DANMARKS NATIONALBANK

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STRESS TEST

A few banks have capital shortfall in severe recession scenario

- In Danmarks Nationalbank's semi-annual stress test, a few of the largest banks fall short of their capital buffer requirements in a severe recession scenario. The rest meet the requirements, but with a narrow margin.
- If the buffer requirements are not met, the banks should expect that accessing external funding in financial markets may become expensive or difficult.
- The focus of this semi-annual stress test is on market risk and the losses suffered by the banks due to falling in equity prices, changes in interest rates and widening credit spreads.

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Kr. 1.8 billion

is the amount of SIFIs' capital shortfall at end-2020 in the severe recession scenario

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Kr. 2.3 billion

is the capital shortfall of the non-systemic banks at end-2020

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New model

for market risk with scenarios for equity, interest and credit risk

Read more

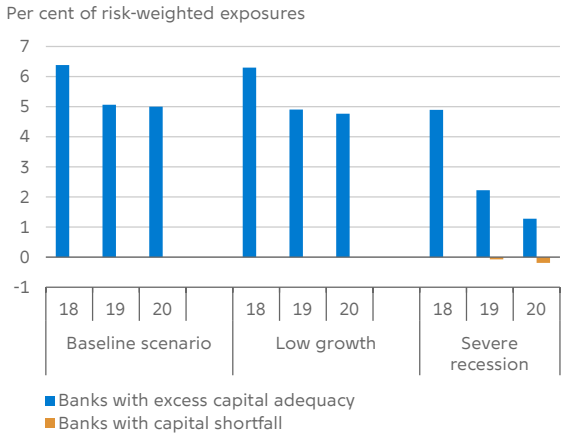
Since the financial crisis, stress tests have increasingly been used as a tool to ensure that the banking sector is sufficiently capitalised. Danmarks Nationalbank performs a stress test of the Danish banking sector semi-annually. The stress test compares the banks' capitalisation under stress with the current capital requirements, which consist of both statutory minimum requirements and additional buffer requirements. The stress test comprises the banking activities of the 15 largest Danish banking groups.

The stress test shows that a few of the largest Danish banks, SIFIs, do not have sufficient capital to meet the buffer requirements for banks' capitalisation, while the rest meet the requirements with a narrow margin, cf. Chart 1.[1] No SIFIs are close to falling below the statutory minimum capital requirements, however.

If the banks' capital falls below the buffer requirement, a number of restrictions will be imposed on the banks, e.g. in relation to dividend payments, and it may also weaken their access to external funding in the financial markets.

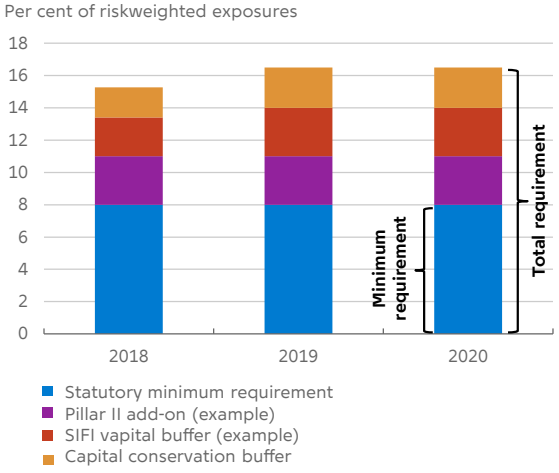
In order to meet all capital requirements in the severe recession scenario, the SIFIs will have a shortfall of kr. 1.8 billion at end-2020, while from 2019 their shortfall will be kr. 0.7 billion. From 2019 onwards, the capital conservation buffer and the SIFI capital buffer will be fully phased in, cf. Chart 2, so the capital requirements are assumed to be constant from that time onwards. The countercyclical buffer is not activated in Denmark. If the countercyclical buffer had already been activated – and the banks had increased their capitalisation accordingly – the banks would be more strongly positioned in a stress situation, as the buffer could be released and thus give the banks some room for manoeuvre.[2]

SIFIs close to buffer requirements Chart 1



Note: The chart shows the SIFIs' excess capital adequacy or capital shortfall as percentages of total risk-weighted exposures relative to the capital requirement including buffers.
Source: Danish Financial Supervisory Authority and own calculations.

Banks are facing increasing capital requirements towards 2019 Chart 2



Note: Example of capital requirement developments towards 2020. The Pillar 2 add-on varies from bank to bank, while the SIFI capital buffer affects only SIFIs, varying between SIFIs depending on their systemic importance.

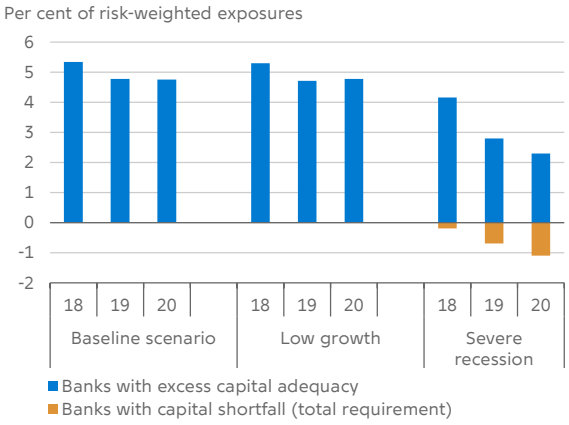
1 SIFIs are "systemically important financial institutions". Four SIFIs, Danske Bank, Jyske Bank, Nykredit Bank and Sydbank, are included in the stress test.

