INTERNATIONAL MONETARY FUND

IMF Country Report No. 14/347

DENMARK

FINANCIAL SECTOR ASSESSMENT PROGRAM

December 2014

MACROPRUDENTIAL POLICIES—TECHNICAL NOTE

This Technical Note on Macroprudential Policies on Denmark was prepared by a staff team of the International Monetary Fund as background documentation for the periodic consultation with the member country. It is based on the information available at the time it was completed in December 2014.

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International Monetary Fund
Washington, D.C.

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MACROPRUDENTIAL POLICIES

Prepared By
Monetary and Capital Markets Department

This Technical Note was prepared by IMF staff in the context of the Financial Sector Assessment Program Update in Denmark. It contains technical analysis and detailed information underpinning the FSAP's findings and recommendations. Further information on the FSAP can be found at: http://www.imf.org/external/np/fsap/fssa.aspx.

CONTENTS

Glossary

ATC	Advisory Technical Committee
BCBS	Basel Committee for Banking Supervision
BIS	Bank for International Settlements
BSI	Banking Stability Index
BUQ	Bottom-up-Questionnaire
CEDFS	Credit Edge Data File Service
CCA	Contingent Claims Analysis
CCB	Counter Cyclical Buffer
CCRIS	Central Credit Reference Information System
CDS	Credit Default Swap
CET1	Core Equity Tier 1
CRD	Capital Requirements Directive
CRR	Capital Requirements Regulation
DFSA	Danish Financial Supervisory Authority
DN	Danmarks Nationalbank
D-SIFIs	Domestic Systemically Important Financial Institutions
DSTI	Debt-Service-to-Income
ECB	European Central Bank
ESRB	European Systemic Risk Board
FA	Financial Auxiliaries
FDI	Foreign Direct Investment
FSA	Financial Supervisory Authority
FSAP	Financial Sector Assessment Program
FSI	Financial Soundness Indicators
FX	Foreign Exchange
GDP	Gross Domestic Product
GFC	Global Financial Crisis
GG	General Government
GVAR	Global Vector Auto Regression
HH	Households
IC	Insurance Corporations and Pension Funds
IMF	International Monetary Fund
IRB	Internal Risk Based
JPOD	Joint Probability of Distress
LGD	Loss Given Default
LTI	Loan-to-Income
LTV	Loan-to-Value
MCIs	Mortgage Credit Institutions
MFI	Monetary and Financial Institutions
MKMV	Moody's KMV
MoBG	Ministry of Business and Growth
MOF	Ministry of Finance
NBMF	Nordic Baltic Macroprudential Forum
NFC	Non Financial Corporations

NPL	Nonperforming loan
OFI	Other Financial Intermediaries
POD	Probability of Default
ROA	Return on Assets
ROW	Rest of World
RW	Risk Weight
SIFI	Systemically Important Financial Institution
SRC	Systemic Risk Council
TITF	Too-Important-To-Fail
UK	United Kingdom

EXECUTIVE SUMMARY[1]

Macroprudential policy has three interlocking tasks. First, it seeks to contain the build-up of macrofinancial imbalances associated with credit booms and asset price bubbles, a function which is particularly important in Denmark, where the space for monetary policy action is limited. Second, it plays an important role in controlling structural vulnerabilities that arise from size and interconnectedness within the financial sector, but also from interlinkages between the financial sector and other sectors of the economy. Third, it seeks to increase the resilience of the financial system to aggregate shocks, by building buffers which enable financial institutions to continue their credit providing function under adverse economic conditions. Importantly, even though vulnerabilities appear contained and a crisis distant, risks can build up rapidly, so early development and implementation of macroprudential tools are essential.

Against this background, Denmark's adoption of an institutional framework for macroprudential policy in 2013 is welcome. The framework includes a Systemic Risk Council (SRC), which brings together representatives from the Danmarks Nationalbank (DN), the Danish Financial Supervisory Authority (DFSA), relevant government ministries, as well as independent experts. The Chairman of the DN's Board of Governors heads the SRC and the central bank hosts the secretariat. The DFSA and the other ministries represented in the SRC participate in the secretariat. The SRC's tasks are to identify and monitor systemic financial risks and to issue observations, warnings, and recommendations to the DFSA and the government. The decision-making power on most macroprudential instruments currently available lies with the Minister of Business and Growth (MoBG), which has been appointed as the designated macroprudential authority.

Domestic systemically important financial institutions (D-SIFIs) have been identified and capital surcharges are being imposed. The six largest banking groups (Danske Bank, Nordea Bank Denmark, Nykredit, Jyske Bank, Sydbank, and DLR Kredit) were designated as D-SIFIs in June 2014 and, starting in 2015 and following a phase-in period until 2019, will be subject to higher capital requirements ranging from 1–3 percent of risk weighted assets, depending on their systemic importance. In addition, the framework for a countercyclical capital buffer (CCB) will be phased in starting with an upper bound of 0.5 percent in 2015 increasing to 2.5 percent in 2019. From 2020, the buffer could be further increased based on the authorities' assessment.

To further strengthen the macroprudential policy framework going forward, the authorities could consider the following actions:

- **Expand the range of analytical tools used to identify and monitor systemic risk.** The analyses prepared for the SRC meetings include a broad assessment of risks using indicators in a risk dashboard, supported by an illustration of macroprudential risks under each intermediate target over time. The material also includes notes on specific topics of interest.

[1] The note was prepared by Prachi Mishra. The mission would like to thank all officials and particularly those from the DN, DFSA, MoBG, Ministry of Economic Affairs, and the Ministry of Finance, for their cooperation, hospitality, and willingness to share data and information, and discuss all relevant issues with great frankness.

Other possible tools could include a financial stability spidergram that shows changes in overall risks over time, risk heat maps (based on thresholds for various indicators), as well as measures of interconnectedness across financial institutions and economic sectors.

- **Introduce new policy instruments to have the ability to address time-varying systemic risk.** In addition to the expected implementation of the CCB framework in January 2015, the authorities should explore the potential use of limits on loan-to-value (LTV) ratios and debt service-to-income (DSTI) ratios, and imposing higher risk weights on lending to particular sectors. Many countries (e.g., Norway, Sweden, Israel, Hong Kong, and Singapore) use complementary macroprudential instruments, which help improve the effectiveness of macroprudential policy. For example, while limits on LTV ratios may become less binding and require successive tightening as house prices increase, caps on DSTI ratios are more effective. To inform the eventual decisions on the calibration and activation of such instruments, improved data collection is warranted on the distribution of LTVs and DSTIs across loans, types of property, categories of borrowers, and over time.

- **Review the experience with the institutional arrangements, especially the appointment of the government as the designated authority for most macroprudential instruments.** The SRC has important strengths, including sound transparency and accountability arrangements, such as the "comply or explain" rule and the abstention rule for government representatives and the DFSA on recommendations to the government. However, given that decision-making power lies with the government (as opposed to an institution with operational independence), there is a greater risk that political considerations could delay necessary macroprudential action. Indeed, Denmark is one of only three countries in Europe where the designated authority is the government. After a year or so, when the SRC is to be evaluated, the authorities are encouraged to assess the effectiveness of the current system, including the appointment of the government as the designated macroprudential authority.

This note presents a comprehensive overview of macroprudential policies. Section I discusses the identification of systemic risk and presents a range of additional analytical tools that could be used for identification and monitoring of systemic risks. Section II provides an overview of existing macroprudential tools and suggestions for additional tools. Section III presents the institutional arrangements, cross-country evidence, and an assessment on how the current arrangement is working.

Table of Recommendations on Macroprudential Policy

Recommendations	Priority[1/]
➢ Expand the range of analytical tools used to identify and monitor systemic risk (DN)	Medium term
➢ Explore new instruments capable of addressing time-varying systemic risk, such as limits on LTV and debt service to income (DSTI) ratios (DN, DFSA)	Short term
➢ Review the experience with the institutional arrangements, especially the appointment of the government as the designated authority for most macroprudential instruments	Short term

1/ Short-term indicates within 18 months; medium-term indicates from 18 months to three years.

IDENTIFICATION OF SYSTEMIC RISK

1. An effective framework for monitoring systemic risk is key to operationalizing macroprudential policy (IMF, 2013). Systemic risks can be classified into two categories:

(i) Structural risk (or cross-sectional risk): Arises from structural features of the financial system, such as interlinkages between financial intermediaries and the critical role played by institutions in key markets that can render individual institutions too important to fail.

(ii) Cyclical risk: Is the amount of risk that the financial system takes at a point in time relative to its capital and liquidity. The most relevant cyclical risks are credit risk, liquidity risk, and market risk. In most financial systems, credit risk is the key source of risk. Strong increases in credit can signal buildup of systemic risk. Liquidity risks refer to changes in financial institutions' liquidity, and interactions between market liquidity and funding conditions. Market risk emanates from volatility in interest rates, exchange rates, and asset prices.

2. This chapter provides an analysis of existing frameworks used in Denmark for identifying systemic risk of both structural and cyclical nature. It also suggests additional tools that the authorities could use to further enhance their capacity to evaluate systemic risks.

A. Current Framework: Structural Systemic Risk

3. A framework has been established for the identification of D-SIFIs. Based on recommendations of the SIFIs Committee, the MoBG finalized the SIFI framework, which was subsequently approved by the Parliament.[2] The package has been adopted by law in March 2014.[3] A SIFI is defined as a bank or mortgage-credit institution (MCI) which is so large that if it encounters any difficulty, this could have far-reaching negative consequences for households, enterprises and the national economy in general.

4. Danish SIFIs have been identified essentially on the basis of size criteria.[4] The following criteria are used for SIFIs identification: (i) the size of the balance sheet is equivalent to more than 6.5 percent of Denmark's GDP; (ii) loans comprise more than 5 percent of total sector loans; and (iii) deposits comprise more than 5 percent of total sector deposits. To be defined as a SIFI, the institution must exceed one of the limits for two consecutive years. Measures of interconnectedness were considered by the SIFI Committee. However, given that size and interconnectedness were highly correlated, size criteria were preferred to keep the approach simple and transparent.[5]

[2] A comparison between the SIFI Committee recommendations and the legislation is described at http://risikoraad.dk/media/175853/press_release_after_fifth_meeting.pdf.

[3] Financial Business Act of March 18, 2014 based on the Bank Package 6 (The Systemic Package—October 2013; which was the last of the six rounds of measures adopted during and after the financial crisis).

[4] See Bank Package 6 agreement available at http://www.evm.dk/~/media/oem/pdf/2013/2013-pressemeddelelser/10-10-13-pm-vedr-sifi-aftale-xxxxxx/agreement-10-10-13.ashx.

[5] Data availability (especially in the public domain) on measures of interconnectedness is limited.

5. SIFIs are to be identified every year by the DFSA no later than June 30, on the basis of the most recent financial statements. The first identification took place in June 2014, although a preliminary list of institutions qualifying for the SIFI status had been disclosed together with the publication of the Bank Package 6 in October 2013. New SIFIs must meet the SIFI requirements at the end of the following year—i.e., at least 18 months after having been identified. The DFSA is responsible for formally notifying the institutions of their SIFI status. The designated SIFIs are required by law to publicly disclose their SIFI status, together with justification for designation and the extra capital requirements applied. An institution will cease to be defined as an SIFI if it is below the identification limits for three consecutive years.

6. If bank size changes in an important way, the MoBG may accelerate the process of enlisting or delisting a SIFI. If an institution which was not identified as a SIFI, but which as the result of acquisition or merger substantially exceeds one of the limits, the MoBG may decide that the institution is a SIFI before the two years of meeting the SIFI criteria have passed. However, the MoBG may decide that an institution is no longer a SIFI before these three years have passed if the institution files a request to this effect and if the institution is substantially below the limits—e.g., as a result of divestment of significant parts of the business or similar. Therefore, although discretion is minimized by setting the criteria for identification of SIFIs in the law, some flexibility and discretion for the MoBG is allowed under the framework.

7. The June 2014 SIFI list contains six institutions. Based on the criteria spelled out in the law, six credit institutions (Danske Bank, Nykredit, Nordea Danmark Bank, Jyske, Sydbank, DLR Kredit), were identified as SIFIs in Denmark. BRF Kredit, which previously qualified for SIFI status based on quantitative criteria, is not included in the final list of SIFIs as it has now merged with Jyske (currently on the SIFI list).[6] Formal notifications were sent to the six institutions by the DFSA about their SIFI designation on June 19, 2014.

Table 1. Danish Banks and Mortgage-Credit Institutions Which Fulfill the Quantitative Criteria for Identification as SIFI, Consolidated Level, 2013

	Total assets in percent of GDP	Loans in percent of the total loans of the sector	Deposits in percent of the total deposits of the sector
Danske Bank	160.2	30.4	35.9
Nykredit	76.3	32.7	4.6
Nordea Bank Danmark	44.8	16.0	22.0
Jyske Bank	14.1	3.4	8.9
Sydbank	8.0	1.8	5.4
DLR Kredit	7.9	3.5	0.0

[6] DLR credit is designated a SIFI based on the law. However, based on the SIFI committee recommended threshold of assets/GDP of 10 percent, it did not qualify as a SIFI. The SIFI committee instead recommended DLR Kredit to also be classified as a SIFI based on qualitative indicators such as the institution's large market share of lending to the agriculture sector which is difficult for other institutions to substitute. Instead of using qualitative indicators, the law modified the criteria for identification by lowering the threshold on total assets from 10 percent to 6.5 percent of GDP—in order to reduce discretion in identifying SIFIs and to include DLR Kredit based on the revised thresholds.

B. Current Framework: Cyclical Systemic Risk

8. The SRC is commissioned to monitor and identify systemic risks in the financial system. Monitoring and assessment of systemic risks are conducted in the DN part of the SRC's secretariat in close corporation with the DFSA.

9. The framework for monitoring cyclical or time-varying systemic risk is based on the European Systemic Risk Board' (ESRB) intermediate targets and the related market failures. ESRB specifies five intermediate objectives: (1) mitigate and prevent excessive credit growth and leverage; (2) mitigate and prevent excessive maturity mismatch and market illiquidity; (3) limit direct and indirect exposure concentration; (4) limit the systemic impact of misaligned incentives with a view to reducing moral hazard; and (5) strengthen the resilience of financial infrastructures.[7]

10. In practice, broad-based scans for systemic risks are performed on a quarterly basis using a risk dashboard. The risk dashboard collects relevant indicators connected to intermediate targets of macroprudential policy. These indicators are used to grasp if there are signs of market failures or if current developments indicate increased risk of market failures being activated when the financial cycle turns. The broad-based scan translates into a short surveillance note containing an assessment of current systemic risks, which is submitted to the SRC.

11. The risk dashboard monitoring is supplemented by other analytical tools. Such tools include stress tests of the biggest Danish banks conducted by the DN every six months and event/scenario-analysis to gauge transmission of severe, unlikely events (e.g., Black Swan-type analysis). Also, international and national reports (for example from the ESRB) as well as other available information are used in the assessment of systemic risks. For every SRC meeting, a short surveillance note, an updated risk dashboard, and short ad-hoc notes of relevant issues are produced.

12. The framework for surveillance of systemic risks is fairly new (has been operational for only one year) and is under development. For the time being no econometric models or larger statistical frameworks have been developed nor are used in relation to the risk dashboard.

C. Possible Additional Tools

13. This section presents additional methodologies for estimating systemic risks that could be used by the authorities.

Country Financial Stability Map (Spider-gram)

14. The Country Financial Stability Map provides an overarching framework to identify potential sources of macro financial risks in a country (Cervantes et. al, 2014). The method assesses four broad risks and two conditions affecting financial stability. The four risks are:

[7] Details of the ESRB recommendations on intermediate objectives and instruments of macroprudential policy are available at Recommendation of the ESRB of 4 April 2013 on intermediate objectives and instruments of macroprudential policy, ESRB/2013/1.

macroeconomic, inward spillovers, credit, and market and funding liquidity; the two conditions are: monetary and financial conditions, and risk appetite. Each "category" is represented by an aggregated indicator which is developed based on individual "elements," which are in turn derived from several macroeconomic and financial indicators (Annex I). This is a useful tool to analyze changes in various dimensions of risk over time. A country's evolving risk can also be compared to the evolution of global risk.

