premium for contingent liquidity support, thereby reducing moral hazard from implicit guarantees of public liquidity support during crisis times. While experience is limited so far, an example is the levy on banks' non-core foreign currency liabilities (macroprudential stability levy) introduced in Korea in 2011 (Shin, 2010a and 2010b; IMF, 2013d).

- **Reserve requirements** ensure that banks hold certain amounts of reserves with the central bank, and can also affect broader credit conditions by changing the spread between lending and deposit rates (IMF (2013a); Gray (2011); Tovar and others, (2012); Glocker and Towbin (2012)). Reserve requirements are usually applied on short-term liabilities (including deposits) and can be differentiated by type of liabilities (by maturity, and/or currency), applied on the stock or flows (marginal reserve requirements), and remunerated below the policy rate or unremunerated

[102] See IMF (2013b) and Perotti and Suarez (2011) for relative strength of price-based and quantity-based measures.

[103] See also ESRB, 2014

Gray (2011). Although reserve requirements can be used for monetary policy purposes, countries also change the requirements for financial stability purposes. For example, Brazil expanded the deductible on reserve requirements in 2004 to alleviate funding pressures for small and medium sized banks (Robitaille, 2011).

- **Constraints on open FX positions** aim to limit banks' exposure to exchange rate risks. Countries often impose limits on banks' net open FX positions, i.e. the mismatch between FX asset and liability positions (including off-balance sheet exposure), in aggregate and by individual currency, to reduce the vulnerability to currency fluctuations.

- **Constraints on FX funding** aim to reduce excessive reliance on FX funding. In EMEs, limits on FX funding are often used to reduce banks' reliance on external funding. Limits can be imposed in various ways, for example through a cap on FX borrowing, limits on FX swaps or derivatives positions, differentiated reserve requirements on banks' FX liabilities, taxes or levies on cross-border flows, or more administrative requirements. When reliance on external funding gives rise to financial stability concerns, tools may also include (other) CFMs in certain circumstances and in line with established principles (IMF, 2012b).

- **The policy toolkit for nonbanks** covers tools to manage market and funding liquidity risks from the activities of NBFIs. It includes liquidity requirements tailored to nonbank activities (e.g., for collective investment schemes), restrictions on redemptions, and regulation of margins in securities lending transactions. The Financial Stability Board (FSB) (2013d, 2013e) has proposed a policy framework for nonbank entities and summarizes policy recommendations.

136. Liquidity tools enhance the resilience of the financial system to liquidity shocks (MAG, 2010, IMF 2013c; CGFS, 2012). Tools constraining banks' liabilities, such as stable funding requirements or liquidity charges, reduce reliance on more volatile funding sources. Tools requiring banks to hold liquid assets make banks (i) increase holdings of liquid assets; (ii) reduce holdings of illiquid assets; or (iii) shorten loan maturities, so that banks can liquidate their assets more easily at more stable price at the time of liquidity stress. These improvements in individual bank's resilience in turn reduce the chances of system-wide contagion and negative repercussions of liquidity risks for the real economy, and can reduce the frequency and severity of crises.

137. Tightening liquidity tools to address systemic liquidity risk is also likely to affect credit growth, even though empirical evidence for these effects is not available for all tools. Liquidity tools that constrain the liability side (such as a core funding ratio) and those that affect the asset side (such as a liquid asset ratio) both make funding more costly during a boom (IMF, 2013c; Shin, 2010a and 2010b; CGFS, 2012). To meet tighter funding requirements, a bank needs to (i) increase core funding (for example, by raising retail deposits, lengthening funding terms, or transforming unsecured funding to secured funding); or (ii) reduce the growth of credit. The first option is costly during a boom because core funding grows only slowly. Thus, to the extent a credit boom is funded by non-core funding sources, liquidity tools can also slow loan growth. Similarly, to meet liquidity requirements on assets, a bank needs to increase its share of liquid assets, whose

yields are usually low. To recover a loss of profits, the bank tends to raise its lending spread, thereby putting a brake on credits.

138. The evidence shows that increases in reserve requirements can affect broader credit conditions (IMF, 2013a). As previously described, increases in reserve requirements increase lending spreads, as long as reserves are remunerated below the policy rate or unremunerated, and thus discourage credit growth. Time-varying use of reserve requirements can help curb excessive credit growth, and can indirectly contribute to financial stability. Studies show that raising reserve requirements moderated credit growth and the procyclicality of credit growth (see for example IMF, 2011a and 2013a; Lim and others, 2011). When changing reserve requirements for financial stability goals, the volume of open market operations can be adjusted to sterilize the impact on banking system liquidity and to keep interbank rates close to the target policy rate (IMF, 2013a).

139. Liquidity tools can also contribute to contain structural risks. Since noncore funding is often raised in wholesale financial markets, liquidity tools can reduce domestic or cross-border exposures among financial institutions. The roles of liquidity tools in the structural dimension are discussed in more detail in the chapter on structural tools.

140. Regulatory arbitrage can undermine the effectiveness of liquidity tools, by building up liquidity risks outside of the regulatory perimeter. To avoid leakage, regulators need to monitor activities not subject to liquidity requirements and extend the regulatory perimeter when necessary, as discussed in detail further below.

B. Indicators

141. Advice should be based on continuous monitoring of liquidity risks using information on bank balance sheets, macroeconomic conditions, and developments in funding markets (Table 8). If countries do not have indicators to measure systemic liquidity risks, staff should encourage the authorities to collect and compile the relevant data. Detailed data on bank balance sheets may not be available to staff, but macroeconomic and market-oriented data often contain useful information.

142. Core indicators. The LTD ratio and the share of noncore funding (short-term, wholesale, FX) in total liabilities are two indicators of funding vulnerabilities that can serve as the basis for monitoring the need for liquidity tools (Box 10). The denominator of the LTD ratio can be expanded to include non-deposit stable funding sources, thus becoming a LTSF ratio, where this is a better reflection of country characteristics.

143. Additional balance sheet indicators. The soundness of funding structures should ideally be monitored using bank-level information on the financial sector's asset-liability compositions, for example the share of HQLA (high quality liquid assets) in total assets, asset-liability maturity mismatches, and gross open currency positions. Some liquidity tools, if not controlled, can also be used as signaling indicators to measure liquidity conditions. For example, once implemented, LCRs and NSFRs are regularly reported to supervisors, and hence their developments can be analyzed to

gauge liquidity conditions.[104] However, once binding quantitative limits are imposed on these ratios, they no longer work as signals and policy effectiveness must be measured with other indicators. Indicators of general credit conditions, such as an increasing credit to GDP ratio, are also useful in guiding the use of liquidity tools to moderate (liquidity-driven) credit cycles. These indicators often move in tandem, as banks rely on noncore funding sources to extend loans during credit booms given the slower-moving developments in core funding such as retail deposits.

144. Additional market based and macroeconomic indicators. When collecting balance sheet data is difficult, attention can be paid to indirect measures of market conditions, for example, interbank market turnover, issuance of securities, or the volume of unsecured borrowing. In addition, because liquidity risks tend to build up when markets are calm, careful monitoring of core and additional indicators is warranted in an environment of low and tranquil interbank interest rate spreads, prolonged stability in exchange rates or FX swap rates. For small open economies, trends in short-term capital inflows through financial institutions (as captured by positions and flows of other investments and portfolio investments received by banks) are often important indicators of noncore funding. Supplementary information from market surveys on the composition of funding can be helpful as well.

Table 8. Liquidity Tools: List of Core and Additional Indicators

Core indicators

- Loan-to-deposit ratio;
- Non-core-to-core funding ratio.

Additional indicators

- Liquid asset ratio;
- Maturity mismatch indicators, including NSFR once finalized;
- Gross open FX positions;
- Volume of short-term capital inflows (especially those intermediated by banks);
- Volume of securities issuance;
- Volume of unsecured funding.

[104] The LCR and NSFR will be included in the list of core indicators in the Financial Soundness Indicators (IMF, 2013f).

Box 10. Monitoring FX and Maturity Risks for the Banking Sector

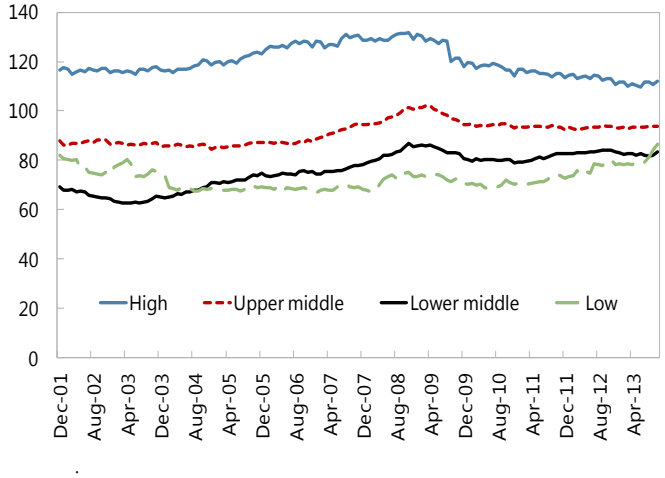
Some monitoring indicators can be defined by currency to monitor risks specific to a currency. In fact, Basel III proposes LCR by significant currency as a key monitoring tool for systemic risks. Net open position limits can go some way to address mismatches in the currency composition of assets and liabilities, and encourage banks to close open on-balance sheet positions by currency swaps. However, even when a bank satisfies limits on FX open positions and liquidity requirements in aggregate, it may still face maturity mismatches in one specific currency. For example, the Singapore FSAP finds that, while banks are largely deposit funded and LTDs are below 90 percent on a consolidated basis, U.S. dollar loans grew more rapidly than U.S. dollar deposits in Singapore, creating liquidity risks. Moreover, when swap contracts need repeated roll-over, they can still expose the banks to sharp increases in swap premiums in stressed periods, or counterparty credit risks (Turkey FSAP), so that the hedge is, in practice, imperfect.

Liquidity tools can be designed to target specific risks in both maturity and currency. Many countries set different reserve requirements by currency (domestic currency versus FX) and by maturity (e.g., differentiated for demand, time, and saving deposits). The Macroprudential Stability Levy in Korea focuses on banks' balance of nondeposit FX liabilities of maturities up to a year (IMF, 2013b). Moreover, in principle, both the LCR and the NSFR ratio can be enforced separately for the major funding currencies. For example, in Sweden, the LCR was initially applied to foreign currency only (Riksbank, 2013). The ESRB (2012b) has recommended to monitor U.S. dollar funding and liqudity risks, and to limit excessive FX exposures.

C. Calibration—Tightening

145. Steep increases in the above indicators can justify tightening of liquidity tools. Although there are no established thresholds for the core indicators, rapid increases in the indicators, such as the LTD ratio, are a clear warning sign and often prompt policy reactions (Box 11). Whether any given level of the LTD ratio remains comfortable should be judged vis-à-vis structural features of the financial market. A cross-country comparison suggests that more developed countries tend to have a higher loan-to-deposit ratio for structural reasons, reflecting the availability of alternative savings products for retail customers and alternative funding sources for banks. High-income countries often find their LTD ratio exceeding 100 percent, higher than the average of 80 percent for low and middle-income countries (Figure 8).

Figure 8. Average LTD Ratios by Income Level
(In percent)



Sources: IFS and IMF staff calculation.

Note: The sample covers all member countries where the data are available. The income classification follows the grouping for 2012 by the World Bank.

146. With a buildup of systemic liquidity risk, staff should consider which aspects of liquidity risks to target with different tools. A country can (i) build liquidity buffers to improve resilience to a funding shock; (ii) improve the funding structure of banking sector balance sheets by encouraging long-term and stable funding; and (iii) introduce liquidity charges that penalize noncore, short-term and FX funding, when certain funding sources are major concern. Finally, when rapid credit growth leads to a more fragile funding structure, LTD ratios or a tightening of funding constraints, such as core funding ratios, can act as a brake on credit growth and maintain stable funding.

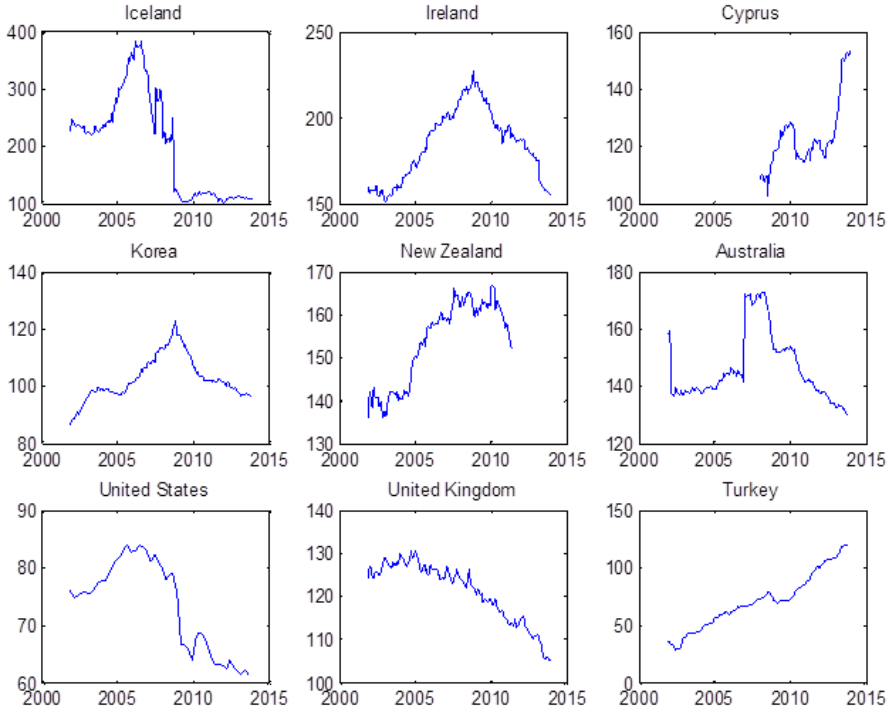
147. The selection and scope of tools should depend on country circumstances and data availability. For financially developed economies, major concerns likely lie in wholesale funding, the quality and amount of liquid assets, and interconnectedness among institutions through funding linkages. For the home countries of systemically-important financial institutions (SIFIs), additional attention should be paid to systemic liquidity risks of the SIFIs that can cause fire sales of global assets. For small open economies where financial institutions rely on foreign funding, FX open position limits and tools that address systemic risks from short-term and FX funding are important. For financially less developed and closed economies, reserve requirements will likely be a primary tool to control aggregate liquidity in the domestic banking system since the availability of high quality liquid assets is often limited. In addition, the calibration of liquidity tools should consider the

strength of the deposit insurance arrangements and more generally the ability of the government or central bank to back-stop the system in case of liquidity stress.[105]

Box 11. Loan to Deposit Ratio for Selected Countries

LTD ratios increased dramatically in some countries prior to the global financial crisis. Crisis-hit European countries indeed experienced large spikes in their LTD ratios. For example, the ratio jumped from 220 percent in 2003 to 385 percent in 2006 in Iceland and from 150 percent to 220 percent in Ireland over five years. Korea and New Zealand activated liquidity tools after their LTD ratios rose by about 25 percentage points over three years.

The cross-country heterogeneity of the LTD ratios makes it difficult to define a comfortable level of the LTD ratio. The levels of LTD ratios are highly heterogenous across countries, because of statistical differences in the underlying series, or differences in the financial sector structure itself. In contrast to some European countries, where the LTD ratios are relatively high, the LTD ratio in the U.S. is low and remained below 85 percent even before the global financial crisis. This is because securities markets are a large component of US financial markets, and the LTD ratio does not capture off-balance sheet funding and the provision of credit by nonbank institutions.



[105] For instance, in calibrating the Basel LCR ratios, assumptions on run-off rates for retail deposits are required to consider the strength of the deposit insurance scheme. Where the scheme is prefunded and credible, run-off rates are three percent, while the run-off rates are increased to ten percent in the absence of a prefunded deposit insurance scheme.

148. Stress testing can help calibrate liquidity tools. If the authorities collect regulatory data for the banking sector, staff should encourage stress testing the banking system for various macro scenarios to identify vulnerabilities of the system and gauge the need for tightening. Scenario analysis based on historical experiences of the country or peers should be applied to assess if the system has enough liquidity in stressed times. Such scenarios can also be used to assess specific risks from funding in FX. In addition, repeating the stress testing exercise after tightening liquidity tools would help assess the measures' effects in strengthening resilience.

