



DENMARK

FINANCIAL SECTOR ASSESSMENT PROGRAM

December 2014

STRESS TESTING THE BANKING, INSURANCE, AND PENSION SECTORS—TECHNICAL NOTE

This Technical Note on Stress Testing the Banking, Insurance, and Pension Sectors 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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STRESS TESTING THE BANKING, INSURANCE, AND PENSION SECTORS

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>

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Glossary

BU	Bottom-up (stress test)
CAR	Capital Adequacy Ratio
CAT	Catastrophic Event
CB	Covered Bond
CCB	Countercyclical Buffer
CET1	Core Equity Tier 1
CPI	Consumer Price Index
CRD	Capital Requirements Directive (EU)
CRR	Capital Requirements Regulation (EU)
DBFA	Danish Financial Business Act
DFSA	Danish Financial Supervisory Authority (Finanstilsynet)
DKK	Danish Krone
DN	Danmarks Nationalbank
D-SIFI	Domestically Systemically Important Financial Institution
EaD	Exposure at Default
EBIT	Earnings before Interest and Taxes
ECB	European Central Bank
EIOPA	European Insurance and Occupational Pensions Authority
EL	Expected Loss
ELC	Excess Liquidity Coverage
EM	Emerging Markets
ESRB	European Systemic Risk Board
FR	Funding Ratio
FSAP	Financial Sector Assessment Program
FSSA	Financial System Stability Assessment
GDP	Gross domestic product
HQLA	High Quality Liquid Assets
ICAAP	Internal Capital Adequacy Assessment Process
IRB	Internal Ratings-Based Approach
LCR	Liquidity Coverage Ratio
LGD	Loss Given Default
MCI	Mortgage Credit Institution
MSE	Mean Square Matrix
NSFR	Net Stable Funding Ratio
NPL	Non-Performing Loan
PD	Probability of Default
PML	Probable Maximum Loss
RAM	Risk Assessment Matrix
ROE	Return on Equity
RWA	Risk Weighted Assets
SIFI	Systemically Important Financial Institution

SME	Small- and Medium-Sized Enterprises
STeM	Stress Test Matrix (for FSAP stress tests)
TD	Top-Down (stress test)
VAR	Vector Auto-Regression
WEO	World Economic Outlook

EXECUTIVE SUMMARY¹

For the 2014 FSAP Update, a comprehensive stress testing program for the banking, insurance and pensions sectors was performed in collaboration with the Danish authorities. The tests comprised the largest commercial banks, mortgage credit institutions (MCIs), life and non-life insurance companies, as well as the largest pension fund (ATP). These tests also included a stress test for a financial conglomerate, in line with the European Union (EU) Financial Conglomerates Directive. The stress tests for banks, insurance companies, and pension funds were based on the same macrofinancial scenarios. This allows estimating in a consistent manner the performance of key financial sector institutions under both expected and unexpected adverse conditions. Scenarios included a protracted slow growth scenario and a severe stress scenario, with the latter simulating a global shock. These macro-financial scenarios were flanked by sector-specific single-factor (sensitivity) tests.

Since the beginning of the global financial crisis, Danish banks have substantially increased their capital buffers. From 2007 to 2013, the banking system's Tier 1 ratio more than doubled from 9 to 20 percent. During that period, several banks (Danske Bank, Jyske Bank, Spar Nord Bank and Vestjysk Bank) were able to raise capital through share issuance, despite adverse market conditions, and undermined confidence in European banks. Governmental capital injections further helped increase banks' capital buffers. Today, the Danish banks are among the best capitalized in Europe.

The banks' capital buffers provide for substantial loss absorbing capacity in case macro-financial conditions deteriorate. Under the most severe stress scenario, the aggregate Tier 1 ratio of large Danish banks drops by almost 4 percentage points, but the solvency position would remain adequate even in such a downturn scenario—underlining the value of solid capital buffers. Credit risk is the main vulnerability, while market risk, including from sovereign debt holdings, is relatively low. The banks would also be able to digest extreme movements in covered bond spreads. Concentration risk, which used to be relatively high before the crisis, has come down considerably, thanks to the authorities' supervisory initiatives. Also, the phase-in of the new EU solvency regime (CRD IV) has a manageable impact for the Danish institutions. However, non-systemic banks continue to record losses and have high levels of impaired loans, so the authorities should remain vigilant and intervene if needed.

Banks and MCIs are expected to meet the liquidity coverage ratio (LCR), as implemented in the EU. The European Commission (EC) recently specified that high-quality covered bonds that meet certain criteria may be classified as Level 1 HQLA up to a ceiling of 70 percent and with a haircut of 7 percent. On this definition, the average bank in the sample had an LCR of 95 percent as of end-2013, reflecting slightly stronger liquidity positions in Group 1 banks and stand-alone MCIs than in Group 2 (medium-sized) banks. Banks are expected to meet the phased-in LCR requirement in the EU, including by exchanging some covered bonds for sovereign bonds. Moreover, banks'

¹ This note was prepared by Emanuel Kopp and Timo Broszeit (Monetary and Capital Market Department).

structural funding patterns appear to be very solid.

Under the restrictive assumptions of the stress test, the adverse scenarios have large negative effects on the solvency and profitability of life insurance companies. The drop in stock prices and the surge in corporate bond spreads lead to big reductions in available capital at life insurers. Net income of life insurers, which has declined in recent years (due to the global low interest rate environment), does not recover, reflecting mainly the zero investment returns from 2015 to 2018 which is a strict assumption applied in the stress test. Life insurers would have to take immediate and decisive actions to restore their solvency levels, mainly via de-risking the investment portfolio, e.g. switching from equity investments into government bonds. Such re-allocation has the potential to reduce capital requirements and proved to be an effective measure in past crisis periods.

Non-life insurers would see a small decline in solvency ratios in the first year of the stress test. Though starting from lower solvency levels than life insurers, the aggregated impact on solvency ratios in the adverse scenario is comparably smaller. With regard to their profits, they would just break even in 2014 but then quickly recover to pre-stress levels, due to profitable underwriting business and less reliance on investment returns.

Sensitivity analysis points to the risks from exposures to covered bonds and the resilience of non-life companies to catastrophic events. In the extreme event of a 500 bps increase in the covered bond spread, insurers' solvency ratios would fall sharply. A severe windstorm (historically the most relevant weather-related risk) would reduce solvency ratios of non-life insurers only a little, reflecting the large use of reinsurance.

The main recommendations are as follows: Danmarks Nationalbank (DN) should also include nonbanks like insurance companies and pension funds in its financial stability analysis. The Danish Financial Services Agency (DFSA) is advised to develop a macro-prudential stress testing framework for the insurance sector. Stress testing for the Danish financial system would benefit from an intensified cooperation between DFSA and DN, thereby exploiting synergies between supervisory and surveillance tests, with the goal of developing a more integrated stress testing framework.

Table 1. Denmark: Summary of Recommendations	
Recommendations and Authority Responsible for Implementation	Time¹
<i>Risk analysis</i>	
Expand financial stability analyses to include insurance and pension funds (DN)	MT
Develop a macroprudential stress testing framework for the insurance sector (DFSA)	MT
Further exploit synergies between micro- and macro-prudential stress testing through intensified cooperation (DFSA, DN)	MT
¹ Short term (ST) indicates within 18 months; medium term (MT) indicates from 18 months to three years.	

INTRODUCTION

A. Stress Testing under the Financial Sector Assessment Program

1. Macro-financial stress testing is one of the most powerful tools for analyzing the stability of a financial system. Stress testing has become a central aspect of the IMF's macroprudential surveillance of individual financial systems and of the international financial system itself. It is a mandatory and key component of the *Financial Sector Assessment Program (FSAP)* and also an important tool in early warning exercises, *Article IV* missions, and in analyses part of the International Monetary Fund's (IMF) *Global Financial Stability Report*.

2. The objective of this FSAP stress test is to assess system-wide (structural) vulnerabilities of the financial sector under different scenarios. FSAPs assess the stability of the financial system as a whole and not that of individual institutions. They are intended to help countries identify key sources of systemic risk in the financial sector and implement policies to enhance its resilience to shocks and contagion. Certain categories of risk affecting financial institutions, such as operational or legal risk, or risk related to fraud, are not covered in FSAPs.

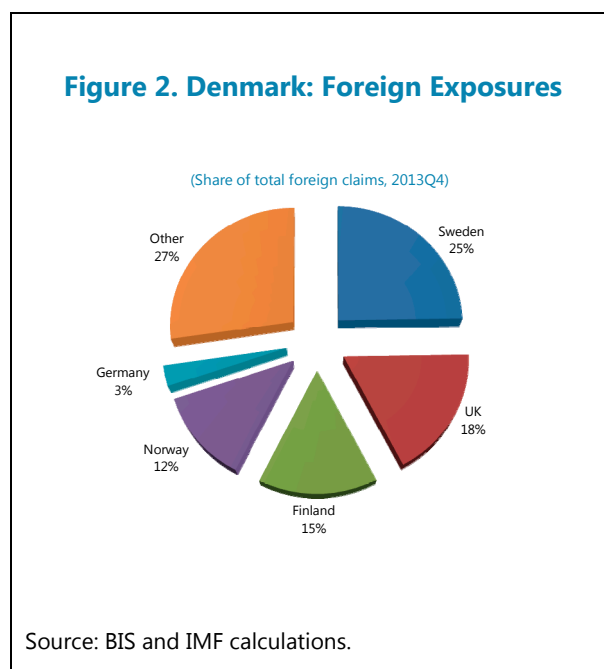
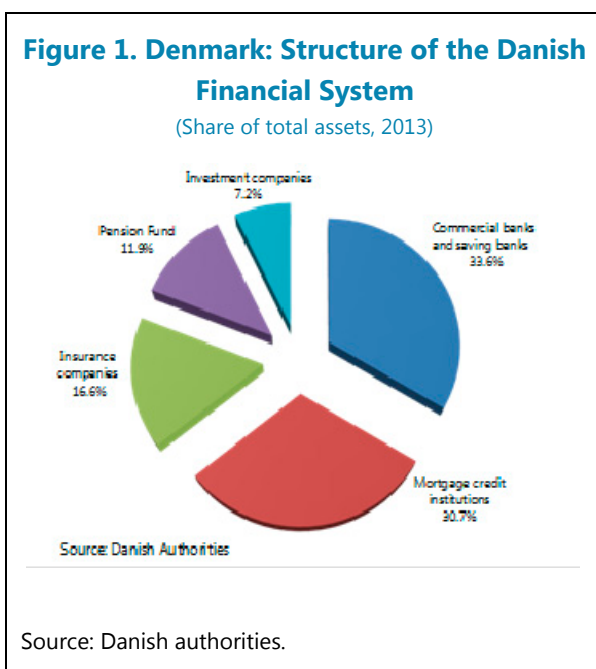
3. Stress test results should always be interpreted with caution. FSAP stress tests are based on market and supervisory data available at a certain point in time, without independent validation of the data by the IMF. More generally, stress tests provide estimates of the potential capital or liquidity shortfalls under hypothetical scenarios based on a number of simplifying assumptions needed to deal with the inherent complexity of financial markets, and do not fully incorporate second-round effects or the impact of policy responses to shocks. While some non-linear effects can be captured in stress tests, it is always possible that unknown patterns emerge, especially if extreme shocks materialize.

B. Macro-Financial Background and Key Risks

4. Denmark's financial system is large, with assets amounting to over 650 percent of GDP. Banks and MCIs together account for two thirds of the financial sector assets (Figure 1). The insurance sector is also large (129 percent of GDP), partly due to the fact that life insurance companies are major providers of occupational pension schemes. The financial system is dominated by six domestic systemically important financial institutions (D-SIFIs), the largest of which is Danske Bank Group (accounting for 182 percent of GDP). The banking system has strong ties with the Nordic countries (Figure 2).

5. Covered bonds, which are the backbone of the securities markets, raise important refinancing risks. The total size of the covered bond market amounts to about 150 percent of GDP, more than four times the size of the government debt market, and represent both an important source of wholesale financing and of liquidity for the financial system. MCIs, which provide almost all mortgage loans to households, rely on covered bonds as their primary source of finance. Domestic investors (including financial institutions) hold more than 80 percent of total bonds. While traditionally the system operated on a conservative business model, significant product innovations

since the mid-1990s has led to a major maturity mismatch in MCIs. Mortgage loans have remained long term, but the average maturity of covered bonds has shortened significantly (with many issuances of just one year), posing important refinancing risks.



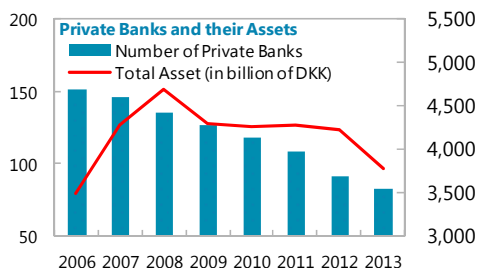
6. The global financial crisis had a major impact on Denmark. Real GDP fell by 5.7 percent in 2009, reflecting in part the housing bust. The combination of sharp drop in house prices (30 percent from 2007 to 2012 in nominal terms) and the high level of household debt dampened private consumption. During 2010–13, real GDP grew only modestly, reflecting deleveraging and the weak external environment, particularly in Europe. Looking forward, output growth is forecast at 1–2 percent in 2014 and beyond, supported by stronger growth in trading partners, improved consumer and business confidence, and a neutral or slightly positive fiscal stance. Real house prices have been broadly stable since mid-2012. Staff estimates suggest that house prices are close to fundamentals, with a valuation gap of less than 10 percent.

7. The repair of the commercial banks is still ongoing. Profitability is only modest, deleveraging continues, and vulnerabilities in the non-systemic banks persist (Figures 3 and 4). All the large commercial banks returned to profitability in 2012, although return on equity (RoE) remained modest at 3.6 and 6.1 percent in 2012 and 2013, respectively. About half of the non-systemic banks continue to record losses. Aggregate capital adequacy ratios (including Tier 1 ratios) almost doubled from 12 percent in 2007 to 23 percent in 2013. Risk weights are among the lowest in the EU, which may be attributed to differences in supervisory approaches and the high proportion of lower-risk exposures. However, this may nevertheless underestimate risks. Reliance on wholesale short-term funding by commercial banks, which was one of the main vulnerabilities before the crisis, has decreased. Short-term debt issuance as a share of banks' overall debt issuance fell from about

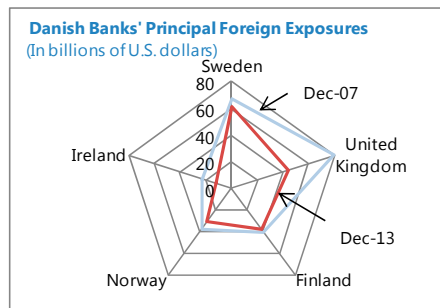
half in 2007 to about 11 percent in 2013. The loan-to-deposit ratio decreased from 135 percent in 2007 to 104 percent in 2013.

Denmark: Figure 3. Overview of the Banking Sector

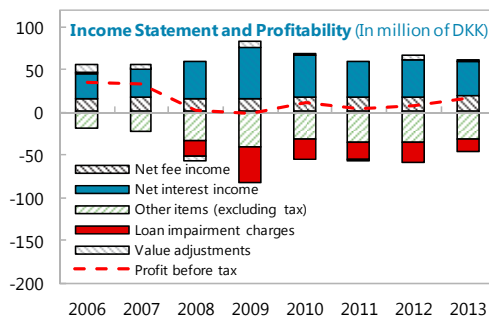
Deleveraging and consolidation have been substantial...



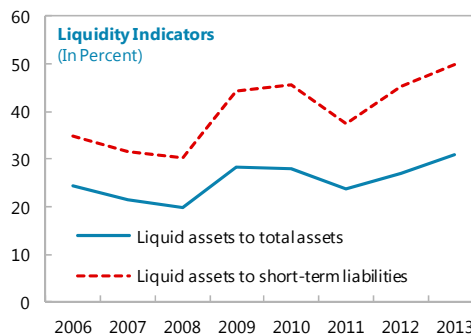
...and cross-border exposures have been reduced.



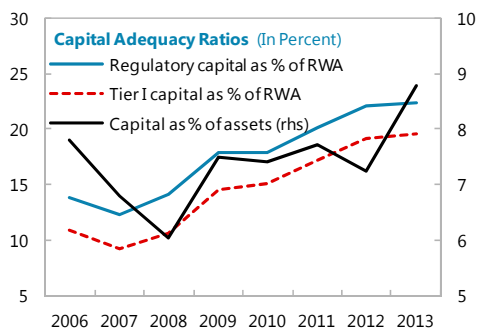
Profitability continues to remain weak...



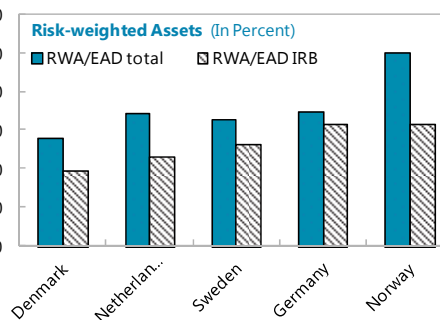
...and liquidity indicators have improved.



Capital adequacy continues to rise...



...but risk weighted assets are very low, which may underestimate true risks.



Source: Danish authorities, Bankscope, and Fund staff calculations.

Source: DFSA, DN, IMF.

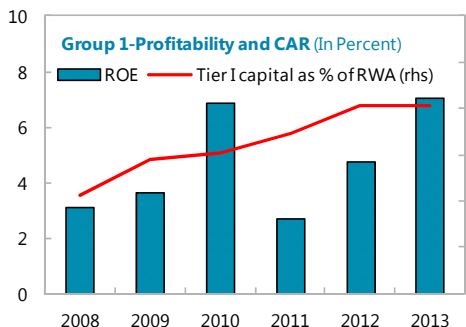
Note: Only commercial banks and mortgage credit institutions are used in the calculation of total assets.

8. The mortgage credit institutions fared much better during the crisis, but reliance on short-term funding continues to be high. MCIs experienced low impairment charges and maintained a better RoE (around 4 percent), boosted by increased lending volumes and rising administrative margins. Their capitalization remained stable, at around 18 percent throughout the post-crisis period. The large maturity mismatch between the assets (long-term mortgages) and liabilities (short-term covered bonds) of MCIs raises important refinancing risks. With a considerable volume of adjustable rate loans, the Danish banks are exposed to indirect, interest rate induced credit risk.

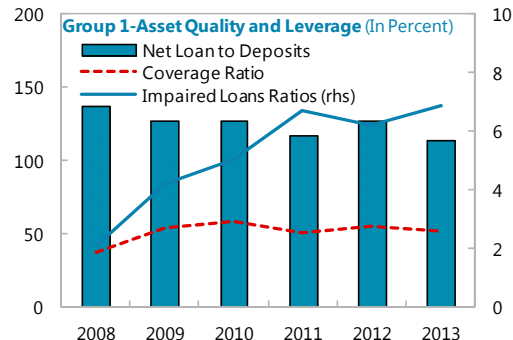
9. The current environment of prolonged low interest rates is challenging for insurance companies. Profitability in the insurance sector has been declining recently, but still remains relatively high in the non-life sector (Figure 5). Non-life insurance is characterized by favorable underwriting results and relatively low expense ratios. In life insurance, high guaranteed interest rates in life insurance policies tend to reduce profitability, given a relatively large (though declining) legacy portfolio of contracts with annual guarantees of more than 4 percent. Low interest rates and the resulting change in product offering as well as search for yield continue to be a key challenge for life companies, while non-life companies are facing growing claims from weather-related events.