15. For illustration, the financial stability map for Denmark in Figure 1 depicts how risks have changed between 2008 and 2013. In parallel with global risks, broader risks have largely receded in Denmark since 2008 but conditions are mixed:

- **Market and liquidity risks and inward spillover risks have declined sharply**. Inward spillover risks declined between 2008 and 2010, and have been unchanged since then; market and liquidity risks also declined since 2010. The decline in market and liquidity risks is driven by a decline in risks on both secondary market and bank funding and liquidity. Inward spillover risks have declined primarily due to a sharp decline in banks' foreign assets and an increase in foreign reserves.

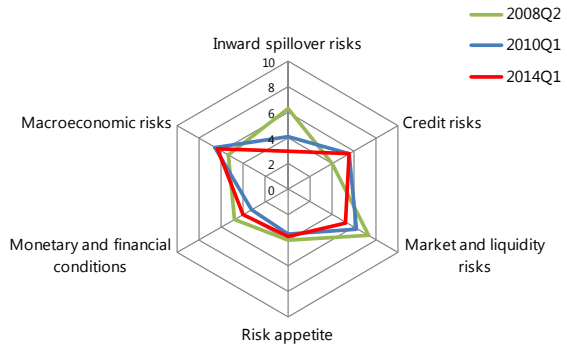
- **Credit risk and risk appetite have increased**. Credit risk rose between 2008 and 2010, reflecting increases in household and corporate debt to GDP, but has been unchanged since then. The increase in risk appetite is primarily driven by decreased volatility of stock price and exchange rate movements; and by rising FDI flows (Figure 2).

- **Monetary and financial conditions have tightened slightly between 2008 and 2010**, driven by a decline in money supply growth.

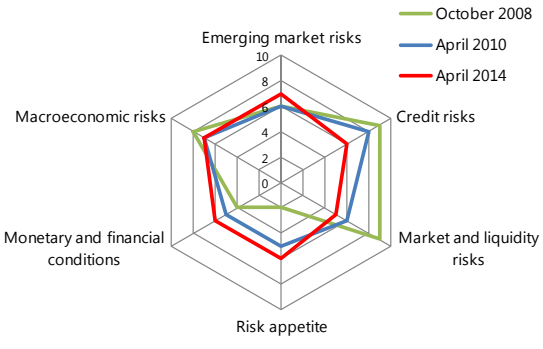
- **Macroeconomic risks remained broadly unchanged.**

Figure 1. Financial Stability Maps for Denmark and the World

Country Financial Stability Map: Denmark

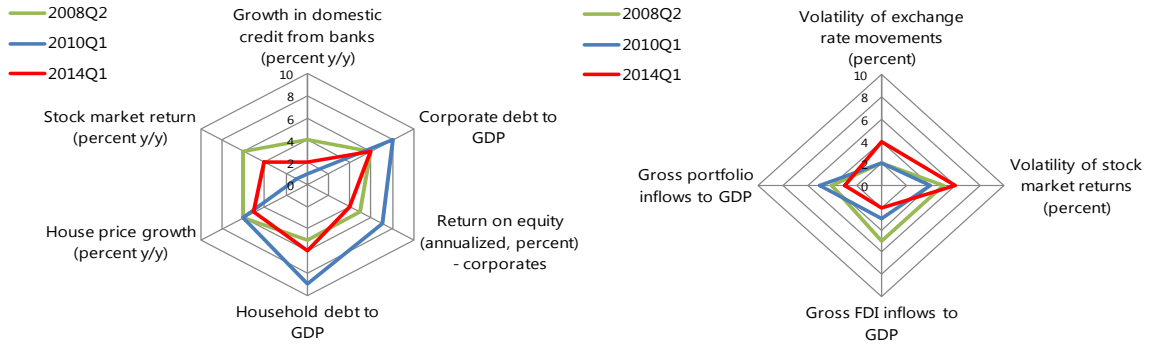


Comparable GFSR Global Financial Stability Map



Note: Away from center signifies higher risks, easier monetary and financial conditions, or higher risk appetite.

Figure 2. Denmark: Financial Stability Map: Components of Credit Risk and Risk Appetite



Note: Away from center signifies higher risks, easier monetary and financial conditions, or higher risk appetite.

Heat Maps

16. Systemic risk can be further assessed by creating an overall financial sector vulnerability rating. Such analysis is based on an average of different signals—credit cycle, balance sheet soundness, and existence of buffers, which capture both current conditions (e.g. balance sheet risks), as well as indicators of potential problems (e.g., credit cycle). Based on the empirical evidence and existing literature, certain thresholds can be used in order to determine how vulnerable a country is, and countries can be ranked as "High," "Medium," or "Low." The framework can also be used to analyze the changes in risk over time.[8]

17. The risk analysis in this section should be considered as complementary with and going a step further than the spider-gram. While the country financial stability map is useful for assessing a country's risk relative to its own history, the risk analysis in this section can be used to create flags or alerts for build-up of systemic risks based on pre-specified thresholds for selected indicators which have been considered in the literature to be good predictors of crises.

18. Indeed, the heat map for Denmark indicates that risks have significantly alleviated compared to the pre-crisis times, but also point towards some existing vulnerabilities. The heat maps for (i) all banks; (ii) commercial; and (iii) mortgage banks, are shown in Table 2. Although credit indicators were on "high alert" prior to the global financial crisis, more recently they do not indicate specific vulnerabilities.

[8] The indicators of systemic risk can also be combined to create an overall financial sector vulnerability measure for a country. Several methods can be used to combine the vulnerability indicators. For example, a z-score could be assigned to each indicator, and then the normalized indicators could be combined using a simple or weighted average. Another possibility would be to take an average of the ranks (0, 1, and 2 for low, medium, and high vulnerabilities respectively) to create an overall index of vulnerability.

Table 2. Financial Sector Vulnerability in Denmark

Table 2a. Heat Map: All Banks

	Dec-06	Dec-07	Dec-08	Dec-09	Dec-10	Dec-11	Dec-12	Dec-13
Risks								
Credit Growth/Cycle	3	3	3	3	0	0	0	0
Deposit/ Loan (FSI definition)	31.5	31.1	29.1	30.1	30.6	31.3	31.2	29.0
Deposit/ Loan (authorities' definition)	26.4	30.0	32.7	34.5	33.0	32.8	32.9	33.8
FX Liabilities/ Total Liabilities	25.7	29.4	29.0	26.5	26.2	25.7	22.7	30.8
FX Loans/ Total Loans	22.6	25.7	26.3	25.4	25.7	23.4	21.3	21.2
FX Liabilities/ Total Liabilities (excl Euro)	11.6	12.7	13.3	10.9	10.8	9.4	6.7	8.4
FX Loans/ Total Loans (excl Euro)	13.2	13.1	11.4	10.7	8.1	8.3	8.5	8.7
Buffer								
Capital / Assets	5.8	6.3	5.5	5.5	5.4	5.1	5.3	7.1
Return on Assets	0.30	0.16	-0.25	-0.08	0.04	-0.02	0.04	0.06
Changes in NPLs		-13.5	303.0	106.6	-4.9	14.1	-4.5	6.9
Level of NPLs	0.7	0.6	2.4	4.9	4.7	5.4	5.1	5.5
Changes in NPLs (all banks - FSI definition)			101.3	175.0	23.3	-10.1	62.6	-22.4
Level of NPLs (all banks -- FSI defintion)		0.6	1.2	3.3	4.1	3.7	6.0	4.6

Table 2b. Heat Map: Commercial Banks

	Dec-06	Dec-07	Dec-08	Dec-09	Dec-10	Dec-11	Dec-12	Dec-13
Risks								
Credit Growth/CyCle								
Deposit/ Loan (FSI definition)	74.4	71.2	65.2	73.9	76.1	83.5	86.2	79.9
Deposit/ Loan (authorities' definition)	73.4	74.1	79.4	89.5	87.7	90.9	95.9	105.2
Deposit/ Loan (excluding Covered Bonds)		71.4	66.8	77.8	80.7	91.0	96.4	87.3
FX Liabilities/ Total Liabilities	42.4	45.8	46.5	42.5	41.4	41.0	36.6	47.4
FX Loans/ Total Loans	40.0	42.6	44.0	44.0	44.9	42.0	39.4	40.8
FX Liabilities/ Total Liabilities (excl Euro)	21.6	23.0	24.1	21.3	21.2	18.3	13.0	16.3
FX Loans/ Total Loans (excl Euro)	26.0	24.6	21.8	22.2	17.0	18.4	19.2	19.8
Buffer								
Capital / Assets	7.4	6.8	6.0	7.7	7.8	8.0	8.4	9.2
Return on Assets	0.36	0.19	-0.37	-0.16	0.04	-0.06	0.02	0.07
Changes in NPLs		-16.9	211.3	82.2	13.5	-0.7	5.6	4.2
Level of NPLs	1.5	1.2	3.8	7.0	7.9	7.9	8.3	8.7
Changes in NPLs (all banks-FSI definition)								-58.0
Level of NPLs (all banks-FSI definition)							2.4	1.0

Table 2c. Heat Map: Mortgage Banks

	Dec-06	Dec-07	Dec-08	Dec-09	Dec-10	Dec-11	Dec-12	Dec-13
Risks								
Credit Growth/Cycle								
Deposit/ Loan (not applicable)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FX Liabilities/ Total Liabilities	6.8	9.8	7.9	10.6	11.8	11.9	10.5	13.7
FX Loans/ Total Loans	5.4	8.0	7.9	9.1	9.4	9.4	8.5	7.5
Buffer								
Capital / Assets	4.0	5.7	4.9	3.1	3.0	2.0	2.1	4.7
Return on Assets	0.20	0.11	-0.03	0.02	0.05	0.04	0.05	0.05
Changes in NPLs		-15.7	431.3	180.6	19.7	-7.4	2.5	48.5
Level of NPLs	0.1	0.1	0.4	1.0	1.2	1.1	1.2	1.7

Sources: Danish Authorities and Fund staff calculation. All figures are for commercial banks unless otherwise noted. Red, yellow, and green indicate high, medium, and low vulnerabilities respectively. For ROA, there is high and low vulnerability (red and no color respectively). For the level of NPLs—no thresholds are specified. Thresholds are not specified for changes in NPLs based on impaired loans' definition. For deposit/loan ratio, authorities' definition is on a consolidated basis, and includes all loans to and deposits from non-banks. The FSI definition of deposit/loan is at individual bank level, and does not include deposits from non-banks. The definition of FX loans to total loans follows FSI definitions, and include all loans, i.e. also interbank loans (even loans to the foreign branches and subsidiaries of the same bank are included) and loans to foreign residents.

19. The deposit-to-loan ratio points to vulnerabilities. Since deposits are a more stable source of funding than market funding, a higher deposit-to-loan ratio indicates lower liquidity risk. For commercial banks, the deposit-to-loan ratio (FSI definition) is in the high risk range. If loans that are funded by covered bonds are excluded, the deposit-to-loan ratio is in the medium vulnerability range. Based on the authorities' definition, which includes all loans to and deposits from non-banks (and is on a consolidated basis), the deposit/loan ratio is now in the low range, after being in the medium range in recent years.[9] In staff's view, if the aim is to assess vulnerabilities in the Danish banking system, it would be prudent to monitor the deposit-to-loan ratio at the individual bank (solo) and the group-wide (consolidated) levels. The former should be defined to ensure that customer deposits exclude deposits from other banks and financial corporations.

20. A first look at the data may suggest that vulnerability associated with indicators of exposure to foreign currency risk rank as high, but it is in practice limited due to the high share of Euro loans and the peg of the Danish Krone to the Euro. Internationally, past experience of crises has pointed to the importance of foreign currency exposures as an indicator of future repayment problems, especially when the exchange rate sharply depreciates. For the banking system, this is assessed through two measures. First, over-extending foreign currency loans can increase credit risk as increased debt service may put pressure on the repayment capacity of borrowers. Second, banks may struggle to generate sufficient foreign currency to meet their own liabilities in the face of exchange rate pressures. For commercial banks in Denmark, both foreign exchange (FX) loans as well as liabilities exceed the 40 percent threshold (Annex II). However, foreign currency risk is likely to be limited given that majority of the foreign currency loans are denominated in Euros with the Danish Krone being pegged to the Euro (rows in Tables 2a–2b exclude euros). The risk may also be mitigated by the fact a large part of the Danish FX loans is to subsidiaries and branches abroad, as well as other foreign counterparties.

21. The indicators measuring asset quality also flag some risks. The increase in the impaired loan ratio (authorities' definition) has been in the range of medium to high vulnerability. In particular, the impaired loan ratio for MCIs increased by 48 percent year-on-year in end 2013, though the level of impaired loans is still very low. The 90-day past due NPL ratios (FSI definition) are much lower and are have improved over time. This implies that there are loans that are considered impaired, even though they are not yet past due, which underlines the Danish authorities' conservative approach to measuring and monitoring asset quality.

[9] There are two main differences between the FSI and authorities' definition. First, the FSI definition is at the individual bank level, while the authorities' definition is on a consolidated basis, which includes banks' foreign branches and subsidiaries. Second, the FSI definition includes loans to non-banks but excludes deposits from non-banks, while the authorities' definition includes all non-bank counterparties in both the numerator and the denominator.

22. Deeper analyses of specific indicators (e.g. NPL ratios by groups of banks) may offer better insights into the build-up of systemic risk. There is substantial variation across banks in impaired loan ratios. For example, medium-sized and small banks have higher impaired loan ratios than large banks, and the ratios have increased sharply. Although the impaired loan ratio for large banks is much lower, it has also grown sharply.

Table 3. NPL Ratios by Group of Commercial Banks
(In Percent)

	Biggest 5	Medium	Small	Branches	Total
2006	0.84	1.88	5.24	6.22	1.48
2007	0.69	2.26	3.69	3.83	1.23
2008	2.07	9.97	8.44	10.14	3.84
2009	4.21	14.72	19.62	9.35	6.99
2010	5.04	22.11	18.25	12.29	7.94
2011	6.72	11.42	14.95	12.53	7.88
2012	6.19	20.49	17.93	7.42	8.33
2013	6.83	19.84	17.35	7.13	8.67

23. Additional specific indicators should also be used to analyze systemic risk. Examples of such indicators could include different components of credit and house prices, both residential and commercial.