149. In light of limited experiences with liquidity tools, there can be merit in a gradual tightening of policy measures The authorities can take a learning-by-doing approach to see market reactions and unexpected consequences. An example of a gradual phase-in is found in New Zealand where the minimum CFR was initially set at 65 percent of total loans and advances in 2010, and raised in two steps in 2011 and 2013 to reach 75 percent. In addition, when the liquidity related requirements are imposed on the stocks on banks' balance sheets, the authorities should allow a preparation period for banks to meet the new requirements. For example, Korea announced a ceiling on the LTD ratio in December 2009, and Korean banks were expected to meet the ceiling by the end of 2013 (subsequently brought forward to June 2012).[106] On the other hand, if the measures target new funding (e.g., a marginal reserve requirement) or new lending, the implementation should take effect immediately.

150. Various considerations affect the calibration of measures. When the central bank is committed to provide liquidity support at times of liquidity stress, the buffer at banks can be smaller (as in the U.K. where the FPC recommended a relaxation of liquidity requirements given the availability of central bank liquidity facilities). Where markets in sovereign debt are thin, committed lines provided by the central bank can serve as an effective macroprudential liquidity tool that may be allowed to count towards liquidity buffers, such as the LCR (Australia FSAP). If foreign bank branches have a large presence in the financial system, measures tailored to their activities may be needed. An example is the cap on FX derivatives positions of foreign bank branches applied in Korea.

151. Staff should be mindful of potential side effects of liquidity tools. (IMF, 2010b; IMF, 2011d)

- Liquidity tools can excessively restrict banks' ability to undertake maturity transformation, reducing the efficiency of the banking system in providing financial intermediation. Alternatively, they can limit the ability of interbank money markets to act as a buffer in helping institutions manage short-term liquidity needs, unintentionally undermining the tool's objective.

- If the calibration is too restrictive, it could encourage migration of some banking activities into the less-regulated financial system, including toward shadow banks, and potentially accentuate rather than alleviate systemic risk.

[106] In June 2011, the Korean authorities brought the deadline forward to June 2012.

- Because yields on high quality liquid assets are usually low, the liquidity requirements may lead to increased risk taking by banks that are in search of additional returns to recover their profits. Higher reserve requirements can then lead banks to higher risk segments without curbing credit growth (see Turkey FSAP).

- In countries where domestic debt markets are still shallow, requiring greater term funding may force banks to take on exchange rate risks.

D. Addressing Systemic Liquidity Risks in the Nonbank Financial Sector

152. Staff should pay close attention to the build-up of potential systemic liquidity risks outside of the banking sector. In general, short-term funding of long-term and illiquid securities can lead to procyclical feedback between market and funding liquidity, as pressure on the liability side can cause fire-sales of assets, which can cause further pressure on the balance sheets of holders of these assets (Brunnermeier and Pedersen, 2009; Stein, 2013).

153. The global financial crisis has vividly demonstrated the empirical relevance of systemic liquidity risks in the nonbank sector. In the U.S., money market funds—key providers of short-term wholesale funding for banks—suffered from redemption requests in 2008, leading to a large scale liquidity freeze in the whole financial system that spilled into European markets. Margin calls and a freeze on rollovers of exposures to investment banks that were using short-term repo funding to invest in asset-backed securities led to fire-sales of these securities and the failures of Bear Stearns and Lehman.

154. More recently, structural changes in securities markets and growing prevalence of maturity transformation outside of the banking system may have exacerbated the potential for systemic liquidity risk. In the context of global regulatory reforms, banks reduced their corporate bond inventories, weakening liquidity in secondary corporate bond markets (IMF, 2014a). However, repo financing involving corporate bonds has grown in importance. Furthermore, there is a growing presence of collective investment vehicles (e.g., mutual funds, bond funds in the U.S.) or off-balance sheet products (e.g., wealth management products in China) that are redeemable at short maturities, while their assets can be hard to sell during stressed times (IMF, 2014a; IMF, 2013g). Once end-investors seek to withdraw, the redemption pressure could lead to fire sales and pose rollover risks.

155. Data collection on and basic oversight of relevant nonbank institutions and markets are important fist steps in addressing systemic risks in the nonbank sector (IMF, 2010b; FSB, 2011c). The FSB has recommended a two step approach, where the net is first cast wide, and a wide range of data is collected and assessed to understand the flow of funds in the economy to identify potential areas of concerns. Then, the focus should be narrowed to trends in the activities of nonbanks engaging in credit intermediation that involve leverage or maturity transformation, or result in inter-linkages with the banking sector. Where appropriate, staff should encourage the authorities to establish a monitoring framework involving regular data reporting by systemic nonbank institutions.

156. Macroprudential measures can be extended to nonbank financial intermediaries and activities. Where nonbank credit institutions and intermediaries are involved in bank-like activities, prudential regulations can be extended to nonbanks to mitigate liquidity and fire sale risks. Basic tools to manage liquidity risks include liquidity buffer requirements; limits on investments in illiquid assets as a proportion of assets; limits on asset concentration in particular market segment; limits on leverage; and limits on the maturity of portfolio assets to reduce maturity mismatches (FSB, 2013d). Although the design and calibration of these tools needs to take into account the specific nonbank institutions' risk-return profile, such policy measures have benefits of subjecting all bank-like activities to prudential requirements and ensuring a level playing field for banks and nonbanks.

157. For securities lending markets, the regulation of margin requirements can help mitigate fire sale risk and margin spirals that contribute to excess leverage and procyclicality (IMF 2013c; Geanakoplos, 2010; Longworth 2010; Hanson and others, 2011; FSB, 2012b).

- A margin is collateral (cash or securities) that a borrower deposits to cover some or all of the credit risk of their counterparty. Such margins arise in securities lending markets, where securities (such as stocks and bonds) are bought "on margin," that is, financed in part by a loan, which in turn is collateralized by the securities bought. They also arise in repo markets, where the borrower posts collateral in exchange for short-term credit and this credit is typically rolled over by the lender.

- Margins are often very low when markets are calm, but tend to increase sharply in periods of stress, requiring the posting of additional collateral by borrowers (FSB, 2014b). This can squeeze their liquidity position and may force the liquidation of the securities holding. These liquidations, and the effect they have on the level and volatility of prices, in turn may justify a further increase in margin requirement by lenders, since their protection depends on the collateral value of the assets they lent against. This process is known as a "margin spiral" (Brunnermeier and Pedersen, 2009).

- Regulatory minimum requirements on margins (e.g., minimum floor on the dollar amount of collateral to be posted, where this minimum might depend on the type of security offered as collateral) increase financial buffers and can dampen margin spirals.[107] In particular, the FSB has issued a policy framework establishing standard calculation methodologies and minimum numerical floors for collateral haircuts in bank-to-nonbank securities financing transactions (FSB, 2013e; 2014a).[108] Some argue that margin requirements should be broadly applied to any party that uses short-term collateralized funding to finance its securities holdings (universal

[107] The 1934 Securities and Exchange Act gave the Federal Reserve broad authority to regulate margins in securities lending markets, except for government securities. Between 1934 and 1974 the Federal Reserve actively managed the margin requirements for stock market investors (Regulation T). See further Elliott and others, 2013.

[108] The haircut floors are applied to securities financing transactions backed by collateral other than government securities. The minimum haircuts are ranging from 0.5 to 4 percent for corporate bonds and 1 to 7 percent for securitized products, depending on their maturities, 6 percent for main index equities, and 10 percent for other assets. The framework will be implemented by end-2017.

margin requirements) (Stein, 2013). FSB (2014a) also proposes to expand minimum margin requirements to nonbank-to-nonbank securities financing transactions.

158. Additional tools are being proposed for intermediaries in securities lending markets, such as broker-dealers, although the experience with these tools is limited to date. These include capital and liquidity requirements, restrictions on the use of clients' assets (e.g., limits on re-hypothecation), and liquidity-linked capital surcharges (FSB, 2013d; Tarullo, 2013; Stein, 2013).

159. A range of other tools may have the potential to manage run-risk and fire sale externalities for collective investment funds. For activities by collective investment vehicles (CIVs) (e.g., mutual funds, exchange traded funds), the FSB has issued a policy framework to strengthen oversight and regulation. The FSB framework here contains two sets of policy tools (FSB 2013d). The first set of tools amount to an extension of liquidity requirements to CIVs. The second set of tools aims to manage redemption pressures in stressed market conditions. (See Table 9). Indeed, liquidity fees and redemption gates were recently adopted in the U.S, alongside liquidity requirements, as new tools to address the potential for destabilizing runs on money market funds (SEC, 2014) (see further Box 12).

Table 9. Policy Toolkit for Collective Investment Vehicles—Tools to Manage Redemption Pressures in Stressed Market Conditions

Redemption gates	Redemption gates constrain the redemption amounts by CIVs to a specific proportion on any one redemption day, thereby easing redemption pressures.
Suspension of redemptions	Suspending redemptions would mitigate the impact of redemption pressure like redemption gates, albeit in a stronger manner. It is an exceptional measure to buy time for the fund manager to assess the situation and decide the next step.
Imposition of redemption fees or other redemption restrictions	Imposing redemption fees would make investors bear liquidity costs in times of stress and otherwise restrain redemptions. Fees may be applied at all times or be imposed depending on market contingencies.
Side pockets	When redemption pressure is triggered by a problem related to specific assets, side pockets can be used to legally separate the impaired or illiquid portions of an investment portfolio to prevent them from affecting a CIV's return until market conditions stabilize. A CIV would continue its normal operations with the higher quality portion of its portfolio and avoid an increase in redemption demands.

160. Caution is needed in activating these tools. These tools may be applied at all times or be imposed depending on market contingencies, but caution is needed in their use. In the case of trigger-based or regulator-imposed redemption fees or gates, the imposition of these tools may send negative market signals and lead to pre-emptive runs ahead of them coming into force. On the other hand, the beginning of a run may trigger the redemption fee or redemption gate and thus "self-correct" the run (FSB, 2013d).

161. The scope to impose restrictions on redemptions may require prior supervisory action that affects the legal structure and documentation of the fund. For instance, unless the possibility of imposing a restriction on redemptions is described in the documentation governing the operations of the CIV ex ante, it will be difficult for the authorities to require such an action in stressed conditions. Therefore, the imposition of such policy tools typically require an active role of the securities and conduct regulators, and their close collaboration with the macroprudential authorities.

162. Such measures may need to be complemented by arrangements that enable the authorities to provide liquidity in stressed market conditions. The government or the central bank could assess its ability to provide emergency liquidity to break vicious feedback loops between funding and market liquidity in times of stress. This also requires the strengthening supervision of nonbanks to avoid moral hazard from a perception that investors are being insured.[109]

163. Ensuring appropriate supervision and prudential regulations in the nonbank sector can have positive international spillovers. Recently, there is growing presence of foreign nonbank investors in emerging market economies in primary markets of local currency government bonds, while liquidity in secondary markets has declined. As a result, should foreign investors decide to sell the bonds, their actions could cause large price movements (systemic liquidity mismatch) (IMF, 2014a). In this context, prudent supervision in the home country of nonbank institutions might have some additional benefit of mitigating the spillover of fire sale risks, although this would likely depend on many factors.

164. Outside of macroprudential policies, other types of policies also contribute to mitigating spillover risks in countries which are recipients of cross-border nonbank investments. In financially less developed economies, where securities markets are centered on primary markets, policies to deepen secondary markets for securities or policies to promote a larger local investor base can help increase the resilience to fire sales and sudden stops (IMF, 2014b). In particular, local institutional investors who are less subject to run risk, such as insurance companies and pension funds, can provide long-term financing to match their long-term liabilities and act as a shock absorber (IMF, 2013c; FSB, 2013d).

165. Another set of policy tools includes limits on portfolio investments by foreign nonbank institutions and investors. As such measures can also be considered CFMs, staff should ensure that the objectives of the measure is explicitly associated with systemic liquidity risks, the measure is not a substitute for necessary macroeconomic adjustment, and the measure is most effective and least distortive in addressing risks (IMF, 2012b).

[109] For example, during the global financial crisis, the U.S. Treasury provided liquidity guarantees for Money Market Mutual Funds (MMMFs) and the Federal Reserve supported a range of securities markets that had come under stress, while Korea created the Bond Market Stabilization Fund to ease liquidity problems in the local bond market. In the U.K., the BoE recently announced the extension of its liquidity facilities to some nonbanks (large broker-dealers and central counterparties) (Carney, 2013 and 2014). However, a commitment to emergency liquidity support to nonbanks creates incentives for increased risk taking and increases the need for stronger supervision and regulation.

Box 12. Money Market Mutual Funds in the U.S.

MMMFs have played a central role in the wholesale money market. MMMFs in the U.S. originated in the 1970s from a desire to escape Regulation Q, which did not allow interest to be paid by deposit-taking institutions on demand deposits. Moreover, as nonbanks, MMMF could avoid the reserve requirements and FDIC contributions imposed on depository institutions. MMMFs have also flourished due to two key regulatory features: (1) "hold to maturity" accounting conventions that allowed them to use stable net asset values (NAVs) for reporting and redemptions, giving investors a deposit-like claim, and (2) the right to take on some credit, market, and maturity risk without being subject to the full set of prudential regulations. At their peak, the U.S. MMMFs' total holdings of financial assets at end 2008 amounted to about US$3.8 trillion, equivalent to 27 percent of GDP, and they also accounted for a significant share of the triparty repo market.

U.S. MMMFs became vulnerable in the early stages of the financial crisis, particularly due to their outright purchases of asset-backed commercial paper (ABCP). During 2007–08, MMMFs were exposed to substantial losses, first as a result of losses on the debt securities underpinning the ABCP, and then by the default of debt securities issued by Lehman Brothers Holdings Inc. Customers had become used to the notion that constant NAVs of one dollar were nearly assured until one large MMMF "broke the buck" following the Lehman default in September 2008, causing a run and redemptions across a large number of MMMFs. Sponsors provided substantial support to avoid the forced liquidation of funds as well as to limit the impact on their reputations. The key role played by MMMFs increased the vulnerability of bank funding markets to any sudden withdrawal of liquidity by the MMMFs due to redemption requests by their investors. When this occurred, the provision of short-term funding to corporate borrowers, through commercial paper and ABCP, threatened to dry up. Unprecedented emergency facilities established by the treasury and Federal Reserve were ultimately needed to contain the run on money market funds and provide the necessary additional liquidity.[1]

Since that event, the Securities and Exchange Commission (SEC) has sought to make MMMFs more resilient and less susceptible to runs. Rule changes (effective in May 2010) were intended to increase resilience by reducing interest rate, credit and liquidity risks in MMMFs' portfolios. In response to recommendations by FSOC, in July 2014, the SEC adopted a reform that requires a floating NAV for prime institutional money market funds[4] and allows all money market funds the use of liquidity fees and redemption gates (i.e., a temporary suspension of redemptions) in times of stress. The reform also includes additional diversification, disclosure and stress testing requirements.

The Financial Stability Oversight Council (FSOC), which has long been vocal on the need for MMF reform, will be weighing in on the sufficiency of the SEC's new reforms and will consider whether the rule will impact its next steps for designating certain asset managers as systemically important

_____

1/ The Treasury Department introduced the Temporary Guarantee Program, which temporarily guaranteed certain investments in money market funds that decided to participate in the program. The Federal Reserve Board created its ABCP MMMF Liquidity Facility, through which it extended credit to U.S. banks and bank holding companies to finance their purchases of high-quality asset backed commercial paper from money market mutual funds. The programs expired in September 2009 and February 2010, respectively.

2/ MMMFs could, under normal circumstances, use the penny rounding method to maintain a price of US$1.00 per share without pricing to the third decimal point like other mutual funds, and the amortized cost method so that they need not strike a daily market-based NAV.

3/ The adoption of NAV requires funds to value their portfolio securities using market-based factors.

4/ Prime institutional MMMFs are geared toward institutional investors and primarily invest in corporate debt.

E. Calibration—Relaxation

166. Relaxation of liquidity tools can be an effective policy option in periods of financial stress. When stress results in liquidity tools becoming a binding constraint on the provision of interbank liquidity or the provision of credit more broadly, a relaxation of liquidity tools can help reduce liquidity pressure that may otherwise lead to a freezing of interbank markets, fire-sale dynamics or deleveraging processes. Indeed, during the global financial crisis, many central banks loosened collateral frameworks and undertook liquidity provisions including Emergency Liquidity Assistance to ease funding stress. Reserve requirements were also lowered in many countries. Empirical analysis also supports the effectiveness of lowering reserve requirements to support credit growth in financial downturns (IMF, 2013b).[110]

167. Declines in credit supply or signs of liquidity stress can provide grounds for relaxation of liquidity requirements. When bank lending declines, staff should investigate if the decline reflects a lack of credit demand or problematic constraints on credit supply that may be sourced in liquidity constraints. In the latter case, relaxing liquidity tools can help ease the market stress and avoid a system-wide contagion from liquidity shortages. A recommendation to use excess liquidity to support additional lending is a case in point (BoE, 2012a and 2013).