Figure 4. Denmark: Indicators by Group of Banks

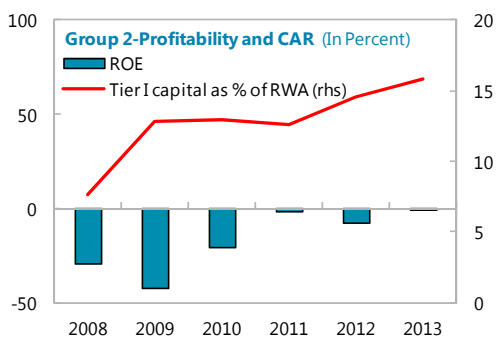
Large banks improved capital, but earnings remain weak...



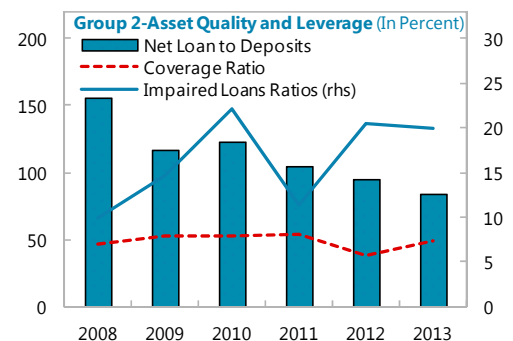
...while impaired loans ratios are increasing and leveraging is still high.



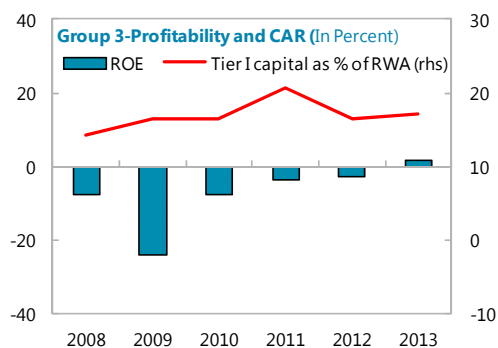
Non-systemic banks' earning capacity is problematic...



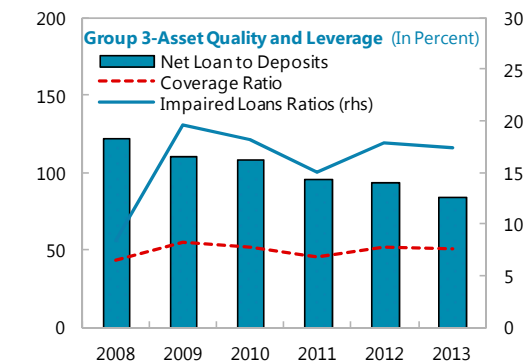
...and large impaired loans remain a problem.



Smaller banks improved earnings...



...but impaired loans are still high.



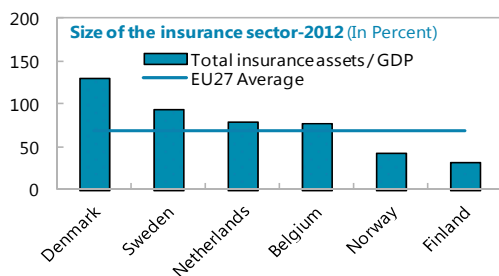
Source: Danish Authorities

Note: Group 1 is defined as banks whose working capital are more than 65 billion DKK (87% of total assets), group 2 is defined as banks whose working capital are between 12 and 65 billion DKK (8% of total assets), and group 3 is defined as banks whose working capital are between 250 million and 12 billion DKK (5% of total assets).

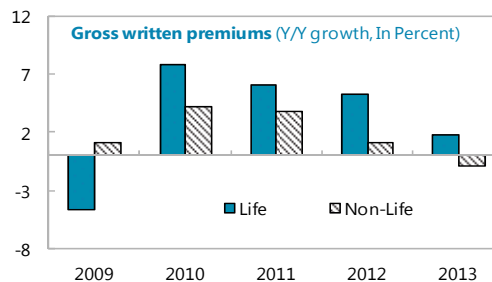
Net Loan = Loan and Impairment Losses to Deposits. They are annual from 2008 to 2011 and are semi-annual for 2012 and 2013.

Figure 5. Denmark: Insurance Sector

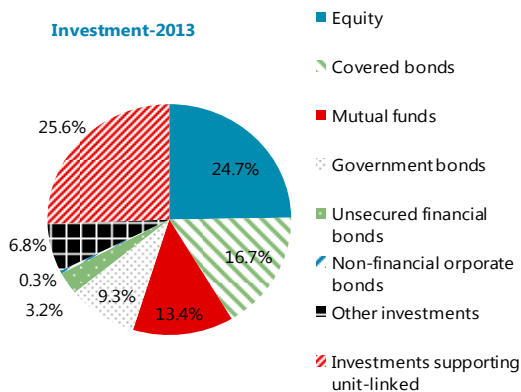
Denmark's insurance sector is large...



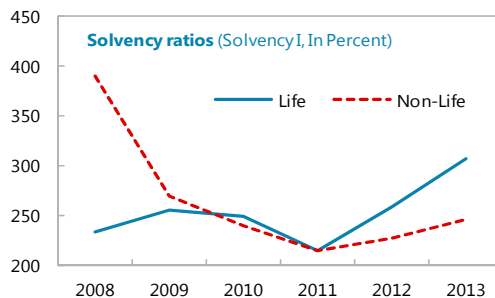
...but its growth rate has declined in recent years.



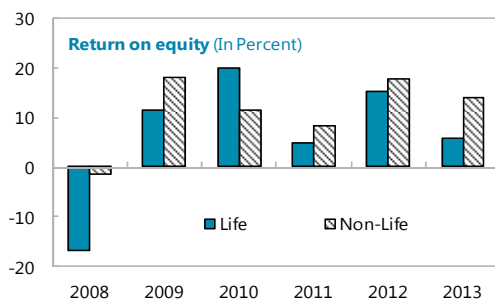
Investments are diversified.



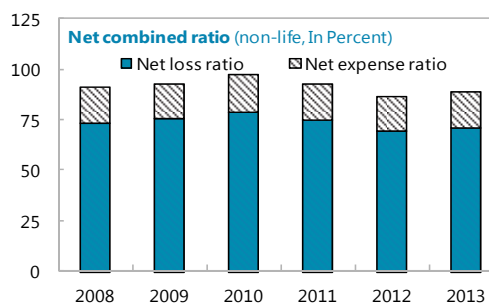
Solvency ratios have been recovering, especially in the life sector.



Profitability has declined recently but it is still high in the non-life sector.



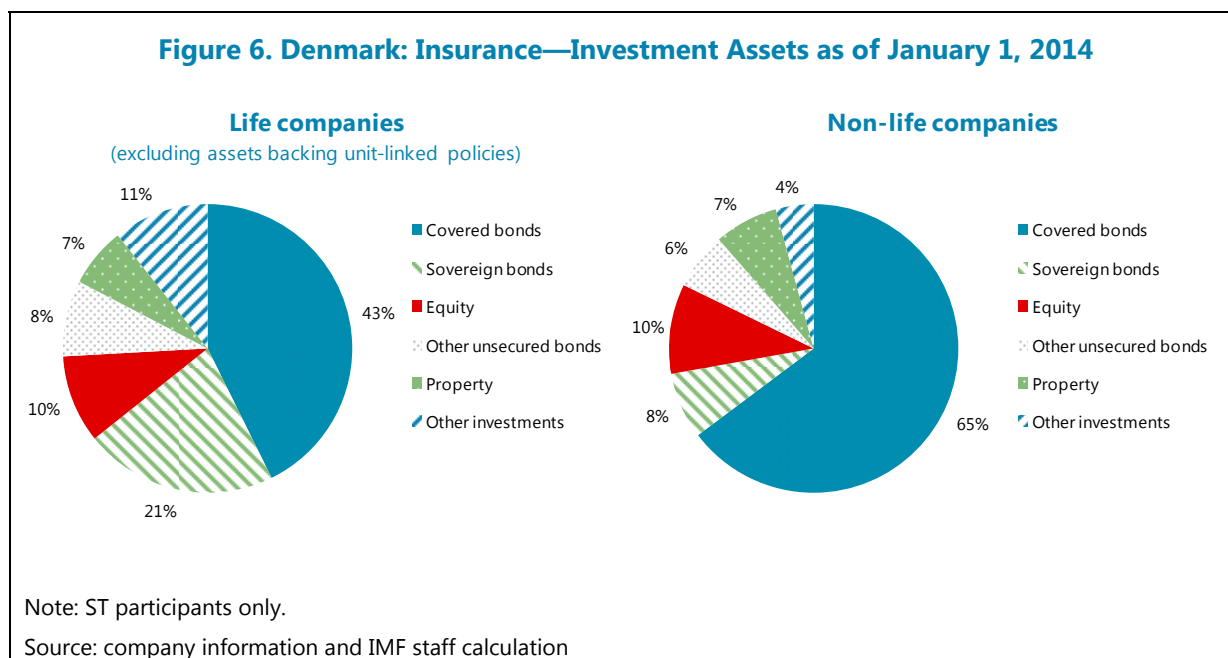
The profitability of non-life insurers reflects in part few large catastrophes and low expenses.



Sources: DFSA, EIOPA, Eurostat

Source: DFSA, EIOPA, Eurostat

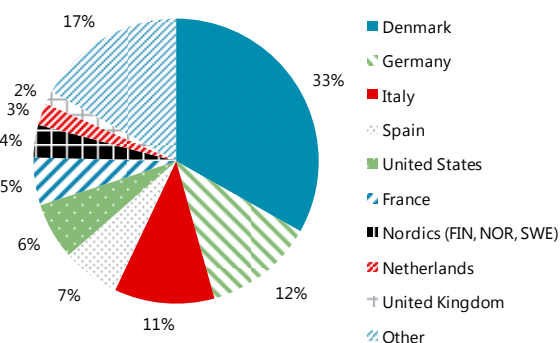
10. Danish insurers are characterized by a high concentration of their investment assets in covered bonds (Figure 6). For both life and non-life companies, covered bonds make up the largest asset class, accounting for 43 percent of investment assets of the four life insurance companies in the stress test sample (excluding assets backing unit-linked policies) and 65 percent for the four non-life companies in the sample. Other relevant classes include sovereign bonds (21 percent and 8 percent for life companies and non-life companies, respectively) and equity (10 percent in each sub-sample).



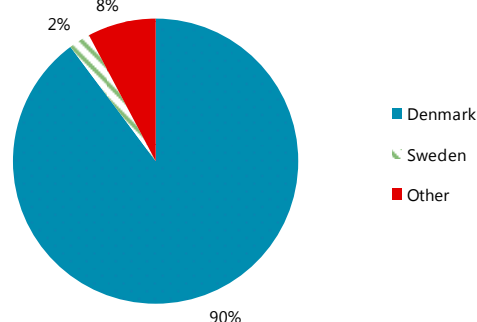
11. Bond investments of insurers are very strongly geared towards domestic bonds, given the regulatory need to match the currency of assets and liabilities (Figure 7). Danish government bonds account for one third of the sovereign bond portfolio, while German government bonds rank second with 12 percent. Among the periphery euro area countries, Italian and Spanish government bonds stand out with relative shares of 11 percent and 7 percent, respectively. Covered bonds held by insurance companies from the stress test sample are nearly exclusively issued by Danish institutions—only 10 percent are foreign bonds.

Figure 7. Denmark: Insurance—Bond Investments as of January 1, 2014

Breakdown of sovereign bonds



Breakdown of covered bonds



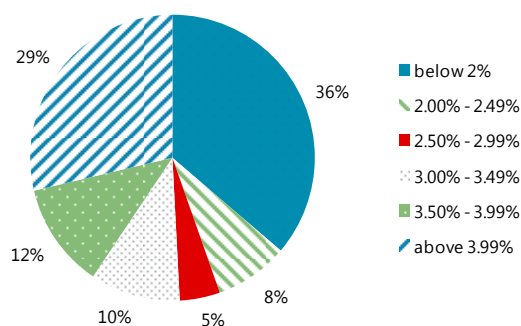
Source: Company information and IMF staff calculations.

Note: Data refers only to those insurance companies assessed in the FSAP stress test.

12. As in most other advanced economies, life insurers in Denmark are coping with a prolonged period of low interest rates. Although Danish authorities have reacted already well more than a decade ago by repeatedly lowering the maximum guaranteed interest rate for new life insurance policies (now being at 1.0 percent), old contracts still remaining on the books pose a challenge. As of early 2014, 29 percent of technical provisions in life business are associated with contracts guaranteeing 4 percent or more per year (Figure 8). The average guaranteed interest rate of the four companies in the sample is 2.7 percent.

Figure 8. Denmark: Insurance—Interest Rate Guarantees as of January 1, 2014

Share of guaranteed interest rates
(percent of technical provisions, life insurance)



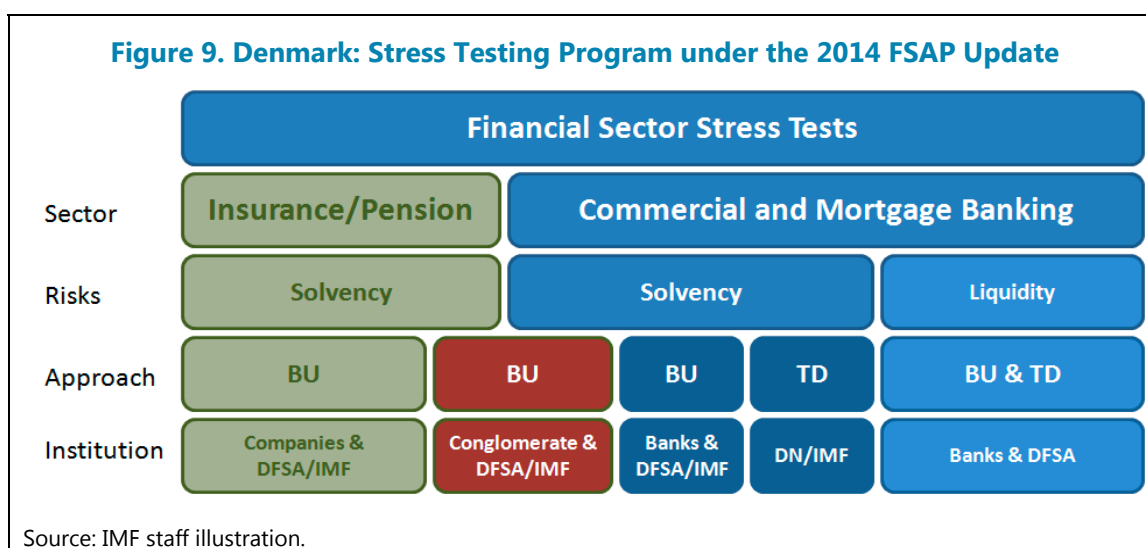
Source: Company information and IMF staff calculations.

Note: Data refers only to those insurance companies assessed in the FSAP stress test.

C. Overview of the Stress Testing Program

13. The impact of these risks on the financial system are assessed through comprehensive stress tests of banks, mortgage credit institutions, insurance companies, and pension funds.

The stress tests covered 87 percent of the commercial banks' assets and 95 percent of the mortgage credit institutions' assets, as well as 50 percent of the life insurance sector and 65 percent of the non-life insurance sector, in terms of gross premiums (Table 2).² The public pension fund *Arbejdsmarkedets Tillægspension* (ATP) was included as well, given its size and importance as the largest pension fund. The stress testing approach involved both top-down and bottom-up methodologies, as well as a cross-sectoral setup.



14. The resilience of banks, insurance companies and pension funds was tested against common macro-financial multi-factor stress scenarios.

This allowed analyzing the potential impact from consistent macroeconomic and financial scenarios derived from the IMF's *Global Risk Assessment Matrix (GRAM)* on financial key institutions simultaneously. Furthermore, an integrated solvency stress test for a financial conglomerate (*Danske Group*) was conducted, based on the EU Financial Conglomerates Directive (2002/87/EC).³

² It should be noted that the different buckets of banks (i.e., banking groups, commercial banks, mortgage banks) are not exclusive, and that banking group results are not the sum of the result for commercial banks and mortgage credit institutions. For details, please see the grouping in Table 2.

³ In the conglomerate stress test, it was assumed that, in the case of a solvency shortfall in the subsidiary, dividend payouts to the parent company would not be possible. In addition, solvency shortfall in the subsidiary are assumed to trigger a capital injection from the parent.

Table 2. Denmark: Samples of Institutions**Banking Sector Solvency Stress Test*****Bottom-up Test***

Banking Groups	Commercial Banks	Mortgage Credit Institutions
Danske Bank	Danske Bank A/S	Realkredit A/S
Nykredit Realkredit	Nykredit Bank (subgroup)	Nykredit Realkredit A/S
Nordea Bank Danmark	Nordea Bank Danmark A/S	Nordea Kredit
Jyske Bank	Jyske Bank (group)	Totalkredit A/S
Sydbank	Sydbank (group)	BRFkredit Group
BRFkredit		

Top-down Test

Banking Groups	Commercial Banks	Mortgage Credit Institutions
	Danske Bank A/S	
	Nykredit Bank A/S	
	Nordea Bank Danmark A/S	
	Jyske Bank A/S	
	Sydbank A/S	

Coverage: 95% of mortgage sector and 87% of commercial bank sector.

Insurance Sector Solvency Stress Test***Bottom-up Test***

Life	Non-Life	Pension Funds
PFA Pension	Tryg	ATP
Danica Pension	Codan	
Nordea Liv	TopDanmark /1	
Sampension	Alm.Brand /1	

Coverage: 50 percent of life insurance and 65 percent of non-life insurance.

Source: DFSA, DN, IMF staff.

Note: /1 While non-life business is the core business, the company is also active in the life business.

D. Regulatory Framework

15. As regards the solvency position of the banking system, the Capital Requirements Directive (CRD) IV and national regulation forms the basis of the assessment. This includes the definitions of capital and capital components as well as the minimum solvency requirements (“hurdle rates”). The hurdle rates for the solvency stress tests follow the phase-in and arrangements under the CRD IV. The definition of capital changes according to the schedule for phase-out of capital instruments no longer eligible for CET1 and Tier capital. In addition to that, “soft” hurdle rates, like the Capital Conservation Buffer are shown for the FSAP solvency stress tests. The largest

financial institutions that are deemed systemically important (SIFI) are further subject to a domestic SIFI buffer. The Danish authorities also make use of additional capital requirements through Pillar 2, which are reflected in the results, as well.

16. In terms of bank liquidity risk regulation, the analysis was performed based on both the existing Danish regulation and EU transposition of the Basel III Liquidity Coverage Ratio (CRD IV). Section 152 of the Danish Financial Business Act (DFBA) requires institutions to hold sufficient unencumbered liquid assets (“liquidity buffer”) exceeding at least 10 percent of total debt and guarantee exposure, or 15 percent of short-term debt exposures (with contractual maturities lower than 30 days), whichever is higher. Furthermore, banking institutions are subject to the *Funding Ratio* (FR), an indicator for potential structural maturity imbalances between stable funding and banks’ lending, similar to the Net Stable Funding Ratio (NSFR).⁴ MCIs are not subject to section 152 DFBA requirements.