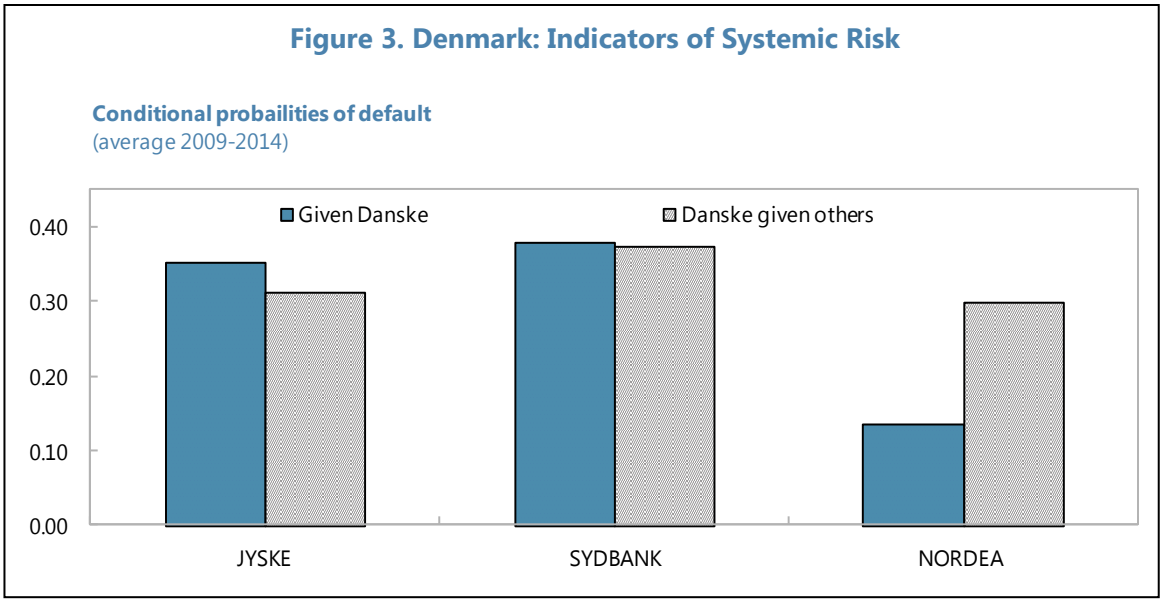
Measures of Interconnectedness Among Financial Institutions

24. A comprehensive analysis of systemic risk must incorporate interconnectedness among financial institutions. While some degree of interconnectedness is vital to the functioning of financial system, experience as well as a growing body of academic research suggests that complex interactions among market may serve to amplify existing market frictions, information asymmetries, or other externalities (Yellen, 2013). Simple measures of interconnectedness include interbank loans as a ratio of total loans, interbank deposits as a ratio of total deposits, and holding of securities of other institutions. In Denmark, the SIFI Committee considered measures of interconnectedness, but—given the high correlation between measures of interconnectedness and size—decided to use size criteria only to keep the approach simple and transparent. Given the paucity of publicly-available data on direct measures of interconnectedness, some possible econometric frameworks to analyze interconnectedness are presented below.

25. Estimates of distress dependence confirm that cross-bank spillovers are very high. Distress dependence is estimated with financial market data using the framework developed by Segoviano and Goodhart (2009). The sample includes four D-SIFIs: Danske, Jyske, Sydbank, and Nordea (for the latter, data on the parent bank are used). Conditional probabilities of distress are estimated for each pair of banks. On average over 2009–2014, conditional probabilities of default for other banks given that Danske is in distress are slightly higher than the conditional

probabilities of default for Danske given other banks in stress, with the exception of Nordea (Figure 3). If Nordea goes into default, there is a much higher probability of Danske going to default, compared to the reverse situation. The tail risk of the Danish system (measured by joint probability of distress—JPoD) and interconnectedness among banks (measured by the Banking Stability Index (BSI)) are other possible measures that can be used. Joint probability of distress (JPoD) is the probability of all the four banks becoming distressed i.e. the tail (or extreme) risk of the system. The JPoD typically closely follows the average unconditional expected default frequency (EDF) for the banks. Banking Stability Index (BSI) is a measure of interconnectedness. It calculates the expected number of banks becoming distressed, given that at least one bank has become distressed. A higher number signifies increased instability.

Figure 3. Denmark: Indicators of Systemic Risk



26. Systemic importance can also be measured based on the Too-Important-To-Fail (TITF) Subsidy. The quantification of the importance of Danske is based on two approaches (Annex III). The first is the Contingent Claims Approach (CCA), and second is the ratings based approach. The CCA methodology compares the difference between observed CDS spreads (reflecting probability of bank default as well as the likelihood and size of any government support) and fair value (or "implied") CDS spreads (calculated based on equity price information, disregarding any probability of government support). The ratings based approach on the other hand uses a breakdown provided by credit rating agencies between a stand-alone rating, and an assessment of government's willingness to provide support. Both approaches suggest a positive government subsidy for Danske. The introduction of Bank Package III largely removed the government subsidy for the largest D-SIB. However, based on the CCA approach, the renewed market turmoil in the Euro Area increased the "too-big-to-fail" implicit subsidy to levels much higher than those seen during the global financial crisis (GFC). Although the trend has reversed since, the subsidy remains large (estimated at 80 bps or equivalent to US$15 billion for Danske Bank). [10] Together with intensified supervisory oversight and increased loss absorbency capacity, an effective resolution regime for D-SIBs remains necessary to catalyze the reversal.

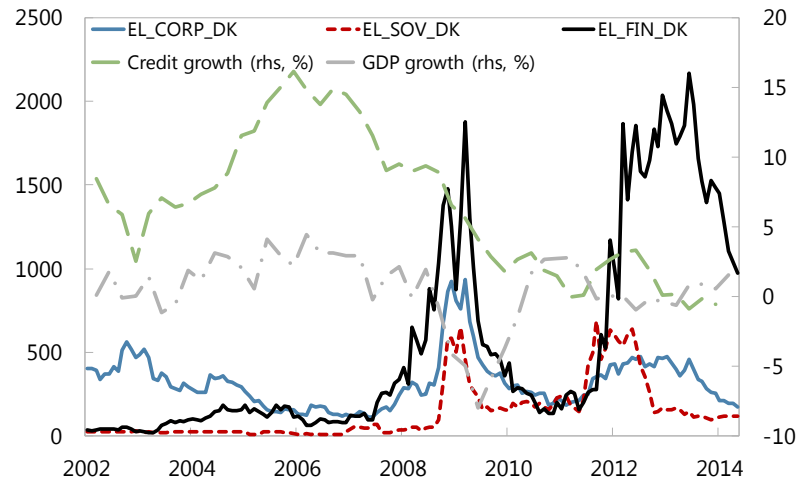
[10] The subsidy in US dollar is calculated by multiplying the subsidy in basis points by the total liability of the bank.

Cross-Sector Interlinkages

27. An alternative framework to estimate cross-sector linkages within Denmark is the Contingent Claims Analysis-Global Vector Auto regression (CCA-GVAR) framework (Gray et. al 2013). Cross-sector inter-linkages within Denmark are measured by responses of credit spreads for banks, corporate, and sovereign, and of growth rate of credit and real GDP for a standardized shock to each sector. The analysis includes only one bank—Danske (due to data availability), and 111 corporates.[11]

28. The banking, corporate, and sovereign expected loss (EL) ratios increased during both the GFC and the euro area turmoil, but have been declining since then. Figure 4 shows the evolution of the EL ratios for the sovereign, banking system, and the corporate sectors for Denmark, all expressed in basis points, along with real GDP and credit growth expressed in year-on-year growth rates. ELs are the expected loss ratios over a five-year horizon. Notably, the banking sector EL ratio spikes when real activity dropped over the 2008–09 period.

Figure 4. Denmark: Risk Indicators, GDP, and Credit Growth



Sources: Danmarks Statistik, BIS, and IMF Staff Calculations

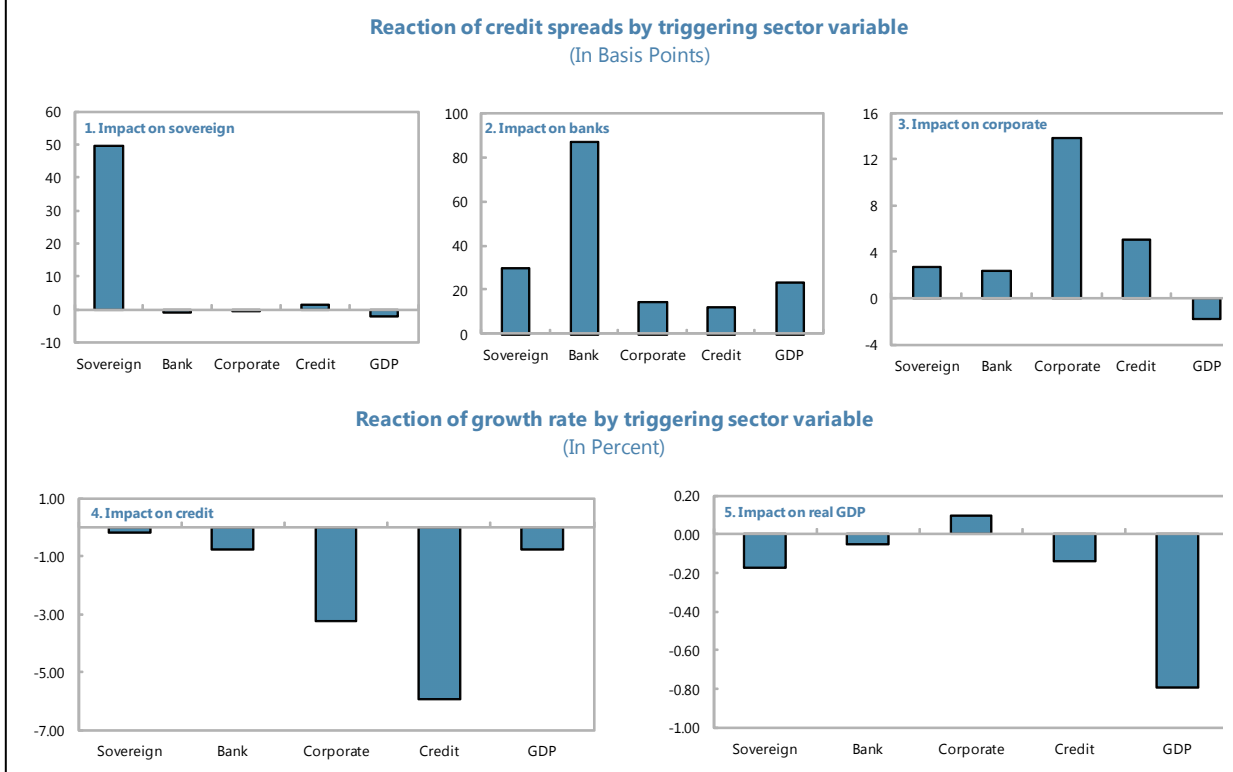
29. CGA-GVAR results show that feedback effects from other sectors to Danske Bank are strong. Danske Banks' credit spreads rise appreciably in case of distress in the real economy, corporate and the sovereign sector. For example, a 50 basis point shock to sovereign credit spreads increases Dankse Bank's credit spreads by 29 basis points. Similarly, a 14 basis point shock to corporate spreads increases Danske Bank's credit spreads also by 14 basis points (sovereign and corporate bars in Figure 5, panel 2). The estimates also suggest that weak GDP growth affects bank asset quality. A one standard deviation shock to GDP increases Danske Bank's credit spreads by 23 basis points. The impact of Danske Bank distress on credit is also

[11] The VAR includes credit indicators for banks, non-financial corporate, sovereign; and growth rates for bank credit and real GDP. The model is estimated using "expected loss (EL) ratios," as calculated by Moody's KMV. The expected loss ratios are defined as expected losses to debt holders over a five-year horizon divided by the debt (or more precisely the debt default threshold, which is the present value of promised payments on debt. Expected loss ratios are closely related to "fair value" CDS spreads ("credit spreads" hereafter)—changes in which can be interpreted as changes in funding costs for debt issuers.

substantive. The impact of corporate distress on credit however dominates—implying that credit growth may be more constrained by demand side rather than supply side factors.

Figure 5. Denmark: Cross-Sector Linkages Within Denmark

(Maximum adverse cumulative response to a one standard deviation shock to EL ratios, credit, or GDP)



Source: IMF Staff Calculations

30. The CCA-GVAR model also suggests some linkages between Denmark and other countries. The linkages are mainly to the banking sector, and to credit especially to the Nordic—Norway and Sweden as well as to other countries. Linkages to sovereign and corporate sectors and to GDP in these countries are limited. For example, a one standard deviation shock to the banking sector in Denmark—87 basis points increase in credit spreads—would increase the average credit spreads in Norway and Sweden by 19 basis points; and in other countries in the model (excluding Spain, Greece, Italy, Ireland, and Portugal) by 26 basis points.[12] The effect of bank distress on credit in other countries (especially Norway and Sweden) is also substantive.

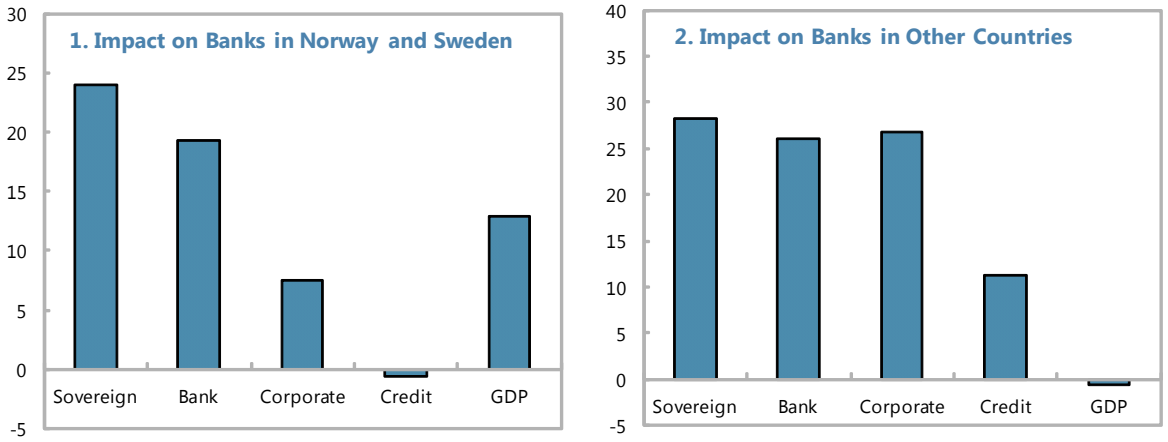
[12] The model includes the following 16 countries: Austria, Belgium, France, Germany, Greece, Ireland, Italy, Netherland, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and United States.

Figure 6. Cross-Sector Linkages from Denmark to Other Countries

(Maximum adverse cumulative response in 24 months to a one standard deviation shock)

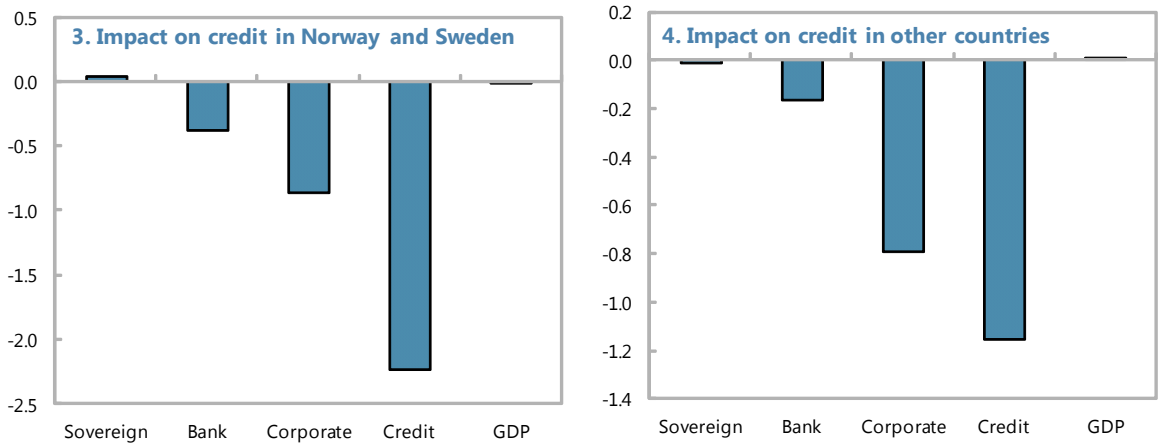
Reaction of credit spreads by triggering sector variable in Denmark

(In Basis Points)



Reaction of credit spreads by triggering sector variable in Denmark

(In Basic Points)



Source: IMF Staff Calculations

Financial Network Analysis[13]

31. The Danish economy is characterized by a high degree of interconnectedness across sectors. Network analysis (using quarterly flow of funds data) can be used to study interlinkages across and within sectors in Denmark. The method maps the web of major interlinkages within the Danish economy, i.e. those larger than 5 percent of GDP.