168. Risks of liquidity crisis are best monitored with high frequency market indicators and by tracking the usage of central bank liquidity facilities. These indicators can play an important role in early warning of a crisis, and stress readings on them would call for immediate release of liquidity buffers to avoid fire sales of assets and maintain market confidence. Various indicators can be proposed from theory and the experiences of the global financial crisis—in particular, increases in unsecured interbank rate spreads, repo spreads, margins and haircuts on repo collateral, FX swap rates, CDS-bond spreads, bid-ask spreads in FX, equity, bond and money markets, as well as the bidding premium at central bank auctions for money market operations (IMF, 2011a); Drehmann and Nikolaou, 2013; European Central Bank,2007, Box 9; ESRB, 2014). In addition, increased usage of the central bank's overnight or emergency facilities is a strong sign that liquidity pressures are building up. IMF (2011a) summarizes information from various indicators in a systemic liquidity risk index by applying principal component analysis.

169. Liquidity buffers should be released promptly during times of stress. Relaxation of some liquidity tools—including liquid buffer requirements, reserve requirements and add-ons to Basel III liquidity tools—reduces banks' cost of funding, and thereby supports credit supply. Indeed, emerging market countries often lower reserve requirements (rather than cut policy rates) to stimulate credit growth, as this may avoid a depreciation of the exchange rate or capital outflows (IMF, 2013a and Box 13). As the immediate liquidity risks fade, considerations should be given to balance the need to avoid liquidity stress and to build a buffer for the next cycle.

[110] On the other hand, country experiences with the use of liquidity tools in financial upturns are still limited, except for reserve requirement policy.

170. Financial institutions should be allowed to use liquidity buffers when deemed necessary. Static liquidity requirements can work pro-cyclically, as they tend to create concentrated demand for stable funding and aggravate liquidity stress during stressed times. For these tools to contribute to a reduction of systemic risk, rather than work as an amplifier, they need to be relaxed in periods of stress. The authorities can allow temporary falls below the minimum requirements, without formally changing the liquidity requirements. Indeed, the Basel III proposals confirm ex-ante that "during periods of stress, it would be entirely appropriate for banks to use their stock of HQLA, thereby falling below the minimum [for LCR]" (BCBS, 2013b). However, depending on the severity of the stress, even prompt relaxation of liquidity buffers may not be adequate to reduce feedback effects.

171. Measures encouraging prudent funding structures, such as limits on maturity mismatches, should be relaxed in the presence of severe funding pressures. Regulating vulnerabilities in funding structure is a relevant policy objective in both upturns and downturns. However, if the market suffers from a severe liquidity squeeze, the authorities should be advised to consider temporarily relaxing stable funding requirements to prevent fire-sales of assets, and abrupt deleveraging. When banks are under pressure, investors will naturally be inclined to shorten the maturity of their funding; and banks may face difficulties rolling over maturing long-term funding. A relaxation of stable funding requirements can accommodate this and help maintain market access.

172. Price-based measures should be given the lowest priority when liquidity tools need to be relaxed. Taxes and charges work as sands in wheels, and do not prohibit transactions themselves. As such, potential distortions arising from these measures do not change along the cycles, and the main impact of maintaining such measures in periods of liquidity stress will be on bank profitability. Implementing changes in tax policy may also take considerable time.

173. In the event of extreme funding stress, central bank liquidity support should be provided alongside the relaxation of macroprudential tools. When market funding freezes up, systemic liquidity shortfalls quickly lead to large-scale solvency problems. Experiences from the global financial crisis show the importance of the central bank as a lender of last resort to contain the propagation of shocks. In order to prevent moral hazard problems associated with central bank emergency support, countries can impose ex ante measures on the financial sector, as described in this note, to force banks to internalize their contribution to liquidity risks.

F. Leakage and Cross-Border Dimensions

174. Regulatory arbitrage can undermine the effectiveness of liquidity tools, by building up liquidity risks outside of the regulatory perimeter. For example, a narrowly-applied stable funding requirement can be avoided by creation of new products that provide maturity transformation off-the-balance sheet (e.g., ABCP). Maturity transformation may more generally move to the nonbank financial sector (e.g., CIVs).

175. To avoid leakage, regulators need to monitor activities not subject to liquidity requirements and extend the regulatory perimeter when necessary. Liquidity requirements can

be extended to foreign bank branches and NBFIs, with tailored calibration to consider their funding structure. In addition, regulators need to monitor potential migration to off-balance sheet activities and to activities not subject to the requirements. As noted in Box 12, in the U.S. liquidity requirements were tightened on MMMFs since the crisis (in 2010 and further in 2014). Many countries have designed reserve requirements to close loopholes that allowed banks and nonbanks to avoid reserve requirements: Turkey recently extended regulations on reserve requirements to financing companies; Brazil (in 2008) and Serbia (in 2005)[111] introduced reserve requirements on commercial leasing operations in their effort to contain credit growth.

176. Among highly integrated countries, regional harmonization of liquidity requirements may be desirable. Harmonizing liquidity requirements allows a level playing field, reduces the cost of compliance for banks, and avoids potential concentration of funding risks in one country where liquidity requirements are weak. If a home country is hit by a liquidity shock, it can easily spread to other countries and have a larger impact, because home bias may cause sudden withdrawal of credits from host countries during the time of stress (ESRB, 2014). Hence, it is of mutual interests for home and host countries to agree on liquidity requirements (or their minimum standards) to avoid liquidity problems in any countries in the region.

[111] In 2012, Serbia lifted the reserve requirement on foreign borrowing by financial leasing companies that became effective in December 2005.

Box 13. Use of Liquidity Tools Since 2008[1/]

	Advanced Economies	Emerging and Developing Economies
Changes in liquidity ratios	France (2009); Iceland (2012); Netherlands (2012);	Albania (2013); Armenia (2008, 12); Argentina (2008); Azerbaijan (2010); Burundi (2013); Colombia (2011); Georgia (2008, 10, 13); Jamaica (2010); Kosovo (2012); Macedonia (2009, 11, 12); Nigeria (2008, 09, 11); Peru (2012); Romania (2008, 09); Russia (2008–09); Serbia (2012); Slovak (2009); Solomon Islands (2009); Sri Lanka (2008, 12, 13); Ukraine (2011); Zambia (2008)
Stable funding requirements (LTD ratio, LTSF ratio, CFR)	Ireland (2011); Korea (2009); New Zealand (2010, 11, 13); Portugal (2011);	Bangladesh (2011); Indonesia (2011, 13); Kuwait (2008, 12); Pakistan (2008); Slovak (2012); Ukraine (2008)
Currency mismatch measures (e.g., changes in open FX position limits)	Austria (2010); Korea (2010, 11)	Albania (2010); Angola (2010); Armenia (2008, 09); Azerbaijan (2008); Bangladesh (2009); Brazil (2011–13); Burundi (2009); Croatia (2009); Democratic Republic of Congo (2009); Gambia (2013); Ghana (2012); Haiti (2008, 09); Honduras (2013); Kenya (2011); Kosovo (2012); Mauritius (2010–11); Mongolia (2010); Nigeria (2008–12); Pakistan (2009); Paraguay (2008, 11); Peru (2010, 12); Russia (2008–09, 12); Senegal (2011); Serbia (2007, 09,11)
Changes in reserve requirements 2/		Argentina (2008, 12, 13); Armenia (2010–13); Azerbaijan (2008–13); Brazil (2008–13); Bosnia and Herzegovina (2008, 09, 11); Bulgaria (2008–09); Cambodia (2008, 09, 12); China (2008–13); Colombia (2008–09); Ecuador (2009, 10, 12); El Salvador (2008, 13); Ethiopia (2008, 12, 13); Fiji (2009–10); Gambia (2012, 13); Georgia (2008, 10, 11); Haiti (2008, 12, 13); India (2008–13); Indonesia (2011, 13); Kazakhstan (2011–12); Lebanon (2009); Macedonia (2009, 12, 13); Moldova (2011); Mongolia (2008, 11, 12); Mozambique (2008–12); Nigeria (2008, 2011); Peru (2008, 13); Philippines (2008, 11, 12); Romania (2008–13); Russia (2008–13); Saudi Arabia (2008); Serbia (2010–12); Sri Lanka (2008, 09, 11, 13); Tajikistan (2012); Tonga (2009, 13); Turkey (2011); Uruguay (2008–13)
Liquidity charges	Korea (2011)	
Other		Argentina (URR; 2005, 06, 12); Colombia (URR; lifted in 2008); Brazil (IOF on capital inflows; 2009-12); Croatia (MRR, lifted in 2008); Peru (MRR);

Sources: IMF (2013c), Lim and others (2013), Tovar and others, (2012) and IMF Global Macroprudential Policy Instruments database.

Notes:

1/ The table does not cover liquidity tools introduced before 2008 and implementation of Basel III tools (LCR and NSFR). Parentheses show the time when a country introduced, tightened, relaxed or lifted a measure since 2008. Specific design and coverage of the measures differ by country.

2/ The table includes changes in reserve requirements only applicable to a subset of liabilities (e.g. short-term liabilities, FX liabilities, nonresident liabilities), and changes in reserve requirements for purposes other than financial stability (e.g., for monetary policy purposes).

STRUCTURAL TOOLS[112]

A. Rationale for Structural Tools[113]

177. The structural dimension of systemic risk arises from interconnectedness and the risk of contagion from the failure of individual systemic institutions. When the financial system is exposed to aggregate or idiosyncratic shocks, distress may spread as a result of linkages within the financial system. Linkages can arise due to credit exposures or funding dependencies between financial institutions or vulnerability across institutions to common shocks. These direct or indirect linkages can create contagion through spillovers between institutions and across the system.[114] They can expose all firms to cascading effects from a solvency or liquidity event in any one firm, leading to system-wide liquidity squeezes and runs, as well as fire-sales. The failure of an SIFI in particular is likely to create large negative externalities, and could lead to the collapse of the entire system. The expectation of government support to such institutions exacerbates the problem, since it generates an implicit subsidy and leads those with claims on systemic institutions to disregard the risk that they will fail, thereby muting market discipline. This implies that risk taking by systemic institutions can be socially excessive.

178. A range of complementary tools can contain structural risks from interconnectedness and contagion within the financial system (Figure 9). Structural macroprudential policy tools target two objectives: (1) increasing the resilience of too-important-to-fail institutions; and (2) reducing excessive exposures within the financial system.

179. To improve resilience and resolvability of those institutions whose failure poses systemic risks, prudential requirements can be tightened on those firms. Indeed, strengthening the resilience of SIFIs has emerged as the key strategy in addressing the problem of institutions that are "too important to fail," and capital surcharges on such institutions are increasingly used across countries. This is in addition to efforts to improve the resolvability of such institutions.

180. To reduce the contagious effect from the failure of such institutions, prudential tools can be used to discourage exposures to these institutions or make such exposures more secure. They can also be used to discourage excessively large exposures within the financial system more generally, to increase the resilience of the system to shocks in funding markets and to discourage overly complex financial groups (Arregui and others, 2013). Many of these tools are the same ones mentioned in prior sections, but applied with a different objective.

[112] Prepared by Nicolas Arregui (MCM).

[113] For a broader discussion of key issues in the staff's advice on the use of macroprudential policy tools, see the main Staff Guidance Note on Macroprudential Policy.

[114] See De Nicolo and others (2012).

- This can take the form of quantitative **limits** on the size of **exposures** between financial institutions relative to capital and extending existing large exposure regimes to exposures within the financial system, as is currently being discussed by the Basel Committee.

- It can also take the form of increased **sectoral capital requirements** for exposures within the financial system or specific types of exposures that are growing rapidly, as established for the U.K. FPC.

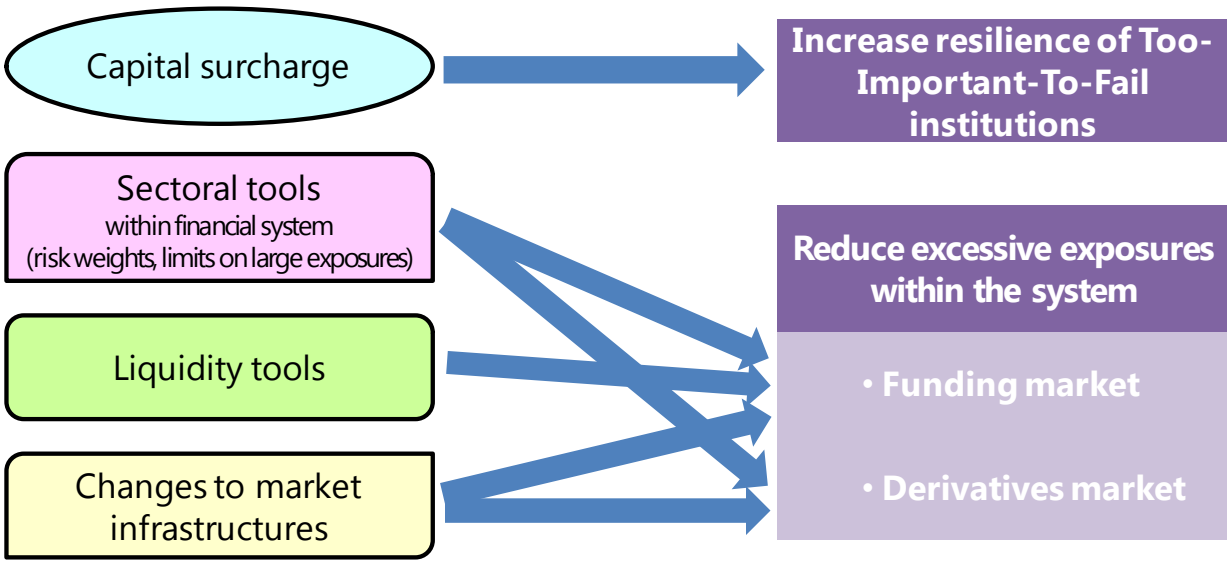
- Since noncore funding is often raised in wholesale financial markets, **liquidity instruments** can contribute to a reduction of domestic or cross-border exposures among financial institutions (Shin, 2010a and 2010b).

- Minimum **margin requirements** can be introduced in securities lending and derivatives markets to provide security against loss, which works to reduce the strength of margin spirals from idiosyncratic or common shocks to the value of collateral used in these markets.

- To reduce the build-up of credit exposures arising from transactions within the financial system, changes can also be made to the **market infrastructure**, including payment, settlement and clearing arrangements.

- Policies to restrict the size and **scope of activity** of systemic institutions can reduce interconnectedness and complexity, and limit the number of systemic institutions. However, limiting size and scope of financial institutions also entails costs.

Figure 9. Mapping Tools to Objectives: Structural Dimension



Source: IMF staff.

181. This chapter provides practical guidance on risk monitoring and macroprudential policy to address risks in the structural dimension. It proposes a three step approach to guide staff in their assessment of risks in the structural dimension and in developing policy recommendations. This approach is recommended to tailor the staff's analysis and advice to the degree of complexity and specific features of the financial system in a given country. The chapter also discusses introduction and calibration issues and covers unexpected consequences, including cross-border, of macroprudential policy in the structural dimension.

B. Three Step Approach

182. Staff should follow a three step approach for surveillance of risks in the structural dimension. First, staff should analyze the composition of the financial system, using aggregate information by financial sector and its subsectors and information from the sectoral flow of funds, if available. This analysis should generate an initial characterization of the financial network's structure and can contribute to identify the appropriate perimeter of sectors requiring further surveillance. Second, given the prominent role usually played by banks in financial intermediation, staff should turn to structural risks in the banking sector. This step should focus on identifying systemically important banks and the tools needed to improve the resilience of such institutions (encompassing improved supervision, resolvability and loss absorbency). Third, and depending on country characteristics, the analysis should be expanded to consider further structural risks and/or to cover relevant financial activities and NBFIs that may pose systemic risk.