- **With the introduction of the Supervisory Diamond, requirements have been raised further.** The section 152 DFBA requirement has become supplemented by the minimum *Excess Liquidity Coverage* (ELC) of 50 percent, i.e., banks have to hold at least 150 percent of the regulatory minimum for liquid assets described above. The ELC tests show, in monthly intervals, the evolution of banks’ liquid asset position under up to 12 months of stress. The scenarios are standardized and assume, for instance, a complete dry-out of wholesale funding sources, deposit run-offs, and systemic market liquidity shocks reducing the value of liquid assets.⁵
- **Starting in October 2015, Danish banks and MCIs have to comply with the LCR under the EU Capital Requirements Directive (CRD) IV.** The LCR helps ensure that banks maintain an adequate level of unencumbered, liquid assets that can be converted into cash to meet the liquidity needs over a period of 30 days. The stock of *High Quality Liquid Assets* (HQLA), after the application of haircuts due to market liquidity shocks, is compared with net cash outflows (cash outflows minus cash inflows, where the latter cannot exceed 75 percent of the former). A ratio above or equal to 1 means that a bank would be able to cover the (expected) loss in funding over 30 days with its stock of liquid assets after haircuts on asset values. Starting in October 2015, the minimum requirement is successively increased (“phased-in”) from 60 percent to 100 percent in 2019. The existing section 152 DFBA liquidity requirements will remain in place as well until end-2016 in the form of floors.

17. As regards insurance companies, Denmark introduced in January 2014 a new solvency regime, which is used as the basis for this stress test.⁶ The new regime is very close to the EU

⁴ The ratio compares lending with working capital (deposits, own bonds, subordinated debt, and shareholder equity) less bond issuance with term to maturity below one year. It is assumed that banks cannot refinance long-term senior debt until 2015 and that three-year loans extended by the DN cannot be refinanced with other long-term liabilities.

⁵ For further details on the ELC scenario, see Box 1.

⁶ Therefore, instead of using end-2013 as the reference date as is done in the banking stress test, January 1, 2014 is used.

Solvency II regime (2009/138/EC) which is going to be implemented in 2016. However, it does not incorporate the latest changes to the Solvency II package, most notably the measures of the so-called long-term guarantee package which European policymakers agreed upon in November 2013. Insurance companies have to calculate their capital requirements based on the old Solvency I regime and the new regime and hold capital against the higher of these.

18. The insurance sector solvency regime is built on a market-consistent valuation of assets and liabilities, thereby continuing previous practice in Danish insurance regulations.

The value of both assets and liabilities barely changes under the new regime. The main difference is however seen in the capital requirement which by design is higher under the new regime than under Solvency I (see Table 3). For life insurers, the required capital increases by 15 percent while available capital barely changes, causing the solvency ratio to drop by 30 percentage points on average. For non-life insurers, the effect is more pronounced: required capital is 70 percent higher under the new regime. With available capital being only 5 percent higher, this results in solvency ratios which are on average about 100 percentage points lower than those under Solvency I. The stress test results have to be interpreted against these transitional changes.

Table 3. Denmark: Transition from Solvency I to the New Solvency Regime

per 01.01.2014	Life			Non-Life		
	Solvency I	New regime	change	Solvency I	New regime	change
Required capital	25,263	28,950	+15%	7,965	13,575	+70%
Available capital	58,067	57,834	+/-0%	21,062	22,148	+5%
Solvency ratio (weighted average)	230%	200%	-30pp	264%	163%	-101pp
Solvency ratio (median)	232%	209%	-23pp	283%	159%	-124pp

Source: Company information and IMF staff calculations.

Note: Data refers only to those insurance companies assessed in the FSAP stress test.

19. The pension fund ATP is not subject to insurance solvency regulations. ATP is a statutory pension fund which forms part of the first pillar of the Danish pension system. It is a fully-funded system with flat contributions. The pension benefit is designed as a deferred life annuity with nominal amounts which can be increased in the form of indexation or bonus allowances based on investment returns and the financial status of ATP. Being subject to specific legislation, ATP is supervised by the DFSA, however it does not fall under the solvency requirements in place for life insurers and other pension funds. As an equivalent to insurer's solvency ratios, the ratio of the bonus potential to ATP's individual reserve requirement is used in the stress test calculations.

20. DFSA and DN share stress testing responsibilities. The largest Danish banks and MCIs are stress tested annually by the DFSA, based on bottom-up methodologies. The DFSA is also in charge of model validation for Internal Ratings Based (IRB) approaches, Pillar 2 stress testing, and participates together with the largest Danish banking groups in the European-wide stress tests and capital exercises. The insurance companies are subject to quarterly microprudential stress test under

the so-called “traffic light system” which covers mainly sensitivity analyses to changes in interest rates and asset prices. The DFSA publishes, on an annual basis, aggregate results from these tests using red- and green-light indicators. The DN performs macroprudential stress tests for the largest commercial banks (groups 1 and 2), published in the DN’s financial semi-annual financial stability reports.

SOLVENCY RISK

A. Scenarios and Methodologies

Scenarios

21. In order to analyze solvency risk in Danish financial institutions, macro-financial scenario and sensitivity analyses were performed. Solvency stress tests for insurance companies, pension funds, commercial banks and MCIs were based on identical macro-financial scenarios. This allowed estimating the impact from adverse states of the world, derived from the FSAP’s Risk Assessment Matrix (Appendix I), on a relatively wide range of financial sector entities, allowing for consistent stress test results. In addition to that, sector specific tests were performed, targeted at each sector’s key risks.⁷ Detailed scenario tables can be found in Appendix II.

22. A baseline⁸ and two adverse scenarios were analyzed (Figure 10):

- **The “protracted slow growth” scenario reflects a prolonged period of weak global growth.** Under this scenario, euro area growth is persistently low, leading to weaker exports, private consumption, and residential investment in Denmark. The scenario assumes a five-year cumulative shock to real GDP growth of about one standard deviation (2.4 percentage points). House prices, household balance sheets, and consumer confidence in Denmark improve more slowly than under the baseline, which negatively affect asset quality in banks.
- **The “severe stress scenario” reflects a surge in global financial market volatility.** Financial market volatility could be triggered by geopolitical tensions, revised expectations about UMP exit in the United States, or concerns about fundamentals in emerging economies. A slowdown in major trading partners would weigh heavily on Danish exports and consumer confidence, undercutting the recovery sharply. The adverse scenario assumes a two-year cumulative shock to GDP growth of 2½ standard deviations (5.4 percentage points). The total loss in output over five years mounts up to 8.2 percent relative to baseline projections. Depressed collateral prices, higher unemployment, and lower GDP growth fuel credit risk substantially while profitability

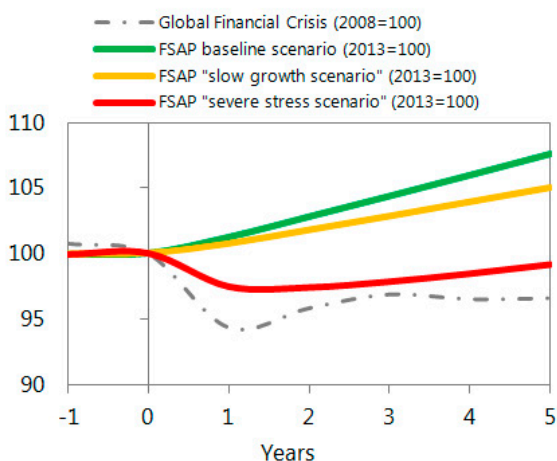
⁷ Banks and insurance companies have different exposures to risks. Due to differences in balance sheet structures, an adverse shock for banks may have positive effects on insurance companies, and vice versa. For a detailed discussion on this, please see Jobst and others (forthcoming), Macroprudential Solvency Stress Testing of the Insurance Sector, IMF Working Paper.

⁸ The October 2013 WEO forecast was used as a baseline. That baseline was slightly more conservative than the latest WEO projections available at the time of publication.

declines. In line with flight-to-quality effects observed during the European sovereign debt crisis, periphery yields would rise while safe haven spreads decline. Market risk shocks are substantial in size, and the effect is amplified by the assumption that prices would not recover.

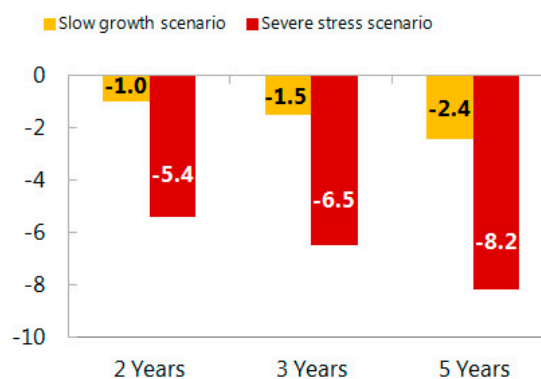
Figure 10. Denmark: Real GDP Growth under the Stress Scenarios

Real GDP Levels



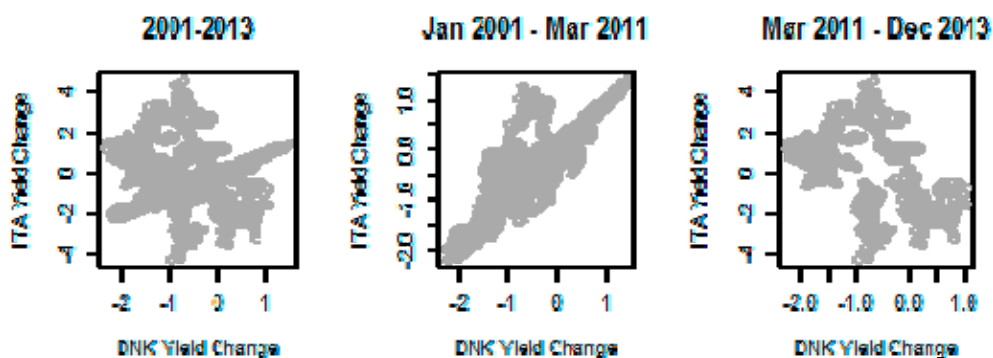
Shocks to Real GDP Growth

(in Percentage Points relative to Baseline)



Source: IMF staff estimates.

23. Sovereign risk scenarios were designed against the backdrop of flight-to-quality effects. A new methodology, able to capture the flight-to-quality effect, has been developed specifically for the 2014 Denmark FSAP Update. It is expected that countries that are perceived as more stable (*safe havens*), do not experience rising refinancing costs, despite strong adverse yield movements in the Euro area periphery, similar to the patterns during the European sovereign debt crisis. Comparing Danish and Italian yields' behavior, Figure 11 illustrates how dramatically the dependence structure has changed.

Figure 11. Denmark: Annual Changes in Danish and Italian Five-Year Sovereign Bond Yields

Source: IMF staff illustration.

Note: Yield changes in generic sovereign bonds are given in percentage points.

24. Dependence between sovereign bonds issued by different countries can be modeled using multivariate copulas. Standard copulas, like the Gaussian, are not flexible enough to model the dependence among a larger number of variables precisely. Multivariate copulas that consist of a cascade of bivariate copulas (pair-copulas)—where each pair-copula can be chosen independently from the others—allow for greater flexibility in dependence modeling. In contrast to standard copulas, such *mixed vine copulas* are capable of modeling tail dependence and tail asymmetries, including heavy tails. Figure 12 shows the flight-to-quality effect based on 10-dimensional C-vine copulas. Clearly, the dependence patterns, captured using Kendall's τ (a correlation measure), have reversed completely since the start of the European sovereign debt crisis, underlining the need to take such flight-to-quality effects into account when designing sovereign risk scenarios for European countries. Markets now clearly differentiate between risky (GRE, ESP, ITA, POR) and less risky sovereigns (GER, UK, SWE, FIN, US, DNK), expressed by negative and high τ values. The fact that the German Bund is dominating the other sovereign yields has not changed, however.

Table 4. Denmark: Sovereign Scenarios

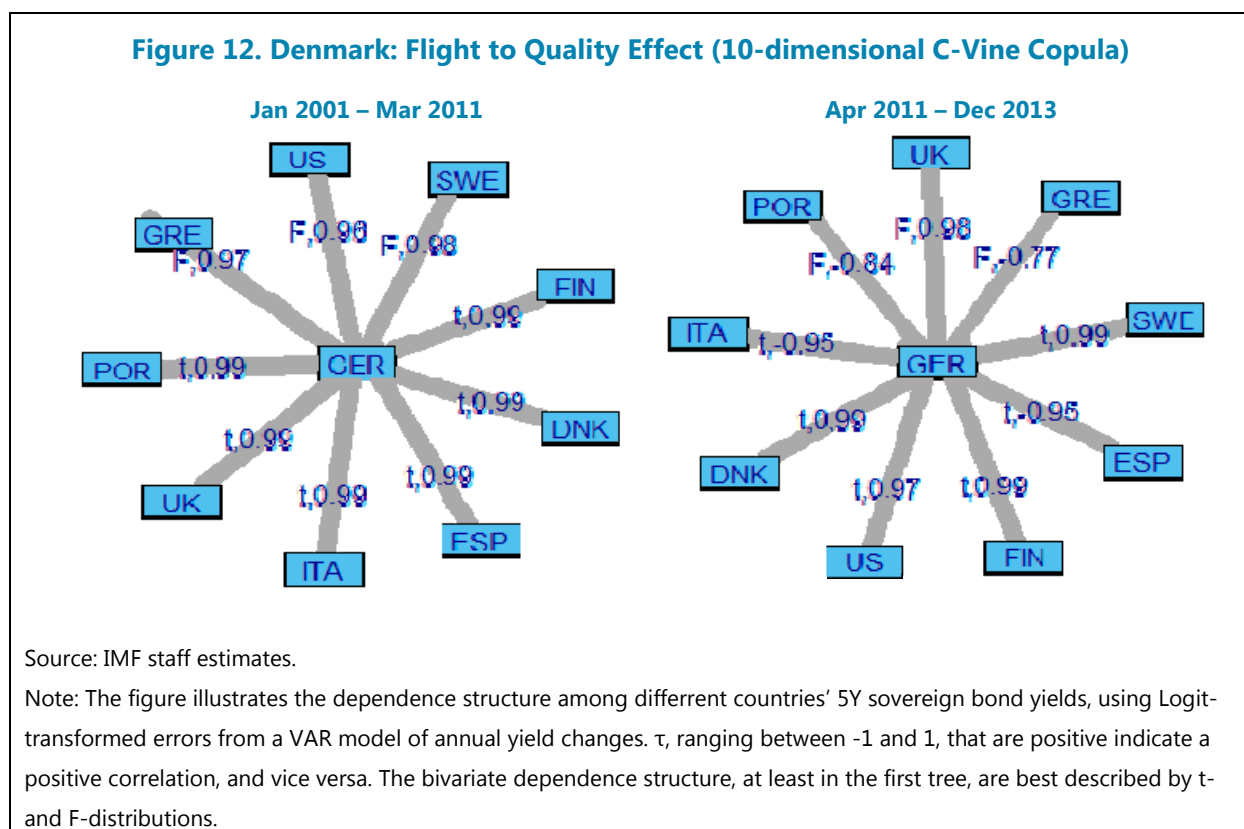
	Yield Change
Denmark	-2.9
Finland	22.7
Germany	7.7
Greece	399.1
Italy	364.3
Netherlands	24.5
Norway	25.7
Portugal	273.1
Spain	255.0
Sweden	-21.8
UK	-18.1
US	6.5
Other	44.0

Source: IMF staff calculations.

Note: Yield changes in basis points. Data comprises 5Y generic government bond yields (gross yields before taxes) from Bloomberg. Yield changes resulting from a VAR model.

25. To project future yields in a dynamic way, the simultaneous behavior of sovereign bonds is modeled by means of VAR projections. The VAR without exogenous variables is given by a set of K countries sovereign bond yields $y_t = (y_{t-1}, y_{t-2}, \dots, y_{Kt})$ for $k = 1, \dots, K$. The VAR(1) process

can be defined as $y_t = A_1 y_{t-1} + \dots + A_p y_{t-p} + u_t$, where A_i are $(K \times K)$ coefficient matrices for $p = 1$, and u_t is a K -dimensional process with $E(u_t) = 0$, and the positive definite covariance matrix $E(u_t u_t^T) = \Sigma_u$ giving white noise.⁹ The model clearly captures the flight-to-quality effect (Table 4). In line with the adverse macroeconomic scenario, the reemergence of the Euro area crisis causes periphery spreads to widen, while sovereign spreads in more stable countries either contract, or remain more or less unchanged. Refinancing costs for Greece and Italy increase by about 400 and 350 basis points, respectively, followed by Portugal and Spain. The countries that are perceived as more stable (*safe havens*), do not experience rising refinancing costs, despite such considerable shocks in the euro area periphery. In scenario analyses, it was assumed that valuation gains in one asset, if any, cannot offset any losses from other assets.¹⁰



26. Shocks to other market risk-sensitive asset classes are substantial in size, and the assumption that prices would not recover over 5 years introduces another layer of severity.

For debt instruments other than sovereign bonds, shocks depend on the credit rating, and range from 38 to 786 basis points in the slow growth scenario, and from 43 to 1178 under the severe

⁹ The model has passed tests for serial autocorrelation (Portmanteau test), normality (Jarque-Bera test), heteroscedasticity (ARCH-LM test), Granger causality tests, and the Johansen cointegration test.

¹⁰ Danish, Swedish, and British sovereign bonds are therefore not stressed in scenario analyses (but in the sensitivity tests, see Table 4).

stress scenario. Shocks to equity prices were estimated at 18.7 percent (slow growth scenario) and 26.6 percent (severe stress scenario), respectively. It is assumed that prices do not recover, i.e., that

the shocks have a permanent impact. This conservative assumption assures that valuation gains induced by price recoveries cannot be realized by financial institutions.

27. The FSAP stress scenarios are comparable with those applied in the 2014 EU-wide stress tests (Figures 13 and 14). The FSAP scenarios stretch

over five years, while the European Systemic Risk Board (ESRB) works with a 3-year forecasting horizon and the European Insurance and Occupational Pensions Authority (EIOPA) uses an instantaneous scenario. Second, the FSAP's assumption that prices do not recover adds a

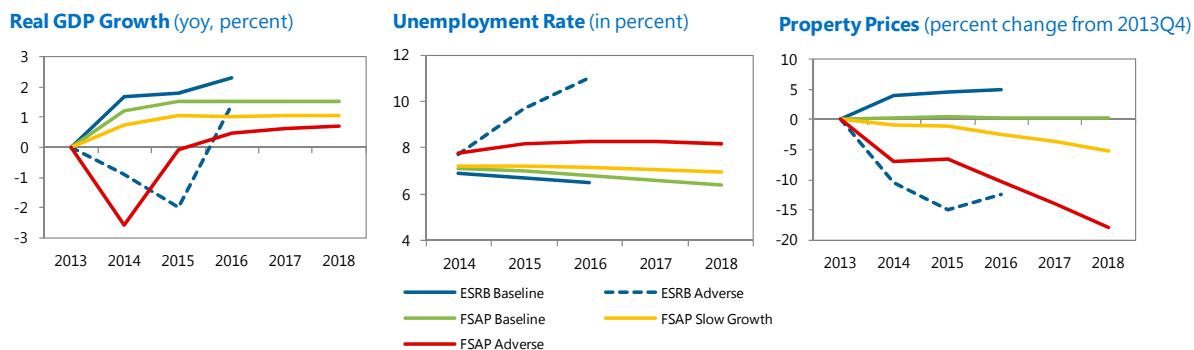
considerable amount of stress on top of relatively strong shocks. Third, while the FSAP scenario puts more emphasis on market and credit risks (incl. comparably higher shocks for some risk factors), the EIOPA stress test also includes some underwriting risks which are not directly linked to a macrofinancial scenario, like e.g. longevity and mortality shocks.