[13] The analysis draws from FSAP for Chile. See http://www.imf.org/external/pubs/ft/scr/2011/cr11261.pdf. Thanks to Martin Oksbjerg from the DN for detailed comments on this section.

- **The nonfinancial corporate sector and the banks are the most important players in the network.** Total gross claims on the corporate sector and banks were 442 and 417 percent of GDP respectively in 2013Q4 (Figure 7, panels A and B). On the other hand, *net* assets are the highest for the household sector at 143 percent of GDP. (Figure 7, panels C and D)

- **Other financial intermediaries and insurance and pension funds have significant asset positions abroad (in gross terms).**[14] Banks and corporate sector also have significant gross asset positions abroad, though not in net terms [Figure 7, panels A–B and C–D]. Insurance and pension funds, on the other hand, play a relatively small role in financing of domestic firms. However, they do play an indirect role—by investing in mortgage bonds of say commercial real estate—issued by mortgage credit institutions.

- **Many sectors have large financial claims on and obligations to the non-financial sector and rest of the world *relative* to their balance sheets** (Figure 7, panels E–F and G–H).[15] Financial claims on the corporate sector are among the largest for corporate sector itself, financial auxiliaries, general government, and rest of the world. All of these exceed 30 percent of their total assets (up to 58 percent for the corporate sector itself). In addition, most of these sectors have large financial obligations to the corporate sector relative to their overall liabilities.

- **There are also other large *relative* links between real and financial sectors.** There are other relatively large obligations owed to households that are owned by insurance corporations and pension funds (85 percent of their liabilities). On the other hand, the largest obligations the households have are owned by banks (90 percent of household liabilities), which in turn represent a relatively large claim for banks on households (30 percent of their assets).

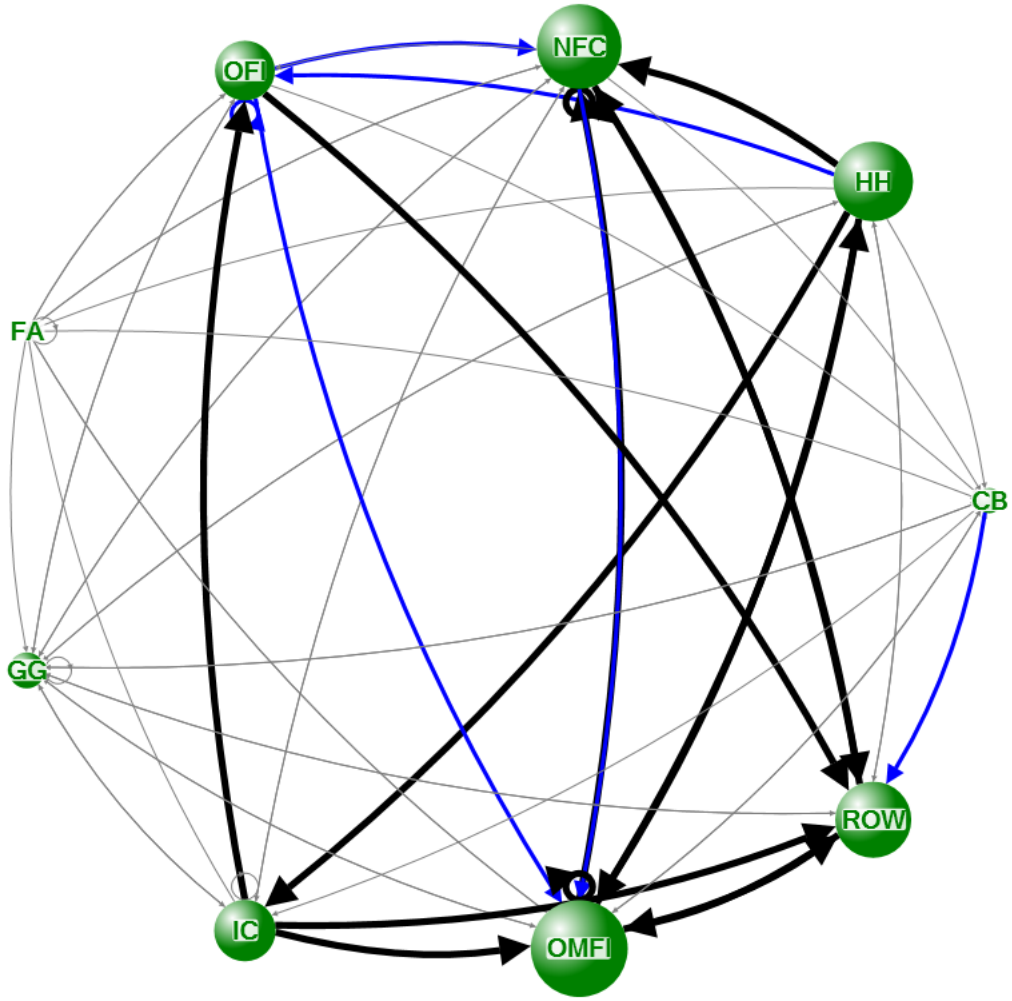
32. In the financial sector, the banking sector is the most important part of Danish network. Banks are the largest financial sector entity (gross financial assets at 422 percent of GDP), followed by insurance and pension funds (170 percent of GDP), and other financial intermediaries (161 percent of GDP). The largest financial sector linkages are the interbank ones (110 percent of GDP). The second largest linkage is between insurance and pension funds, and other financial intermediaries (52 percent of GDP).[16] While large *relative* claims exist between other financial entities, banks also continue to play a central role in relative terms. Other financial institutions (DN, Financial auxiliaries, Insurance and pension funds, and other financial

[14] Other Financial Intermediaries consist of most financial companies other than banks, insurance companies and pension funds, and include predominantly investment funds and also some financial holding companies.

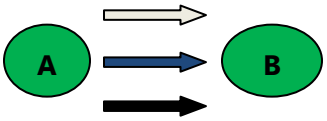
[15] Besides the absolute magnitude of financial interlinkages, the size of exposures relative to balance sheets is also relevant for stability. Even if exposures are small relative to GDP, they can be important when compared to balance sheet of the claimant. Shocks in one sector can be transmitted to others which have strong balance sheet links even though the bilateral exposures are small relative to GDP. The financial interlinkages can be direct or indirect. When a sector A has a large claim relative to its assets vis-à-vis sector B, which in turn has a large relative claim vis-à-vis sector C, then sector C can be identified as a systemically important funding destination.

[16] In Denmark, insurance and pensions have to a large degree chosen to invest their assets through investment funds, which are part of OFI.

Figure 7. Panel A: Network of largest gross claims (>5 percent of GDP)



Gross claims of A on B (% of GDP)



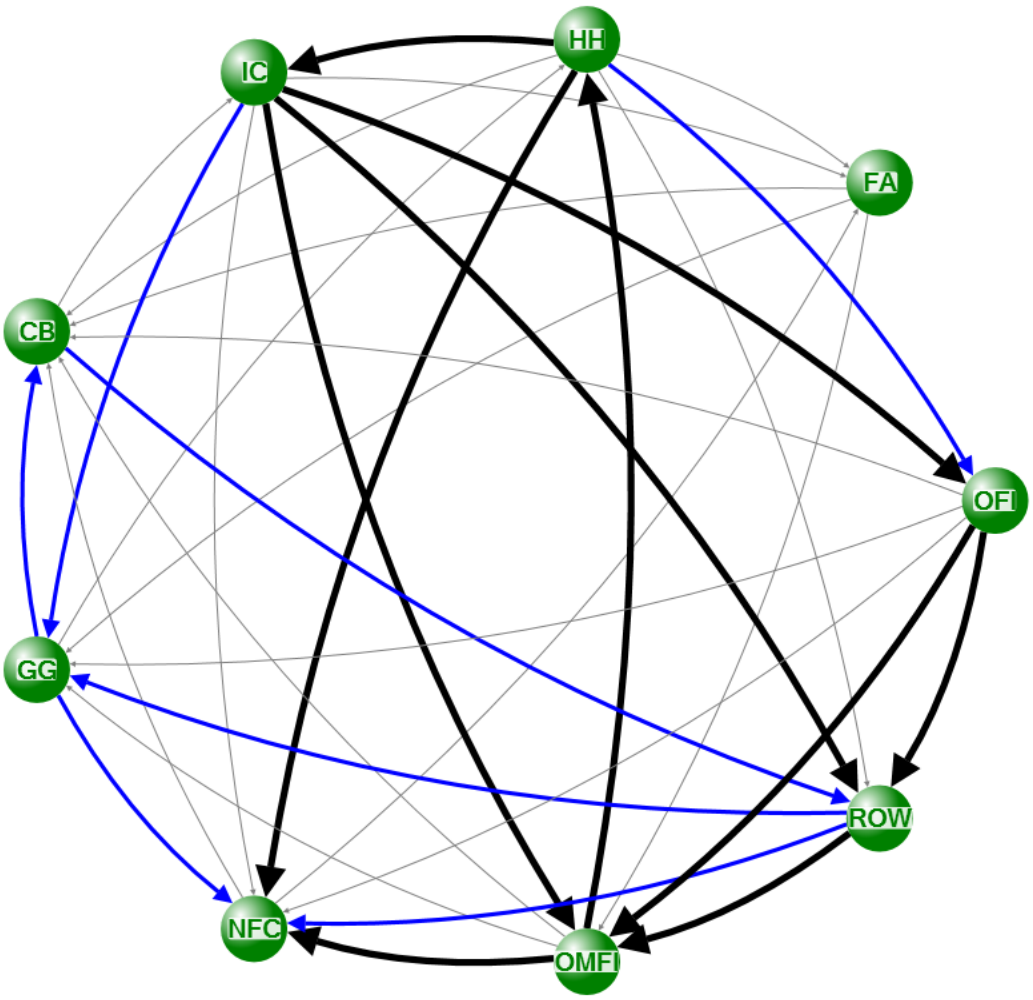
5%< A <20%
20% <=A<40%
A >=40%

"CB"= Danmarks Nationalbank.
"FA"=Financial auxiliaries. "GG"=General government."HH"=Households and NPISH.
"IC"=Insurance corporation and pension funds. "NFC"=Non-financial corporation.
"OFI"= Other financial intermediaries.
"OMFI"=Other monetary financial conditions.
"ROW"=Rest of the world.

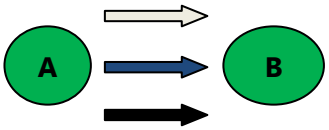
Panel B: Matrix of all cross-sectoral exposures as a % of GDP

Gross Claims (as % of GDP) / Asset of	Liabilities of: CB	FA	GG	HH	IC	NFC	OFI	OMFI	ROW	
Danmarks Nationalbank	0	0	0	0	0	0	0	4	24	29
Financial auxiliaries	0	0	0	0	0	0	0	0	0	1
General government	12	0	9	8	1	18	2	6	1	58
Households and NPISH	2	0	2	0	144	56	24	51	6	286
Insurance corporations and pension funds	0	0	20	0	3	6	52	42	47	170
Non-financial corporations	1	1	2	5	5	187	19	27	77	323
Other financial intermediaries	0	0	4	0	3	21	32	37	63	161
Other monetary financial institutions	13	0	9	129	6	64	12	110	80	422
Rest of the world	2	0	18	0	7	89	5	140	0	261
	30	1	65	142	168	442	146	417	299	

Panel C: Network of largest net claims (>5 percent of GDP)



Net claims of A on B (% of GDP)



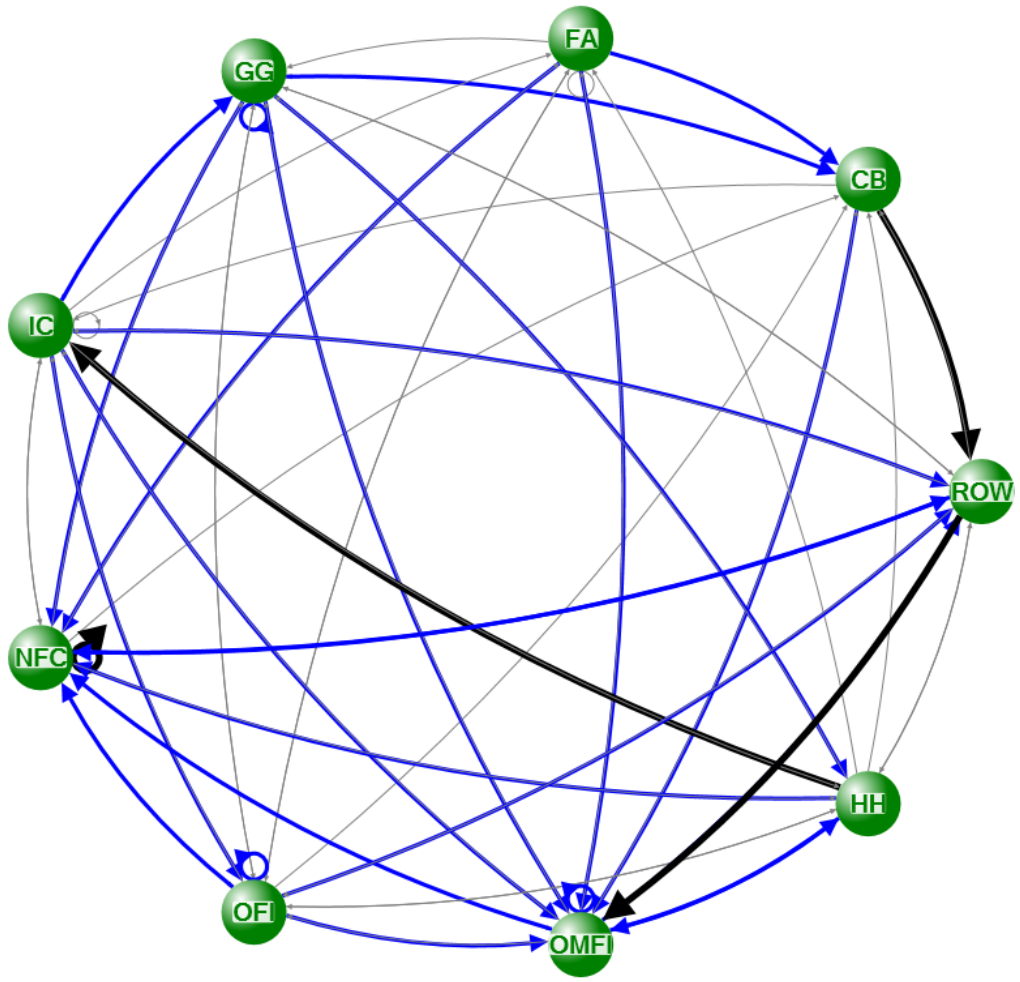
5%< NC <10%
10% <=A<25%
A >=25%

"CB"= Danmarks Nationalbank. "FA"=Financial auxiliaries. "GG"=General government."HH"=Households and NPISH. "IC"=Insurance corporation and pension funds. "NFC"=Non-financial corporation. "OFI"= Other financial intermediaries. "OMFI"=Other monetary financial conditions. "ROW"=Rest of the world.