Table 10. Chile: Financial System Structure

	2005			2010		
	Number of institutions	Assets (Percent Total)	Assets (Percent GDP)	Number of institutions	Assets (Percent Total)	Assets (Percent GDP)
Banks	26	50.5	92.7	25	49.4	102.8
Domestic banks	13	22.6	41.5	11	21.7	45.2
Foreign banks	12	19.2	35.2	13	19.1	39.7
Subsidiaries	6	16.5	30.3	8	18.8	39.1
Branches	6	2.7	4.9	5	0.3	0.7
State-owned	1	8.7	16.0	1	8.6	17.9
Insurance companies 1/	51	11.0	20.1	57	9.7	20.1
Property and casualty	22	0.6	1.0	26	0.8	1.6
Life	29	10.4	19.1	31	8.9	18.5
Pension fund administrators 1/ 2/	6	31.7	58.1	6	30.6	63.7
Other fund administrators 1/ 2/ 3/	43	6.9	12.6	43	10.3	21.4
Total	126	100.0	183.5	131	100.0	208.1

Sources: SBIF, SVS, SP, and staff calculations.
1/ 2010 figure as of September.
2/ Assets under management.
3/ Includes mutual funds, investment funds, investment funds for foreign capital.

Step 1: Financial system overview

183. Understanding the structure of the financial system is key to assessing where risks may arise. Thus, the first step in the analysis should characterize the composition of the financial system, including the size and interconnectedness of the different financial sectors at the aggregate level. The size of each financial sector should be measured not only relative to the entire financial system, but also relative to some measure of the real economy, like GDP. For countries with flow of funds data, the analysis could be expanded to characterize the interconnectedness between different financial sectors at the aggregate level. Table 10 (above) and Figure 10 (below) illustrate the analysis of size and interconnectedness at the aggregate level in the Chile FSAP Update (2011). If flow of funds data are unavailable, staff (in consultation with authorities) should at least aim to characterize the channels and degree of interconnectedness between the banking sector and other financial sectors. The types of linkages considered should be comprehensive, including funding exposures, common exposures and counterparty credit risk.

Step 2: Systemically important banks

Identification

184. The identification of systemically important institutions is a key step in managing the structural dimension of systemic risk. There is a growing consensus that the size of an institution alone is not the only (or even the main) consideration in assessing systemic risk.[115,116] In the aftermath of the global financial crisis, IMF-FSB (2009) proposed a number of criteria to assess systemic importance of a financial institution based on their potential to have a large negative impact on the financial system and the real economy. The three main criteria are size, interconnectedness, and lack of substitutability. This assessment may be complemented by additional considerations that can affect the assessment of systemic importance. For example, indicators of vulnerability, such as leverage and maturity mismatch, can be useful to identify more or less risky institutions or types of financial business.

185. In line with the IMF-FSB proposal, supervisors and policymakers have generally developed an indicator-based measurement approach for assessing systemic importance. Under this approach, selected indicators are chosen to reflect the different aspects that make an institution systemically important. For each institution, the score for a particular indicator is calculated by dividing the individual institution amount by the aggregate amount summed across all institutions in the sample for a given indicator. The score is then weighted by the indicator weighting for and within each category. All weighted scores are added to obtain the overall score for systemic importance. As no assessment approach will perfectly measure systemic importance across all institutions, it is important to complement the indicator based approach results with supervisory judgment and validation.

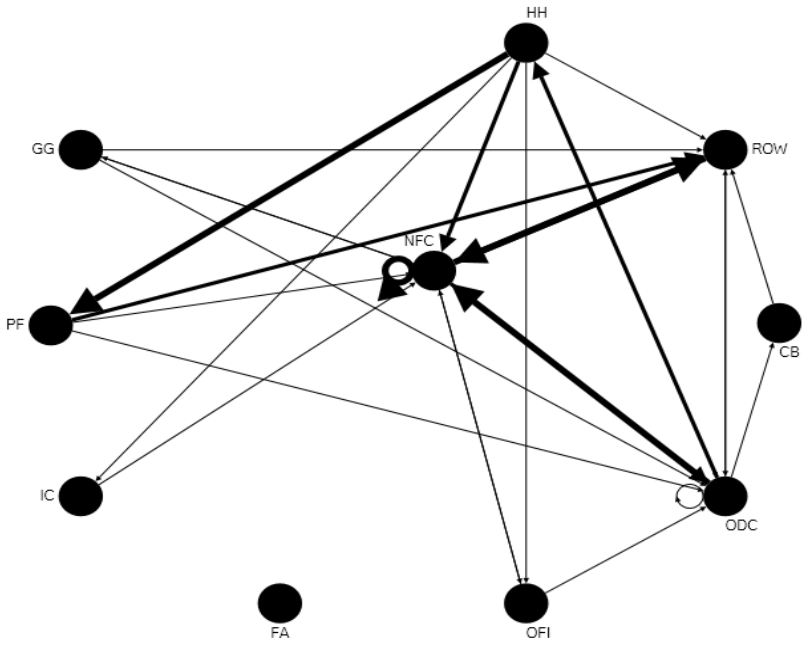
[115] See Laeven and others (2014) for evidence on systemic risks posed by large banks.

[116] See BCBS (2013); Arsov and others (2013); Cont and others (2012).

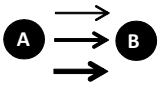
Figure 10. Chile: Major Gross Cross-Sectoral Financial Exposures

(In percent of GDP, 2009)

Panel A: Network of largest claims (>5% of GDP)



Asset of A on B (% of GDP)



5% < A < 20%
20% <= A < 40%
A >= 40%

ODC= Banks and cooperatives. OFT= Other financial institutions.
FA= Financial auxiliaries. PF= Pension funds.
IC= Insurance companies. HH= Households.
NFC= Nonfinancial corporations. GG= General government.
CB= Central bank. ROW= Rest of the world.

Panel B: Matrix of all cross-sectoral exposures as a % of GDP

	Liability of ↓										
Asset of →	**CB**	**ODC**	**OFI**	**FA**	**IC**	**PF**	**GG**	**NFC**	**HH**	**ROW**	
Central Bank	0%	5%	1%	0%	0%	0%	0%	0%	0%	14%	20%
Banks & Coop.	13%	6%	1%	0%	0%	0%	2%	42%	30%	7%	102%
Other Fin. Instit.	1%	15%	1%	1%	0%	0%	2%	8%	3%	4%	33%
Fin. Aux.	0%	1%	0%	0%	0%	0%	0%	2%	0%	0%	4%
Insurance Comp.	0%	4%	1%	0%	0%	0%	2%	9%	2%	2%	20%
Pension funds	4%	13%	3%	0%	0%	0%	4%	16%	0%	27%	66%
Government	2%	6%	0%	0%	0%	0%	0%	7%	2%	11%	28%
Non-fin. Corp.	0%	22%	12%	2%	2%	1%	4%	115%	0%	31%	188%
Households	2%	16%	8%	0%	17%	66%	0%	23%	0%	7%	141%
Rest of World	1%	11%	2%	0%	1%	0%	2%	96%	0%	0%	114%
	23%	99%	30%	3%	20%	67%	16%	318%	38%	102%	717%

Sources: BCCh (Financial Accounts) and World Bank staff estimates.
Notes: Exposures exclude net derivative positions. Preliminary BCCh estimates of long-term securities positions (item AF.32) are included. World Bank staff estimates of Shares and Other Equity (excluding mutual funds) (item AF.51) and Other Accounts (item AF.7) are based on maximum entropy methods.

186. The BCBS has published guidelines for identifying globally and domestically systemic important banks (GSIBs and DSIBs, respectively). The identification of GSIBs uses indicators to capture five dimensions of systemic importance: size, interconnectedness, lack of substitutability, complexity, and global scope of activities. Table 11 shows the indicators proposed to cover each dimension. The main criteria for identifying DSIBs are the same as those proposed for GSIBs, with the exception of global scope of activities.[117] The reference system for assessing the impact of failure of a DSIB is the domestic economy, so a bank may be identified as a DSIB even if not identified as a GSIB. In addition, the framework for identifying DSIBs provides considerable national discretion in determining the systemic importance of domestic banks. The Basel Committee proposes that national authorities publish the outline of the methodology used to assess domestic importance.

Table 11. Indicator-Based Approach for Banks

	Global SIBs		Domestic SIBS			
	W	BCBS	W	Braemer-Gischer (2012)	W	IMF 2012
Size	**20 percent**	Total exposures[1]	**20 percent**	Total resident assets	**33.3 percent**	Total resident assets
Interconnectedness	**20 percent**	Intra-financial system assets Intra-financyal system liabilities Wholesale funding ratio	**20 percent**	Loans to fin. corp. Deposits from fin. Corp.	**33.3 percent**	Investment securities Wholesale funding Loan deposit ratio Intra-group exposures
Non-Substitutability	**20 percent**	Assets under custody Payments cleared and settled through payments system Values of underwritten transactions in debt and equity markets	**20 percent**	Loans to households and non-profit org. Loans to non-fin. corp. Loans to general government		------ not included -------
Complexity	**20 percent**	OTC derivatives notional value Level 3 assets Held for trading and available-for-sale securities	**20 percent**	Investment securities Trading securities	**33.3 percent**	Trading book
Cross-jurisdictional activity	**20 percent**	Cross-jurisdictional claims Cross-jurisdictional liabilities		------ not included -------		------ not included -------
Domestic sentiment		------ not included -------	**20 percent**	Deposits from households		------ not included -------

SIBs: Systemically Important Banks; W: Weight.

[1] As defined in Basel III leverage ratio.

187. Identification exercises have already been conducted for GSIBs and for DSIBs in certain jurisdictions. The FSB publishes annually the list of identified GSIBs. The list for 2013 included a total of 29 global banks. Examples of identification exercises for DSIBs are also available. For example, using publicly available data for Australian banks, Braemer and Gischer (2012) provided an

[117] There are several ways to establish thresholds for indicators. These may be *relative* thresholds (e.g., using statistical clustering techniques to group institutions according to their scores or defining indicator thresholds as a specific multiple of the industry average) or *absolute* thresholds based on empirical evidence and expert judgment.

early example of the GSIB approach translated for DSIBs. The authors substitute a measure of the impact of a bank on domestic sentiment for cross-jurisdictional activity and use banks' market share of loans to various sectors (households, nonfinancial corporations, and government) as an indicator of non-substitutability. The Australia FSAP Update (2012), instead, proposed an assessment based only on size, interconnectedness and complexity.

188. Additional analytical tools can complement the identification of systemically important institutions. Two sets of model-based tools that are commonly used to identify systemic risk in the structural dimension are network analysis and market-based indicators (Box 14). However, as emphasized by the Basel Committee, the advantages of the multiple indicator-based measurement approach are that it encompasses more dimensions of systemic importance, is relatively simple, and is more robust than currently available model-based measurement approaches that tend to rely on a small set of indicators or market variables. That said, model-based tools can be incorporated within the indicator approach to capture specific dimensions (e.g., interconnectedness).

Box 14. Analytical Tools to Assess Interconnectedness

Two sets of tools commonly used to identify systemic risk in the structural dimension are network analysis and market-based indicators. They have been developed at the IMF and externally and are classified according to their main data requirements, i.e., balance sheets or market data. Arregui and others (2013) survey the tools and their use in the context of Article IV consultations, FSAPs, and spillover reports. For practical guidance on the use of these tools, see Blancher and others (2013).

Network analysis allows for the identification of core elements of the architecture of financial interconnectedness, thus providing elements for visual and analytical representation of exposures and facilitating the assessment of risk transmission (or absorption) of shocks. The analysis requires, as a starting point, the measurement of exposures among financial institutions. The kind of claims or exposures to be covered depend on the purpose of the analysis (e.g., to uncover dependencies in funding markets versus through credit exposures). Data availability often limits the analysis. Certain exposures are sometimes not collected or hard to measure (e.g., derivatives or cross-border exposures). Bilateral exposures reported to supervisors are usually confidential, and their analysis therefore requires coordination between staff and the authorities. Three main tools for network analysis are used within the IMF and externally: centrality analysis, cluster analysis, and balance sheet simulation methods.

Market-based measures of systemic risk rely on asset prices (such as stocks, bonds, and derivatives) to estimate distress dependence among financial institutions. Data required for these measures are publicly available, often on a high-frequency basis. However, when a large fraction of the financial sector is not publicly traded or market data are not reliable due to thin trading or reporting issues, market-based measures may not be feasible or meaningful. The concept of distress dependence underlying such market-based measures is based on the fact that financial institutions are linked both directly and indirectly through a variety of channels. To capture this, methodologies developed for the measurement of risk in portfolios of securities have been adapted to the measurement of systemic risk for a "portfolio" of institutions. In this context, the methodologies have been enhanced to identify common risk factors, track how distress in one institution may affect others, and measure the contributions of individual institutions to system-wide risks. A variety of market-based tools are currently used at the IMF, including CoVaR, CoRisk, return spillovers, distress spillovers, JPod/CoPoD, and systemic CCA.

Tools

189. The FSB and the BCBS have favored a three-pillar approach for systemic banks: intensified supervision, improved resolvability and enhanced loss absorbency.

190. Intensified supervision. As a first line of defense, microprudential supervisors should approach these institutions with intensified supervision and special attention to their risk management practices. In 2010, the FSB published a number of recommendations to enhance the intensity and effectiveness of SIFI supervision. It is important that authorities have the proper mandate, resources, operating independence and full set of powers to supervise SIFIs effectively. The adoption of higher supervisory standards specific to SIFIs is recommended, and coordination at international level is needed among supervisors, as the activities of SIFIs tend to extend beyond national borders. Supervisory authorities should also focus on strengthening internal controls for areas of SIFIs activities, including governance, and incentive and remuneration systems. More supervisory resources should be allocated to SIFIs, which should be subject to more continuous supervision (for example, establishing communication channels and a shorter supervisory cycle). Finally, greater information disclosure and transparency have been called for.

191. Improved resolvability.[118] Endorsed by the G20, the FSB's 2011 "Key Attributes for Effective Resolution Regimes for Financial Institutions" aims to establish a framework for policies that address the problem of moral hazard of SIFIs and make resolution feasible, without severe systemic distress or costly taxpayer bail-outs. The Key Attributes are broad in scope and encompass any institution of systemic importance, including not only banks, but also NBFIs and market infrastructures, such as central counterparty clearing houses (CCPs). The Key Attributes involve 12 key principles considered essential to an effective resolution regime. These imply the need for three broad powers: (i) powers to intervene quickly (prior to insolvency) and assume control from existing owners and managers; (ii) powers to effect a resolution; and (iii) powers to support the resolution, for example, by suspending third party actions that could otherwise undermine it. In addition, effective recovery and resolution plans (RRPs) are recommended to reduce the cost of bailouts and bring down the probability of government support. Having SIFIs prepare individual, tailor-made RRPs, as being implemented in the U.S. and in Europe, reduces uncertainties about what creditors, depositors, and other economic agents can expect in case of failure. Importantly, the objectives of the Key Attributes extend beyond the national level to ensure the containment of cross-border contagion, whereby jurisdictions establish arrangements for mutual cooperation in resolving GSIFIs. International coordination is essential to prevent regulatory arbitrage and make cross-border resolution effective.

192. Enhanced loss absorbency.[119] The BCBS GSIB framework introduces capital surcharges ranging from 1 to 3.5 percent. Banks are ranked by systemic importance using an indicators based approach (and supervisory judgment) and placed in five buckets with a graduated scale of capital

[118] As per IMF (2013c), resolution tools are thought of as a complement to and not as part of macroprudential policy.

[119] See also Lim (2013).

surcharge. The surcharge is required to be met by common equity tier one capital. The guidelines for DSIBs give national discretion in the calibration of systemic capital surcharges. As a guiding principle, higher loss absorbency requirements imposed on banks should be commensurate with their degree of systemic importance.[120] The calibration should be informed by quantitative methodologies, country specific factors (e.g., concentration in banking sector or size of banking sector relative to GDP) and supervisory judgment. The principle of "equal expected impact" provides an intuitive guide to calibrate surcharges. Following such principle, higher surcharges should be set to reduce the probability of failure of systemic institutions relative to nonsystemic institutions, given their higher impact in case of failure, keeping the expected impact of failure the same.[121] Box 15 discusses the calibration exercise in the context of the Australia FSAP update (2012). Alternatively, the implied funding cost advantage can indicate the degree of systemic importance and be used to define higher capital requirements to offset this implicit subsidy.[122]

193. Higher loss absorbency requirements are expected to be increasingly used in the coming years. A number of countries, namely, Australia, Canada, and Singapore require major banks to maintain a common equity ratio one percent higher (two percent for Singapore) than those proposed by Basel III.[123] Austria, Denmark, and Sweden have set supplementary capital requirements of up to three percent (five percent for Sweden) for domestically important institutions. Switzerland has a progressive systemic surcharge of six percent for its two large banks that can be fulfilled by "low trigger" contingent capital (CoCos).[124] In a survey conducted by the IMF, 35 additional countries reported plans to introduce capital surcharges on SIFIs within the next two years.