Table 5. Denmark: Sensitivity Test Sovereign Risk

	Yield Change	Haircut
Denmark	66	3
Finland	63	3
Germany	61	3
Greece	964	48
Italy	103	5
Netherlands	62	3
Norway	63	3
Portugal	270	13
Spain	108	5
Sweden	73	4
UK	68	3
US	77	4
Other	165	8

Source: IMF staff estimates.

Figure 13. Denmark: Macroeconomic Scenarios (incl. Comparison with the ECB/ESRB Scenarios)



Source: ESRB, IMF staff.

Figure 14. Denmark: Financial Risk Scenarios (incl. Comparison with the EIOPA Stress Test)



Source: EIOPA, IMF staff.

28. Sector-specific assumptions were applied to take into account methodological and technical specificities. For the banking sector stress test, additional sensitivity tests were used to analyze the impact of shocks to one risk factor at a time, assuming that the shock materializes immediately. The analyses included a calculation of valuation losses from sovereign bond holdings

(Table 5);¹¹ 100 and 500 basis points shocks to covered bond spreads—with and without hedges taken into account; and credit concentration risk tests, simulating the default of the 1, 3, 5, 10 and all large exposures.

29. Given the high importance of market and underwriting risks in the insurance sector, these risk factors have been specified in more detail in the scenario analysis. Asset price shocks are assumed to occur only during the first year of the five-year projection horizon (front-loaded), while interest rates are assumed to change each year, in line with the macrofinancial scenario. In all scenarios, including the baseline, the interest rate term structure contains a significant downward shift in the first year for longer maturities, which increases the value of liabilities (see Figure 15). As an additional liability-side shock, a higher rate of policyholders surrendering their life insurance policies has been assumed to occur in the first year. All shocks are applied to both assets and liabilities, consistent with the “total balance sheet approach” of the Danish regulatory regime and the forthcoming Solvency II regime. Next, the available capital (the excess of assets over liabilities, adjusted for quality of capital) is compared to capital requirements, which gives the solvency ratio. Capital requirements are also affected by changes in interest rates and the value of liabilities. In order to allow for a better understanding of the dynamics of available capital, projections of net income for the five-year projection horizon under all scenarios were requested from participating companies.

30. The insurance sector stress test makes a number of important restrictive assumptions:

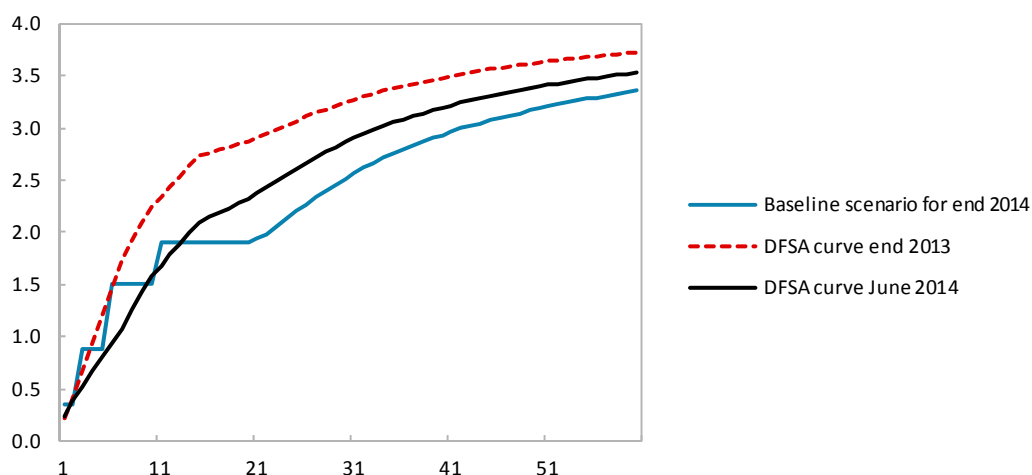
- a) **No discretionary management actions are allowed:** only existing hedge positions are assumed to roll over, thereby increasing the asset-liability mismatch over time. In practice, if adverse shocks materialize, insurance companies would react quickly to limit the impact on solvency ratios, at the cost of reducing profitability in the short run. Among the most effective measures would be re-allocating assets (reducing stocks and corporate bonds and increasing government bonds), which would reduce capital requirements and thus improve solvency ratios. Such reallocation is part of life insurers’ day-to-day risk management and proved to be effective in past periods of stress, but this stress test did not model this mitigating effect to ensure comparability of results across companies.¹² Other possible actions to reduce capital requirements include purchasing reinsurance or interest rate derivatives. These measures would likely have a negative impact on profitability in the short run.

¹¹ Shocks were derived for each country from the historical distribution of year-on-year movements in daily five-year sovereign bond yields. The shock constitutes a negative two-standard deviation move in two-year real GDP growth.

¹² Equity exposure accounts for 12 percent of investment assets of life insurers (excluding unit-linked investments), which corresponds to 116 percent of available capital. A 39 percent shock to equity exposure, as applied in the calculation of insurers’ capital requirements, equals 122 percent of the required capital. These numbers illustrate the significant potential for reducing capital requirements by divesting or hedging equity exposures. In a real-world scenario, however, life insurers would have to ensure that the replacement assets, e.g. government bonds, earn a yield high enough to cover outstanding interest rate guarantees.

- b) **No investment returns are assumed for the period from 2015 to 2018**, apart from changes in the value of fixed-income instruments, which result from change in the interest rates.
- c) **No additional buffer stipulated under Solvency II is allowed.** Looking ahead, the forthcoming Solvency II regime will provide for additional buffers in a stress scenario e.g., the volatility adjustment would allow for an increase in the discount rate, which will reduce the value of liabilities.

Figure 15. Denmark: Interest Rate Term Structure



Sources: DFSA and IMF staff.

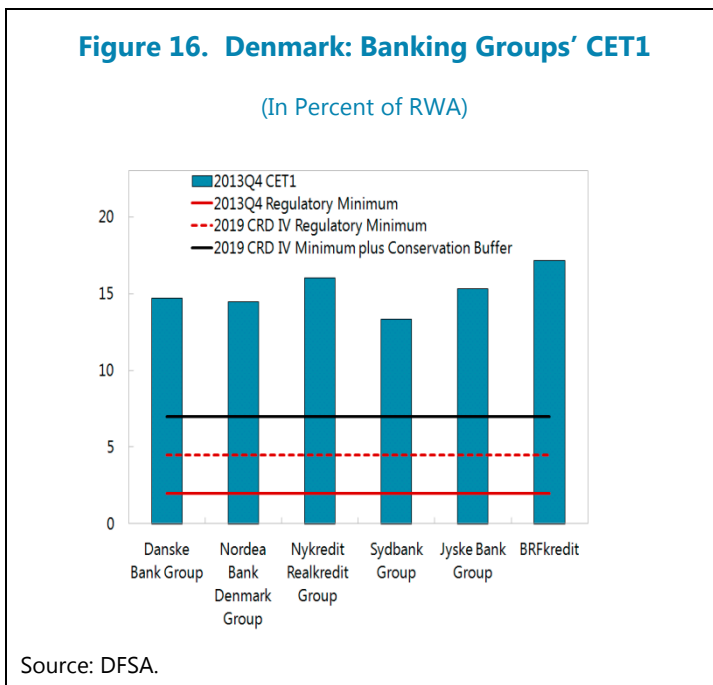
Note: The interest rate term structure for the scenarios has been derived from the IMF's EUROMOD model which outputs short-term and long-term rates. For the period from the 10-year to the 20-year maturity where no model data is available, the curve has been assumed to stay flat, while after year 20, the extrapolation towards the "ultimate forward rate" follows the rules of the Danish solvency regime. As life insurers are very sensitive to changes in long-term rates, the baseline scenarios as of end 2014 represents a substantial decline in interest rates compared to the term structure observed at end 2013 and used by stress test participants to perform the valuation of their liabilities at the reference date. It is however noted that interest rates have declined substantially in the first six months of 2014.

B. Results for the Banking Sector

Scenario Analyses

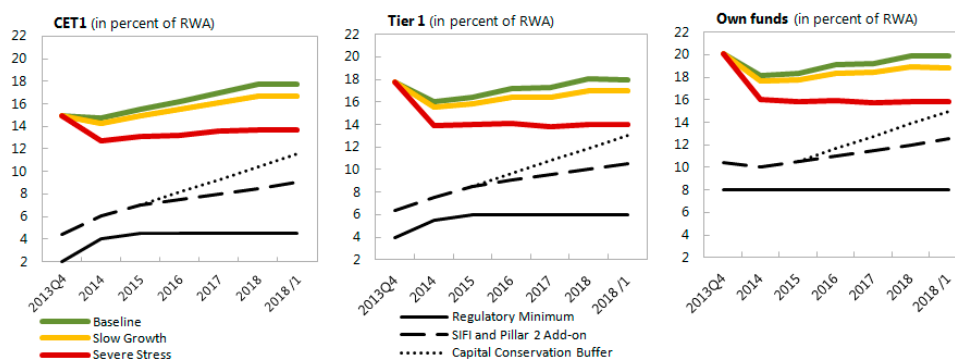
31. The large banking groups are in a strong position to withstand even severe shocks, which clearly underlines the value of solid capital buffers. As of end 2013, the starting point of the scenario time horizon, the six largest banking groups' CET1 and own funds stand at 15 and 20 percent of RWA, respectively. The top-5 MCIs are even better capitalized, with an aggregated CET1 ratio of 19.5 percent and a CAR of 20.5 percent. The levels of capital are expected to further increase under the baseline as better growth prospects and

lower financial market volatility will increase profitability, compensating for CRDIV-driven increase in RWA, as well as phase-out of hybrid capital instruments and the phase-in of CRDIV capital deductions (Figure 16). Even the strong shocks applied in the severe stress scenario, causing capital ratios to drop by almost 4 percentage points, would be manageable. And none of the institutions is particularly weaker than the average—all remained well above hurdle rates, despite considerable macrofinancial stress.¹³



lower financial market volatility will increase profitability, compensating for CRDIV-driven increase in RWA, as well as phase-out of hybrid capital instruments and the phase-in of CRDIV capital deductions (Figure 16). Even the strong shocks applied in the severe stress scenario, causing capital ratios to drop by almost 4 percentage points, would be manageable. And none of the institutions is particularly weaker than the average—all remained well above hurdle rates, despite considerable macrofinancial stress.¹³

Figure 17. Denmark: Bottom-up Solvency Stress Test: Results for Consolidated Banking Groups

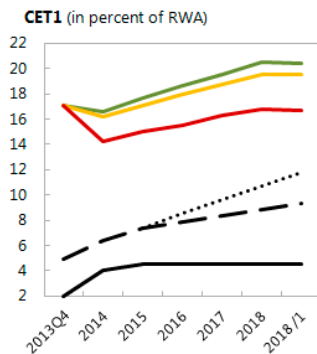


¹³ Small banks have not been subjected to the stress tests.

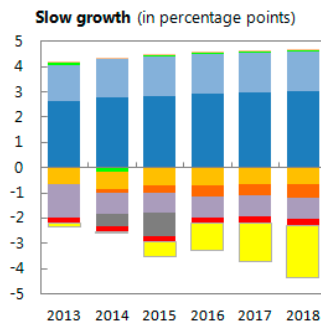
Figure 18. Denmark: Bottom-up Solvency Stress Test: Commercial Banks and MCIs

Commercial Banks

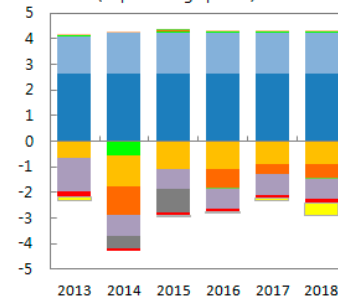
A. Evolution of CET1 Ratios



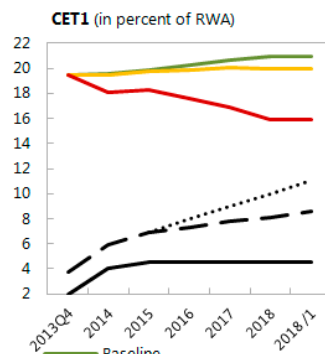
B. Key Drivers of CET1 Ratio



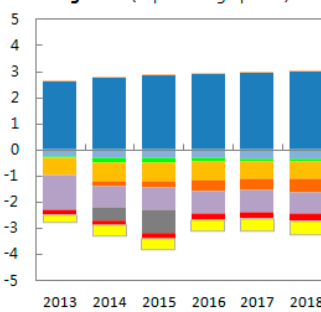
Adverse (in percentage points)



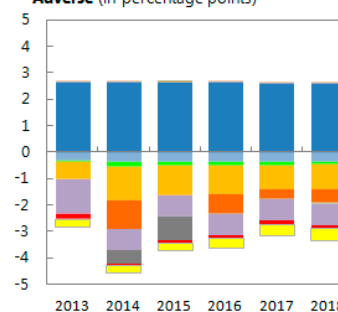
Mortgage Credit Institutions



Slow growth (in percentage points)



Adverse (in percentage points)



— Baseline
— Slow Growth
— Severe Stress
— Regulatory Minimum
— SIFI and Pillar 2 Add-on
..... Capital Conservation Buffer

■ Net interest income
■ Value adjustments
■ Loan losses (Expected Loss)
■ Balance sheet size
■ Phase-out hybrid instruments
■ Dividend pay-out
■ Net fee and commission income
■ Share dividends
■ RWA (Unexpected Loss)
■ Deductions from CET1
■ Taxes

Source: BRFkredit Group, Danske Bank Group, Jyske Bank Group, Nordea Bank Danmark Group, Nykredit Realkredit Group, Sydbank Group. IMF staff illustration.

Note: /1 The 2018 capital ratios are also given assuming a front-loading of capital deductions (fully phased-in).

32. Under the baseline scenario, it is expected that bank groups' solvency position will continue to increase (Figure 17). This is in line with the increase in capital ratios observed over the last couple of years (see also Figure 3) and banks' expectations for the medium-term. Due to the new capital regulation, there will be some shifts in the composition of regulatory capital, including a phase-out of certain capital components no longer eligible for CET1 and Tier 1 capital.

33. In the “protracted slow growth scenario” (RAM scenario 1), the large banking groups would maintain their current solvency position. The slow growth scenario shows that a deceleration in economic activity would reduce profits and increase credit risk. As a result, capital ratios would under this scenario be about one percentage point lower than under the baseline. The impact from the new regulatory framework is expected to be absorbed by the banks. However, further increases in capital would be more difficult to achieve, since profitability is expected not to recover under the slow growth scenario.

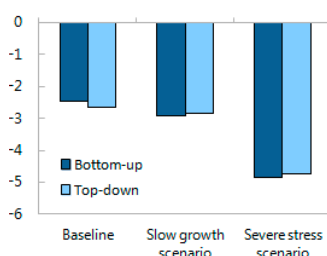
34. Under the “severe stress scenario” (RAM scenario 2), banking groups would see their aggregate Tier 1 ratio drop by 4 percentage points (to 14 percent). This considerable decline is mainly driven by the projected increase in credit risk (RWA increase by more than 15 percent while balance sheet deleveraging is negligible), and by actual loan losses (which increase by 70 percent compared to the baseline). Furthermore, net interest income is 13 percent lower than under the baseline, and net fee and commission income 12 percent, respectively. All banks in the sample remain well above regulatory minima throughout the forecasting time-horizon.

35. While MCIs have higher capital buffers than commercial banks, they are more affected in the stress scenarios, reflecting the greater exposure to real estate (Figure 18). Loan losses reduce capital ratios by 5.3 percentage points (vs. 4.5 in commercial banks) over the projection horizon. And the RWA impact is 2.7 percentage points—compared to 1.8 percentage points in commercial banks—which is in particular induced by the house price shock under of the severe stress scenario (affecting collateral values and, therefore, effective loss rates). However, it should be noted that due to the high degree of collateralization, lower loan-to-value ratios, and the common use of loan loss guarantees granted by commercial banks, effective loan losses in MCIs are nevertheless relatively low. While profitability is lower than in commercial banks, their higher capital buffers provide for substantial loss absorbing capacity.

Figure 19. Denmark: Top-down Tests confirm Bottom-up Calculations

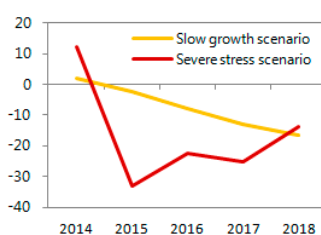
Top-down vs. Bottom-up

Maximum change in Tier 1 ratio
(in percentage points)

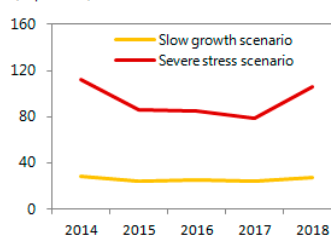


Top-down: Key Drivers

Core earnings, deviation from baseline
(in percent)



Loan impairments, deviation from baseline
(in percent)

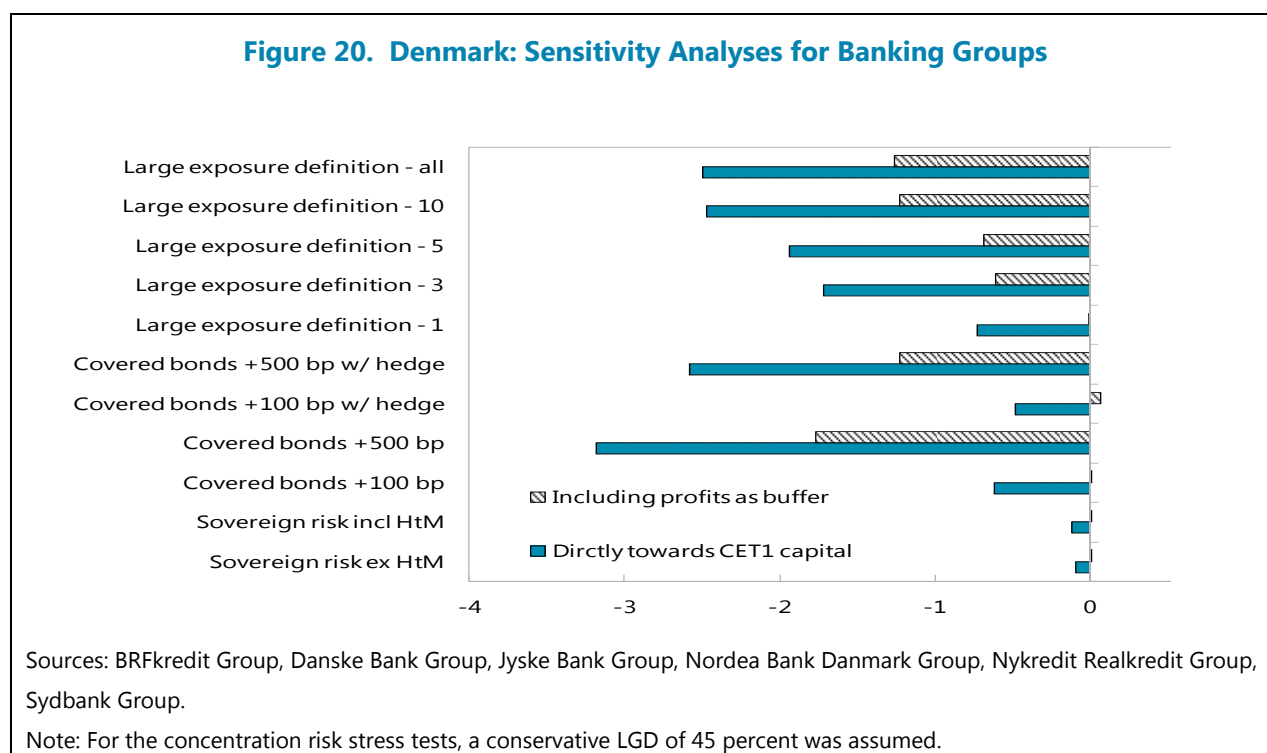


Sources: DN and DFSA; BRFkredit Group, Danske Bank Group, Jyske Bank Group, Nordea Bank Danmark Group, Nykredit Realkredit Group, Sydbank Group.