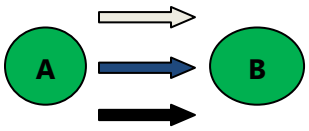
Panel D: Matrix of all cross-sectoral exposures as a % of GDP

Net Claims (as % of GDP)	Liabilities of									
Asset of	CB	FA	GG	HH	IC	NFC	OFI	OMFI	ROW	
Danmarks Nationalbank	0	0	-12	-2	0	-1	0	-9	23	-1
Financial auxiliaries	0	0	0	0	0	0	0	0	0	0
General government	12	0	0	6	-19	16	-2	-2	-17	-6
Households and NPISH	2	0	-6	0	143	51	24	-77	6	143
Insurance corporations and pension funds	0	0	19	-143	0	1	49	36	41	2
Non-financial corporations	1	0	-16	-51	-1	0	-2	-38	-13	-119
Other financial intermediaries	0	0	2	-24	-49	2	0	26	58	14
Other monetary financial institutions	9	0	2	77	-36	38	-26	0	-60	5
Rest of the world	-23	0	17	-6	-41	13	-58	60	0	-38
	1	0	6	-143	-2	119	-14	-5	38	

Panel E: Network of largest relative claims



Assets of A on B (% of total assets of A)



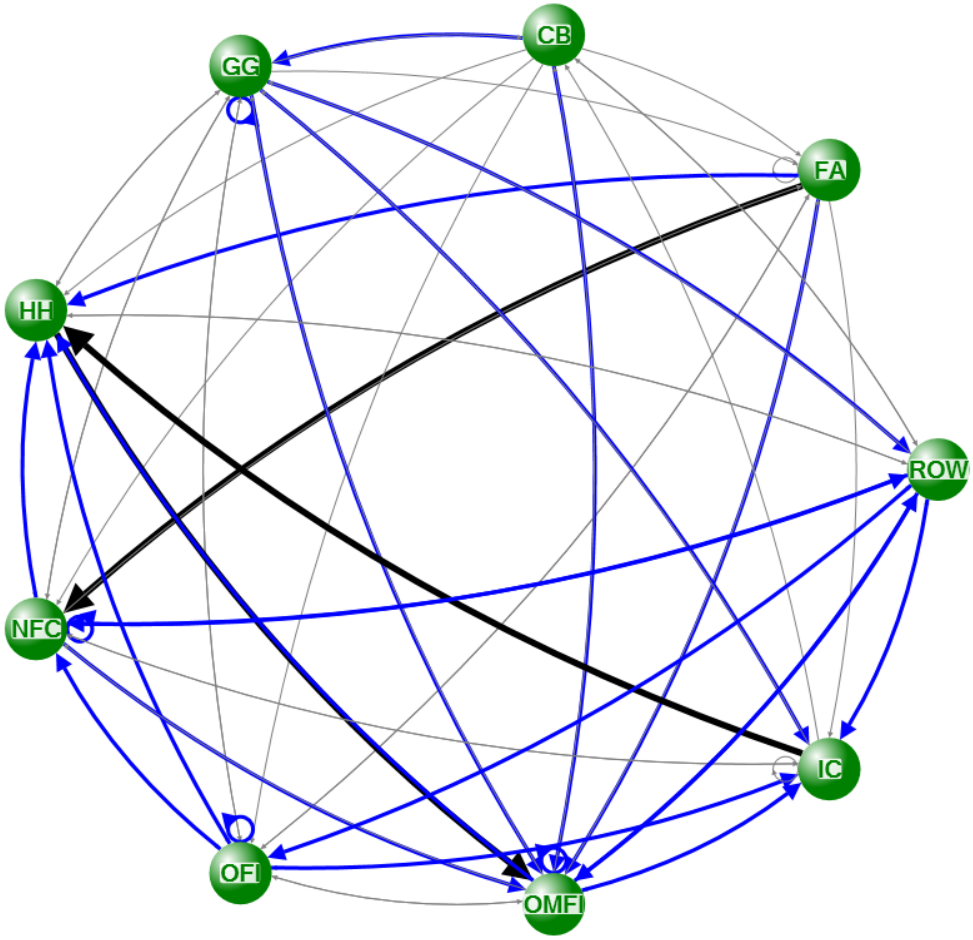
0%< A <10%
10%<=A<50%
A >=50%

"CB"= Danmarks Nationalbank. "FA"=Financial auxiliaries. "GG"=General government."HH"=Households and NPISH. "IC"=Insurance corporation and pension funds. "NFC"=Non-financial corporation. "OFI"= Other financial intermediaries. "OMFI"=Other monetary financial conditions. "ROW"=Rest of the world.

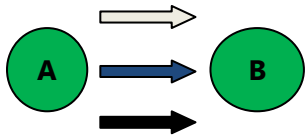
Panel F: Matrix of all cross-sectoral exposures as a percent of total assets of A

Asset of A on B (as % of Total Assets of A) / Asset of	Liabilities of CB	FA	GG	HH	IC	NFC	OFI	OMFI	ROW	
Danmarks Nationalbank	0	0	0	0	0	0	0	14	85	100
Financial auxiliaries	17	4	4	0	0	33	8	33	0	100
General government	21	0	16	14	2	31	4	11	2	100
Households and NPISH	1	0	1	0	50	19	9	18	2	100
Insurance corporations and pension funds	0	0	12	0	2	4	31	25	28	100
Non-financial corporations	0	0	1	1	2	58	6	8	24	100
Other financial intermediaries	0	0	3	0	2	13	20	23	39	100
Other monetary financial institutions	3	0	2	30	1	15	3	26	19	100
Rest of the world	1	0	7	0	3	34	2	54	0	100
	42	5	45	47	61	208	81	212	199	

Panel G: Network of largest relative obligations



Liabilities of A on B (% of total liabilities of A)



0%< L <10%
10%<=L<50%
L >=50%

"CB"= Danmarks Nationalbank. "FA"=Financial auxiliaries. "GG"=General government."HH"=Households and NPISH. "IC"=Insurance corporation and pension funds. "NFC"=Non-financial corporation. "OFI"= Other financial intermediaries. "OMFI"=Other monetary financial conditions. "ROW"=Rest of the world.

Panel H: Matrix of all cross-sectoral exposures as a percent of total liabilities of A

Liabilities of A on B (as % of Total Liabilities of A) / Liabilities of	Assets of CB	FA	GG	HH	IC	NFC	OFI	OMFI	ROW	
Danmarks Nationalbank	0	1	41	8	0	3	1	43	5	100
Financial auxiliaries	0	4	0	13	4	58	8	13	0	100
General government	0	0	14	3	31	3	6	13	28	100
Households and NPISH	0	0	6	0	0	3	0	90	0	100
Insurance corporations and pension funds	0	0	1	85	2	3	2	3	4	100
Non-financial corporations	0	0	4	13	1	42	5	15	20	100
Other financial intermediaries	0	0	1	17	36	13	22	8	3	100
Other monetary financial institutions	1	0	1	12	10	6	9	26	34	100
Rest of the world	8	0	0	2	16	26	21	27	0	100
	9	5	69	152	100	158	74	238	95	

intermediaries) have a substantial claim on banks as a fraction of OFI's assets. It is 14 percent for DN, 33 percent for Financial Auxiliaries, 25 percent for insurance and pension funds, and 23 percent for other financial intermediaries. As discussed above, bank interconnectedness is also very large, and represents 26 percent of bank assets.

POLICY INSTRUMENTS

33. This section will first describe the existing set of policy instruments in Denmark. The section will also elaborate on some cross country experience and IMF advice on the use of different macroprudential instruments.

A. Existing framework

SIFI Capital Surcharges

34. Danish SIFIs will become subject to capital surcharges consisting of Common Equity Tier 1 capital. The additional capital requirement will be determined on the basis of a measure of the institution's "systemic importance" and a quantitative scale (a SIFI scale) which converts the calculated measure of systemic importance into a capital requirement (Table 4). With this model, the capital requirement for SIFIs will constitute 1 to 3 percent of the risk-weighted assets. Although the SIFI committee recommended a capital surcharge of 3.5 percent for the most systemic institution, after intensive discussions in Parliament, the upper limit was reduced to 3 percent.

Table 4. Scale for the SIFI Capital Requirement

Institution	Systemic importance	Systemic importance	Capital requirement (In Percent)
DLR Kredit	1.9	<=5	1
Sydbank	3.2		
Jyske Bank	5.4	5–15	1.5
Nordea Bank Denmark	16.9	15–25	2
Nykredit Realkredit	19.7		
-	-	25–35	2.5
Danske Bank	37.5	>=35	3

35. The capital requirement of SIFIs will be phased in gradually during the period from 2015 to 2019. If any changes are made to a SIFI's systemic importance, the SIFI must comply with any changes to its capital requirement by the end of the year concerned. From 2019, a combined capital requirement of at least 11.5–13.5 percent of risk-weighted assets will be required of Danish SIFIs, depending on the individual institution's systemic importance. The

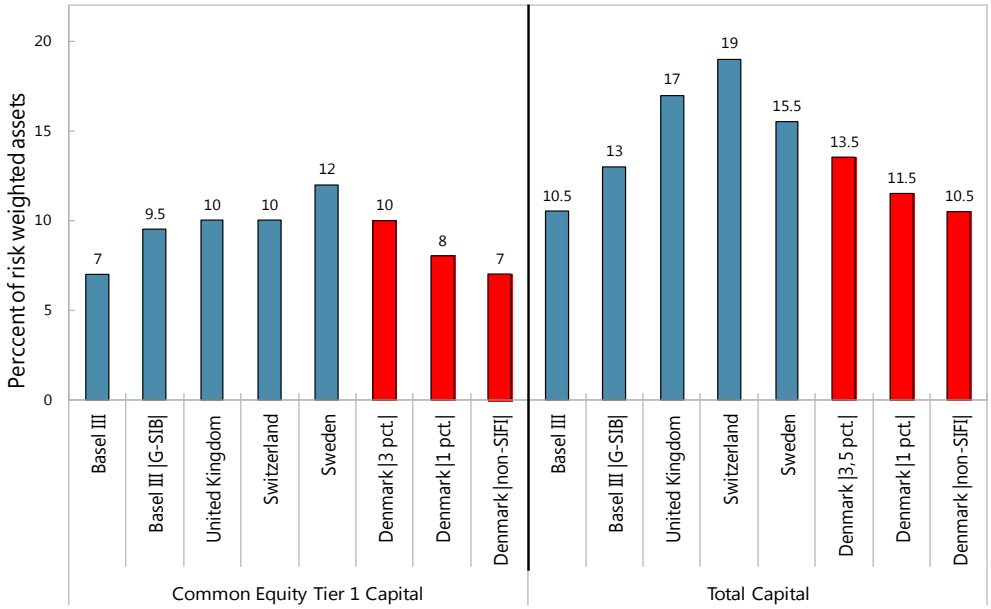
capital requirement will comprise both the Pillar I requirement (minimum capital requirement) of 8 percent, which will be the same for all institutions, and a combined buffer requirement consisting of a capital conservation buffer (2.5 percent, applicable to all institutions based on the CRDIV implementation schedule) and a systemic risk buffer (1–3 percent). Of the total capital requirement of SIFIs, up to 10 percent is stipulated to be comprised of CET 1 (this is excluding the Countercyclical Capital Buffer and the Pillar 2 requirements).[17]

36. The DFSA is also making use of Pillar II requirements, depending on the institution's risk profile. Currently, this is just below an average of 2 percent for SIFIs; and more than 3 percent for other banks and mortgage credit institutions. All banks in Denmark are required to publish their Pillar II requirements, which—according to the latest data available—range from 1.8 percent for Jyske to 2.8 percent for Nordea. The SIFI Committee had also recommended that all SIFIs establish a "crisis management buffer" of 5 percent of risk weighted assets. The SIFI Committee recommended that the crisis management buffer could include certain types of Tier 1 and Tier 2 capital instruments (up to 3.5 percent) and be established over a three-year period starting in 2020, i.e. when the additional requirement for SIFIs has been fully phased-in. However, a decision in this regard has been postponed until the implementation of the EU Bank Recovery and Resolution Directive is clarified.

37. The final level of the Danish SIFI capital requirement is subject to a "review clause." The intention is for the capital requirements imposed on Danish SIFIs to be on a par with the requirements set in other comparable European countries. If it turns out that the final level of the Danish SIFI capital requirement is not on a par with the final level in comparable European countries (i.e. Sweden, Norway, the United Kingdom, Germany, France, the Netherlands, Austria and Switzerland), the final level of the SIFI capital requirement will be adjusted accordingly. Although the SIFI surcharges currently are lower than other Nordic countries (Figure 8), unlike the countries in the region, the DFSA required the publication of the individual institutions' Pillar II requirements, which improves transparency of the actual level of capital requirements.

[17] The combined capital requirements also includes a G-SIFI buffer, which is currently not applicable to Danish institutions.

Figure 8. SIFI Requirements: Comparison across Countries



Source: Danish authorities. The CET1 capital includes the Pillar 1(4.5 percent), the Capital Conservation Buffer (2.5 percent), and the Systemic Risk Buffer (1–3 percent). Total capital requirements also include the non CET1 Pillar 2 capital (3.5 percent).

Countercyclical Capital Buffer

38. A countercyclical capital buffer (CCB) will also be implemented as a new instrument. The implementation of the CCB is also required under CRDIV, which can be set by national authorities to ensure that in addition to the minimum requirements, additional capital buffers are built in periods of excessive aggregate credit growth. With the countercyclical capital buffer, the institutions can be ordered to have up to 2.5 percent of extra Common Equity Tier 1 capital in relation to the basic capital requirement (see details on CCB below). The buffer can be further increased if justified on the basis of the authorities' assessment.

39. The framework for the countercyclical capital buffer will be phased in gradually. The buffer can be set up to 0.5 percent in 2015, 1 percent in 2016, 1.5 percent in 2017, 2 percent in 2018 and 2.5 percent in 2019. Buffer rates set in other countries in which Danish institutions have exposure will as a starting point be recognized up to 2.5 percent from 2015.

40. The operational framework for the CCB (including the calibration) is currently under development. This work is carried out by the DFSA and the DN under the auspices of the SRC. Preliminary analytical work underlying the activation of CCB found that the credit-to-GDP gap (calculated using the one-sided Hodrick-Prescott filter) performed relatively well and is likely to be used as a core indicator for activation of CCB. The gap will likely be used to calibrate the buffer based on the BCBS formula. Although the credit to GDP gap would be one of the primary indicators, the authorities plan to use judgment and information available from various indicators of systemic risk.

41. The MoBG is responsible for setting the countercyclical capital buffer (CCB). When

setting the CCB rate, the MoBG will take into account the deviation of the credit-to-GDP ratio from its long term trend and other indicators and factors deemed relevant. The MoBG's setting of the buffer rate can be based on a recommendation from the SRC, and it may ask the Danish FSA for input to be used in the buffer decision.

42. A number of elements should be taken into consideration while designing the operational framework for setting up the CCB (Annex IV). Based on the recommendations of the BCBS, the credit gap should be used as a core indicator for build-up of systemic risks and recommending the activation of the CCB, along with a BCBS formula that translates the credit gap measure into activation of CCB. While leading indicators denote build up of systemic risk, additional contemporaneous indicators should be used for signaling the release phase of CCBs. Such indicators could include growth rate of new loans, market based measures (e.g., credit spreads), and measures of asset quality (e.g., NPLs). Finally, the framework should also include strategies to address domestic and cross-border leakages from use of capital tools.

B. Possible Additional Policy Instruments

43. The authorities have made good progress in developing tools to address structural systemic risk, but more work is needed to further develop instruments to address cyclical or time-varying systemic risk. Most existing macroprudential tools are not designed to change over time—therefore are not suitable to address time varying risk. The CCB, whose design is currently in progress can address time-varying risk, but has some limitations. First, it is a blunt tool, applied uniformly to all exposures and is likely to be slow in reacting to the build-up of risks in particular segments of the credit market. Second, it may not be effective in certain circumstances, for example, where banks hold voluntary buffers above the minimum, or can easily generate capital through strong earnings.