194. Additional requirements can be put in place to increase the resilience of systemic banks. The U.S. has established (effective in 2018) a higher leverage ratio requirement for systemic banks.[125] Systemic banks will be required a leverage buffer of two percentage points above the minimum supplementary leverage ratio requirement of three percent, for a total of five percent. The BoE has issued a consultation paper considering the introduction of a supplementary leverage ratio

[120] The guidelines also establish that the higher loss absorbency requirements be met with common equity tier one capital and recommend imposing the higher of either the DSIB or GSIB capital requirements in the case where the bank has been identified as a DSIB in the home jurisdiction as well as a GSIB.

[121] See, for example, BCBS (2011) and ESRB (2014a).

[122] See IMF (2014c) for an overview of methodologies to estimate implicit government subsidies to systemic institutions.

[123] Higher capital requirements were imposed on all Singapore-incorporated banks because each of these banks was assessed as systemically important.

[124] Contingent convertible capital instruments (CoCos) are hybrid capital securities that absorb losses when capital of the issuing bank falls below certain level. The trigger is the point at which the loss absorption mechanism is activated, reducing debt and boosting capital.

[125] The rule applies to U.S. top-tier bank holding companies with more than US$700 billion in consolidated total assets or more then US$10 trillion in assets under custody (covered BHCs) and their insured depository institution subsidiaries. Insured depository institution subsidiaries of covered BHCs must maintain at least a six percent supplementary leverage ratio to be considered "well capitalized" under the agencies' prompt corrective actions framework.

to systemically important banks and its interaction with capital (risk-weighted) surcharges. Additionally, tighter liquidity requirements for systemic banks could also complement capital surcharges in increasing the resilience of such institutions. Liquidity surcharges can be applied to SIFIs and made proportional to the banks' contribution to systemic liquidity risks, giving incentives for banks to internalize their liquidity risks. IMF (2011d) summarizes several proposals on the design of the surcharges.

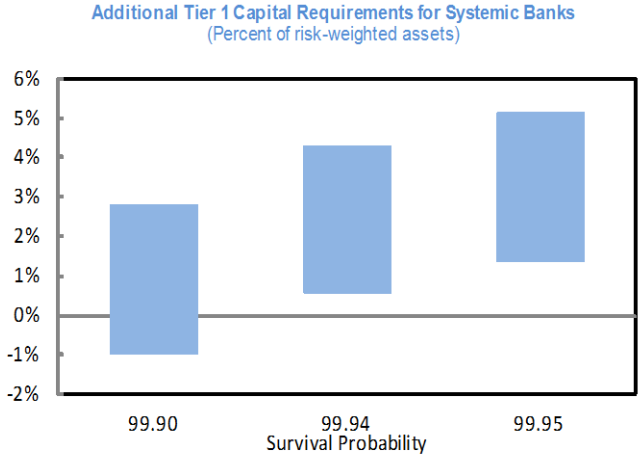
Box 15. Higher Loss Absorbency for Systemically Important Banks in Australia[1]

This box presents the results of the calibration exercise of capital requirements for the largest domestic systemically important banks conducted during the 2012 FSAP for Australia.

A CCA approach was used in the 2012 FSAP for Australia (IMF, 2012) to estimate the additional capital required for the four largest DSIBs. A higher minimum capital requirement for SIBs, in addition to heightened supervision and a credible resolution framework, mitigates systemic risk by providing higher loss absorbency that reduces the likelihood of a SIB becoming insolvent. How much additional capital is necessary depends on the acceptable probability of default of the SIBs, and this may be estimated by using a CCA approach. The Australian assessment used the expected default frequency obtained from Moody's CreditEdge as an estimate of default probabilities.

To determine a desired probability of survival, the key is to find a robust relationship between the estimated default probability and the market-capitalization-to-assets ratio. A power function was found to be a relatively robust fit for the top four Australian banks based on daily data from June 2011 to June 2012.

The market value of assets and regulatory risk-weighted assets closely coincides if the supervisor's view of risk weights coincides closely with the market's view. Furthermore, abstracting from the discount offered at the time of additional equity issuance, one assumes that additional capital can be raised at the current market value of equity. With these two assumptions, the marginal change in the market-capitalization-to-assets ratio and in the Tier 1 regulatory-capital ratio can be deemed equal for the additional equity raised. For Australia, the reported Tier 1 capital ratio and the market-capitalization-to-assets ratio were very similar at 10.1 percent and 9.4 percent, respectively, in 2011; the ratio between the two was used to adjust the Tier 1 capital equivalent of the market capital requirements.



Sources: Moody's CreditEdge; and IMF staff estimates.

This exercise suggests, as an illustration, that maintaining a one-year-ahead probability of 99.9 percent of not defaulting on any payment would require the four major banks to hold additional Tier 1 capital ranging from 0.9 to 2.8 percent of RWA at the end of 2011. If the goal were to achieve a 99.95 percent probability of no default, additional Tier 1 capital ranging from 1.4 to 5.2 percent of RWA would be necessary. This would require all large banks to fund themselves with more capital—some by a small amount, others more substantially. The actual amount of loss absorbency required would be determined by the regulator's risk tolerance.

1/ This box was prepared by Luc Everaert and Xiaoyong Wu for Chapter 3 Global Financial Stability Report April 2014.

Step 3: Advanced analysis

195. The third step, depending on country characteristics, expands the analysis to consider further tools to address structural risks and/or to cover relevant financial activities and NBFIs that may pose systemic risk. In certain countries, the complexity of banks' businesses and corporate organization may require the use of additional tools to limit excessive exposures within the financial systems. In addition, the presence of nonbank systemically important financial intermediaries can require expanding the perimeter of macroprudential action. In general, the more developed and complex a financial system, the higher the requirements for staff coverage in this third step. The analysis performed in Step 1 can be used as a starting point to guide the need for such further analysis.

Additional activities and institutional coverage

196. The analysis of risks in the structural dimension should look beyond banks. For the purposes of systemic risk monitoring, all institutions which perform critical functions in financial markets, including credit intermediation, maturity transformation, risk management, the payments and settlement of securities transactions, and the support of primary and secondary funding markets should be considered. Special attention should be given to risks arising from shadow banking activities operating outside the regulatory perimeter. Because detailed data for all such activities may be less readily available, some studies have focused on characterizing the aggregate exposures across different sectors of the financial system.

197. The assessment of systemic importance should extend beyond individual entities. Focusing on individual financial institutions may disregard potentially important sources of systemic risk.[126] Clusters of institutions may be individually small but collectively significant if they tend to undergo stress at the same point in time or have similar responses to a given shock. Systemic risks may also arise from products offered by a class of institutions or from the activities of a diverse range of nonbank institutions. Some of those entities may not be individually systemically important, but their collective actions may pose systemic risk.[127]

198. The assessment of systemic importance should take into account the specific nature of the financial sector examined and its potential for systemic risk. This should include asset correlations, leverage and maturity mismatch (Nier, 2009). For example, insurance underwriting risks are generally not correlated with the economic cycle or financial market risks. Moreover, the nature of insurance liabilities makes it less likely for insurers engaged in traditional activities to suffer a run on their liabilities. In contrast, insurance groups and conglomerates that engage in non-traditional or non-insurance activities, such as the provision of protection against the default of securities, can

[126] For example, MMMFs in the U.S. are an important source of liability interconnectedness risk since they invest heavily in the short-term liabilities of banks. Contagious runs on MMMFs can therefore result in the withdrawal of a major source of liquidity from the banking sector, as discussed further in the chapter on liquidity tools.

[127] See IMF (2014a) for a discussion in the context of the U.S.

be more vulnerable to financial market developments and therefore more likely to contribute to systemic risk (see Box 16 for a discussion of the case of AIG).[128,129] For this reason, the International Association for Insurance Supervision (IAIS) in its guidelines for identifying global systemically important insurers (G-SIIs), has stressed the role of interconnectedness and the extent to which the insurance companies perform non-traditional and non-insurance activities. These criteria should therefore be assigned greater weight in an assessment of systemic importance of insurers (Table 12). Size, in turn, receives a lower weight as in the context of insurance, size is a prerequisite for effective pooling and diversification of risks.[130]

Box 16. The Case of AIG[1]

The near failure of AIG, the world's largest insurance conglomerate at that time, is largely attributed to losses in AIG Financial Products' (AIGFP) CDS book.[2] AIG Financial Products was a noninsurance subsidiary of AIG managing financial products, with major operations in London and regulated by the Office of Thrift Supervision, not the insurance regulator.

Relying on the guarantee of the parent company, AIGFP became a major over-the-counter derivatives dealer. Among other derivatives activities, the unit issued CDS' guaranteeing debt obligations held by financial institutions and other investors. AIGFP did not post collateral when it wrote CDS contracts, but agreed to post collateral if the value of the underlying assets dropped, or if the rating agencies downgraded AIG's long-term debt ratings.

In 2007–08, ratings downgrades on the reference securities and valuation losses by market participants resulted in valuation allowances in AIG contracts, triggering collateral calls from counterparties and draining AIG's liquidity. Valuation write-downs into the billions and collateral calls from CDS counterparties intensified pressure on AIG's own credit rating. Subsequent downgrades of AIG's credit rating in turn precipitated additional collateral calls. This negative feedback loop exposed the firm's securities lending business, as trading partners worried about exposure to AIG chose to unwind a large number of lending transactions in a matter of days, reinforcing the liquidity squeeze.

AIG was so interconnected with many large commercial banks, investment banks, and other financial institutions through the relationships of credit default swaps and other activities, such as securities lending, that its failure would have been of systemic importance. The U.S. government concluded that AIG was too important to fail, prompting its bailout in September 2008.

_____

1/ Based on IAIS (2011).

2/ Securities lending activities and investments in MBS' also contributed to AIG's financial stress.

[128] See IAIS (2011) and IAIS (2013).

[129] Examples of non-traditional and non-insurance activities include financial guarantee insurance, capital markets activities such as CDS issuance, transactions for non-hedging purposes, derivatives trading or leveraging assets to enhance investment returns.

[130] The IAIS' framework of policy measures for G-SIIs consists of three main types of measures: enhanced supervision, effective resolution and higher loss absorption (HLA) capacity. The development of the basic capital requirements (BCR) is the first step of a long-term project to develop risk-based, group-wide global capital standards. The second step is the development of HLA requirements to apply to G-SIIs. The HLA will build on the BCR and address additional capital requirements for G-SIIs reflecting their systemic importance in the international financial system. The final step is the development of a risk-based group-wide global insurance capital standard.

199. Some countries have moved ahead in the analysis of systemic importance beyond banks. For example, in the U.S., section 113 of the Dodd Frank act authorizes the FSOC to determine that a non-bank financial company shall be supervised by the Federal Reserve and subject to heightened prudential control if the nature, scope, size, scale, interconnectedness or mix of activities of the non-bank financial company could pose a threat to the financial stability of the U.S. The methodology used by FSOC is an indicators-based approach.[131] The FSOC used its designation power in 2013, when it designated three nonbank financial firms as systemically important (AIG, GE Capital and Prudential Financial). Designation powers currently apply only to individual entities and financial market utilities, rather than classes of intermediaries.

Table 12. Indicator-Based Approach for Global Insurers

	W	Global SIIs (IAIS)
Size	**5 percent**	Total assets
		Total revenues
Interconnectedness	**40 percent**	Intra-financial assets
		Intra-financial liabilities
		Reinsurance
		Derivatives
		Large Exposures
		Turnover
		Level 3 assets
Non-Substitutability	**5 percent**	Premiums for specific business lines
Complexity		------ not included -------
Cross-jurisdictional activity	**5 percent**	Revenues derived outside of home country
		Number of countries
Non-traditional insurance and non-insurance activities	**45 percent**	Non-policy holder liabilities and non-insurance revenues
		Derivatives trading
		Derivatives trading (excluding hedging and replication) in economic terms
		Short term funding
		Financial guarantees
		Minimum guarantee on variable insurance products
		Intra-group commitments
		Liability liquidity

SIIs: Systemically Important Insurers; W: Weight.

200. It is also important to monitor, assess and contain risks that may arise from shadow banking. Shadow banking refers to parts of the financial system that carry out bank-like

[131] In a first stage, the process narrows the universe of non-bank financial companies by applying quantitative thresholds on size, interconnectedness, leverage and liquidity risk and maturity mismatch. A nonbank financial company would be subject to additional review if it meets both given thresholds on size and any one of the other category. In a second stage, the Council conducts a comprehensive analysis using a six category analytic framework: size, interconnectedness, substitutability, leverage and liquidity risk and maturity mismatch, and existing regulatory scrutiny.

intermediation, but are typically less regulated and lacking safety net guarantees.[132] Such intermediation may emerge due to regulatory arbitrage, taking advantage of perceived profit opportunities of activities outside the regulatory perimeter. Shadow banking activities can create systemic stability risk in particular when credit intermediation is ultimately funded short-term, giving rise to credit risks and maturity mismatches outside of the banking system.[133] Absence of formal funding backstops may make these structures vulnerable to runs and give rise to fire sales due to forced unwinding of large positions in periods of distress. Moreover, these risks may also result in adverse spillovers (contagion risk) across the financial system, through ownership linkages or through complex, opaque credit intermediation chains.

201. The monitoring of shadow banking should be informed by systemic risk considerations. Given the evolving nature of the financial system, a flexible and forward-looking perspective is crucial to capture mutations in credit intermediation that can pose systemic risks. Firstly, the net should be cast wide, looking at all non-bank credit intermediation to ensure that data gathering and surveillance cover all the activities within which shadow banking-related risks might arise. Secondly, the focus should be narrowed, concentrating on the subset of non-bank credit intermediation that gives rise to either regulatory arbitrage concerns or systemic risks concerns (i.e., where maturity/liquidity transformation and/or flawed credit risk transfer and/or leverage create important risks).

202. Access to granular data is a prerequisite for effective risk assessment, regulation and supervision. Data gaps often hinder the assessment of risks arising outside of the banking system, and surveillance needs to focus on closing these data gaps. Where information is already available to the authorities, staff should encourage them to share the relevant data. Where the authorities do not possess the information, staff should encourage them to collect and share it with staff. Market intelligence should complement and inform staff's assessment.

203. Regulatory intervention should be proportionate and tailored to the risks posed by shadow banks. Authorities should have the power to regulate all activities and entities that may pose systemic risks. This means that, in first step such activities need to be defined and subject to a licensing regime. Regulatory intervention should then be proportionate to the systemic risks posed by shadow-banking activities. (FSB, 2013d). Credit intermediation activities that involve significant maturity or liquidity transformation, imperfect credit risk transfer, or excessive leverage should be assessed for indications of an increase in systemic risks or regulatory arbitrage, and be subject to

[132] FSB (2011d) defines the shadow banking system as credit intermediation involving entities and activities (fully or partially) outside the regular banking system. See also IMF Global Financial Stability Report, October 2014 (forthcoming).

[133] Shadow banking may also have associated benefits. It may provide alternative financing to the economy and liquidity to financial markets and it may emerge as a result of unmet demand for credit or safe investments.

additional regulation and oversight.[134] As a general principle for regulation, equivalent prudential intervention should be extended to financial intermediaries facing "bank-like" sources of risk.[135]

Additional tools

204. In addition to tools that strengthen the resilience of individually systemic financial institutions, staff should consider measures to contain risks from interconnectivity and from contagion. These target funding and counterparty credit risks within the financial system and reduce the potential for contagious defaults.

205. Exposure limits. Prudential exposure limits on exposures within the financial system intend to reduce the financial network's complexity, concentration and connectivity, resulting in a less contagious network of exposures between financial institutions.[136] Rules on exposure limits have long been generally accepted principles and were broadly defined internationally, but it is not until recently that the Basel Committee decided to review the framework and establish an internationally agreed-upon standard.[137] Although almost all supervisors have set prudential limits to restrict bank exposures to single counterparties or groups of connected counterparties, interbank exposures are usually exempted (Figure 11).[138] However, in order to address contagion risks, limits on a bank's exposure to other financial institutions would need to be included.[139] In addition, tighter limits for exposures between SIFIs, and for exposures of smaller banks to SIFIs could be useful. The relevance that these prudential requirements have in containing systemic risk deriving from interconnectedness is clear, as they represent hard limits.

[134] In this regard the FSB has identified five areas of shadow banking to make policy recommendations to mitigate potential systemic risks. These five areas are: mitigating spillover risks from the interconnection between banks and shadow banks, reducing the susceptibility of money market mutual funds to runs, regulating other shadow banking entities, better aligning incentives in securitization, and dampening the pro-cyclicality in repos and securities lending.