Note: In the charts, results for (unconsolidated) commercial banks are compared.

36. Top-down stress tests confirm bottom-up calculations (Figure 19). The top-down analysis involved the estimation of core earnings profits, loan impairments, and market risk induced value adjustments. The evolution of RWA was estimated based on banks' bottom-up results. Core earnings include, among others, interest income (from lending, interbank claims, and bonds), interest expenses (deposit funding, interbank liabilities, bond issuance, and subordinated debt), as well as net fee and commission income. Changes in these variables were estimated using macrofinancial variables from the scenarios and institution-specific information. In case models did not yield elasticities that were significant or substantial enough, given the shocks, expert judgment was applied. The projected changes in the Tier 1 ratio in response to the three macrofinancial scenarios (left chart) was almost identical. Comparing the changes in core earnings and loan losses resulting from the top-down test show patterns that are very similar to those in the bottom-up test, with the slow growth scenario being fairly close to the baseline trajectories, and the severe stress scenario with substantially more negative impacts.

37. Sensitivity analysis support the notion that sovereign risk and concentration risk in Danish banking groups are relatively low (Figure 20). Even when disregarding the banking groups' gross profits as a first line of defense, a sovereign yield shock of 60 basis points would result in only a 10 basis points reduction in the CET1.¹⁴ And if the banking groups' entire sovereign debt holdings were marked-to-market, the impact would increase only marginally. Concentration risk is manageable, and has come down in recent years as a result of supervisory actions.



¹⁴ As the impact is linear, the impact may be scaled.

38. Extreme changes in covered bond spreads, however, could have significant, but manageable, impacts. Tests were performed for a 100 and a 500 basis point hike in spreads. The lower shock could be fully absorbed by the banking groups' gross profits and would, therefore, not affect the solvency position. The 500 basis point shock would eat into capital and reduce the aggregate CET1 ratio by 1.7 percentage points.¹⁵ Experience during the global financial crisis, where the peak in spreads was about 150 basis points (Figure 21), illustrates that a 500 basis point move is a low probability tail event.¹⁶ Given the dominance of adjustable rate loans in Denmark, the effect of the shock on the banks is somewhat mitigated through the pass-on of higher funding costs to borrowers.

Figure 21. Denmark: Spread on Callable Segments of Covered Bonds



Source: Nordea.

Notes: Option-adjusted spread of callable bonds to 6-month DKK SWAP.

C. Results for the Insurance and Pensions Sectors

39. The stress test for insurance companies and pension funds is designed as a bottom-up exercise. With each four life insurers¹⁷ and four non-life insurers¹⁸ it covers 50 percent of the life sector and 65 percent of the non-life sector, measured in terms of domestic premiums. In addition, ATP as the largest pension fund has been included. Companies reported on a consolidated basis for

¹⁵ If pre-impairment profits were not included, the impact would be 3.2 percentage points.

¹⁶ In addition, the FSAP looked into separate sensitivity analyses of indirect credit risk from interest rate volatility (that large banking groups perform as part of the ICAAP), using information collected by the DFSA. In these tests, adjustable rate interest-rate sensitive exposures are repriced based on 200 and 500 basis points shocks, combined with collateral devaluations between 10 and 30 percent. For the banking groups, a 500 basis point shock in the interest rate combined with a 10 percent (30 percent) drop in collateral values would, on average, increased the impairment rate by only 30 basis points (50 basis points), pointing to limited interest rate risk for the banking group.

¹⁷ Danica Pension, Nordea Liv, PFA Pension, Sampension.

¹⁸ Alm.Brand, Codan Forsikring, Topdanmark, Tryg Forsikring. Alm.Brand and Topdanmark also include life insurance business. See Table 2 for details.

their worldwide operations based on the new solvency regime which has been implemented in January 2014.

Scenario Analyses

Results

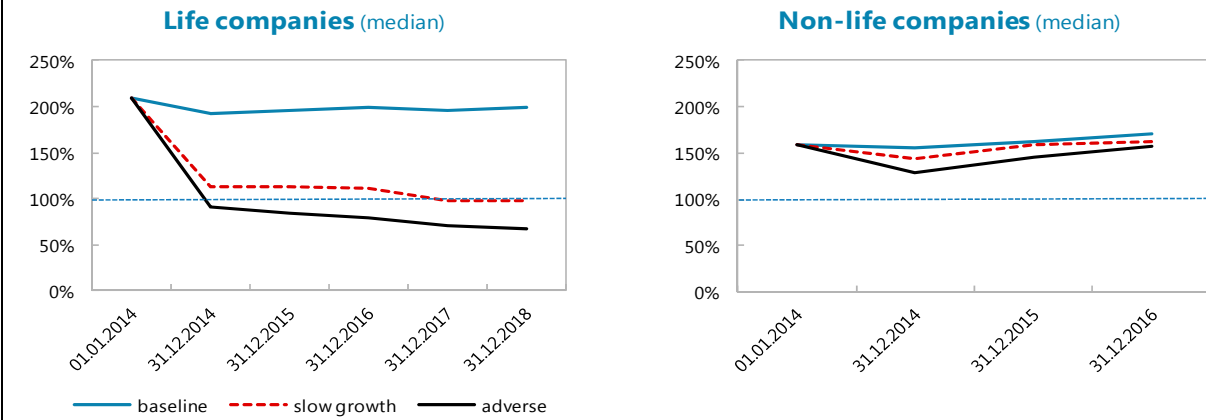
40. Solvency ratios of life insurers drop substantially both in the slow growth and the adverse scenario while non-life companies are less affected (Figure 22). Starting from a median solvency ratio of 209 percent on January 1st 2014, the capital position of life insurers remains rather flat until the end of 2018 under the baseline scenario, not dropping below 190 percent. In the slow growth scenario, solvency ratios decline to 112 percent in the first year, in the adverse scenario even further to 91 percent, thereby resulting in a capital shortfall. The aggregated capital shortfall of those insurers dropping below the solvency ratio of 100 percent in 2014 in the adverse scenario amounts to about DKK 13 billion. After 2014, solvency ratios do not improve which is mainly caused by the very conservative assumption of zero investment returns in the years from 2015 to 2018 (Figure 22).

41. Non-life insurers are less affected by the stresses applied in the stress test exercise.

While their solvency ratios are on average lower than those of life insurers, their ratios increase from 159 percent at the beginning of 2014 to 171 percent at the end of 2016 in the baseline scenario.¹⁹ In the slow growth scenario, the drop in solvency ratios of about 15 percentage points in 2014 is nearly completely reversed in the following year, improving even further to 163 percent in 2016. Results in the adverse scenario are only slightly worse than in the slow growth scenario with median solvency ratios of 128 and 157 percent at the end of 2014 and 2016, respectively.

¹⁹ As one non-life company in the sample did not provide projections for 2017 and 2018, the presentation of aggregated results in the non-life sector ends in 2016.

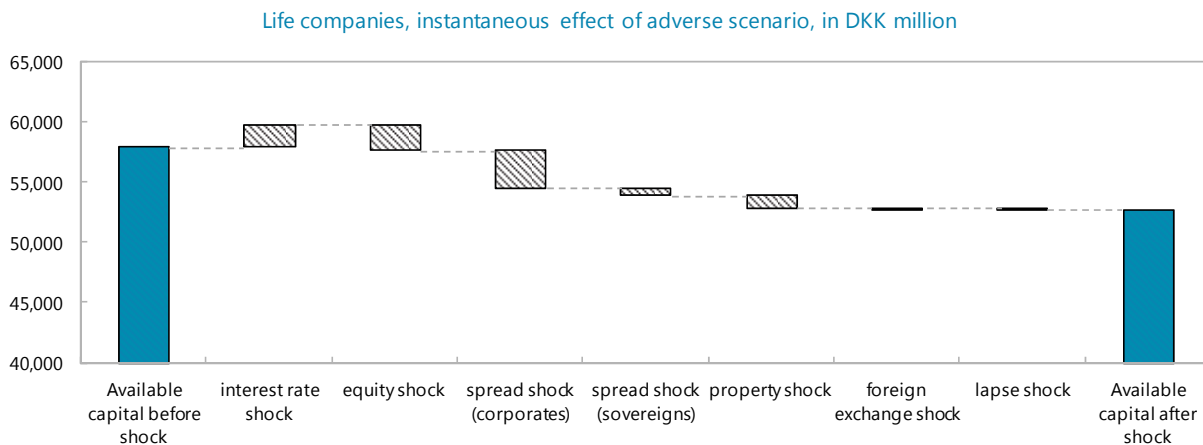
Figure 22. Denmark: Insurance—Solvency Ratios



Source: Company information and IMF staff calculations.

42. While most asset price shocks affect only the available capital of insurers, notably the equity and corporate bond spread shock (Figure 23), the interest rate shock can have a substantial effect also on capital requirements. Danish life insurers rely quite largely on interest rate derivatives like swaps and swaptions in order to reduce their asset-liability mismatch. In the severe stress scenario, the possibilities to roll-over expiring interest rate hedges might however be hampered or very costly. As a result, the average duration of assets could decline, leading to an increased asset-liability mismatch. The Solvency II standard formula punishes such mismatches by higher capital charges in the interest rate risk sub-module.

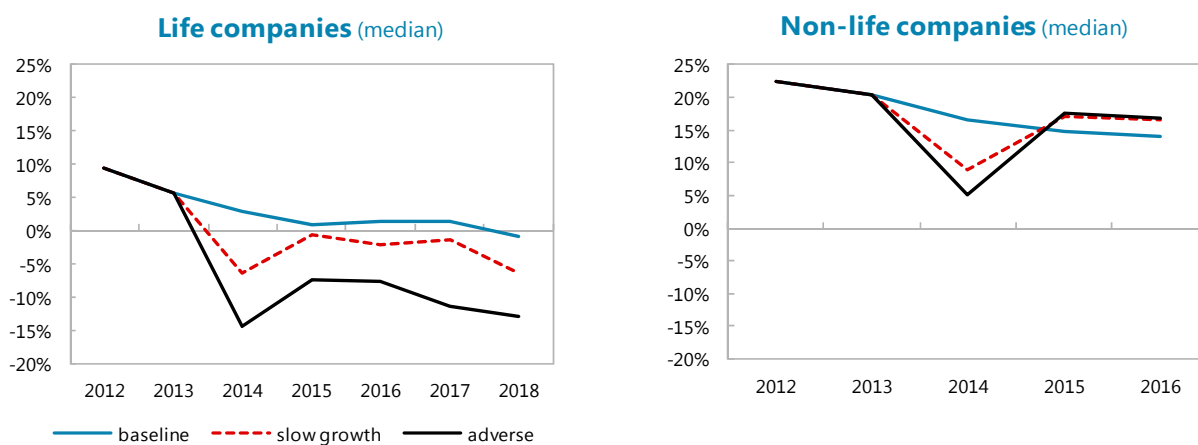
Figure 23. Denmark: Life Insurance—Contributions to Changes in Available Capital in the Adverse Scenario



Source: Company information and IMF staff calculations.

43. Net income of insurance companies is severely affected in both stress scenarios, but only non-life insurers recover close to pre-stress levels soon after the occurrence of the shocks. In the severe stress scenario, the aggregated loss of the life insurance companies in 2014 amounts to DKK 5.9 billion. The median return on equity (RoE) accordingly drops from 5.7 percent in 2013 to -14.5 percent. For the whole period from 2014 to 2018, the cumulative loss amounts to DKK 11.9 bn. Non-life insurers which on aggregate made a profit of DKK 4.6 billion in 2013 (with a median RoE of 20.4 percent) would just break even in 2014 in the adverse scenario (Figure 24). All but two companies in the sample predict no dividends to be paid out in the first two years after the severe stress scenario unfolds, while five out of eight paid dividends for the year 2013.

Figure 24. Denmark: Insurance—Return on Equity



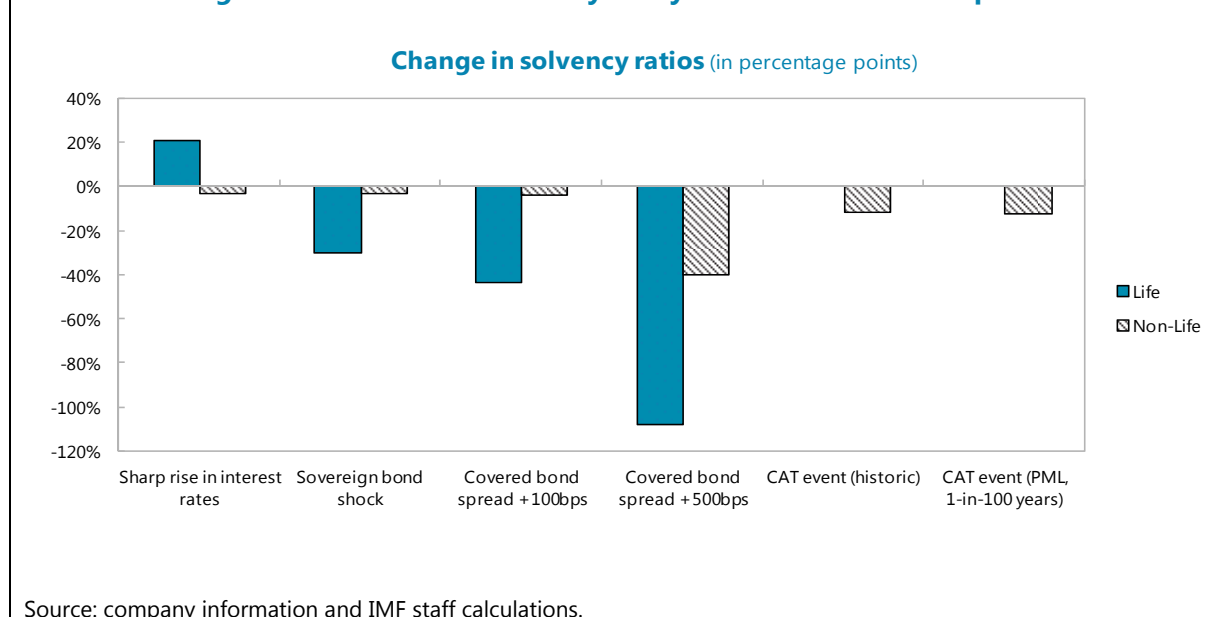
Source: company information and IMF staff calculations.

Sensitivity Analyses

44. Sensitivity analyses reveal the risks underlying the concentrated exposure towards Danish covered bonds (Figure 25). In the extreme event of a substantial loss in confidence in this market, expressed by an increase in spreads of 500 basis points, the immediate mark-to-market loss would result in a drop in solvency ratios of life insurers of 108 percentage points on average; non-life companies would experience declines in their solvency ratios of 41 percentage points.

45. The stress test shows the resilience of non-life companies to catastrophic (CAT) events. Historic experience has shown that the most serious weather-related risks are those from severe windstorms. A repetition of the 1999 windstorm “Anatol” (or “Decemberorkanen”), which is widely seen as a 1-in-80 years event, reduces solvency ratios of non-life insurers by 12 percentage points. However, natural catastrophes are difficult to model and a recent cloudburst in the Copenhagen area which was not adequately covered by the CAT models caused considerable losses for some insurers.

Figure 25. Denmark: Sensitivity Analyses for Insurance Companies



Stress Testing of Pension Funds—ATP

46. The largest domestic pension fund (ATP) shows a large degree of resilience in the stress test. ATP's excess cover relative to the individual reserve requirement drops slightly in the baseline scenario and by a bit more in the two stress scenarios, but stays comfortably close to ATP's internal targets. The pension fund is barely affected by the interest rate shocks as the discounting framework used by ATP allows for a nearly complete offsetting of changes in the value of bond holdings in the valuation of technical provisions. The main driver of the reduction in the bonus potential²⁰ is the equity shock. As ATP's holdings of corporate bonds are small compared to those of life insurers, the corporate bond shock does not materially affect ATP. However, the stress scenarios would reduce ATP's profits, which would turn negative in both scenarios.

LIQUIDITY RISK

A. Scenarios and Methodologies

47. Banks' and MCIs' market and funding liquidity risks were analyzed by means of different methodologies, and over various timeframes. The banks' liquidity position was assessed against the *Excess Liquidity Coverage* (ELC), the *Funding Ratio* (FR), and the *CRD IV Liquidity Coverage Ratio* (LCR). In order to compare banks' performance under the ELC and the LCR, the same time horizon of one month is applied. And to enhance comparability between ELC and LCR, the ELC ratios were rescaled by +100 percentage points. Consequently, if a bank's ELC drops below 100, it breaches the regulatory minimum (section 152 of the DFBA); if the ELC is equal or above 150

²⁰ The bonus potential represents ATP's free reserves and acts as a buffer to negative investment returns.

percent (red horizontal line), the bank is also compliant with the (50 percent) supplementary requirement under the Supervisory Diamond. The ELC scenarios, capturing group-specific funding risks, can be found in Box 1. The Danish FR gives the relationship between lending and stable (long-term) funding sources, a measure specified similar to the Basel III Net Stable Funding Ratio but based on a less granular approach. The maximum FR tolerable under the regulatory framework is 100 percent. MCIs are not subject to the FR requirement.

48. Due to issues of data confidentiality with regard to bank-specific cash-flow data, the DFSA organized the BU liquidity stress test with the banks and performed TD analyses.

Methodologies and scenarios were agreed with the FSAP team. The composition of the samples is the following:

- 81 banks for the ELC, with 5 group 1, 10 group 2, 48 group 3, and 18 group 4 banks;
- 16 banks and MCIs for the LCR, with 2 group 1 banks, 3 group 1 banks including their MCIs, 9 group 2 banks, and 2 (stand-alone) MCIs;
- 85 banks for the FR, with 5 group 1, 11 group 2, 50 group 3, 15 group 4, and 4 group 6 banks.

Box 1. Denmark: Stress Scenario for ELC Test

Groups 1 and 2 Banks

- Complete loss of capital-market financing and debt to credit institutions when existing contracts mature.
- Debt to central banks may be renewed to the extent that this option is available under normal market conditions. Temporary borrowing facilities cannot be included.
- Repo financing (and reverse repos) or lending of liquid assets defined under section 152 DFBA still possible.
- 6 percent loss of stable retail and corporate deposits in first month, without recovery in following 11 months.
- Less stable retail and corporate deposits fall by 12 percent over the first month, without recovery in following 11 months.
- Rated banks are downgraded by two notches in the first month, impacting derivative collateral.
- Additional collateral requirement corresponding to 10 percent of collateral currently pledged (net amounts) during the first month, with some subsequent recovery during later months.
- Retail (corporate) customers draw 5 (10) percent of committed but unused credit and liquidity facilities.
- Possibility of utilizing 50 percent of committed facilities granted but not utilized.

Box 1. Denmark: Stress Scenario for ELC Test (concluded)

- Cash, central-bank deposits, CDs, Danish government and mortgage bonds are liquidated at market value. Unencumbered liquid assets in the form of European government bonds and European covered bonds including euro-denominated mortgage bonds are liquidated with a haircut of 7.5 percent. Other liquid assets (as defined in section 152 DFBA) experience a haircut of 10 percent.
- Loans to credit institutions mature contractually and are not renewed. No growth in retail/corporate lending.