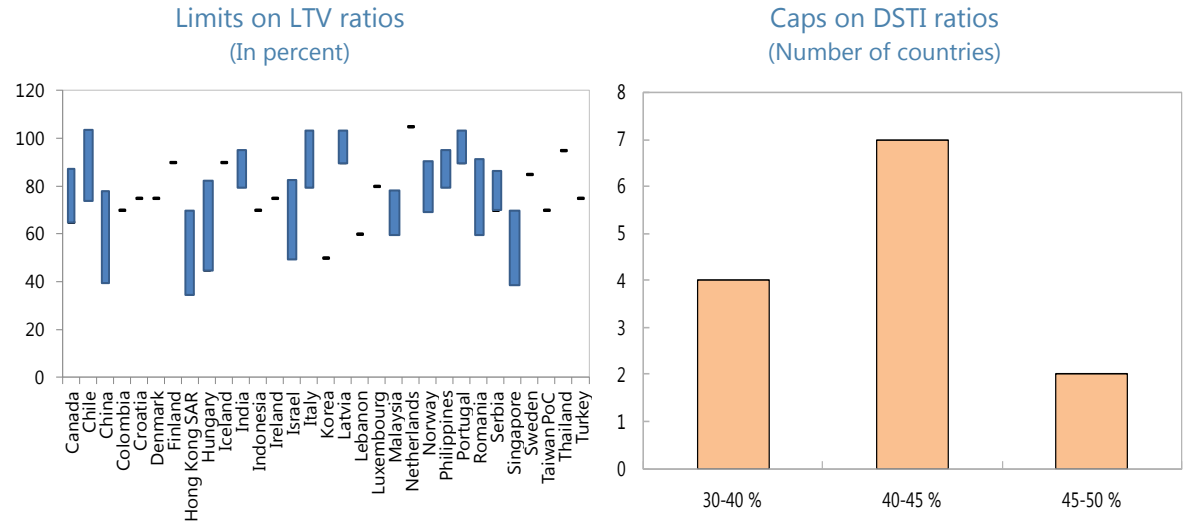
44. Increases in risk weights for lending to particular segments of the credit market can complement the CCB. A targeted increase in risk weights can be applied to any sector where strong credit growth is worrisome. For example, it can be applied to mortgage lending, unsecured consumer credit, or specific segments of such credit, as in Brazil and Turkey, and corporate lending or specific corporate segments, such as lending to commercial property, as proposed in the United Kingdom. Higher risk weights, increased sectoral capital requirements, or higher provisioning can also be applied to sectors with higher LTVs; or to loans exceeding certain thresholds for LTVs. Importantly, the legal basis for imposing higher risk weights already exists under Articles 124, 164, and 458 of the CRR.[18]

[18] Under Article 124 of the CRR, competent authorities may set higher risk weights of up to 150% on exposures secured by mortgages on immovable property or impose stricter criteria for assessing the mortgage lending value, on the basis of financial stability considerations. Article 164 CRR allows the competent authority to require banks using an internal ratings-based approach (IRB) to apply a higher exposure-weighted loss-given-default (LGD) floor for retail exposures secured by residential or commercial property than is usually allowed under the CRR, on the basis of financial stability considerations. Article 458 CRR allows national authorities, under certain conditions, to impose stricter national requirements to address macroprudential or systemic risks at the national level, by tightening the requirements for own funds, large exposures, public disclosure, liquidity, risk weights for the property sector, or intra financial sector exposures.

45. Limits on LTV and DSTI (debt-service-to-income) ratios have been used rather commonly to contain vulnerabilities in the housing sector (Figure 9). Although Denmark has LTV limits on mortgage loans funded by covered bonds, borrowers can still supplement those types of loans by taking out other bank loans secured by property which are not subject to LTV limits. The House Price Bubble Committee set up by the DFSA has explored several options, and has submitted a report to the MoBG which is likely to be submitted to the SRC. The introduction of new instruments like caps on LTV or DSTI would require legislative changes, although "softer" requirements could be imposed through supervisory processes (i.e. Supervisory Diamond)[19].

46. There are several transmission channels through which caps on LTV and DSTI can contain vulnerabilities. The 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 house price growth, and thus restrain credit booms (credit demand channel). DSTI caps also enhance borrowers' resilience to interest rate and income shocks, so that low DSTI lending is associated with lower delinquency rates and probability of default. Moreover, while limits on LTV ratios may become less binding and thus lose effectiveness with the increase of house prices, requiring successive tightening, caps on DSTI ratios become more binding when house prices (and mortgage loans) tend to grow at a faster pace 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.

Figure 9. Limits on LTV and DSTI Ratios Across Countries



Source: IMF staff calculation.

47. Interlocking use of different instruments can improve the effectiveness and efficiency of the macroprudential policies. Limits on the LTV and DSTI ratios can complement each other in dampening the cyclicality of mortgage loan demand, addressing the wealth aspect (resilience to house price shocks) and the affordability aspect (resilience to income and interest rate shocks), respectively. Since the global financial crisis, many countries started to use a mix of

[19] Offsite monitoring tool of the DFSA.

these measures (e.g., Norway, Sweden, Israel, Hong Kong, and Singapore).

48. Legal and operational framework for policy instruments should be developed ahead of time. Importantly, even though vulnerabilities appear contained and a crisis distant, risks can in fact build up rapidly but acquiring and implementing these tools takes time. When tools have not been established ahead of time, policymakers may be unable to contain risks when are building up.

49. Implementation of LTV/DSTI involves three main challenges: (i) calibration, (ii) application and enforcement; and (iii) communication. Calibration involves setting up of the LTV/DTI parameters (levels and adjustments during the upward and the downward phases of the cycle), the loan segments targeted, and the type of financial institutions (depository institutions, other financial institutions) subject to the measures. Application and enforcement would include decisions on how the standards would be enforced across financial institutions, how they would be phased-in, and any other operational considerations. For example, what considerations should be taken in choosing the announcement date and the implementation date; how to minimize unintended side-effects by tailoring the measures to accommodate country-specific circumstances such as the existence of mortgage insurance and exceptions for first-time home buyers. Third, it is important to decide how the LTV/DTI measures would be discussed with the financial institutions and explained to the public. Given the direct impact of the decisions on both the financial institutions and the public, a delicate balance exists between moderating the amplitude of real estate and credit cycles and exerting a negative effect on house buyers and consumers.

50. Since the experience with LTV/DTI ratios is still relatively new, analyzing cross country experience could help in thinking about a framework in the context of Denmark (see Annex V for details).

- **Malaysia** offers a useful example—where the Central Bank has been particularly successful in targeting the limit on LTV. Based on the indicators and supervisory assessments, the Bank designed the LTV ratio limit of 70 percent on the third and above outstanding housing loan. Brazil on the other hand has introduced risk weights based on LTV ratios for loans in a specific sector (i.e. automobiles).
- The example of **Brazil** is particularly informative for calibration of risk weights. They use supervisory data on NPL ratios by vintages and information on LTVs, and apply the Basel II Advanced Approach (IRB) to calibrate the risk weights.
- Furthermore, sectoral tools have been used within the Nordic region as well. For example, the **Norwegian** FSA introduced guidelines in March 2010 that set recommended limits on loan-to-value (LTV) and loan-to-income (LTI) ratios for mortgages. The FSA further lowered the cap on the LTV ratio on mortgages to 85 percent in December 2011, along with other tightening measures. Changes in risk weights for residential mortgages are also underway.
- Similarly, a cap on LTV ratio was introduced for the first time in **Sweden** in 2010 by the FSA. A cap of 85 percent was applied to all new mortgages or extensions to existing mortgages that use the home as collateral. While most banks offered a first mortgage limited to LTV ratio of

75–85 percent, a second mortgage often exceeded this limit. The Swedish FSA also introduced a risk-weight floor of 15 percent to cover the risks in Swedish mortgages in 2013.

- Outside the Nordic region, there are many countries is Europe—e.g. **Netherlands**, **Poland**, and **Romania**, which have implemented sectoral tools.

51. Implementing the policy instruments should be supported by rich data collection. The distribution of LTVs and DSTIs across loans, types of property, and borrowers has typically been used across countries in the calibration phase. Therefore, in order to impose LTV limits or DSTI ceilings, the Danish authorities should gather borrower and loan specific data. In order to change these instruments to address time-varying risks (or for activation), household loan growth and house price growth can be considered jointly as core indicators; however a range of additional indicators can also be used to trigger policy actions. Such indicators include additional credit indicators by banks and non-banks, balance sheet indicators (e.g., average LTV by borrowers across commercial banks and MCIs, the LTV distribution across new loans over a period, etc.), and affordability indicators (i.e., average and distribution of DTIs across new borrowers and all borrowers at a certain point in time).

INSTITUTIONAL FRAMEWORK

52. This section focuses on the institutional framework for macroprudential policy in Denmark. First, the current set up is described, followed by some recommendations based on cross country experiences.

A. Current Framework

53. SRC was set up by the MoBG in February 2013. The set up of the SRC followed the ESRB recommendation, that all member states appoint authorities to be responsible for managing systemic risks—e.g. in the form of a national systemic risk council.

54. The SRC has only an advisory function. The mandate of the SRC in Denmark is to identify and monitor systemic financial risks and to issue observations, warning, and recommendations to the DFSA and to the government if it relates to legislation on how to handle risks. It has no power to give instructions to other authorities. The Danish Parliament may therefore continue to exercise its parliamentary control in relation to financial regulation and supervision through the MoBG.

55. The SRC is composed of 10 members from various relevant authorities and external experts. The SRC members comprise: one representative from the MoBG, one from the Ministry of Finance, one from the Ministry of Economic Affairs and the Interior, two from the DFSA, two from DN and three independent experts. Currently, the members are the Chairman of the Board of Governors and a Governor from the DN, the Director General and the head of a division from the DFSA, and the three Permanent Secretaries from the government. The Chairman of the DN's Board of Governors chairs the SRC. DN also performs the secretariat services for the SRC. The DFSA, MoBG, MOF, and the Ministry of Economic Affairs and the Interior participate in the secretariat.

56. The independent experts must have sufficient knowledge about the financial sector either through research or from their employment in the financial sector. The experts must be independent of the institutions to which the activities of the SRC relate. Currently, the three independent experts are a director from the Central Bank of Iceland, former CEO of Nordea Danmark, and a professor from Aarhus University.

57. The Minister for Business and Growth appoints members of the SRC as well as alternates. Members are appointed for a period of up to four years and may be reappointed. The members are appointed by the Minister based on recommendations from the DN, DFSA, and the other two ministries. The Minister can in principle veto the recommendations though according to the authorities, in practice, this is highly unlikely. The three independent expert members are nominated by the Minister on the basis of recommendations from the staff within the MoBG, and after consultation with the DN.

58. The SRC meets at least four times a year. According to the rules of procedure for SRC, the secretariat keeps the minutes of the meetings containing summary of important discussions in the SRC as well as the SRC's decisions on observations, warnings, recommendations, and any other publication concerning the SRC's work in general. The minutes of the SRC meetings are confidential internal documents given that they main contain market sensitive information.

59. The decisions within the SRC are taken on the basis of majority voting by the members. If the SRC has to decide on a recommendation to be made to the government (e.g., on the rate at which the MoBG has to set the CCB), the SRC members from the government would abstain from voting. Since the DFSA directly advises the MoBG (other than through the SRC), the DFSA members are also required to abstain from voting in case of recommendations to the government. However, when the SRC issues observations, warnings and recommendations directed towards the government, they must include a statement by the representatives of the ministries. Moreover, the SRC is expected to strive for consensus in order to strengthen the effect of recommendations.

60. There is a high degree of transparency in the communication of the SRC. The SRC publishes observations, warnings and recommendations. However, on the grounds of, for example, financial stability, the SRC may decide that a warning or recommendation is confidential and shall not be made public. In addition, to inform the general public of its activities the SRC sends out a press release after each meeting with reference to the discussions and the content thereof. The SRC's press releases can be accessed online.[20]

61. The MoBG is the national designated macroprudential authority for the purpose of the CRR and CRDIV implementation. Under CRDIV, each member state is in charge of appointing either a national designated authority and/or competent authority for implementing macroprudential instruments. The competent authority refers to the banking supervisor. Following the implementation of CRD IV/CRR measures in Denmark and in accord with the

[20] The framework for the SRC's observation, warnings, and recommendations, is described in http://risikoraad.dk/media/173646/statements.pdf.

Financial Business Act of March 18, 2014 and Bank Package 6, the decision-making power either lies with the *designated authority* (the Minister for Business and Growth) or the *competent authority* (the DFSA). The responsibilities are split as follows:

- **The DFSA is the competent authority for Pillar 2 measures as well as measures under CRR Articles 124 and 164.** Pillar 2 has been developed in the Basel II supervision framework as a complement to Pillar 1. It aims at enhancing risk management of banks and at addressing risks that are not (or insufficiently) covered by Pillar 1, by providing supervisors with a broad set of flexible tools. Concerning exposures secured by mortgages on immovable property, competent authority may set higher risk weights of up to 150 percent or stricter criteria for assessing the mortgage lending value, on the basis of financial stability considerations (CRR Article 124). CRR Article 164 allows the competent authority to require banks using an internal ratings-based approach (IRB) to apply a higher exposure-weighted LGD floor for retail exposures secured by residential or commercial property than is usually allowed under the CRR, on the basis of financial stability considerations.

- **The MoBG is the designated authority for the various buffers and for applying the national flexibility measures under CRR Article 458.** The MoBG is responsible for setting the countercyclical capital buffer, the Systemic Risk Buffer (additional capital requirements for SIFIs), the G-SII-buffer (Global Systemically Important Institutions) and for setting higher requirements to address systemic risks (CRR Article 458). CRR Article 458 allows national authorities, under certain conditions, to impose stricter national requirements to address macroprudential or systemic risks at the national level, by tightening the requirements for own funds, large exposures, public disclosure, liquidity, risk weights for the property sector, or intra financial sector exposures.

62. Despite its prominent role in contributing to financial stability, the DN has no decision making powers on macroprudential instruments—those included in the CRDIV/CRR framework as well as the various buffers. As an independent institution one of DN's three main objectives is to contribute to the stability of the financial system. Important tasks for Danmarks Nationalbank in this context include assessing financial stability and making recommendations on measures that may contribute to enhancing financial stability; the latter could include recommendations on macroprudential policy independent of the decisions of the SRC. On an international level, the Governor is a voting member of the European Systemic Risk Board (ESRB). The Governor (in addition to the Director General of DFSA) also participates in the Nordic Baltic Macroprudential Forum (NBMF). The NBMF is a forum for cooperation on matters concerning macroprudential policy between the Nordic and Baltic central banks and supervisory authorities. As a member of the SRC, the DN contributes to monitoring and addressing systemic risks in the financial area. As described above, DN holds two of the ten seats in the SRC, and the chairman of the DN’s Board of Governors also chairs the SRC.

63. The MoBG is authorized to evaluate the SRC three years after its establishment on the basis of experience with the SRC's function and international developments. The first evaluation will take place in 2016.

64. Danish authorities also engage with the European Systemic Risk Board (ESRB) which acts as a macroprudential overseer at the European level. The ESRB is mandated to identify and prioritize systemic risks at the European level. While the top-down risk surveillance and assessment is a fundamental tool for the ESRB, it also carries out a "bottom-up" risk identification and assessment at a quarterly frequency. It sends bottom-up questionnaires (BUQ) to all Advisory Technical Committee) members individually (rather than by country) to gather their views on existing and new risks. The BUQ is an important input to the ESRB risk discussions, complementing other material such as; the regular top-down surveillance and assessment of risks conducted by the ECB, the ESRB Risk Dashboard, the Secretariat's Issues Note, various thematic notes on specific topics, the semi-annual report Analysis of National Banking Systems and; market intelligence reports by the ECB and the Bank of England. This complementary bottom-up approach is well-suited for: identifying risks that are at an early stage of development, or focused in specific regions, and/or are not yet visible from a top-down perspective; identifying different perspectives on existing risks; monitoring the level of structural risks in the system; and cross-checking the top-down approach. Separate answers to the BUQ are provided by the DN and the DFSA.