[135] See Carvajal and others (2009) for a discussion on setting the perimeter for financial regulation.

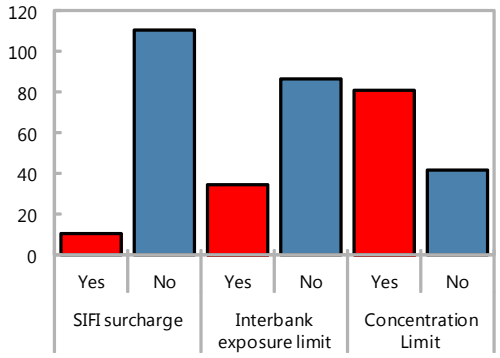
[136] Financial interconnectedness could have opposing effects on financial stability, as linkages may act as "shock transmitters" or "shock absorbers." Because increases in interconnectedness are not always associated with increases in systemic risk, assessing whether interconnectedness is excessive can be challenging in practice.

[137] Limits are normally designed as non-risk sensitive backstops. An exception to non-risk sensitive microprudential exposure limits arises in the EU, where large exposure limits, in particular, are allowed to be risk-weighted.

[138] Normally, exposures representing ten percent or more of a bank's capital are defined as a large exposure; and twenty-five percent of a bank's capital is the limit for an individual large exposure to a private sector nonbank counterparty or a group of connected counterparties. However, deviations from these limits are frequent and exceptions abound. Exposures arising from off-balance sheet as well as on-balance sheet items and from contingent liabilities should be captured. Current microprudential regimes do not pose limits on sectors, instruments or sovereign exposures, and quite often ignore indirect exposures.

[139] For example, the recent Basel Committee proposal includes, as a general principle, applying the large exposure limit to interbank exposures in the same way that it is applied to any other exposures to third parties (the scope for certain limited exemptions is still being discussed). It also includes proposed tighter limits for exposures between GSIBs, and encourages the consideration of stricter limits for DSIBs and for exposures of smaller banks to GSIBs.

Figure 11. Macroprudential Toolkit for Cross Sectional Dimension
(Number of countries)



Source: IMF survey on Macrorudential Policy Instruments, 2013.

206. Risk weights. Tighter risk weights for intra-financial system exposures may be used to reduce network connectivity. Although risk weights on exposures to other banks are generally low, some tightening has been brought with the implementation of Basel III.[140] The U.K. FPC has the power to set increased sectoral capital requirements for exposures within the financial system, such as specific types of exposures that are growing rapidly. The FPC proposes that sectoral capital requirements on banks' exposures to other parts of the financial system may be applied in two main ways: for exposures to specific types of financial institution, or for specific types of intra-financial system activity or instrument. The introduction of higher risk weights on exposures to SIFIs could be particularly useful, as would increases in risk-weights for types of exposures that grow rapidly, since this would contain increases in systemic risk from innovative products whose risks are poorly understood.

207. Liquidity requirements. By increasing banks liquidity buffers and reducing maturity mismatches at individual banks, liquidity requirements aim to mitigate systemic liquidity and contagion risk (see further Chapter on Liquidity tools. Liquidity requirements that penalize reliance on short-term wholesale funding, particularly from other financial institutions, such as the Net Stable Funding Ratio also provide an incentive to reduce funding interconnectedness, by reducing noncore funding obtained in wholesale financial markets. They can thereby make a contribution to containing interconnectedness within the financial system (IMF 2013c; Shin, 2010a and 2010b). Although liquidity requirements (like the LCR and NSFR) generally apply to all banks, tighter liquidity requirements for systemic banks that take into account the funding linkages among these banks could complement capital surcharges in increasing the resilience of such institutions.

[140] Basel III establishes a higher correlation parameter (and therefore a higher risk weight) for exposures to large financial institutions.

208. Margin requirements. The regulation of margins in securities lending and repo markets, as well as margin requirements in derivatives markets can help avoid margin spirals that contribute to excess leverage and procyclicality (Geanakoplos, 2010; Longworth, 2010; Hanson and others, 2011; FSB, 2012b). In particular, regulation may seek to establish a minimum floor on the dollar amount of collateral to be posted, where this minimum might depend on the type of security offered as collateral. In addition to increasing financial buffers, such regulatory minimum requirements could have two benefits (Tarullo, 2014). First, to the extent they are applied on a market-wide basis, they could help to harmonize regulation across organizational forms, thereby reducing the incentive for lending activity to migrate into the shadow banking sector. Second, for those assets that do come to be used in the funding of the shadow banking system, haircut regulation can dampen the destabilizing dynamics described above.[141] In addition to funding markets, margin requirements can play a role in derivatives markets. For instance, the U.S. has issued for comment a proposed rule to establish minimum margin requirements for the exchange of initial and variation margin between covered swap entities and their counterparties to non-cleared swaps and non-cleared security-based swaps. The amount of margin that would be required under the proposed rule would vary based on the relative risk of the counterparty and of the non-cleared swap or non-cleared security-based swap.

209. Changes to market infrastructures. Changes can also be made to the market infrastructure, including payment, settlement, and clearing arrangements to reduce the build-up of credit exposures arising from transactions within the financial system. Encouraging adoption of real time gross settlement, for example, provides broader security against a payment system failure. Since the crisis, there has been a strong push also to establish stronger infrastructures for the clearing of derivatives transactions. In September 2009 the G20 leaders committed to mandate the central clearing of all standardized OTC derivatives contracts, which were largely bilaterally cleared before the global financial crisis. The mandatory clearing requirement recognizes the various benefits that CCP clearing has over bilateral clearing. CCPs reduce the potential contagion (shock transmission) effects of the failure of a major counterparty because the impact is absorbed by the CCP and is mutualized among its clearing members who must share in any losses. CCPs mutualize the risk of counterparty failure using various risk management mechanisms, including prefunded default funds. They also manage counterparty credit risk centrally, by imposing margin requirements (initial and variation margin) on both sides of the trade, and reduce exposures through multilateral netting and collateralization of initial and potential future exposures. CCPs also increase transparency of the amount and distribution of risk exposures. These entities need to be designed prudently and supervised closely, however, since while they reduce interconnectedness they also concentrate systemic risk.[142] All CCPs (and Central Securities Depositories) are considered systemically important according to CPSS-IOSCO Principles for Financial Market Infrastructures.

[141] The 1934 Securities and Exchange Act gave the Federal Reserve broad authority to regulate margins in securities lending markets, except for government securities. Between 1934 and 1974 the Federal Reserve actively managed the margin requirements for stock market investors (Regulation T). See further Elliott and others, 2013.

[142] See Arregui and others (2013).

Some central banks in Europe and Asia now have arrangements in place to provide liquidity (intraday and sometimes overnight liquidity) to CCPs, such as in Singapore, France and Korea.

210. Structural limits on activities. Policies to restrict the size and scope of financial institutions can reduce interconnectedness and complexity and reduce the number of systemic institutions. As discussed in Viñals and others (2013), such policies can be useful in managing risks that are difficult to measure and address through other tools, and therefore complement the tools described above. Activities that are too complex for their risk to be accurately measured, too complex for effective supervision, and too complex to be effectively resolved may require outright separation. The structural measures proposed in several jurisdictions range from moving businesses identified as too risky and complex into stand-alone subsidiaries, to prohibiting banks from engaging in these activities altogether.[143] Nevertheless, measures to limit the size and scope of banks also entail costs (IMF, 2014a). First, the empirical evidence supports (albeit weakly) the existence of economies of scale and scope in the banking industry. Market liquidity, efficiency, and risk management capacity are likely to decline when banks' activities are curtailed. Moreover, risks may migrate to less-regulated activities.

C. Calibration and Phase-In

211. The macroprudential tools to address risks in the structural dimension are not meant to be tightened and loosened in response to the credit cycle. The objective of structural tools is to strengthen the resilience of the system to aggregate or idiosyncratic shocks, and to reduce contagious effects from such shocks across the system, rather than to actively manage the growth of credit along the financial cycle. However, it is conceivable that capital surcharges can be eased following structural changes, such as improvements in entities' resolvability or following policies restricting the scope of certain financial institutions.

212. However, the introduction of these measures should take into account their impact on credit. Even if not their main objective, measures like capital surcharges are likely to affect leverage levels, asset prices and the price/supply of credit. To meet higher capital requirements banks may reduce their balance sheet or raise lending rates instead of raising new capital or retaining profits, thereby contributing to lower levels of credit. As outlined for the CCB, introducing systemic surcharges during the expansion of credit, when raising new capital is relatively cheap, would reduce deleveraging pressures that can be generated by such a move in a down-turn. A sufficiently long phase-in period for the surcharges can help avoid unintended deleveraging pressures.

D. Unintended Consequences and International Dimension

213. The potential unintended consequences of macroprudential policy should be taken into consideration. Tools to address risks in the structural dimension may have unintended

[143] For more on specific structural reform proposals in different jurisdictions, see Arregui and others (2013), Chow and Surti (2011), and Viñals and others (2013).

consequences, both domestically and across borders. In particular, in response to tighter requirements, regulated entities face stronger incentives to shift some of their activities to related-party institutions (for example, in a different financial sector or across borders). This would reduce systemic importance of the more tightly regulated entities potentially at the expense of shifting risks to less regulated activities. Moreover, if the degree of (actual or perceived) separation of the targeted institution with its related parties is low, the systemic importance of the entire financial group may not have effectively decreased. Consolidated supervision, transparency of intra-group exposures in addition to appropriate firewalls between related parties are crucial elements to monitor and handle risks that may arise from financial conglomerates.

214. These effects can also cross national borders. In the international dimension, tighter requirements in one country may lead, for example, to: (i) reallocation of certain activities to related parties across the border, (ii) deleveraging by subsidiaries and branches of foreign parent banks, (iii) repatriation by parent banks of voluntary capital buffers from subsidiaries and branches abroad, (iv) and increased risk taking by locally established institutions across the border.

215. The international consequences of macroprudential policy require cross-border coordination. International agreements and guidance (such as the BCBS framework for globally and domestically systemic important banks) are important to counter the risks of inaction and a potential race to the bottom in the application of prudential controls.[144] These should be complemented by international surveillance of macroprudential action. In addition, bilateral and multilateral coordination and consultation is necessary.

- **Supervisory colleges** can facilitate information exchange among regulatory authorities that can help capture the risks taken across the group. They can also foster recognition and understanding of home-host interdependencies and the development of strategies to contain adverse consequences of regulatory actions taken at the level of the group or the level of foreign affiliates.

- **Regional initiatives,** such as the ESRB and the Nordic-Baltic Macroprudential Forum can also help internalizing adverse cross-border effects of macroprudential action. There can also be more ad hoc structures organized to deal with specific problems. An example is the "Vienna Initiative" that was set up to encourage cooperative solutions that helped avoiding excessive deleveraging in central and eastern European countries in the wake of the financial crisis.

[144] See Viñals and Nier (2014) on potential *race to the bottom* among national authorities.

References

Aiyar, Shekar, Charles Calomiris, and Tomasz Wieladek, 2012, "Does Macropru Leak? Evidence from a U.K. Policy Experiment," Bank of England Working Paper, No. 445 (London: Bank of England).

Aiyar, Shekhar, Charles W Calomiris and Tomasz Wieladek, 2014, "How Does Credit Supply Respond to Monetary Policy and Bank Minimum Capital Requirements?" Bank of England Working Paper No. 508 (London: Bank of England).

Adrian, Tobias and Hyun Song Shin, 2010, "Liquidity and Leverage," *Journal of Financial Intermediation*, Vol. 19–3 (July), pp. 418–437.

Ahuja, Ashvin and Malhar Nabar, 2011, "Safeguarding Banks and Containing Property Booms: Cross-Country Evidence on Macroprudential Policies and Lessons from Hong Kong SAR," IMF Working Paper, WP/11/284 (Washington: International Monetary Fund).

Aizenman, Joshua and Yothin Jinjarak, 2009, "Current Account Patterns and National Real Estate Markets," *Journal of Urban Economics*, Vol. 66 (September), Issue 2, pp. 75–89.

Arregui, Nicolas, Jaromír Beneš, Ivo Krznar, Srobona Mitra, and Andrew Oliveira Santos, 2013, "Evaluating the Net Benefits of Macroprudential Policy: A Cookbook," IMF Working Paper, WP/13/167 (Washington: International Monetary Fund).

Arregui, Nicolas, Jodi Scarlata, Mohamed Norat, and Antonio Pancorbo with Eija Holttinen, Jay Surti, Chris Wilson, Rodolfo Wehrhahn, and Mamoru Yanase, 2013, "Addressing Interconnectedness: Concepts and Prudential Tools," IMF Working Paper, WP/13/199 (Washington: International Monetary Fund).

Arsov, Ivailo, Elie Canetti, Laura Kodres, and Srobona Mitra, 2013, "Near-Coincident Indicators of Systemic Stress," IMF Working Paper, WP/13/115 (Washington: International Monetary Fund).

Bank for International Settlements and International Organization of Securities Commissions, 2012, "Principles for Financial Market Infrastructures," mimeo (April).

Bank of England, 2011, "Instruments of Macroprudential Policy," Discussion Paper (December) (London: Bank of England).

_____, 2012a, "Financial Stability Report," Issue No. 31 (London: Bank of England).

_____, 2012b, "Credit Conditions Survey" Survey Results 2014 Q2 (London: Bank of England).

_____, 2013, "Liquidity and Capital Regime for U.K. Banks and Building Societies: Adjustments in Relation to Interim FPC Statement," Supervisory Statement, LSS4/13 (London: Bank of England).

_____, 2014a, "Implementing the Financial Policy Committee's Recommendation on Loan to Income Ratios in Mortgage Lending," Consultation Paper, CP11/14 (London: Bank of England).

_____, 2014b, "The Financial Policy Committee's Review of the Leverage Ratio," Consultation Paper, July 2014 (London: Bank of England).

_____, 2014c, "The Financial Policy Committee's Power to Supplement Capital Requirements," Policy Statement (January) (London: Bank of England).

Bakker, Bas, Giovanni Dell'Ariccia, Luc Laeven, Jérôme Vandenbussche, Deniz Igan, Hui Tong, 2012, "Policies for Macrofinancial Stability: How to Deal with Credit Booms," IMF Staff Discussion Note, SDN/12/06 (Washington: International Monetary Fund).

Barrell, Ray, E. Philip Davis, Dilruba Karim, and Iana Liadze, 2010, "Bank Regulation, Property Prices and Early Warning Systems for Banking Crises in OECD Countries," *Journal of Banking and Finance*, Vol. 34 (September), pp. 2255–2264.

Basel Committee on Banking Supervision, 2008, "Principles for Sound Liquidity Risk Management and Supervision," September (Basel: Bank for International Settlements).

_____, 2010, "Guidance for National Authorities Operating the Countercyclical Capital Buffer" December (Basel: Bank for International Settlements)._____, 2012, "A Framework for Dealing with Domestic Systemically Important Banks," October (Basel: Bank for International Settlements).

_____, 2013, "Global Systemically Important Banks: Assessment Methodology and the Additional Loss Absorbency Requirement," November (Basel: Bank for International Settlements).

_____, 2013a, "Regulatory Consistency of Risk-weighted Assets in the Banking Book—Report issued by the Basel Committee" July (Basel: Bank for International Settlements).

_____, 2013b, "Basel III: The Liquidity Coverage Ratio and Liquidity Risk Monitoring Tools," January (Basel: Bank for International Settlements).

_____, 2014a, "Basel III: The Net Stable Funding Ratio—Consultative Document," January (Basel: Bank for International Settlements).

_____, 2014b, "Supervisory Framework for Measuring and Controlling Large Exposures," April (Basel: Bank for International Settlements).

_____, 2014c, "Basel III Leverage Ratio Framework and Disclosure Requirements," January (Basel: Bank for International Settlements).

Benes, Jaromir, Kevin Clinton, Roberto Garcia-Saltos, Marianne Johnson, Douglas Laxton, Petar Manchev and Troy Matheson, 2010, "Estimating Potential Output with a Multivariate Filter," IMF Working Paper, WP/10/285 (Washington: International Monetary Fund).

Benford, James and Oliver Burrows, 2013, "Commercial Property and Financial Stability," Bank of England Quarterly Bulletin, 2013 Q1 (London: Bank of England).

Blancher, Nicolas, Srobona Mitra, Hanan Morsy, Akira Otani, Tiago Severo, and Laura Valderrama, 2013, "Systemic Risk Monitoring ("SysMo") Toolkit—A User Guide," IMF Working Paper, WP/13/168 (Washington: International Monetary Fund).