Groups 3 and 4 Banks

- Debt with maturity above 1 month is not renewed, and banks cannot issue new bonds.
- The 10 largest time deposits are not renewed upon expiry. 100 percent of short-term debt (<1 month) to credit institutions elapses after the first month.
- Deposits excluding the 10 largest time deposits decrease by 1 percent a month.
- 0.1 percent of financing guarantees and loss guarantees are activated every month.
- Guarantees increase by 1 percent per month, and lending increases by 1 percent per month.
- A 5 percent increase in undrawn but committed credit lines.
- Haircut of 10 percent for equities and 7.5 percent for bonds.
- Temporary borrowing facilities at DN cannot be included.

B. Results for the Banking Sector

49. The ELC test, in which covered bonds are fully eligible, attests the banks a strong liquidity position (Figure 26, left chart, and Figure 28). The results for the ELC after one month (based on section 152 DFBA, allowing the inclusion of covered bonds in full) show that, with the exception of two small banks, all Danish banks maintain a positive coverage, with the smaller banks (Groups 3 and 4) having a relatively stronger liquidity position. Median and lower quartile of each group are well above both the regulatory minimum (section 152 DFBA) and the minimum under the Supervisory Diamond. Aggregate ratios for different groups range between 162 and 530 percent. These results underline that if covered bonds are in full included in the calculation of liquid assets, the Danish banks appear to have adequate capacity to withstand liquidity shocks.^{21,22}

²¹ Differences between group 1 and 2 on the one hand and group 3 and 4 on the other hand can be explained by the different nature of the particular scenario, and to some extent also by differences in funding patterns (with the smaller banks relying on more conservative funding strategies).

²² Figure 28 shows the evolution of banks' ELC over a 12-month period. Even after six months of substantial funding stress, the median of the sample would still be well above the regulatory minimum and close to the requirement

(continued)

Box 2. Denmark: Treatment of Danish Covered Bonds in the Calculation of HQLA

The Basel III proposal for a Liquidity Coverage Ratio and liquidity risk monitoring tools (BCBS 2013) provides that CBs not issued by a financial institution itself or its affiliated entities (like MCIs part of a banking group) be classified as Level 2A HQLA. Since CBs would not qualify for the highest HQLA level, a haircut of 15 percent is applied to current market values, compensation for the lower liquidity of Level 2A assets. Furthermore, the proposal limits the amount of CBs to 40 percent of total HQLA. The definition and composition of HQLA have not yet been agreed on the EU level. The EU ruling is expected for September 2014.

The Danish section 152 DFBA liquidity buffer is, structurally, similar to the LCR in the sense that both measures are short-term coverage ratios. However, there is no such detailed differentiation according to types of assets and liabilities—banks simply have to hold at least 15 percent of all short-term liabilities in liquid assets. The definition of liquid assets is also considerably wider, includes Danish CBs in full, and further allows banks to include all central bank eligible securitizations. While MCIs are not covered under section 152 DFBA, MCIs have to comply with the LCR.

The treatment under Basel III imposes four issues: First, Level 2A classification implies a 15 percent haircut on CB market values. Second, secured funding transactions backed by Level 2A assets experience an outflow of 15 percent. Third, the size of the Level 2 buffer is capped at 40 percent of total HQLA. Hence, a considerable fraction of Danish CBs does not count towards HQLA. And fourth, the calculation of the 40 percent cap should take into account the impact of the stock of HQLA on the amounts of Level 1 and Level 2 assets involved in secured funding. Hence, the amount of Level 1 and Level 2A assets has to be adjusted in order to include the impact of an unwinding of short-term secured funding (incl. repos), lending and collateral swap transactions that involve the exchange of any HQLA for any Level 2A assets that meet (or would meet if held unencumbered) the operational requirements for HQLA (see BCBS, 2013, Annex 1, point 4). Adjustments due to a hypothetical unwinding of repos, to which CBs are often pledged, have a notable impact on the calculation of the 40 percent cap and on the amount of CBs that can be included in HQLA.

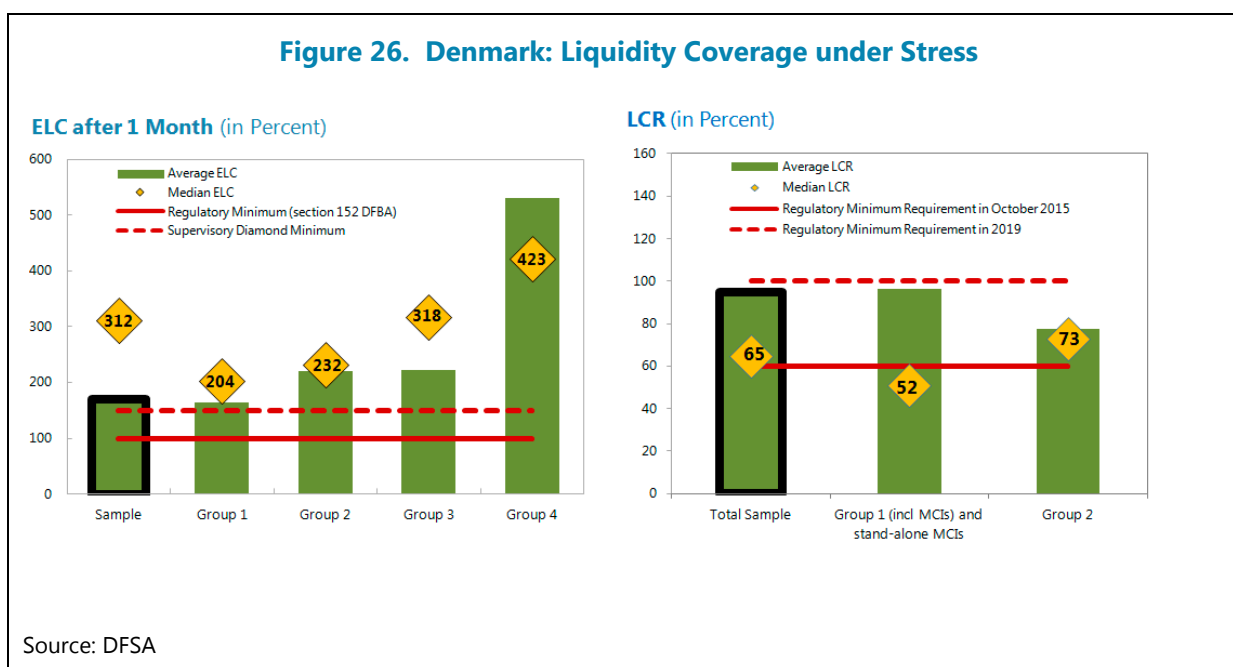
In October 2014, the European Commission ruled on the implementation of the Basel ratios in the European Union (CRD IV). The most liquid CBs qualify as Level 1 HQLA, but experienced a haircut of 7 percent, and were capped at 70 percent of the liquidity buffer, reflecting concentration and market liquidity risks. Less liquid covered bonds were assigned a 15 percent haircut and a cap of 40 percent. The limits also capture rollover risk, at least to some extent.

- **Banks and MCIs are expected to meet the liquidity coverage ratio (LCR), as implemented in the EU** (Figure 26, right chart). The European Commission (EC) recently specified that high-quality covered bonds that meet certain criteria may be classified as Level 1 HQLA up to a ceiling of 70 percent and with a haircut of 7 percent. Using this definition, the median bank in the

under the Supervisory Diamond. 82 percent of banks would still be above the section 152 DFBA regulatory minimum. And after 12 months, 60 percent of banks would still be able to absorb the shocks under the stress scenario.

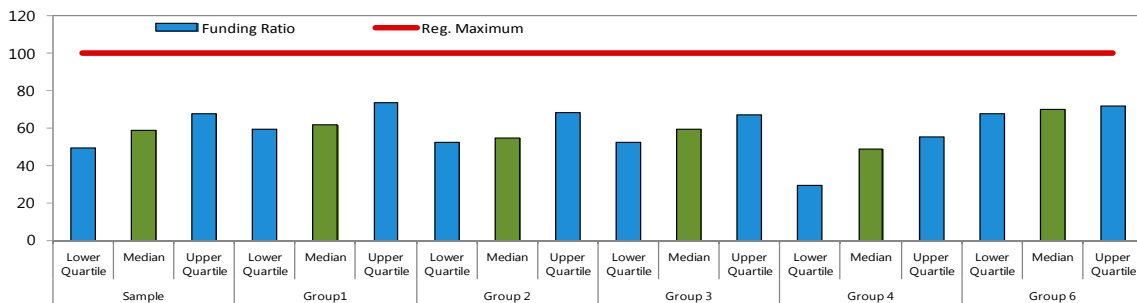
sample had an LCR of 65 percent as of end-2013, reflecting slightly stronger liquidity positions in Group 2 (medium-sized) banks than in Group 1 banks and stand-alone MCIs. The liquidity shortfall for the sample under the LCR is DKK 17.2 bn (USD 3.2 bn) for the 60 percent requirement applicable from October 2015, and DKK 82.0 bn (USD 15.1 bn) for the 100 percent requirement in 2019. This equals 1.0 percent and 4.6 percent of nominal annual GDP (basis 2013). Banks are expected to meet the phased-in LCR requirement in the EU (which starts at 60 percent in October 2015 and increases to 100 percent in January 2018), including by exchanging some covered bonds for sovereign bonds, or by selling Level 2a CBs and buying Level 1 CBs. If institutions switch current holdings of non-eligible HQLA to eligible HQLA, for instance, the shortfall to a 100 percent minimum would only be approximately DKK 6 bn (USD 1.1 bn).

Figure 26. Denmark: Liquidity Coverage under Stress



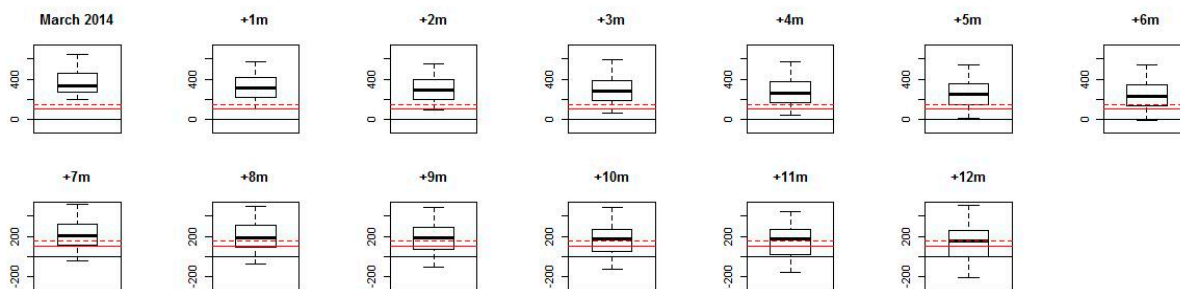
50. Danish banks' funding patterns appear very solid (Figure 27). With two exceptions, all banks have ratios below the regulatory limit of 100 percent. The median values are highest for group 1 and 2 banks, indicating less stable funding behavior. Group 4 banks have a low reliance on wholesale funding and, therefore, fare best in structural maturity mismatch tests.

Figure 27. Denmark: Stability of Banks' Funding Sources



Source: DFSA. IMF staff illustration.

Figure 28. Denmark: Distribution of Banks' ELC over Time



Source: DFSA. IMF staff illustrations.

Notes: These (Tukey) box-plots give the upper and lower quartile (defining the box), the median (horizontal bar inside the box), and the whiskers, which mark the lowest ELC still within 1.5 times the inter-quartile range of the lower quartile, and the highest observation still within 1.5 inter-quartiles of the upper quartile. Outliers, defined as values outside the whiskers, are not shown.

RECOMMENDATIONS

51. The DN is encouraged to expand its financial stability analyses to include the insurance and pension fund sector. The Danish insurance and pension fund sector is large compared to other European countries, its assets accounting for around 170 of GDP. In turn, households have large pension assets. The interconnectedness with other parts of the financial system reflects large holdings in covered bonds and active participation in long-term assets including Danish government bonds and interest rate swaps. In a stressed situation, insurance companies could shift significant portions of their holdings in order to reduce capital requirements and improve solvency positions. Although specific macro-prudential tools targeted at the insurance and pension fund sector are still in an early development stage, the analysis of the sector and its inter-linkages needs to be strengthened.

52. The DFSA is encouraged to complement its well-established microprudential stress testing framework (the so-called “traffic light system”) with state-of-the-art macroprudential stress testing for the insurance and pension fund sector. The macro stress test should be:

- **Severe (but plausible):** Scenarios should entail a high degree of conservativeness and address structural specificities of the Danish insurance sector, especially the concentrated investments in covered bonds, adequately.
- **Comprehensive:** The test should also include risk factors which are not covered by the Solvency II standard formula, e.g. sovereign risk or changes in the ultimate forward rate.
- **Forward-looking:** The test should capture long-term dynamics, e.g. prolonged low interest rates, and assess the feasibility of various risk-mitigating strategies.
- **Easy to communicate:** Each scenario should be based on a clear narrative.

53. The authorities are advised to exploit further synergies between micro- and macro-prudential stress testing through intensified cooperation between the DFSA and DN. The authorities are in excellent position to further increase the quality of stress testing. The DFSA has substantial experience in supervisory bottom-up stress testing, having also participated in European-wide exercises, while the DN has been performing and publishing stress tests for the banking sector. The advantages of supervisory and surveillance stress tests can be fully combined through increased cooperation, and idiosyncratic and systemic risks be analyzed together. Banks-specific results and responses to shocks can be studied on the level of the financial system and, in a next step, the impact on the real economy may be assessed. The DN is already participating in international working groups on the integration of such second-round effects.

54. From a prudential perspective, the DFSA should continue scrutinizing the asset-liability management of life insurers and encourage risk management which takes into account the potentially considerable roll-over risks inherent in the use of interest rate derivatives.

Appendix I. Risk Assessment Matrix (RAM)¹

Source of Risk and Relative Likelihood (High, medium, or low)	Expected Impact if Threat is Realized (High, medium, or low)
<p style="text-align: center;">High</p> <p>Protracted period of slower global growth in advanced and emerging economies:</p> <ul style="list-style-type: none"> Advanced economies: Lower-than anticipated potential growth and persistently low inflation due to a failure to fully address legacies of the financial crisis, leading to secular stagnation. Emerging markets: Maturing of the cycle, misallocation of investment, and incomplete structural reforms leading to prolonged slower growth. 	<p style="text-align: center;">Medium</p> <ul style="list-style-type: none"> Weaker GDP growth and higher unemployment would increase nonperforming loans and lead to higher loan loss impairments, weighing on banks' profitability. Life insurance companies and pension funds would face difficulties in attracting long-term savings in an environment of low interest rates; servicing contracts with guaranteed interest rates would weigh on profitability. <p>This risk has been analyzed in a macrofinancial scenario.</p>
<p style="text-align: center;">High</p> <p>Surge in global financial market volatility</p> <ul style="list-style-type: none"> Global financial market volatility triggered by geopolitical tensions or revised market expectations about UMP exit/emerging market fundamentals. Broad-based correction in asset valuations and an intensification of liquidity strains. 	<p style="text-align: center;">Medium</p> <ul style="list-style-type: none"> Further increase in NPLs, along with higher loss rates due to real estate collateral devaluation, would put pressure on loan generation and banks' and MCIs' profitability. In the face of higher volatility, MCIs would be constrained in their ability to post additional collateral to maintain the bonds' cover ratios. Insurers and pension funds would face market-value losses on their investments, thereby endangering their solvency position, and lowering their investment income. <p>This risk has been analyzed in a macrofinancial scenario.</p>
<p style="text-align: center;">Low</p> <p>A drop in confidence in Danish covered bonds</p> <ul style="list-style-type: none"> A reassessment of household risk could increase concerns about mortgage banks and hence about covered bonds. Under stress conditions, the prospect of forcible extension of covered bond maturities could heighten investor concerns about refinancing risk. 	<p style="text-align: center;">High</p> <ul style="list-style-type: none"> Investors, especially foreigners, would retrench from the Danish covered bond market, which would create financing problems, especially for mortgage credit institutions. Mark-downs of covered bonds would hurt the solvency of banks, life insurance companies, and pension funds. <p>This risk has been analyzed in a sensitivity test.</p>

¹ The Risk Assessment Matrix (RAM) shows events that could materially alter the baseline path (the scenario most likely to materialize in the view of IMF staff). The relative likelihood of risks listed is the staff's subjective assessment of the risks surrounding the baseline ("low" is meant to indicate a probability below 10 percent, "medium" a probability between 10 and 30 percent, and "high" a probability between 30 and 50 percent). The RAM reflects staff views on the source of risks and overall level of concern as of the time of discussions with the authorities. Non-mutually exclusive risks may interact and materialize jointly.

Appendix II. Macroeconomic Baseline and Stress Scenarios

Baseline

		2014	2015	2016	2017	2018
Denmark	Real GDP growth (%)	1.2	1.5	1.5	1.5	1.5
	Real consumption growth (%)	1.2	1.8	2.0	2.0	2.0
	Export growth (%)	2.6	3.3	3.6	3.6	3.6
	Unemployment rate (%)	7.1	7.0	6.8	6.6	6.4
	Real estate prices (index level, 2010=100)	91.6	92.0	92.3	92.6	92.9
	Exchange rate vs. euro	0.134	0.134	0.134	0.134	0.134
Germany	Real GDP growth (%)	1.4	1.4	1.3	1.3	1.2
	Real consumption growth (%)	1.1	1.3	1.3	1.3	1.2
	Export growth (%)	6.7	4.2	4.6	5.4	6.3
	Unemployment rate (%)	5.5	5.5	5.5	5.5	5.5
Sweden	Real GDP growth (%pt deviation)	2.3	2.3	2.3	2.4	2.4
	Real consumption growth (%pt deviation)	2.6	2.1	2.1	2.4	2.4
	Export growth (%pt deviation)	3.5	6.1	6.1	6.2	6.2
	Unemployment rate (%)	7.7	7.5	7.1	6.7	6.4
	Real estate prices (index level, 2010=100)	99.5	100.4	100.8	101.2	101.7
	Exchange rate vs. euro	0.112	0.112	0.112	0.112	0.112
United Kingdom	Real GDP growth (%pt deviation)	1.9	2.0	2.0	2.1	2.3
	Real consumption growth (%pt deviation)	1.9	2.1	2.3	2.3	2.3
	Export growth (%pt deviation)	2.8	4.3	4.6	5.1	5.3
	Unemployment rate (%)	7.5	7.3	7.0	6.7	6.5
	Exchange rate vs. euro	1.196	1.196	1.196	1.196	1.196
United States	Real GDP growth (%pt deviation)	2.6	3.4	3.5	3.4	3.1
	Real consumption growth (%pt deviation)	2.4	2.6	2.7	2.5	2.4
	Export growth (%pt deviation)	3.6	3.7	4.4	4.6	4.6
	Unemployment rate (%)	7.4	6.9	6.4	5.9	5.6
	Exchange rate vs. euro	0.738	0.738	0.738	0.738	0.738
Norway	Real GDP growth (%pt deviation)	2.3	2.3	2.2	2.2	2.2
	Real consumption growth (%pt deviation)	3.3	3.1	2.9	2.8	2.8
	Export growth (%pt deviation)	1.4	1.5	1.5	1.6	1.6
	Unemployment rate (%)	3.3	3.3	3.4	3.5	3.5
	Real estate prices (index level, 2010=100)	112.9	115.5	117.6	118.7	119.8
	Exchange rate vs. euro	0.122	0.122	0.122	0.122	0.122
Netherlands	Real GDP growth (%pt deviation)	0.3	1.6	1.8	2.0	2.2
	Real consumption growth (%pt deviation)	-1.2	-0.3	1.0	1.4	1.7
	Export growth (%pt deviation)	3.0	2.4	2.9	3.4	3.4
	Unemployment rate (%)	7.4	7.0	6.6	6.1	5.8
Finland	Real GDP growth (%pt deviation)	1.1	1.4	2.0	2.0	2.0
	Real consumption growth (%pt deviation)	1.7	2.2	2.2	2.2	2.2
	Export growth (%pt deviation)	2.8	3.2	3.7	3.8	3.8
	Unemployment rate (%)	7.9	7.8	7.7	7.6	7.5
	Real estate prices (index level, 2010=100)	97.5	97.6	97.8	98.0	98.3

Source: IMF World Economic Outlook (WEO), OECD, and IMF staff estimates.