B. Cross-Country Perspectives

65. It may be useful to understand the Danish institutional arrangements in context of cross-country experience. Three models for macroprudential policymaking have gained prevalence internationally.[21]

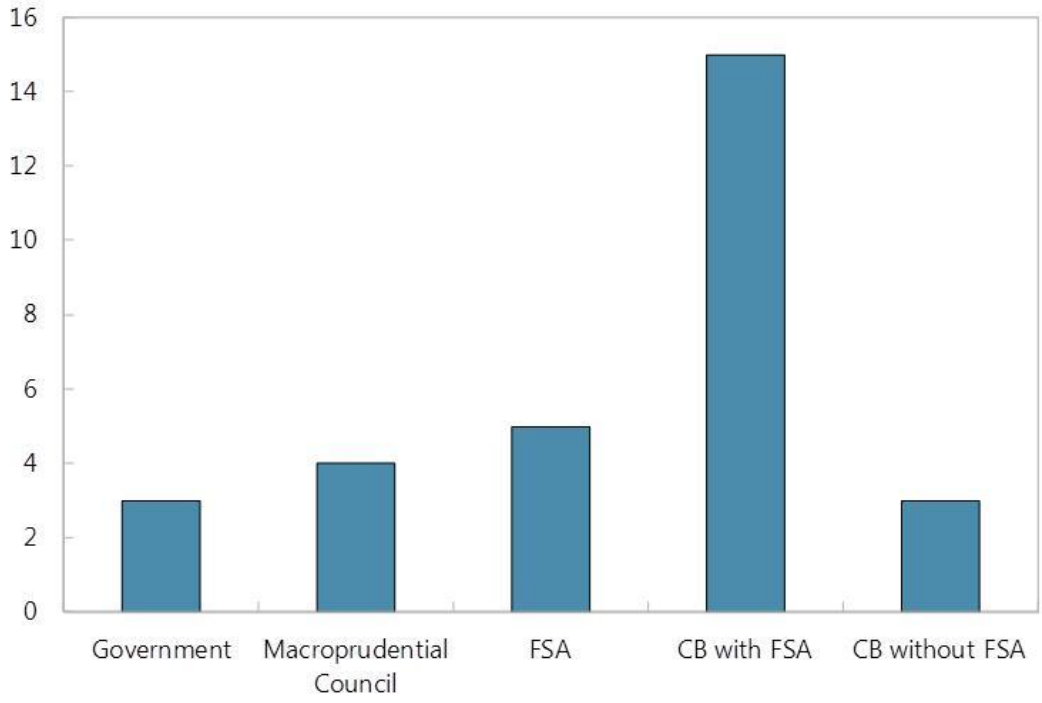
- **Model 1:** The macroprudential mandate is assigned to the central bank, with macroprudential decisions ultimately made by its Board (as in the Czech Republic, New Zealand).
- **Model 2:** The macroprudential mandate is assigned to a dedicated committee within the central bank structure (as in the United Kingdom and Malaysia).
- **Model 3:** The macroprudential mandate is assigned to a committee outside the central bank, with the central bank participating on the macroprudential committee (as in Australia, France and the United States).

66. The institutional framework in Denmark is perhaps closest—though not identical to—Model 3. Model 3 can more easily accommodate a desire for a strong role of the relevant ministry (finance/business). Very few other countries (e.g., Norway and Switzerland) have similar institutional frameworks which are not exactly in line with any of the three models above, and where ultimate macroprudential regulatory powers are with the government. In the case of Norway, the Ministry of Finance has the authority to set the counter cyclical buffer and risk weights on residential mortgages, but the prudential supervisor has the authority to set limits on

[21] Institutional arrangements across countries in Europe are described in the following ESRB publication http://www.esrb.europa.eu/pub/pdf/other/140430_ESRB_response.pdf?b9093a4675ae114e3a23e520cdf2ef0f.

LTVs for mortgages.[22] In Switzerland, the government has the decision-making power, upon recommendation by the SNB, which has to consult FINMA (the regulator).

Figure 10. Number of Countries by Designated Macroprudential Authority in Europe



Source: ESRB and DN.

67. A dominant role of the government risks delaying macroprudential action and, in some cases, can compromise the independence of participating agencies (Nier and others, 2011)**.** Participation of the ministry can be useful when changes in legislation are needed to expand the macroprudential toolkit or the regulatory perimeter. However, there it may also risk interfering with the independence of the central bank or of the supervisory authority. Some of these risks can be countered by sound governance arrangements, good transparency, and clear accountability. In some countries, such risks are deterred by assigning the central bank the chairmanship (as in Australia), a strong voice (as in Mexico) or a veto over policy decisions (as in Germany).

68. The IMF view is that it is desirable for the central bank to play an important role in macroprudential policy (IMF, 2011a; Nier and others, 2011; IMF, 2013a; Viñals, 2011). It is based on several arguments. First, the expertise of the central bank can be used in systemic risk

[22] Norges Bank in consultation with the FSA provides advice to the government on the CCB. The authority for setting risk weights also rests with the MOF (for example, they raised minimum Loss-Given-Default parameter from 10 to 20 percent). However, the prudential supervisor is responsible for setting LTV limites (i.e., LTV limits were initially set in 2010 and lowered in 2011). The supervisor is also responsible for identification of SIFIs based on pre-defined criteria.

identification. Second, it would make sure the central bank's incentives are rightly aligned to ensure that macroprudential policy is pursued effectively. Third, it can foster policy coordination between macroprudential and monetary policy in a manner that preserves the independent pursuit of the former. Finally, an important role of the central bank can also help shield macroprudential policymaking from political interference that can slow the deployment of tools or bias their use toward other objectives. The IMF view on the role of the central bank is also in line with the European Systemic Risk Board (ESRB) recommendations. According to the ESRB, member states are recommended to "ensure that the central bank plays a leading role in the macroprudential policy and that macroprudential policy does not undermine its independence in accordance with Article 130 of the Treaty."

C. Assessment

69. The Danish macroprudential framework is underpinned by transparent decision making and good accountability. The publication of observations, warnings and recommendations by the SRC and the press release after each meeting are good steps towards increasing transparency. The "comply or explain" rule in place ensures accountability. The recipients of a recommendation by the SRC are asked to either implement the initiative or present a report justifying why the recommendation has not been implemented. If the recipient of a recommendation chooses not to follow the recommendation, the recipient must *publicly* explain the reasons for this in accordance with the comply-or-explain principle. The report must be presented to the SRC within three months after the recommendation is notified to the recipient. In special cases, however, the SRC may decide that the report shall be presented earlier. The SRC shall also evaluate whether the actions taken by, for example, by the MoBG or their inactions and the reasons for this are adequate. If a public recommendation is not followed, the SRC shall publish an assessment of the consequences it may have the systemic risks.

70. So far the SRC has issued only one recommendation where transparency and accountability mechanisms worked well. In June 2013, the SRC issued a recommendation to the government regarding the phasing-in of capital requirements legislation in Denmark. The government responded in two stages. The first response was in form of a letter to the chair of the SRC. The letter was published on the SRC website. The response was discussed at the third meeting of the SRC in September 2013. The conclusions were published in the press release following the meeting. Following the Parliamentary adoption of the Financial Business act on March 19, 2014, a second follow-up letter from the government was sent to the chair of the SRC. The letter was published on the SRC website. The second follow-up letter was discussed at the fifth meeting of the SRC in March 2014. An overall assessment of the governments' follow-up on the recommendation was published in the subsequent press release.

71. There are nonetheless political limitations to the accountability mechanism. Even though the MoBG may comply with the SRC recommendations, the recommendations may not win the support of the government, which ultimately has to legislate any *new* changes. A recent example of this is the recommendation by the SRC for the framework of the CCB to be fully implemented as from January 1, 2015. Although the MoBG complied with this recommendation,

it was not approved in the parliamentary process, and the final legislation stipulated for the CCB to be gradually phased-in from 2015 to 2019. Once the legislation has been passed, and the decision making power has already been delegated to e.g. to the MoBG for deciding the CCB rate —in that case, the accountability lies with the MoBG and is less subject to parliamentary constraints.

72. The authorities noted that while the macroprudential arrangement is off for a good start, it remains to be more extensively tested in the years to come. The DN has publicly expressed its disagreement with the MoBG having ultimate decision making power over macroprudential policy (e.g. in the September quarterly review). However, all the agencies as well as an independent expert member of the Council agreed that the SRC is functioning well, the system is very transparent, and the "comply or explain" rule makes it accountable.

73. Staff discussed with the authorities if the role of the DN and/or the DFSA could be further enhanced. Under the current arrangement, it apears that the DN already has an important role. The Governor chairs the SRC, the Secretariat for the SRC is housed in the DN, which in coordination with DFSA and other agencies prepares a tentative agenda for the council meetings.[23] If any changes have to be brought in the decision making powers, it will have to be done through legislation in the Parliament. Staff discussed with authorities, for example whether it would be feasible and desirable to give the DFSA or the DN the decision making authority for a new instrument. While this would definitely increase the role of the DN or the DFSA, coordination with other agencies, e.g. the MoBG which is the designate authority for the CCB, would be instrumental.

74. Overall, staff's view is that the system should be reviewed after more experience is gained. A review of the SRC is already planned for 2016. In the run-up to the review, the SRC could also discuss in its meetings the ongoing progress of the institutional arrangements, and make a recommendation to the government if the Council sees any need for a change in the authority for new or existing instruments. At the current juncture therefore the priority should be to ensure that coordination among the different agencies is working adequately. Importantly, the role of independent experts in the SRC is crucial, and they should be kept appraised on any developments on systemic risk and macroprudential policies.

[23] At the beginning of each meeting, the SRC approves the agenda upon on a proposal of the chairman.

Appendix I. Indicators for Country Financial Stability Map

Indicator	Element Captured	Sub-indicator	Variable
Macroeconomic risks			
	Macroeconomic stability		
		Output	
			Output gap (percent)
		Price	
			Inflation rate (percent y/y)
		Employment	
			Unemployment rate (percent)
		Fiscal space	
			Budget balance to GDP
			Public debt to GDP
		External factors	
			Current account balance to GDP
		Credit to the economy	
			Domestic credit from banks (percentage deviation fro
		Property prices	
			House prices (national currency)
	Macroeconomic outlook		
		Production	
			Industrial production growth (percent y/y)
		Investment	
			Total investment growth (percent y/y)
		Trade	
			Trade (exports plus imports) growth (percent y/y)
Inward spillover risks			
	Exposure to external developments		
		Trade linkages	
			Exports to GDP
		Financial linkages	
			Gross foreign assets of banking sector to GDP
		Global shocks	
			LIBOR-OIS spread--Euro Area (bps)
			LIBOR-OIS spread--Japan (bps)
			LIBOR-OIS spread--United Kingdom (bps)
			LIBOR-OIS spread--United States (bps)
			Implied volatility--Euro Area (percent)
			Implied volatility--Japan (percent)
			Implied volatility--United Kingdom (percent)
			Implied volatility--United States (percent)
	Buffer against external shocks		
		Reserve adequacy	
			Gross international reserves to short-term external del
			Gross international reserves to imports
			Gross international reserves to broad money
	Impact from external shocks		
		Pressure on currency	
			FX market pressure index

Indicator	Element Captured	Sub-indicator	Variable
Credit risks			
	Risks to bank balance sheets		
		Domestic bank credit	
			Growth in domestic credit from banks (percent y/y)
		Corporate financial obligations	
			Corporate debt to GDP
		Corporate financial soundness	
			Return on assets (annualized, percent) - corporates
			Return on equity (annualized, percent) - corporates
	Stress on banking sector from households		
		Household financial obligations	
			Household debt to GDP
		Household financial soundness	
			Unemployment rate (percent) - household financial so
		Household wealth	
			House price growth (percent y/y)
			Stock market return (percent y/y)
	Stress on banking sector from sovereign		
		Government financial obligations	
			Public debt to GDP - credit risks indicator
Market and liquidity risks			
	Exposure to stress in funding markets and liquidity conditions in secondary markets		
		Market funding and liquidity	
			Currency bid-ask spread (bps)
			Stock market turnover (annual average, times)
	Exposure to stress in funding and liquidity of financial institutions		
		Bank funding and liquidity	
			Liquid assets to short-term liabilities
			Foreign liabilities of banking sector to GDP
Monetary and financial conditions			
	Monetary policy stance		
		Interest rate	
			Short-term real interest rate (percent)
		Money supply	
			Growth of real broad money (percent y/y)
	Availability of bank credit		
		Domestic bank credit	
			Growth in domestic credit from banks (percent y/y)
Risk appetite			
		Actual volatilities	
			Volatility of stock market returns (percent)
			Volatility of exchange rate movements (percent)
	Investment decisions		
		Portfolio flows	
			Gross portfolio inflows to GDP
		FDI flows	
			Gross FDI inflows to GDP

Methodology for the Country Financial Stability Map

A z-score is computed for each selected **variable** (e.g. house price growth, stock market return). The z-score is normalized between 0-10 (rank 10 if the 99th percentile, and five corresponds to the long-term average). A score is assigned to each **sub-indicator** (e.g. household wealth) by taking an equally weighted average of the rankings assigned to each variable. An equally weighted average of rankings assigned to each sub-indicator leads to a score for each **element** (e.g. stress in banking sector from households). An **aggregated indicator** representing a particular risk (e.g. credit risk) or condition is then calculated as an equally-weighted average of the associated elements. See for detail pages 13–15 in http://www.imf.org/external/pubs/ft/wp/2014/wp1499.pdf.

Appendix II. Key Indicators for Vulnerability Exercise

Financial Sector Vulnerability: Indicators and Thresholds

	Sub-indicators	Vulnerability Rank		
		High	Medium	Low
Credit Cycle	Credit-to-GDP (x) / Credit-to-GDP 'gap' (y)	x > 5 percent **OR** y > 1.5 s.d. **AND** x >= 10 percent	3 < x < = 5 percent	x < = 3 percent
Balance Sheet Structure Risks	% of FX assets (x)	x > 40 percent	25 <= x <= 40 percent	x < 25 percent
	% of FX liabilities (x)	x > 40 percent	25 <= x <= 40 percent	x < 25 percent
	Deposit-to-loan ratio (x)	x <= 85 percent	85 < x <= 100 percent	x > 100 percent
Buffers	Leverage	x <= 3 percent	3 < x <= 7 percent	x > 7 percent
	Asset quality [Level of NPL (x), Change in NPL (y)]	x in top 10th percentile of pooled distribution **OR** y > 20 percent	0 <= y <= 20 percent	y < 0 percent
	Profitability [ROE (x), ROA (y)]	x **OR** y < 0		

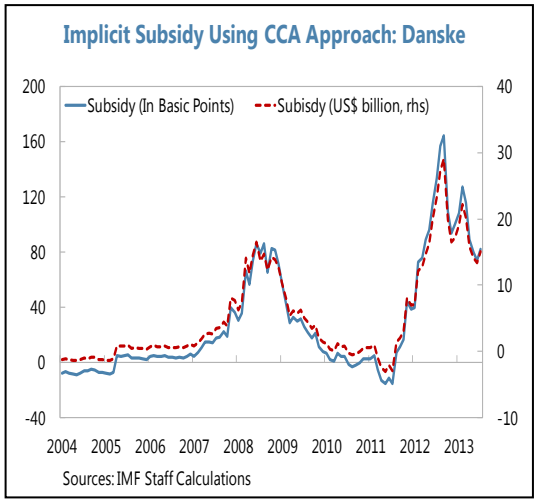
Appendix III. Implicit Government Subsidy for Too Important to Fail Banks: The Case of Danske

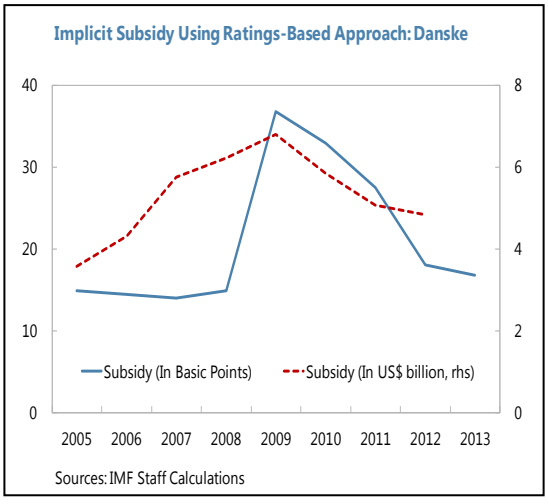
Certain banks are systemically important (SIBs) because of their size, complexity, and/or interconnectedness. The TITF concept is based on the fact that the failure of SIBs would have such impact on the economy as a whole that the government would do whatever to prevent its failure. Such rescue of banks can entail large transfers from taxpayers.