Blundell-Wignall, Adrian and Caroline Roulet, 2014, "Macro-prudential Policy, Bank Systemic Risk and Capital Controls," *OECD Journal: Financial Market Trends*, Vol. 2013/2, pp. 1–22.

Bongini Paola, and Laura Nieri, 2014, "Identifying and Regulating Systemically Important Financial Institutions," Economic Notes by Banca Monte dei Paschi di Siena Spa, Vol. 43, No. 1–2014: pp. 39–62.

Borio, Claudio and Mathias Drehmann, 2009, "Assessing the Risk of Banking Crises—Revisited," BIS Quarterly Review (March), pp. 29–46 (Basel: Bank for International Settlements).

Borio, Claudio and Philip Lowe, 2002, "Assessing the Risk of Banking Crises," BIS Quarterly Review (December), pp. 43–54 (Basel: Bank of International Settlements).

Braemer, Patrick, and Horst Gischer, 2012, "Domestic Systemically Important Banks: An Indicator-based Measurement Approach for the Australian Banking System," Working paper, No. 3/2012, University of Magdeburg.

Bridges, Jonathan, David Gregory, Mette Nielsen, Silvia Pezzini, Amar Radia and Marco Spaltro, 2014, "The Impact of Capital Requirements on Bank Lending," Bank of England Working Paper No. 486, (London: Bank of England).

Brunnermeier, Markus, and Lasse Heje Pedersen, 2009, "Market Liquidity and Funding Liquidity," Review of Financial Studies, Society for Financial Studies, Vol. 22 (6), pp. 2201–2238.

Brunnermeier, Markus K., and Yuliy Sannikov. 2014, "A Macroeconomic Model with a Financial Sector," American Economic Review, 104(2): pp. 379–421.

Carney, Mark, 2013, "The UK at the Heart of a Renewed Globalisation," Speech at an event to celebrate the 125th anniversary of the Financial Times, London, October 24, 2013.

_____, 2014, Speech at the Lord Mayor's Banquet for Bankers and Merchants of the City of London at the Mansion House, London, June 12, 2014.

Carvajal, A., R. Dodd, M. Moore, E. Nier, I. Tower, and L. Zanforlin, 2009, "The Perimeter of Financial Regulation," IMF Staff Position Note 09/07, (Washington, International monetary Fund).

Chow, Julian, and Jay Surti, 2011, "Making Banks Safer: Can Volcker and Vickers do it?" IMF Working Paper, WP/11/236 (Washington: International Monetary Fund).

Claessens, Stijn, Larry Lang and Simeon Djankov, 1999, "Corporate Growth, Financing, and Risks in the Decade before East Asia's Financial Crisis," Policy Research Working Paper, November (Washington: World Bank).

Claessens, Stign, M. Ayhan Kose, and Marco E. Terrones, 2011, "How Do Business and Financial Cycles Interact?" IMF Working Paper, WP/11/88 (Washington: International Monetary Fund).

Collyns, Charles and Abdelhak Senhadji, 2002: "Lending Booms, Real Estate Bubbles and the Asian Crisis," IMF Working Paper, WP/02/20 (Washington: International Monetary Fund).

Committee on the Global Financial System (CGFS), 2012, "Operationalising the Selection and Application of Macroprudential Instruments," CGFS Papers, No. 48 (Basel: Committee on the Global Financial System).

Cont, Rama, Moussa, Amal and Santos, Edson Bastos, 2012, "Network Structure and Systemic Risk in Banking Systems," mimeo (April). http://ssrn.com/abstract=1733528.

Corsetti, Giancarlo ,Paolo Pesenti and Nouriel Roubini, 1998, "What Caused the Asian Currency and Financial Crisis? Part I: A Macroeconomic Overview," NBER Working Paper, No. 6833.

Covitz, Daniel M., Nellie Liang, and Gustavo A. Suarez, 2009, "The Evolution of a Financial Crisis: Panic in the Asset-Backed Commercial Paper Market," Federal Reserve Board Finance and Economics Discussion Series No. 2009–36 (Washington: Board of Governors of the Federal Reserve System).

Craig, Sean and Changchun Hua, 2011, "Determinants of Property Prices in Hong Kong SAR: Implications for Policy," IMF Working Paper, WP/11/277 (Washington: International Monetary Fund).

Crowe, Christopher, Giovanni Dell'Ariccia, Deniz Igan, and Pau Rabanal, 2013, "How to Deal with Real Estate Booms: Lessons from Country Experiences," *Journal of Financial Stability*, No. 9, pp. 300–319.

Davis, E. Philip, 1999, "Financial Data Needs for Macroprudential Surveillance: What are the Key Indicators of Risk to Domestic Financial Stability?" Lecture Series, No. 2, Centre for Central Banking Studies (London: Bank of England).

Davis, E. Philip, 1995, "Debt, Financial Fragility and Systemic Risk," Revised edition, Oxford University Press.

Davis, E. Philip and Haibin Zhu, 2004, "Bank Lending and Commercial Property Cycles: Some Cross-Country Evidence," BIS Working Papers, No. 150 (Basel: Bank for International Settlements).

De Nicolo, G., G. Favara, and L. Ratnovski, 2012, "Externalities and Macroprudential Policy," IMF Staff Discussion Note, No. 12/05 (Washington: International Monetary Fund).

Demirgüc-Kunt, Aslı and Enrica Detragiache, 1999, "Monitoring Banking Sector Fragility: A Multivariate Logit Approach," IMF Working Paper, WP/99/147 (Washington: International Monetary Fund).

Drehmann, Mathias, Claudio Borio, Leonardo Gambacorta, Gabriel Jiménez, and Carlos Trucharte, 2010, "Countercyclical Capital Buffers: Exploring Options," BIS Working Papers, No. 298 (Basel: Bank for International Settlements).

Drehmann, Mathias, Claudio Borio and K. Tsatsaronis, 2011, "Anchoring Countercyclical Capital Buffers: the Role of Credit Aggregates," *International Journal of Central Banking*, Vol. 7 (December), No. 4.

Drehmann, Mathias, and Kleopatra Nikolaou, 2013, "Funding Liquidity Risk: Definition and Measurement," *Journal of Banking and Finance*, Vol. 37 (July), No. 7, pp. 2173–2182.

Drehmann, Mathias and Mikael Juselius, 2012, "Do Debt Service Costs Affect Macroeconomic and Financial Stability?" BIS Quarterly Review (September) (Basel: Bank for International Settlements).

_____, 2013, "Evaluating Early Warning Indicators of Banking Crises: Satisfying Policy Requirements," BIS Working Paper Series, No. 421 (Basel: Bank for International Settlements).

Drehmann, Mathias, and Kostas Tsatsaronis, 2014, "The Credit-to-GDP Gap and Countercyclical Capital Buffers: Questions and Answers," BIS Quarterly Review (March) (Basel: Bank for International Settlements).

Duca, John V., John Muellbauer, and Anthony Murphy, 2011, "House Prices and Credit Constraints: Making Sense of the U.S. Experience," *The Economic Journal*, Vol. 121, pp. 533–551.

Edge, Rochelle M. and Ralf R. Meisenzahl, 2011, "The Unreliability of Credit-to-GDP Ratio Gaps in Real-Time: Implications for Countercyclical Capital Buffers," *International Journal of Central Banking*, Vol. 7 (December), No. 4, pp. 261–98.

Elliot, Douglas, Greg Feldberg, and Andreas Lehnert, 2013, "The History of Cyclical Macroprudential Policy in the U.S.," Finance and Economics Discussion Series, Divisions of Research and Statistics and Monetary Affairs (Washington: Federal Reserve Board).

European Central Bank (ECB), 2000, "Asset Prices and Banking Stability," mimeo (Frankfurt am Main: European Central Bank).

_____, 2007, "Financial Stability Review," June (Frankfurt am Main: European Central Bank).

European Systemic Risk Board (ESRB), 2014, *The ESRB Handbook on Operationalising Macro-prudential Policy in the Banking Sector* (Frankfurt: European System of Financial Supervision).

_____, 2012a, "Lending in Foreign Currencies as a Systemic Risk," European Systemic Risk Board Macroprudential Commentaries, No. 4 (Frankfurt am Main: European System of Financial Supervision).

_____, 2012b, "Recommendation of the ESRB of 22 December 2011 on U.S. Dollar Denominated Funding of Credit Institutions," Official Journal of the European Union 2012/C 72/01 (Frankfurt am Main: European System of Financial Supervision).

Federal Insurance and Deposit Corporation, 2000, "Commercial Real Estate and the Banking Crises of the 1980s and Early 1990s," mimeo.

Fiechter, Jonathan, Inci Ötker, Anna Ilyina, Michael Hsu, Andre Santos, Jay Surti, 2011, "Subsidiaries or Branches: Does One Size Fit All?" IMF Staff Discussion Notes, No. 11/4 (Washington: International Monetary Fund).

Financial Stability Board (FSB), 2010, "Intensity and Effectiveness of SIFI Supervision—Recommendations for Enhanced Supervision," November mimeo (Basel: Financial Stability Board).

_____, 2011a, "Intensity and Effectiveness of SIFI Supervision—Progress Report on Implementing the Recommendations on Enhanced Supervision," mimeo (Basel: Financial Stability Board).

_____, 2011b, "Key Attributes for Effective Resolution Regimes for Financial Institutions," October mimeo (Basel: Financial Stability Board).

_____, 2011c, "Shadow Banking: Strengthening Oversight and Regulation: Recommendations of the Financial Stability Board," October (Basel: Financial Stability Board).

_____, 2011d, "Shadow Banking: Scoping the Issues," Background Note, April (Basel: Financial Stability Board).

_____, 2012a, "Increasing the Intensity and Effectiveness of SIFI Supervision—Progress Report to the G20 Ministers and Governors," mimeo (Basel: Financial Stability Board).

_____, 2012b, "Strengthening Oversight and Regulation of Shadow Banking," Consultative Document, mimeo November (Basel: Financial Stability Board).

———, 2013a, "Guidance on Developing Effective Resolution Strategies," mimeo (Basel: Financial Stability Board).

_____, 2013b, "2013 Update of Group of Global Systemically Important Banks (G-SIBs)," November mimeo (Basel: Financial Stability Board).

_____, 2013c, "Strengthening Oversight and Regulation of Shadow Banking—An Overview of Policy Recommendations," mimeo (Basel: Financial Stability Board), August.

_____, 2013d, "Strengthening Oversight and Regulation of Shadow Banking—Policy Framework for Strengthening Oversight and Regulation of Shadow Banking Entities," mimeo (Basel: Financial Stability Board), August.

_____, 2013e, "Strengthening Oversight and Regulation of Shadow Banking—Policy Framework for Addressing Shadow Banking Risks in Securities Lending and Repos," mimeo (Basel: Financial Stability Board), August.

_____, 2014a, "Strengthening Oversight and Regulation of Shadow Banking—Regulatory Framework for Haircuts on Non-Centrally Cleared Securities Financing Transactions," mimeo (Basel: Financial Stability Board), October.

_____, 2014b, "Regulatory Framework for Haircuts on Non-Centrally Cleared Securities Financing Transactions, Background Document—Procyclicality of Haircuts: Evidence from the QIS1," mimeo (Basel: Financial Stability Board).

Financial Services Authority, 2009, "Mortgage Market Review," Discussion Paper, No. 09/3 (London: Financial Services Authority).

Financial Supervisory Authority of Norway, 2014, "Risk Weights for Mortgages," mimeo.

Galac, Tomislav, 2010, "The Central Bank as Crisis-Manager in Croatia—A Counterfactual Analysis,"Croatian National Bank Working Paper, W-27 (Zagreb: Croatian National Bank).

_____, 2012, "Global Crisis and Credit Euroisation in Croatia," Croatian National Bank Working Paper, W-33 (Zagreb: Croatian National Bank).

Galindo, Arturo J., Liliana Rojas-Suarez and Marielle del Valle, 2013, Macroprudential Regulations in Andean Countries—Center for Global Development Working Paper, No. 319.

Geanakoplos, John, 2009, "The Leverage Cycle," Cowles Foundation Discussion Paper, No. 1715R, (New Haven: Yale University).

Geanakoplos, John, 2010, "Solving the Present Crisis and Managing the Leverage Cycle," FRB of New York Economic Policy Review (August), pp. 101–31 (New York: Federal Reserve Bank).

Geanakoplos, John, and Lasse Pedersen, 2011, "Monitoring Leverage," Cowles Foundation Discussion Paper, No. 2011 (New Haven: Yale University).

Genworth Financial, 2012, "Response to Liikanen Report Consultation," mimeo.

Gerdrup, Karsten, Aslak Bakke Kvinlog and Eric Schaanning, 2013, "Key Indicators for a Countercyclical Capital Buffer in Norway—Trends and Uncertainty," Staff Memo, No. 13/2013, (Oslo: Norges Bank).

Ghent, Andra C. and Marianna Kudlyak, 2010, "Recourse and Residential Mortgage Default: Theory and Evidence from U.S. States," Working Paper Series, No. 09–10R (Richmond: Federal Reserve Bank of Richmond).

Giese, Julia, Henrik Andersen, Oliver Bush, Chrisitian Castro, Marc Farag, and Sujit Kapadia, 2014, "The Credit-to-GDP Gap and Complementary Indicators for Macroprudential Policy: Evidence from the UK," *International Journal of Finance & Economics*, Vol. 19, Issue 1, pp. 25–47.

Gilchrist, Simon, and Egon Zakrajšek. 2012. "Credit Spreads and Business Cycle Fluctuations," American Economic Review, 102(4): pp. 1692–1720.

Glaeser, Edward L., Joseph Gyourko and Albert Saiz, 2008, "Housing Supply and Housing Bubbles," *Journal of Urban Economics,* Vol. 64, Issue 2, pp. 198–217.

Glocker, Christian, and Pascal Towbin, 2012, "Reserve Requirements for Price and Financial Stability: When Are They Effective?" International Journal of Central Banking Vol. 8, No. 1, pp. 65–114.

Gobat, Jeanne, Mamoru Yanase, and Joseph Maloney, 2014, "The Net Stable Funding Ratio: Impact and Issues for Consideration," IMF Working Paper, WP/14/106 (Washington: International Monetary Fund).

Gray, Simon, 2011, "Central Bank Balances and Reserve Requirements," IMF Working Paper, WP/11/36 (Washington: International Monetary Fund).

Habermeier, Karl, Annamaria Kokenyne, and Chikako Baba, 2011, "The Effectiveness of Capital Controls and Prudential Policies in Managing Large Inflows," IMF Staff Discussion Note, SDN/11/14 (Washington: International Monetary Fund).

Haldane, Andrew G., 2013, "Constraining Discretion in Bank Regulation," Bank of England Speech, Speech given at the Federal Reserve Bank of Atlanta Conference on 'Maintaining Financial Stability: Holding a Tiger by the Tail(s)', Federal Reserve Bank of Atlanta.

Haldane, Andrew G. and Vasileios Madouros, 2012, "The Dog and the Frisbee," Bank of England Speech, Speech given at the Federal Reserve Bank of Kansas City's 36th economic policy symposium, "The Changing Policy Landscape," Jackson Hole, Wyoming, August 2012.

Hallissey, Niamh, Robert Kelly, and Terry O'Malley, 2014, "Macro-prudential Tools and Credit Risk of Property Lending at Irish Banks," Economic Letter Series, Vol. 2014, No. 10 (Dublin: Central Bank of Ireland).

Hanson, Samuel G., Anil Kashyap, and Jeremy C. Stein, 2011, "A Macroprudential Approach to Financial Regulation," *Journal of Economic Perspectives*, Vol. 25, No. 1.

Huang, Rocco, and Lev Ratnovski, 2011, "The Dark Side of Bank Wholesale Funding," *Journal of Financial Intermediation*, Vol. 20 (2), pp. 248–63.

Igan, Deniz and Heedon Kang, 2011, "Do Loan-to-Value and Debt-to-Income Limits Work? Evidence from Korea," IMF Working Paper, WP/11/297 (Washington: International Monetary Fund).

Igan, Deniz and Prakash Loungani, 2012, "Global Housing Cycles," IMF Working Paper, WP/12/217 (Washington: International Monetary Fund).

International Association of Insurance Supervisors, 2011, "Insurance and Financial Stability," mimeo (November).

_____, 2013, "Macroprudential Policy and Surveillance in Insurance," mimeo (July).

_____, 2013, "Global Systemically Important Insurers: Initial Assessment Methodology," mimeo (July).

_____, 2013, "Global Systemically Important Insurers: Policy Measures," mimeo (July).

International Monetary Fund, 2006, Republic of Croatia: 2006 Article IV Consultation—Staff Report (Washington: International Monetary Fund).