Shocks to Macroeconomic and Financial Variables

Slow Growth Scenario

		2014	2015	2016	2017	2018
Denmark	Real GDP growth (%pt deviation)	-0.5	-0.5	-0.5	-0.5	-0.5
	Real consumption growth (%pt deviation)	-0.4	-0.5	-0.7	-0.7	-0.7
	Export growth (%pt deviation)	-1.1	-1.0	-1.0	-0.8	-0.8
	Unemployment rate (%pt deviation)	0.1	0.2	0.3	0.5	0.6
	Real estate prices (index level, 2010=100)	-0.9	-1.1	-2.4	-3.6	-5.2
	Exchange rate vs. euro (%pt deviation; +=appreciation for local currency)	0.0	0.0	0.0	0.0	0.0
Germany	Real GDP growth (%pt deviation)	-0.7	-0.7	-0.6	-0.6	-0.5
	Real consumption growth (%pt deviation)	-0.3	-0.6	-0.6	-0.7	-0.6
	Export growth (%pt deviation)	-1.6	-1.3	-1.1	-0.9	-0.8
	Unemployment rate (%pt deviation)	0.1	0.3	0.5	0.7	0.8
Sweden	Real GDP growth (%pt deviation)	-0.4	-0.5	-0.8	-0.8	-0.1
	Real consumption growth (%pt deviation)	-0.1	-0.4	-0.8	-1.0	-0.8
	Export growth (%pt deviation)	-0.9	-1.0	-1.3	-1.1	-0.2
	Unemployment rate (%pt deviation)	0.0	0.1	0.1	0.1	0.2
	Real estate prices (% deviation)	0.2	0.1	-0.1	-0.4	-0.6
	Exchange rate vs. euro (%pt deviation; +=appreciation for local currency)	-0.8	-1.4	-2.2	-3.2	-4.5
United Kingdom	Real GDP growth (%pt deviation)	-0.4	-0.3	-0.2	-0.2	-0.1
	Real consumption growth (%pt deviation)	-0.2	-0.2	-0.2	-0.2	-0.2
	Export growth (%pt deviation)	-1.3	-1.1	-1.0	-0.7	-0.6
	Unemployment rate (%pt deviation)	0.0	0.1	0.1	0.2	0.2
	Exchange rate vs. euro (%pt deviation; +=appreciation for local currency)	-0.3	-0.8	-1.7	-2.7	-4.0
United States	Real GDP growth (%pt deviation)	-0.7	-1.1	-1.2	-0.9	-0.3
	Real consumption growth (%pt deviation)	-0.5	-1.0	-1.3	-1.0	-0.5
	Export growth (%pt deviation)	-1.9	-1.6	-1.1	-1.2	-0.6
	Unemployment rate (%pt deviation)	0.1	0.4	0.5	0.5	0.5
	Exchange rate vs. euro (%pt deviation; +=appreciation for local currency)	-0.2	-0.1	-0.9	-1.6	-2.4
Norway	Real GDP growth (%pt deviation)	-0.3	-0.5	-0.7	-0.8	-0.3
	Real consumption growth (%pt deviation)	-0.1	-0.4	-0.6	-0.9	-0.7
	Export growth (%pt deviation)	-1.0	-1.1	-1.5	-1.4	-0.4
	Unemployment rate (%pt deviation)	0.0	0.1	0.1	0.1	0.2
	Real estate prices (% deviation)	0.1	0.0	-0.3	-0.6	-0.8
	Exchange rate vs. euro (%pt deviation; +=appreciation for local currency)	-0.5	-0.7	-1.2	-1.9	-3.4
Netherlands	Real GDP growth (%pt deviation)	-0.6	-0.6	-0.6	-0.5	-0.5
	Real consumption growth (%pt deviation)	-0.3	-0.5	-0.5	-0.5	-0.5
	Export growth (%pt deviation)	-1.1	-1.1	-1.0	-0.8	-0.7
	Unemployment rate (%pt deviation)	0.1	0.3	0.5	0.6	0.8
Finland	Real GDP growth (%pt deviation)	-0.7	-0.6	-0.6	-0.5	-0.5
	Real consumption growth (%pt deviation)	-0.4	-0.7	-0.9	-0.8	-0.8
	Export growth (%pt deviation)	-1.4	-1.1	-0.9	-0.7	-0.7
	Unemployment rate (%pt deviation)	0.1	0.3	0.5	0.7	0.8
	Real estate prices (% deviation)	-1.2	-1.7	-3.3	-4.9	-6.8

Source: IMF staff estimates.

Effects of Shocks on Macroeconomic and Financial Variables

Slow Growth Scenario

		2014	2015	2016	2017	2018
Denmark	Real GDP growth (%)	0.7	1.0	1.0	1.1	1.0
	Real consumption growth (%)	0.8	1.3	1.3	1.3	1.3
	Export growth (%)	1.5	2.3	2.7	2.8	2.8
	Unemployment rate (%)	7.2	7.2	7.1	7.1	7.0
	Real estate prices (index level, 2010=100)	90.7	91.0	90.1	89.2	88.1
	Exchange rate vs. euro	0.134	0.134	0.134	0.134	0.134
Germany	Real GDP growth (%)	0.7	0.7	0.7	0.7	0.7
	Real consumption growth (%)	0.8	0.7	0.7	0.7	0.6
	Export growth (%)	5.1	2.9	3.5	4.5	5.5
	Unemployment rate (%)	5.6	5.8	6.0	6.2	6.3
Sweden	Real GDP growth (%)	1.9	1.8	1.6	1.6	2.2
	Real consumption growth (%)	2.4	1.7	1.4	1.4	1.6
	Export growth (%)	2.5	5.1	4.8	5.1	6.0
	Unemployment rate (%)	7.8	7.6	7.3	6.9	6.6
	Real estate prices (index level, 2010=100)	98.7	99.0	98.6	98.0	97.1
	Exchange rate vs. euro	0.111	0.111	0.110	0.109	0.107
United Kingdom	Real GDP growth (%)	1.5	1.7	1.8	1.9	2.2
	Real consumption growth (%)	1.7	1.9	2.1	2.1	2.1
	Export growth (%)	1.5	3.2	3.7	4.4	4.7
	Unemployment rate (%)	7.6	7.4	7.1	6.9	6.7
	Exchange rate vs. euro	1.192	1.186	1.176	1.164	1.148
United States	Real GDP growth (%)	1.9	2.3	2.3	2.5	2.8
	Real consumption growth (%)	1.9	1.6	1.4	1.5	1.9
	Export growth (%)	1.7	2.2	3.3	3.4	4.0
	Unemployment rate (%)	7.5	7.3	6.9	6.4	6.1
	Exchange rate vs. euro	0.736	0.738	0.732	0.726	0.720
Norway	Real GDP growth (%)	2.0	1.8	1.5	1.4	2.0
	Real consumption growth (%)	3.2	2.7	2.3	1.9	2.1
	Export growth (%)	0.4	0.4	0.1	0.2	1.2
	Unemployment rate (%)	3.3	3.4	3.5	3.6	3.7
	Real estate prices (index level, 2010=100)	112.9	115.5	117.2	117.9	118.9
	Exchange rate vs. euro	0.121	0.121	0.120	0.119	0.118
Netherlands	Real GDP growth (%)	-0.3	1.0	1.2	1.5	1.8
	Real consumption growth (%)	-1.5	-0.8	0.5	1.0	1.2
	Export growth (%)	1.9	1.3	1.9	2.6	2.7
	Unemployment rate (%)	7.5	7.3	7.0	6.8	6.6
Finland	Real GDP growth (%pt deviation)	0.5	0.8	1.3	1.5	1.5
	Real consumption growth (%pt deviation)	1.3	1.5	1.3	1.4	1.4
	Export growth (%pt deviation)	1.4	2.2	2.8	3.1	3.1
	Unemployment rate (%)	8.0	8.1	8.2	8.3	8.3
	Real estate prices (index level, 2010=100)	96.3	95.9	94.6	93.3	91.6

Source: IMF staff estimates.

Shocks to Macroeconomic and Financial Variables

Adverse Scenario

		2014	2015	2016	2017	2018
Denmark	Real GDP growth (%pt deviation)	-3.8	-1.6	-1.1	-0.9	-0.8
	Real consumption growth (%pt deviation)	-3.2	-2.2	-1.9	-1.5	-1.1
	Export growth (%pt deviation)	-8.3	-2.5	-1.2	-0.8	-0.7
	Unemployment rate (%pt deviation)	0.7	1.2	1.5	1.7	1.8
	Real estate prices (index level, 2010=100)	-7.0	-6.5	-10.3	-14.1	-17.9
	Exchange rate vs. euro (%pt deviation; +=appreciation for local currency)	0.0	0.0	0.0	0.0	-0.1
Germany	Real GDP growth (%pt deviation)	-5.4	-1.9	-0.9	-0.6	-0.5
	Real consumption growth (%pt deviation)	-2.2	-2.5	-1.3	-1.0	-0.8
	Export growth (%pt deviation)	-12.2	-2.0	-0.3	-0.2	-0.3
	Unemployment rate (%pt deviation)	1.1	1.9	2.2	2.3	2.3
Sweden	Real GDP growth (%pt deviation)	-2.7	-0.4	-0.3	-0.5	-0.1
	Real consumption growth (%pt deviation)	-1.1	-1.8	-1.7	-1.8	-1.4
	Export growth (%pt deviation)	-7.1	-0.8	-0.2	-0.4	0.2
	Unemployment rate (%pt deviation)	0.3	0.4	0.3	0.2	0.2
	Real estate prices (% deviation)	1.3	0.4	-0.3	-1.1	-1.8
	Exchange rate vs. euro (%pt deviation; +=appreciation for local currency)	-6.1	-8.8	-11.2	-13.5	-15.8
United Kingdom	Real GDP growth (%pt deviation)	-3.1	-0.8	-0.2	-0.2	-0.3
	Real consumption growth (%pt deviation)	-1.7	-1.5	-1.0	-0.7	-0.7
	Export growth (%pt deviation)	-9.9	-1.2	0.1	-0.1	-0.3
	Unemployment rate (%pt deviation)	0.3	0.6	0.8	0.8	0.9
	Exchange rate vs. euro (%pt deviation; +=appreciation for local currency)	-1.9	-5.3	-8.2	-10.3	-12.1
United States	Real GDP growth (%pt deviation)	-5.3	-3.3	-2.6	-1.7	-0.3
	Real consumption growth (%pt deviation)	-4.0	-4.2	-3.5	-2.4	-0.9
	Export growth (%pt deviation)	-14.4	0.1	0.3	-0.3	0.4
	Unemployment rate (%pt deviation)	0.8	1.8	2.4	2.5	2.3
	Exchange rate vs. euro (%pt deviation; +=appreciation for local currency)	-1.5	-3.6	-4.5	-5.4	-7.3
Norway	Real GDP growth (%pt deviation)	-2.4	-0.8	-0.6	-0.6	-0.1
	Real consumption growth (%pt deviation)	-0.7	-1.9	-0.8	-0.8	-0.4
	Export growth (%pt deviation)	-7.8	-1.1	-0.7	-0.8	0.0
	Unemployment rate (%pt deviation)	0.2	0.3	0.3	0.3	0.4
	Real estate prices (% deviation)	0.6	0.0	-0.6	-1.1	-1.4
	Exchange rate vs. euro (%pt deviation; +=appreciation for local currency)	-3.6	-6.6	-9.1	-11.5	-14.4
Netherlands	Real GDP growth (%pt deviation)	-4.6	-2.2	-1.0	-0.4	-0.2
	Real consumption growth (%pt deviation)	-2.2	-2.3	-1.1	-0.7	-0.5
	Export growth (%pt deviation)	-8.6	-3.2	-1.0	-0.2	-0.1
	Unemployment rate (%pt deviation)	0.9	1.8	2.2	2.4	2.3
Finland	Real GDP growth (%pt deviation)	-5.3	-1.7	-0.8	-0.3	-0.1
	Real consumption growth (%pt deviation)	-3.5	-3.7	-2.8	-1.5	-0.8
	Export growth (%pt deviation)	-10.9	-1.2	0.2	0.3	0.0
	Unemployment rate (%pt deviation)	1.1	1.9	2.3	2.5	2.4
	Real estate prices (% deviation)	-8.8	-9.3	-13.6	-17.6	-21.5

Source: IMF staff estimates.

Effects of Shocks on Macroeconomic and Financial Variables

Adverse Scenario

		2014	2015	2016	2017	2018
Denmark	Real GDP growth (%)	-2.6	-0.1	0.5	0.6	0.7
	Real consumption growth (%)	-2.0	-0.4	0.1	0.5	0.9
	Export growth (%)	-5.7	0.8	2.5	2.8	2.9
	Unemployment rate (%)	7.8	8.2	8.3	8.3	8.2
	Real estate prices (index level, 2010=100)	85.2	86.1	82.8	79.6	76.3
	Exchange rate vs. euro	0.134	0.134	0.134	0.134	0.134
Germany	Real GDP growth (%)	-4.0	-0.5	0.4	0.6	0.7
	Real consumption growth (%)	-1.1	-1.2	0.0	0.3	0.4
	Export growth (%)	-5.5	2.2	4.3	5.2	6.0
	Unemployment rate (%)	6.6	7.3	7.7	7.8	7.8
Sweden	Real GDP growth (%)	-0.4	1.9	2.0	1.8	2.3
	Real consumption growth (%)	1.5	0.3	0.4	0.6	1.1
	Export growth (%)	-3.6	5.3	5.9	5.8	6.4
	Unemployment rate (%)	8.0	7.9	7.4	6.9	6.6
	Real estate prices (index level, 2010=100)	100.8	100.7	100.4	100.1	99.8
	Exchange rate vs. euro	0.105	0.102	0.100	0.097	0.094
United Kingdom	Real GDP growth (%)	-1.2	1.2	1.8	1.8	2.0
	Real consumption growth (%)	0.1	0.6	1.3	1.6	1.6
	Export growth (%)	-7.1	3.2	4.7	5.0	5.0
	Unemployment rate (%)	7.8	7.9	7.8	7.6	7.4
	Exchange rate vs. euro	1.173	1.132	1.098	1.072	1.051
United States	Real GDP growth (%)	-2.7	0.0	0.9	1.6	2.7
	Real consumption growth (%)	-1.5	-1.6	-0.8	0.1	1.5
	Export growth (%)	-10.8	3.8	4.8	4.3	5.0
	Unemployment rate (%)	8.2	8.7	8.7	8.4	7.9
	Exchange rate vs. euro	0.727	0.711	0.705	0.698	0.684
Norway	Real GDP growth (%)	-0.1	1.5	1.6	1.6	2.1
	Real consumption growth (%)	2.5	1.2	2.1	2.0	2.4
	Export growth (%)	-6.4	0.4	0.8	0.7	1.6
	Unemployment rate (%)	3.5	3.6	3.7	3.8	3.9
	Real estate prices (index level, 2010=100)	113.5	115.5	116.9	117.4	118.1
	Exchange rate vs. euro	0.117	0.114	0.111	0.108	0.104
Netherlands	Real GDP growth (%)	-4.3	-0.5	0.9	1.6	2.0
	Real consumption growth (%)	-3.4	-2.6	-0.1	0.7	1.2
	Export growth (%)	-5.6	-0.8	1.9	3.2	3.3
	Unemployment rate (%)	8.3	8.8	8.8	8.5	8.1
Finland	Real GDP growth (%)	-4.1	-0.3	1.2	1.7	1.9
	Real consumption growth (%)	-1.8	-1.5	-0.6	0.7	1.4
	Export growth (%)	-8.0	2.0	3.9	4.1	3.8
	Unemployment rate (%)	9.0	9.7	10.0	10.1	9.9
	Real estate prices (index level, 2010=100)	88.9	88.5	84.5	80.8	77.1

Source: IMF staff estimates.

Interest rate scenarios

The interest rate shock determines changes in the risk-free interest rate term structure. The shocks for “up to two years” and “10.01 years and beyond” have been derived from WEO projections and the deviations provided by the macro model (short-term and long-term government bonds). The other maturities have been interpolated. For market risks, the deviations are assumed to occur all at once in the first year of the projection horizon.