Based on the methodology in IMF (2014), this box uses two approaches to measure the implicit government subsidy for Danske.

The first approach is Contingent Claims Approach (CCA). It compares the difference between *observed* CDS spreads and fair value (or "*implied*") CDS spreads (calculated based on equity price information). While observed CDS spreads reflect both probability of bank default as well as the likelihood and size of any government support, the fair value CDS spread calculates the "equity-market-implied" spread, which disregards any probability of government support.[24]

Estimates from CCA approach suggest a positive government support for Danske. Calculations indicate that the observed CDS spreads are lower than the fair value spreads, implying a positive subsidy by the government. Based on the latest data available, the subsidy amounts to 80 bps, which is equivalent to US$15 billion.





The estimate of the TITF subsidy reached a peak of 86 bps (equivalent to US$17bn) around the Lehman crisis. Since then it declined significantly before rising again around end-2011 to levels much higher than the global financial crisis (GFC). In 2013, the subsidy started to decline again, but is currently at levels comparable to the peak around the GFC.

[24] Under the assumption that equity holders are not bailed out.

The second approach is a ratings-based approach. This approach uses a breakdown provided by credit rating agencies between a stand-alone rating, and an assessment of government's willingness to provide support. The estimation of the implicit subsidy is carried out in three steps. First, the boost in ratings from government support is calculated based on a regression of the ratings' uplift on banks' fundamental factors and government capacity across a wide sample of banks from a number of countries. Second, the ratings boost is converted into a funding cost spread based on historical estimates of the relationship between credit ratings and bond spreads from Sousa (2000). The implicit subsidy in United States dollar is finally calculated by multiplying the funding cost spread by the total liability of Danske.

The ratings based approach also suggests a positive government support for Danske. In 2012, the subsidy based on this methodology amounted to US$4.8 bn.

The results based on this method suggest that although implicit subsidies have declined from their peaks during the financial crisis, they remain high. The ratings based approach suggests that subsidy reached a peak of 37 bps in 2009 (equivalent to US$6.8 bn) before starting to decline again. The estimates from this approach, although somewhat lower in magnitude than that from the CCA method, are nonetheless broadly consistent in qualitative terms.

The estimated value of government support in the event of Danske going into distress can be substantially higher. The ratings based approach can also be used to estimate the implied subsidy value conditional on the bank being distressed, i.e., with a rating just below investment grade. Simulating the alternative distress scenario is based on estimates from Sousa (2000), which also provides differential funding cost advantages as a function of the ratings category. Lower is the bank's rating, larger is the funding cost advantage from government subsidy. As illustrated in the figure, even though the estimated subsidy is only about 17 bps in the current scenario, in the event that Danske goes into distress, the subsidy can increase up to 76 bps. Therefore, even though implicit government support to Danske may currently be small, it can increase substantially in the event of a crisis.

Appendix IV. Countercyclical Capital Requirements: Guidelines

Designing a country-specific CCB framework should follow the recommendations of the Basel Committee on Banking Supervision (BCBS). The CCB should be determined at national level for all exposures to counterparties in that country. Banks have to meet the CCB with common equity tier 1 or they will be subject to restrictions on dividend distributions. While the framework depends on national regulator's discretion, the framework contains international reciprocity (see below) to make the CCB more effective and to ensure the level playing field between domestic and foreign banks which operate in more than one jurisdiction.

The credit gap should be used as a core indicator for assessing the build-up of systemic risks and recommending the activation of the CCB. This indicator was put forward in the BCBS proposal as a common reference guide based on academic studies. Studies suggest 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, including for emerging market economies. The CCB should be activated when credit growth is judged to be excessive and associated with an increase in systemic risks. In particular, activation of the CCB should be considered if the credit-to-GDP ratio exceeds its trend value by a certain magnitude.

Calculating the credit gap requires calculation of the credit-to GDP ratio and estimation of the gap. In calculation of the credit-to-GDP ratio a broad measure of credit to the private sector, comprising all lending by domestic and foreign financial institution as well as debt raised in financial markets, should be used to avoid underestimating risks. Using a broad measure of credit may also reduce incentives for regulatory arbitrage. Total credit to the domestic non-financial sector is available from the BIS. To estimate the gap, a trend should be extracted from the ratio by using the Hodrick-Prescott filter with relatively high smoothing parameters (lamda equal to 400, 000 instead of 1600 for quarterly data). This is justified by the fact that credit cycles tend to be longer than business cycles. Note that the estimates of credit gap are highly sensitive to the sample, the value of lambda, and the credit series used.

All available information should be used to analyze systemic risks when making recommendations on activation of the CCB. Instead of relying mechanically on the credit gap Staff should use a range of indicators to arrive at the advice on when and whether to act. The combined information that arises from analyzing the joint behavior of the indicators generally provides a better signal than relying on a single indicator. The following indicators might be considered, in addition to the credit gap, as they proved to be useful early warning indicators in cross-country studies.

Core indicators

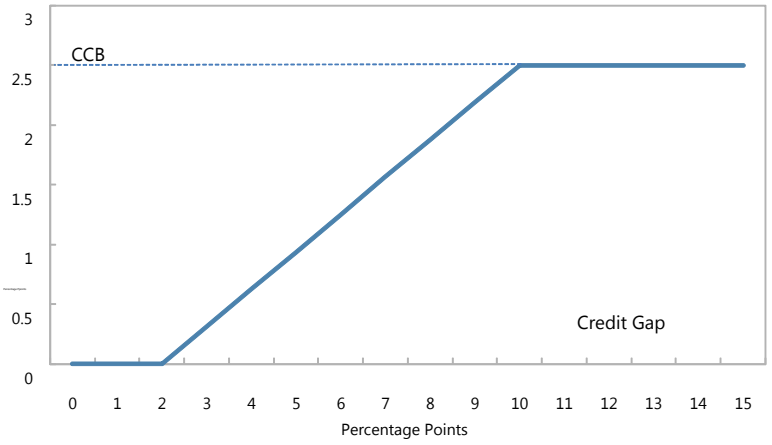
- Credit-to-GDP gap

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)
- Debt service ratio
- Asset price growth (m-o-m and y-o-y change), gaps and levels of house prices-to-income, real commercial property prices
- Leverage on individual loans or at the asset level (e.g. loan-to-value (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 non-core liabilities and the wholesale funding ratio (gap and level)
- Current account deficits

When using the credit gap to calibrate the CCB, the BCBS formula should be used that translates the credit gap measure into the buffer reference guide. The credit gap should serve as a common starting point in guiding decisions on buffer rates. A lower threshold value of the credit gap defines the level of the credit gap at which the buffer should be considered to be deployed. If the indicator is below the lower threshold, the buffer guide is zero and if the indicator is above the upper threshold the buffer guide should be set at its maximum which under the BCBS proposal should be 2.5 percent of risk-weighted assets. The CCB would vary linearly between the lower and upper threshold (Figure A1). The values of 2 percent and 10 percentage points for the lower and upper threshold are found to provide a reasonable and robust specification based on historical banking crises across countries (but depend, however, on the smoothing parameter). Moreover, the BCBS methodology based on these common thresholds performs well for a large majority of countries.

Figure A1. The Mapping of the Credit Gap to the Size of the CCB



Sources: IMF Staff

The set of indicators used to guide the deactivation of the CCB will depend on how financial system stress materializes. In case the systemic risks dissipate and financial imbalances start to unwind the CCB should be reduced gradually based on the same set of indicators that were used for the activation of the CCB. However, it is unlikely that same indicators would capture both the build-up phase and the release phase in the case where an increase in systemic risk leads to incipient financial stress- the former requires leading indicator properties and the latter must be a contemporaneous indicator of banking distress. Moreover, a prompt release of the CCB will be necessary to lessen the risk of a credit crunch due to regulatory capital requirements. The following indicators, possibly used in combination, seem best for signaling the beginning of the release phase: (i) Growth rate of new loans; (ii) high frequency market based indicators that are forward looking like credit spreads, price-based measures of default or distress or "near-coincident" indicators of systemic stress; and (iii) asset quality (see below indicators and thresholds used by several countries for activation and deactivation of CCBs).

Strategies should be used to address leakage from capital tools. Domestic leakages can occur through increases in connected lending by nonbank entities or via off-balance sheet vehicles and need to be addressed by expanding the perimeter of capital requirements and/or by consolidating such activity. Cross-border leakages from capital tools can be addressed by subsidiarization and reciprocity arrangements.

	India	New Zealand	Norway	Peru	Switzerland	UK	BCBS principles
Indicators for increasing the CCB	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.	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.	**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.**
Indicators for decreasing the CCB	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.	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.	**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.**
Low and high threshold of indicators behind activation/deactivation of the CCB	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.	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.	**For credit gap 2 and 10 percent respectively.**
Detailed information	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/	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	http://www.bis.org/publ/bcbs187.htm

Appendix V. Cross-Country Experience on Caps on LTV/DSTI Ratios and Higher Risk Weights

This annex provides some country-specific experience on implementation of caps on LTV/DSTI, and higher risk weights. Malaysia offers a useful example—where the Central Bank has been particularly successful in targeting the limit on LTV. Based on the indicators and supervisory assessments, the Bank designed the LTV ratio limit of 70 percent on the third and above outstanding housing loan. Importantly, the Bank refrained from introducing a broad-based LTV ratio limit across all new housing loans, as this could affect first-time house buyers and non-speculators, and potentially affect the wider property market and economy. They decided to target borrowers with three or more outstanding housing loans given the relatively higher delinquencies and the intention to curb speculations. Implementation wise, this was made possible due to the availability of data from Bank's Central Credit Reference Information System (CCRIS), which all lenders have access to. In fact, even lenders outside of the Bank's purview, such as a building society and key credit companies also report to CCRIS.

Brazil on the other hand has introduced risk weights based on LTV ratios for loans in a specific sector (i.e., automobiles). The example of Brazil is particularly informative for calibration of risk weights for two reasons. First, they use supervisory data on NPL ratios by vintages (e.g., NPLs after 12 months of seven vintages). The rationale is that if a financial institution loosens the lending criteria, and starts to operate with riskier borrowers, the deterioration will be clear only after some months, when these loans start to have a significant weight in outstanding loans. The Central Bank of Brazil, through its Credit Information System has access to detailed loan data to calculate NPLs by vintages. As a rule, they found that greater the maturities and the LTV, higher the NPL and therefore risk weight (RW) for auto loans (which were growing at a rapid pace) should reflect both factors. The second aspect they considered was to calibrate the risk weights (based on LTV ratios) using the Basel II Advanced Approach (IRB), where RW are calculated according to the probability of default (PD) and the loss given default (LGD). Based on these two considerations, CBB decided that a RW of 150 percent was conservative enough to provide the right incentives and to account for the higher risk in the auto loans. Although Brazil uses this calibration framework for auto loans—it can in principle be extended to mortgages.

Furthermore, sectoral tools have been used within the Nordic region as well. For example, the Norwegian FSA introduced guidelines in March 2010 that set recommended limits on loan-to-value (LTV) and loan-to-income (LTI) ratios for mortgages. The FSA further lowered the cap on the LTV ratio on mortgages to 85 percent in December 2011, along with other tightening measures. Changes in risk weights for residential mortgages are also underway. In October 2013, the Ministry of Finance raised the minimum loss-given-default (LGD) risk model parameter from 10 percent to 20 percent. The risk weights for residential mortgages have on average ranged from 10–15 percent before. A minimum LGD requirement of 20 percent is expected to increase the average risk weighting of residential mortgage loans to about 20 percent. Prime Minister recently suggested that the LTV limit of 85 percent should be increased to 90 percent, but no

action has been taken so far. New loans exceeding the FSA-recommended 85 percent LTV cap fell to 17 percent in 2012 in spite of robust income growth and falling unemployment in 2010–12, suggesting that the LTV cap started to have some impact by 2012.

Similarly, a cap on LTV ratio was introduced for the first time in **Sweden** in 2010 by the FSA. A cap of 85 percent was applied to all new mortgages or extensions to existing mortgages that use the home as collateral. While most banks offered a first mortgage limited to LTV ratio of 75–85 percent, a second mortgage often exceeded this limit. Following the introduction of cap on LTVs, the trend of steadily rising LTV ratios has stopped; and the average LTV for new loans is around 70 percent (compared to an average of 75 percent in 2009).[25] The Swedish FSA also introduced a risk-weight floor of 15 percent to cover the risks in Swedish mortgages in 2013. This measure applies to firms that use the internal ratings based approach to calculate the capital requirement for credit risk on Swedish mortgages. The risk weight floor of 15 percent is set on an aggregated portfolio level for each bank and relates to the exposure-weighted average risk weight. Both Riksbank and FSA believe that the risk weight floor should be raised further to 25 percent, given that the high level of household debt poses a risk to financial stability.[26]

Outside the Nordic region, there are many countries is Europe which have implemented sectoral tools. For example, a cap on LTV of 106 percent for new mortgage loans was introduced in **Netherlands** in 2013. The limit is stipulated to decrease by one percentage point each year, so that it would be 100 percent by 2018. The measure was introduced to slow down the sharp growth in mortgage lending which resulted in household debt stocks at historically high levels. Other countries in Europe which have implemented caps on LTV and DTI ratios include Poland and Romania. **Poland**, for example, introduced "soft" LTV limits for mortgage loans in 2011. The limit was set at 80 percent for real estate loans with maturity above five years and 90 percent for other loans. The limit was considered "soft" in the sense that banks could establish higher LTV limits if backed by thorough analysis. However, in 2013, strict LTV caps were introduced for mortgage loans (80 or 90 percent depending on the collateral). A transition period is provided during which the limits will be reduced. **Romania**, on the other hand, has introduced LTV limits by type of borrower (hedged/unhedged), and by currency: 75 percent for consumer loans, 85 percent for mortgage loans denominated in local currency, 80 percent on mortgage loans to hedged borrowers denominated in foreign currency, 75 percent for mortgage loans to unhedged borrowers denominated in Euros, and 60 percent for mortgage loans to unhedged borrowers in other foreign currency.

[25] http://www.fi.se/upload/43_Utredningar/20_Rapporter/2013/bolan_2013eng_2.pdf

[26] http://www.riksbank.se/Documents/Rapporter/FSR/2013/FSR_2/rap_fsr2_131128_eng.pdf and http://www.fi.se/Folder-EN/Startpage/Press/Press-releases/Listan/Risks-in-the-financial-system-2012/#.

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