_____, 2010a, "A Fair and Substantial Contribution by the Financial Sector," Final Report for the G-20, June (Washington: International Monetary Fund).

_____, 2010b, "Systemic Liquidity Risk: Improving the Resilience of Financial Institutions and Markets," Global Financial Stability Report, October, Chapter 2 (Washington: International Monetary Fund).

_____, 2011a, "Toward Operationalizing Macroprudential Policies: When to Act?" Global Financial Stability Report, September, Chapter 3 (Washington: International Monetary Fund).

_____, 2011b, "Housing Finance and Financial Stability—Bank to Basics?" Global Financial Stability Report, April, Chapter 3 (Washington: International Monetary Fund).

_____, 2011c, "Macroprudential Policy: An Organizing Framework," IMF Policy Paper (Washington: International Monetary Fund).

_____, 2011d, "How to Address the Systemic Part of Liquidity Risk", Global Financial Stability Report, April, Chapter 2 (Washington: International Monetary Fund).

_____, 2011e "Chile: Financial Sector Stability Assessment," IMF Country Report, No. 11/261 (Washington: International Monetary Fund).

_____, 2012a, "Singapore: 2012 Article IV Consultation Staff Report," IMF Country Report, No. 12/248 (Washington: International Monetary Fund).

_____, 2012b, "The Liberalization and Management of Capital Flows—An Institutional View," IMF Policy Paper (Washington: International Monetary Fund).

_____, 2012c, "Australia: Financial Sector Stability Assessment," IMF Country Report, No. 12/308 (Washington: International Monetary Fund).

_____, 2012d, "Australia: Addressing Systemic Risk through Higher Loss Absorbency—Technical Note," IMF Country Report, No. 12/311 (Washington: International Monetary Fund).

_____, 2012e, "The Key Attributes of Effective Resolution Regimes for Financial Institutions—Progress to Date and Next Steps," IMF Policy Paper (Washington: International Monetary Fund).

_____, 2012f, "Enhancing Financial Sector Surveillance in Low-Income Countries: Financial Deepening and Macro-stability," IMF Policy Paper (Washington: International Monetary Fund).

_____, 2012g, "Turkey: Financial Sector Stability Assessment," IMF Country Report, No. 12/261 (Washington: International Monetary Fund).

_____, 2013a, "The Interaction of Monetary and Macroprudential Policies—Background Paper," IMF Policy Paper (Washington: International Monetary Fund).

_____, 2013b, "Key Aspects of Macroprudential Policy—Background Paper," IMF Policy Paper (Washington: International Monetary Fund).

_____, 2013c, "Key Aspects of Macroprudential Policy," IMF Policy Paper (Washington: International Monetary Fund).

_____, 2013d, "The Interaction of Monetary and Macroprudential Policies," IMF Policy Paper (Washington: International Monetary Fund).

_____, 2013e, "Guidance Note for the Liberalization and Management of Capital Flows," IMF Policy Paper (Washington: International Monetary Fund).

_____, 2013f, "Modifications to the Current List of Financial Soundness Indicators," IMF Policy Paper (Washington: International Monetary Fund).

_____, 2013g, "People's Republic of China: 2013 Article IV Consultation—Staff Report," IMF Country Report No. 13/211 (Washington: International Monetary Fund).

_____, 2013h, "Singapore: Financial Sector Stability Assessment," IMF Country Report, No. 13/325 (Washington: International Monetary Fund).

_____, 2014a, "Making the Transition from Liquidity- to Growth-Driven Markets," Global Financial Stability Report, April, Chapter 1 (Washington: International Monetary Fund).

_____, 2014b, "How Do Changes in the Investor Base and Financial Deepening Affect Emerging Market Economies?" Global Financial Stability Report, April, Chapter 2 (Washington: International Monetary Fund).

_____, 2014c, "How Big is the Implicit Subsidy for Banks Seen as Too-Important-to-Fail," Global Financial Stability Report, April, Chapter 3 (Washington: International Monetary Fund).

International Monetary Fund, Financial Stability Board and Bank for International Settlements, 2009, "Guidance to Assess the Systemic Importance of Financial Institutions, Markets and Instruments: Initial Considerations," mimeo (Washington: International Monetary Fund).

Jiménez, Gabriel, Steven Ongena, José-Luis Peydró and Jesus Saurina, 2012, "Macroprudential Policy, Countercyclical Bank Capital Buffers and Credit Supply: Evidence from the Spanish Dynamic Provisioning Experiments," mimeo, Tilburg University.

Jordà, Òscar, Moritz Schularick and Alan M Taylor, 2010, "Financial Crises, Credit Booms, and External Imbalances: 140 Years of Lessons," NBER Working Paper, No. 16567.

Kaminsky, Graciela, and Carmen Reinhart, 1999, "The Twin Crises: The Causes of Banking and Balance-of-Payments Problems," *American Economic Review*, Vol. 89, pp. 473–500.

Kapadia, Sujit, Mathias Drehmann, John Elliott and Gabriel Sterne, 2012, "Liquidity Risk, Cash-Flow Constraints and Systemic Feedbacks," Bank of England Working Paper No. 456 (London: Bank of England).

KPMG, 2011, "Securitization Vehicles—Is IFRS the End of the Road?" Insights into Canadian Banking, Issue 2, Spring 2011 Edition.

Kraft, Evan and Tomislav Galac, 2011, "Macroprudential Regulation of Credit Booms and Busts-The Case of Croatia", World Bank Policy Research Working Paper, No. 5572 (Washington: World Bank).

Krznar, Ivo and James Morsink, 2014, "With Great Power Comes Great Responsibility: Macroprudential Tools at Work in Canada," IMF Working Paper, WP/14/83 (Washington: International Monetary Fund).

Kuttner, Kenneth N. and Ilhyock Shim, 2013, "Can Non-interest Rate Policies Stabilise Housing Markets? Evidence from a Panel of 57 Economies," BIS Working Papers, No. 433 (Basel: Bank for International Settlements).

Laeven, Luc and Fabian Valencia, 2012, "Systemic Banking Crises Database: An Update," IMF Working Paper, WP/12/163 (Washington: International Monetary Fund).

Laeven, Luc, Lav Ratnovski, and Hui Tong, 2014, "Bank Size and Systemic Risk," IMF Staff Discussion Note, No. 14/04 (Washington: International Monetary Fund).

Lang, Larry, Stijn Claessens and Simeon Djankov, 1999, "Corporate Growth, Financing, and Risks in the Decade before East Asia's Financial Crisis" World Bank Policy Research Paper, (Washington: World Bank).

Lee, Jong Kyu, 2012, "The Operation of Macroprudential Policy Measures: The Case of Korea," mimeo (Seoul: Bank of Korea).

Lim Cheng Hoon, 2013, "Capital Surcharges for Systemically Important Banks," MCM Policy Position Note (Washington: International Monetary Fund).

Lim, Cheng Hoon, Ivo Krznar, Fabian Lipinsky, Akira Otani, and Xiaoyong Wu, 2013, "The Macroprudential Framework: Policy Responsiveness and Institutional Arrangements," IMF Working Paper, WP/13/166 (Washington: International Monetary Fund).

Lim, Cheng Hoon, Francesco Columba, Alejo Costa, Piyabha Kongsamut, Akira Otani, Mustafa Saiyid, Torsten Wezel, Xiaoyong Wu, 2011, "Macroprudential Policy: What Instruments and How Are They Used? Lessons from Country Experiences," IMF Working Paper, WP/11/238 (Washington: International Monetary Fund).

Logan, Andrew, 2000, "The Early 1990s Small Banks Crisis: Leading Indicators" Bank of England Financial Stability Review: December 2B00 (London: Bank of England).

Longworth, David, 2010, "Warding Off Financial Market Failure: How to Avoid Squeezed Margins and Bad Haircuts," C.D. Howe Institute, Backgrounder, No. 135.

Macroeconomic Assessment Group (MAG), 2010, "Assessing the Macroeconomic Impact of the Transition to Stronger Capital and Liquidity Requirements—Final Report," December (Basel: Bank for International Settlements).

_____, 2010b, "Assessing the Macroeconomic Impact of the Transition to Stronger Capital and Liquidity Requirements—Final Report," Basel Committee on Banking Supervision, December.

Mian, Atif and Amir Sufi, 2011, "House Prices, Home Equity-Based Borrowing, and the U.S. Household Leverage Crisis," *American Economic Review*, Vol. 101, Issue 5, pp. 2132–56.

Nier, Erlend W., 2009, "Financial Stability Frameworks and the Role of Central Banks: Lessons from the Crisis," IMF Working Paper, WP/09/70 (Washington: International Monetary Fund).

Nier, Erlend W. and Lea Zicchino, 2008, "Bank Losses, Monetary Policy and Financial Stability—Evidence on the Interplay from Panel Data," IMF Working Paper, WP/08/232 (Washington: International Monetary Fund).

Nordic Working Group on Basel III/CRD IV and National Discretion, 2012, "Report from the Nordic Working Group on Basel III / CRD IV," mimeo.

Oet, Mikhail V., Timothy Bianco, Dieter Gramlich, and Stephen Ong, 2012, "Financial Stress Index: A Lens for Supervising the Financial System," Federal Reserve Bank of Cleveland Working Paper, No. 12–37 (Cleveland: Federal Reserve Bank of Cleveland).

Perottia, Enrico, and Javier Suarez, 2011, "A Pigovian Approach to Liquidity Regulation," *International Journal of Central Banking*, Vol. 7, No. 4, pp. 3–41.

Reinhart Carmen M. and Kenneth S. Rogoff, 2009, "The Aftermath of Financial Crises," *American Economic Review,* Vol. 99(2), pp. 466–72.

Renaud, Bertrand, Ming Zhang, Stefan Koeberle, 2001, "Real Estate and the Asian Crisis: Lessons of the Thailand Crisis," A Global Perspective on Real Estate Cycles The New York University Salomon Center Series on Financial Markets and Institutions, Volume 6, 2001, pp. 25–61.

Repullo, Rafael and Jesús Saurina, 2011, "The Countercyclical Capital Buffer of Basel III: A Critical Assessment," CEPR Discussion Papers, No. 8304.

Riksbank, 2013, "Financial Stability Report 2013:2" (Stockholm: Riksbank).

_____, 2014, "Financial Stability Report 2014:1" (Stockholm: Riksbank).

Reserve Bank of New Zealand, 2014, "C30 New Residential Mortgage Lending: Loan-to-Valuation Ratio (LVR)," Statistics (Wellington: Reserve Bank of New Zealand).

Robitaille, Patrice, 2011, "Liquidity and Reserve Requirements in Brazil," International Finance Discussion Papers, No. 121 (Washington: Board of Governors of the Federal Reserve System).

Rosenberg, Christoph B. and Marcel Tirpák, 2008, "Determinants of Foreign Currency Borrowing in the New Member States of the EU," IMF Working Paper, WP/08/173 (Washington: International Monetary Fund).

Saurina, Jesús, 2009, "Dynamic Provisioning, the Experience of Spain," mimeo (Washington: World Bank).

Securities and Exchange Commission (SEC), 2014, "Money Market Fund Reform; Amendments to Form PF: Final Rule," July (Washington: Securities and Exchange Commission).

Sengupta, Rajdeep, 2010, "Alt-A: The Forgotten Segment of the Mortgage Market," Federal Reserve Bank of St. Louis Review, Vol. 92(1), pp. 55–71 (St. Louis: Federal Reserve Bank of St. Louis).

Shleifer, Andrei and Robert Vishny, 2011, "Fire Sales and Finance and Macreconomics," *Journal of Economic Perspectives,* Vol. 25, No. 1, pp. 29–48.

Shin, Hyun Song, 2010a, "Non-Core Liabilities Tax as a Tool for Prudential Regulation," Policy memo.

_____, 2010b, "Macroprudential Policies Beyond Basel III," Policy memo.

_____, 2011, "Global Liquidity," Remarks at the IMF conference on "Macro and Growth Policies in the Wake of the Crisis", Washington DC, March 7–8, 2011.

_____, 2012, "Global Banking Glut and Loan Risk Premium," Mundell-Fleming Lecture, presented at the 2011 IMF Annual Research Conference, November 10–11, 2011.

_____, 2013, "Procyclicality and the Search for Early Warning Indicators," IMF Working Paper, WP/13/258 (Washington: International Monetary Fund).

Singh, Manmohan, 2007, "Use of Participatory Notes in Indian Equity Markets and Recent Regulatory Changes," IMF Working Paper, WP/07/291 (Washington: International Monetary Fund).

Stein, Jeremy C., 2013, "The Fire-Sales Problem and Securities Financing Transactions," Speech at the Federal Reserve Bank of Chicago and International Monetary Fund Conference in Chicago, Illinois, November.

_____, 2014, "Incorporating Financial Stability Considerations into a Monetary Policy Framework", Speech at the International Monetary Fund 2014 Spring Meetings on April 13, 2014, and at the 2014 Financial Markets Conference on April 16, 2014.

Stone, Mark R., 2000, "The Corporate Sector Dynamics of Systemic Financial Crises," IMF Working Paper, WP/00/114 (Washington: International Monetary Fund).

Sveriges Riksbank, 2012, "Financial Stability Report 2012:1," Chapter 3 (Stockholm: Sveriges Riksbank).

Tarullo, Daniel K., 2013, "Evaluating Progress in Regulatory Reforms to Promote Financial Stability," Speech at the Peterson Institute for International Economics, Washington, D.C., May.

_____, 2014a, "A Macroprudential Perspective on Regulating Large Financial Institutions," Banque de France Financial Stability Review, April, No. 18 (Paris: Banque de France).

_____, 2014b, "Rethinking the Aims of Prudential Regulation," Speech At the Federal Reserve Bank of Chicago Bank Structure Conference, Chicago, Illinois, May 8, 2014.

TD Economics, 2012, "Tighter Mortgage Rule to Cool Debt Growth but Higher Rates Ultimately Required," Special Report, September.

Tovar, Camilo E., Mercedes Garcia-Escribano, and Mercedes Vera Martin, 2012, "Credit Growth and the Effectiveness of Reserve Requirements and Other Macroprudential Instruments in Latin America," IMF Working Paper, WP/12/142 (Washington: International Monetary Fund).

United Kingdom Parliament, 2013, "Minutes of Evidence," Treasury Committee of House of Commons, HC 873, Session 2012–13.

Viñals, José, Ceyla Pazarbasioglu, Jay Surti, Aditya Narain, Michaela Erbenova, and Julian Chow, 2013, "Creating a Safer Financial System: Will the Volcker, Vickers, and Liikanen Structural Measures Help?" IMF Staff Discussion Note, No. 13/4 (Washington: International Monetary Fund).

Viñals, José and Erlend W. Nier, 2014, "Collective Action Problems in Macroprudential Policy and the Need for International Coordination," Banque de France Financial Stability Review, April, No. 18 (Paris: Banque de France).

Wezel, Torsten, 2010, "Dynamic Loan Loss Provisions in Uruguay: Properties, Shock Absorption Capacity and Simulations Using Alternative Formulas," IMF Working Paper, WP/10/125 (Washington: International Monetary Fund).

Wezel, Torsten, Jorge A. Chan-Lau, and Francesco Columba, 2012, "Dynamic Loan Loss Provisioning: Simulations on Effectiveness and Guide to Implementation," IMF Working Paper, WP/12/110 (Washington: International Monetary Fund).

Woods, Maria, 2007,"A Financial Stability Analysis of the Irish Commercial Property Market", Central Bank of Ireland, Financial Stability Report 2007 (Dublin: Central Bank of Ireland).

Wolken, Tony, 2013, "Measuring Systemic Risk: The Role of Macro-prudential Indicators," Reserve Bank of New Zealand Bulletin, Vol. 76, No. 4 (Wellington: Reserve Bank of New Zealand).

Wong, Eric, Tom Fong, Ka-fai Li and Henry Choi, 2011, "Loan-to-Value Ratio as a Macroprudential Tools—Hong-Kong's Experience and Cross-Country Evidence," HKMA Working Paper, No. 01/2011 (Hong Kong: Hong Kong Monetary Authority).

Wong, Eric, Andrew Tsang, and Steven Kong, 2014, "How Does Loan-To-Value Policy Strengthen Banks' Resilience to Property Price Shocks-Evidence from Hong Kong," HKIMR Working Paper No. 03/2014 (Hong Kong: Hong Kong Institute of Monetary Research).