<i>DKK : risk-free interest rate in percent</i>	2014	2015	2016	2017	2018
	Baseline scenario				
up to 2 years	0.35	0.62	1.13	1.72	2.16
2.01 to 5.00 years	0.89	1.17	1.57	2.00	2.35
5.01 to 10.00 years	1.51	1.80	2.08	2.31	2.57
10.01 years and beyond	1.90	2.20	2.40	2.50	2.70
	Slow growth scenario				
up to 2 years	0.35	0.38	0.63	0.86	1.02
2.01 to 5.00 years	0.84	0.91	1.08	1.20	1.33
5.01 to 10.00 years	1.41	1.51	1.59	1.59	1.69
10.01 years and beyond	1.76	1.89	1.91	1.84	1.92
	Adverse scenario				
up to 2 years	0.35	0.41	0.66	0.88	1.05
2.01 to 5.00 years	0.53	0.74	0.95	1.10	1.25
5.01 to 10.00 years	0.75	1.13	1.30	1.35	1.49
10.01 years and beyond	0.88	1.37	1.51	1.51	1.64

*GBP : risk-free interest
rate in percent*

	2014	2015	2016	2017	2018
Baseline scenario					
up to 2 years	0.77	1.29	2.12	2.89	3.45
2.01 to 5.00 years	1.65	2.07	2.68	3.23	3.64
5.01 to 10.00 years	2.65	2.97	3.33	3.63	3.86
10.01 years and beyond	3.27	3.53	3.73	3.88	3.99
Slow growth scenario					
up to 2 years	0.71	1.01	1.60	2.21	2.66
2.01 to 5.00 years	1.58	1.83	2.25	2.67	2.98
5.01 to 10.00 years	2.57	2.77	3.00	3.20	3.34
10.01 years and beyond	3.19	3.36	3.46	3.53	3.57
Adverse scenario					
up to 2 years	0.71	1.04	1.41	2.00	2.60
2.01 to 5.00 years	1.41	1.72	2.00	2.41	2.83
5.01 to 10.00 years	2.21	2.49	2.67	2.88	3.10
10.01 years and beyond	2.71	2.98	3.08	3.17	3.27

*EUR : risk-free interest
rate in percent*

	2014	2015	2016	2017	2018
Baseline scenario					
up to 2 years	0.54	0.96	1.59	2.17	2.55
2.01 to 5.00 years	1.02	1.40	1.88	2.29	2.60
5.01 to 10.00 years	1.56	1.89	2.20	2.42	2.66
10.01 years and beyond	1.90	2.20	2.40	2.50	2.70
Slow growth scenario					
up to 2 years	0.54	0.76	1.16	1.41	1.54
2.01 to 5.00 years	0.97	1.16	1.44	1.57	1.70
5.01 to 10.00 years	1.46	1.62	1.75	1.77	1.87
10.01 years and beyond	1.76	1.90	1.94	1.89	1.98
Adverse scenario					
up to 2 years	0.54	0.81	1.21	1.45	1.59
2.01 to 5.00 years	0.66	1.01	1.33	1.49	1.63
5.01 to 10.00 years	0.79	1.24	1.46	1.54	1.68
10.01 years and beyond	0.88	1.39	1.55	1.57	1.71

*USD : risk-free interest
rate in percent*

	2014	2015	2016	2017	2018
Baseline scenario					
up to 2 years	0.09	0.16	0.93	2.08	3.59
2.01 to 5.00 years	1.15	1.33	2.07	3.06	4.23
5.01 to 10.00 years	2.35	2.68	3.38	4.20	4.97
10.01 years and beyond	3.10	3.51	4.20	4.90	5.43
Slow growth scenario					
up to 2 years	0.09	0.15	0.20	0.81	2.23
2.01 to 5.00 years	1.12	1.27	1.49	2.11	3.22
5.01 to 10.00 years	2.30	2.55	2.97	3.59	4.35
10.01 years and beyond	3.04	3.36	3.89	4.52	5.06
Adverse scenario					
up to 2 years	0.09	0.18	0.23	0.27	0.31
2.01 to 5.00 years	0.98	1.15	1.39	1.65	1.86
5.01 to 10.00 years	1.99	2.27	2.72	3.22	3.63
10.01 years and beyond	2.62	2.96	3.56	4.21	4.73

Corporate Bond Spread Scenarios

Slow growth scenario :

<i>Spread change in percentage points</i>	AAA	AA	A	BBB	BB and lower	Unrated
Non-financial corporate bonds	0.39	0.49	0.62	1.24	3.10	1.49
Financial corporate bonds, unsecured	0.42	0.57	1.30	3.14	7.86	3.77
Financial corporate bonds, secured / covered bonds	0.38	0.57	1.30	3.14	7.86	3.77

Adverse scenario :

<i>Spread change in percentage points</i>	AAA	AA	A	BBB	BB and lower	Unrated
Non-financial corporate bonds	0.52	0.55	0.77	1.40	3.50	1.68
Financial corporate bonds, unsecured	0.61	1.21	2.26	4.71	11.78	5.66
Financial corporate bonds, secured / covered bonds	0.43	1.21	2.26	4.71	11.78	5.66

Note: Figures give increases in percentage points

Appendix III. Stress Test Matrix (STeM) for the Banking Sector

Domain		Assumptions		
		Bottom-Up (financial institutions, DFSA, IMF FSAP team)	Top-Down (DN, IMF FSAP team)	Top-Down (FSAP Team)
BANKING SECTOR: SOLVENCY RISK				
1. Institutional Perimeter	Institutions included	<ul style="list-style-type: none"> • <u>6 banking groups</u>: Danske Bank Group, Nykredit Realkredit Group, Nordea Bank Danmark Group, Jyske Bank Group, Sydbank Group, BRFkredit Group. • <u>5 commercial banks</u> (unconsolidated): Danske Bank A/S, Nykredit Bank (subgroup), Nordea Bank Danmark A/S, Jyske Bank (group level), Sydbank (group level). • <u>5 mortgage credit institutions</u> (unconsolidated): Realkredit Danmark A/S, Nykredit Realkredit A/S, Totalkredit A/S, Nordea Kredit, BRFkredit. 	<ul style="list-style-type: none"> • <u>5 commercial banks</u> (unconsolidated): Danske Bank A/S, Nykredit Bank A/S, Nordea Bank Danmark A/S, Jyske Bank A/S, Sydbank A/S. 	<ul style="list-style-type: none"> • N/A
	Market share	<ul style="list-style-type: none"> • 95 percent of mortgage credit sector's and 87 percent of commercial banks' total assets 	<ul style="list-style-type: none"> • 87 percent of commercial banks' total assets 	<ul style="list-style-type: none"> • N/A
	Data and baseline date	<ul style="list-style-type: none"> • Data: bank-internal portfolio, income and balance sheet data • Audited financial statements as of end 2013. • Exposure coverage: (i) all credit risk-sensitive exposures, (ii) all market risk-sensitive exposures, including Danish and foreign sovereign exposures in the held-to-maturity portfolio of the banking book; (iii) cash-flow based funding liquidity data. 	<ul style="list-style-type: none"> • Data: Bank-by-bank supervisory data from year end 2013. • Audited financial statements as of end 2013. • Exposure coverage: (i) all credit risk-sensitive exposures, (ii) all market risk-sensitive exposures, including sovereign exposures as part of gross bond holdings. 	<ul style="list-style-type: none"> • N/A
2. Channels of	Methodology	<ul style="list-style-type: none"> • Constrained bottom-up stress test. • Participating banks' and mortgage credit 	<ul style="list-style-type: none"> • DN top-down stress testing framework (balance sheet-based regulatory 	<ul style="list-style-type: none"> • N/A

Domain		Assumptions		
		Bottom-Up (financial institutions, DFSA, IMF FSAP team)	Top-Down (DN, IMF FSAP team)	Top-Down (FSAP Team)
Risk Propagation		institutions' internal risk management framework.	approach).	
	Satellite Models for Macro-Financial linkages	<ul style="list-style-type: none"> • <u>Credit risk</u>: Banks' Internal Ratings Based (IRB) models and internal models for portfolios under the Standardized Approach; Basel III regulatory framework for calculating capital requirements. Direct and indirect credit risk covered. • <u>Market risk</u>: banks internal risk management models; Basel III regulatory framework for calculating capital requirements, including the market risk effect on RWA through stressed Value-at-Risk (VaR). • <u>Pre-impairment income</u>: bank internal risk management models. • <u>Liquidity risk</u>: Section 152 Danish Financial Business Act requirements (Funding Ratio, Excess Liquidity Coverage (ELC)); and CRD IV Liquidity Coverage Ratio. Estimates include both contractual and behavioral cash-flows, as well as market liquidity shocks. • <u>Credit growth</u>: scenario-dependent, dynamic balance sheet assumption (unconstrained). 	<ul style="list-style-type: none"> • <u>Credit risk</u>: Sectoral credit risk factor model (Abildgren and Damgaard, 2012); linear and static regression model. Regressors include unemployment rate, real long- and short-term interest rates, real growth in house prices. Parameter estimates are then recalibrated based on expert judgment; direct and indirect credit risk covered. • <u>Market risk</u>: Repricing of market-risk sensitive exposures, excluding sovereign debt holdings. • <u>Pre-impairment income</u>: Main income and expenses balance sheet items estimated from linear regression models, with institute-specific add-on estimated from past performance. • <u>Credit growth</u>: Endogenous growth modeling depending on profitability. • No tests for market and funding liquidity risks. 	<ul style="list-style-type: none"> • N/A
	Stress test horizon	<ul style="list-style-type: none"> • Five years (2014Q1–2018Q4); plus separate estimate of impact under full Basel III implementation (2019) 	<ul style="list-style-type: none"> • N/A 	
3. Tail shocks	Scenario analysis	<p>Stress scenarios are generated by the IMF's EUROMOD model. <u>Baseline scenario</u>: IMF World Economic Outlook (WEO), October 2013.</p>		

Domain		Assumptions		
		Bottom-Up (financial institutions, DFSA, IMF FSAP team)	Top-Down (DN, IMF FSAP team)	Top-Down (FSAP Team)
		<p><u>Protracted Slow Growth scenario</u> (Protracted period of slower global growth and prolonged weak consumer confidence in Denmark): Under this scenario, euro area growth deteriorates gradually but persistently. With this uncertainty combined with slower pace of improvement in house prices and household balance sheets, consumer confidence in Denmark does not recover sufficiently to boost private consumption. This would undermine the recovery, with lower levels of exports, residential investment and private consumption. Real GDP growth would be lower each year by about 0.5 percentage points than in the baseline scenario. Depressed collateral prices and slower GDP growth will have a negative impact on asset quality and profitability, increasing the share of NPLs and dampening the already weak profit-generation capacity. The five-year cumulative shock corresponds to a little over one standard deviation move in annual GDP growth relative to the baseline.</p> <p><u>Severe Stress scenario</u> (Surge in global financial market volatility due to geopolitical tensions, revised expectations about UMP exit in the United States, or concerns about fundamentals in emerging economies). Under this scenario, a slowdown in most major export markets (euro area, other Nordics, and the United States) would weigh heavily on Danish exports, undercutting the recovery sharply. Re-emergence of euro zone stress would also affect Denmark via shaken consumer confidence and delay the recovery of private consumption and house prices. A slowdown in emerging markets economies would reduce external demand for Danish exports. Real GDP growth would be lower by -3.8 percentage points in 2014 and -1.6 percentage points in 2015 than in the baseline scenario. Depressed collateral prices, higher unemployment, and lower GDP growth would have a negative impact on banks' profitability and asset quality. The adverse scenario constitutes a 2½ standard deviation shock (5.4 percentage points) to the two-year cumulative real GDP growth rate for 2014–15 compared to the baseline.</p>		
	Sensitivity analysis	<ul style="list-style-type: none"> • <u>Sovereign risk</u>: (country-specific yield shocks, including on own sovereign; including and excluding held-to-maturity portfolio of the banking book. • Hike in <u>Danish covered bond spreads</u> by 100 and 500 basis points. • <u>Credit concentration and counterparty credit</u> 	<ul style="list-style-type: none"> • N/A. 	<ul style="list-style-type: none"> • N/A.

Domain		Assumptions		
		Bottom-Up (financial institutions, DFSA, IMF FSAP team)	Top-Down (DN, IMF FSAP team)	Top-Down (FSAP Team)
		<p><u>risk</u>: (i) simultaneous default of largest 1, 3, 5, and 10 largest single exposures (paragraph 145, Art. V Danish Financial Business Act (DFBA)); (ii) simultaneous default of 1, 3, 5, 10, and all Large Exposures (defined according to paragraph 145, Art. IV DFBA);</p> <ul style="list-style-type: none"> • <u>Assumptions</u>: All off-balance sheet exposures covered (not only the 75 percent via the Credit Conversion Factor); conservative LGD assumption of 45 percent (for all banks and all tests); group-internal exposures excluded; losses calculated after deduction of eligible collateral (up to certain limits e.g. on housing collateral); • <u>Impact measure</u>: Change in capital ratio with and without gross profits as first line of defense. 		
4. Risks and Buffers	Risks/factors assessed	<ul style="list-style-type: none"> • Credit risk, direct and indirect • Credit concentration and counterparty default risk • Market risk (incl. sovereign risk) • Market liquidity risk • Funding liquidity risk • Funding cost risk 	<ul style="list-style-type: none"> • Credit risk, direct and indirect • Market risk (excl. sovereign risk) • Funding cost risk 	<ul style="list-style-type: none"> • N/A
	Behavioral adjustments	<ul style="list-style-type: none"> • Dynamic balance sheet assumption, bank-specific. • Depending on result and contractual obligations. • Constant portfolio allocation/composition. • No management actions. • No capital increases. • Outflow of capital due to CRD4 phasing-out 	<ul style="list-style-type: none"> • Balance sheet growth modeled endogenously, conditional on profitability. The risk-weights reported by banks under the bottom-up test were applied in the top-down test. • The risk-weights are kept constant for the remaining period. • Tax assumed at 25 percent of profits 	<ul style="list-style-type: none"> • N/A

Domain		Assumptions		
		Bottom-Up (financial institutions, DFSA, IMF FSAP team)	Top-Down (DN, IMF FSAP team)	Top-Down (FSAP Team)
		and redemptions of AT1/T2 capital (where relevant).	before tax. <ul style="list-style-type: none"> Dividend payout assumed at 25 percent of profits after tax before dividends. No management intervention assumed in asset disposal, lending standards or portfolio allocation. 	
5. Regulatory and Market-Based Standards and Parameters	Calibration of risk parameters	<ul style="list-style-type: none"> <u>Credit risk</u>: (PD and LGD): point-in-time parameters for Expected Loss estimation; through-the-cycle and point-in-time for capital requirements. <u>Market risk</u>: scenario parameters provided in terms of haircuts. 	<ul style="list-style-type: none"> <u>Credit risk</u>: Point-in-time “impairment rates” (i.e., loss rates) modeled directly (no explicit modeling of PD, LGD). <u>Market risk</u>: scenario parameters provided in terms of haircuts. 	• N/A
	Regulatory/Accounting and Market-Based Standards	<ul style="list-style-type: none"> CRD IV phase-in arrangements for CET1, Tier 1, and Total Capital. Includes Capital Conservation Buffer (CCB), SIFI buffer, as well as bank-specific Pillar 2 add-ons). IAS 39 accounting standards. RWA behave dynamically according to changes in credit and market risk parameters. 	<ul style="list-style-type: none"> CRD IV phase-in arrangements for CET1, Tier 1, and Total Capital. Includes Capital Conservation Buffer (CCB), SIFI buffer, as well as bank-specific Pillar 2 add-ons). IAS 39 accounting standards. RWA behave dynamically according to changes in credit and market risk parameters. 	• N/A
6. Reporting Format for Results	Output presentation	<ul style="list-style-type: none"> Evolution of capital ratios Solvency test result drivers System-wide capital shortfall Percentage of assets below regulatory minimum. 	<ul style="list-style-type: none"> Evolution of capital ratios System-wide capital shortfall Capital shortfall. 	• N/A

Domain		Assumptions		
		Bottom-Up (financial institutions, DFSA, IMF FSAP team)	Top-Down (DN, IMF FSAP team)	Top-Down (FSAP Team)
BANKING SECTOR: LIQUIDITY RISK				
1. Institutional Perimeter	Institutions included	<ul style="list-style-type: none"> Excess liquidity coverage test: 81 banks LCR: 16 banks and MCIs Funding ratio: 85 banks 	• N/A	• N/A
	Market share	<ul style="list-style-type: none"> 100 percent in terms of assets 	• N/A	• N/A
	Data and baseline date	<ul style="list-style-type: none"> Institutions internal and supervisory data as of March 2014. Unconsolidated data for excess liquidity coverage test and funding ratio Consolidated data for LCR 	• N/A	• N/A
2. Channels of Risk Propagation	Methodology	<ul style="list-style-type: none"> Coverage ratios (Excess Liquidity Coverage and CRD IV Liquidity Coverage Ratio) Structural maturity mismatch ratio: Cash-flow-based using maturity buckets (Funding Ratio) 	• N/A	• N/A
3. Risks and Buffers	Risks	<ul style="list-style-type: none"> Multi-factor scenarios comprising funding liquidity shocks and market liquidity shocks. 	• N/A	• N/A
	Buffers	<ul style="list-style-type: none"> Counterbalancing capacity. 	• N/A	• N/A
4. Tail shocks	Size of the shock	<ul style="list-style-type: none"> Dry-up of wholesale funding markets, loss in deposit funding; shocks to market values of liquid assets; downgrades of financial institutions. Please see detailed scenario tables for Excess Liquidity Coverage, and the CRD IV for details on LCR parameterization. 	• N/A	• N/A

Domain		Assumptions		
		Bottom-Up (financial institutions, DFSA, IMF FSAP team)	Top-Down (DN, IMF FSAP team)	Top-Down (FSAP Team)
5. Regulatory and Market-Based Standards and Parameters	Regulatory standards	<ul style="list-style-type: none"> • Section 152 DFBA and Supervisory Diamond. • CRD IV (final version). 	<ul style="list-style-type: none"> • N/A 	<ul style="list-style-type: none"> • N/A
6. Reporting Format for Results	Output presentation	<ul style="list-style-type: none"> • Excess Liquidity Coverage, Liquidity Coverage Ratio, and Funding Ratio for the full sample and, separately, for different size buckets. • Number of banks that do not pass stress test; liquidity shortfall; potential to close shortfall. • Distribution measures of individual results. 	<ul style="list-style-type: none"> • N/A 	<ul style="list-style-type: none"> • N/A

Appendix IV. Stress Test Matrix (STeM) for the Insurance Sector

Domain		Assumptions
		Bottom-Up by Insurance Corporations
INSURANCE AND PENSION FUND SECTOR: SOLVENCY RISK		
1. Institutional Perimeter	Institutions included	<ul style="list-style-type: none"> • 4 life insurance groups (Danica, Nordea Liv, PFA Pension, Sampension) • 4 non-life insurance groups (Alm.Brand, Codan, Topdanmark, Tryg) • 1 pension fund (ATP)
	Market share (gross premiums)	<ul style="list-style-type: none"> • Life: 50% • Non-Life: 65%
	Data and baseline date	<ul style="list-style-type: none"> • Companies' own data • Reference date: 01/01/2014 • Worldwide consolidation
2. Channels of Risk Propagation	Methodology	<ul style="list-style-type: none"> • Companies' internal models
	Valuation	<ul style="list-style-type: none"> • Market-consistent valuation of assets and liabilities
	Stress test horizon	<ul style="list-style-type: none"> • 5 years (2014-2018) • Instantaneous shocks in sensitivity analyses
3. Tail shocks	Scenario analysis	<ul style="list-style-type: none"> • Slow growth scenario (protracted period of slower global growth and prolonged weak consumer confidence in Denmark) • Adverse scenario (Re-emergence of financial stress in the euro area, protracted economic and financial volatility for emerging markets, and tighter financial condition in the United States)
	Sensitivity analysis	<ul style="list-style-type: none"> • Sharp increase in interest rates • Sovereign spread increases • Covered bond spread increases • Catastrophic event
4. Risks and Buffers	Risks/factors assessed	<ul style="list-style-type: none"> • Interest rates, equity, property, FX, credit spreads, lapses • Summation of risks within scenarios, no diversification effects
	Buffers	<ul style="list-style-type: none"> • Absorption effect of technical provisions (profit sharing) • Absorption effect of deferred taxes
	Behavioral adjustments	<ul style="list-style-type: none"> • Management actions limited to non-discretionary rules in place at the reference date
5. Regulatory and	Calibration of risk	<ul style="list-style-type: none"> • Interest rates: macro-model generated • Equity: 90th and 95th percentile of empirical return distribution

Domain		Assumptions
		Bottom-Up by Insurance Corporations
Market-Based Standards and Parameters	parameters	<ul style="list-style-type: none"> • Property: 90th and 95th percentile of empirical return distribution • Currency: macro-model generated • Credit spreads: a) Corporate bonds: 85th and 90th percentile of empirical return distribution, for financials/non-financials/AAA-rated covered bonds; b) Sovereign bonds: model-generated country-specific shocks • Lapses: Mass lapse event, expert judgment • Catastrophic event: a) Repetition of 1999 windstorm (“Anatole”); b) 1-in-100 years probable maximum loss • Sensitivity analyses: expert judgment for sharp interest rate increase and covered bond spread increases; 90th percentile of empirical yield changes for sovereign spread shock
	Regulatory/Accounting and Market-Based Standards	<ul style="list-style-type: none"> • National solvency regime (individual solvency requirement of an insurer is the higher of a) Solvency I requirements and b) QIS5-like Solvency II requirements)
6. Reporting Format for Results	Output presentation	<ul style="list-style-type: none"> • Impact on solvency ratios • Impact on net income • Contribution of individual shocks • Dispersion measures of solvency ratios and net income