2 There is also a risk that banks close to their buffer requirements will tighten their credit standards, affecting the macroeconomy and thus amplifying the stress. The stress test does not directly incorporate such a feedback mechanism. The negative effect on the real economy could be offset if the buffer is activated and can be released. See *Financial stability*, 2nd Half 2017, for a description of the countercyclical capital buffer.

Some of the small, non-systemic banks are seriously challenged in the stress test, and some are unable to comply with the minimum capital requirement. In the first year of the stress test, a few of the banks are already short of capital to meet the buffer requirements. In 2020, the banks' shortfall will be kr. 285 million for the minimum requirement and kr. 2.3 billion for the minimum requirement including buffers. Chart 3 shows the development in capital relative to the buffer requirement.

Before the non-systemic banks hit the minimum requirement, breach of the buffer requirements will allow the authorities to intervene. Although the authorities have the tools required to address such a situation, the owners and creditors of the banks in question may suffer losses if the banks are to be recovered or resolved.

Most non-systemic banks meet buffer requirements, but a few are in substantial difficulties Chart 3



Note: The chart shows the non-systemic banks' excess capital adequacy or capital shortfall as percentages of the total risk-weighted exposures relative to the capital requirement including buffers.
Source: Danish Financial Supervisory Authority and own calculations.

How the stress test works

The basis for Danmarks Nationalbank's stress test is three macroeconomic scenarios over three years: a baseline scenario, low growth and severe recession. The baseline scenario is based on Danmarks Nationalbank's macroeconomic projection followed by a mechanical projection over the last year of the period. In the low growth scenario, the economy is hit by a minor domestic recession with weak GDP growth and a fall in house prices.

In the severe recession scenario, export market growth is reduced, and growing pessimism among consumers and firms leads to falling consumption and fewer investments. This causes GDP and house prices to fall. Unemployment, which has a major impact on the banks' loan impairment charges, rises to 9 per cent at the end of the severe recession scenario.

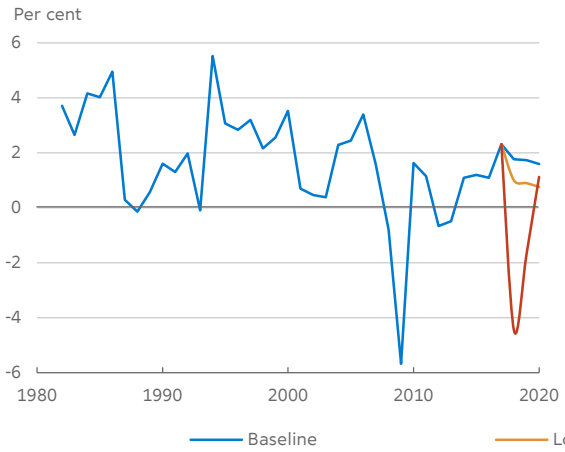
In the baseline scenario, the financial variables develop in line with market expectations, but in the stress scenarios they are affected by the macroeconomic variables, resulting in falling equity prices, changed yield curves and widening credit spreads.

For most Danish banks, profits are particularly affected by loan impairment charges under stress. In the stress test, peak loan impairment charges are at levels seen in previous crises, cf. Chart 4, while total loan impairment charges over the 3-year period are on a par with loan impairment charges for the period 2008-10.[3] Market risk, i.e. the risk of negative value adjustments as a consequence of price developments in financial assets, may also significantly affect the banks' earnings. This applies to both SIFIs and smaller banks.

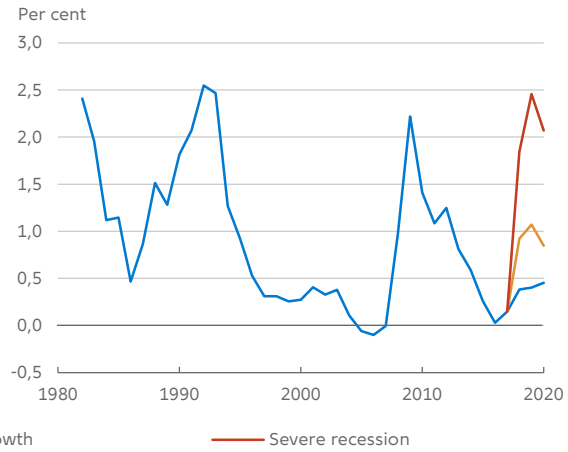
3 The stress test does not take into account the effects of the banks' transition from 2018 to a new impairment model under new accounting standards (IFRS9). The transition may have a one-off effect in the form of higher provisions, and it will also require banks to recognise loan impairment charges at an earlier stage in a crisis situation.

GDP falls and loan impairment charges rise under stress Chart 4

GDP growth



Loan impairment charges



Note: Right-hand chart: Loan impairment charges calculated as a percentage of lending and guarantees before loan impairment charges. The historical series until and including 2015 is based on banks in the Danish Financial Supervisory Authority's groups 1-3. The loan impairment charges from 2016 onwards and the estimated loan impairment charge ratios for 2018-20 have been calculated as a weighted average of the 15 banks in the stress test.
Source: Cato Baldvinsson, Torben Bender, Kim Busch-Nielsen and Flemming Nytoft Rasmussen, *Dansk Bankvæsen* (Danish banking – in Danish only), 5th edition, Forlaget Thomson (2005), Danish Financial Supervisory Authority, Statistics Denmark and own calculations.

Banks are facing various market risks

The Danish banks invest in both equities and bonds, most often with a larger share of bonds than equities. Generally, Danish government bonds and mortgage bonds make up a large share of the Danish banks' portfolios, as they are used for e.g. liquidity management purposes. The bond investments entail considerable interest rate risks, which are to a large extent hedged by means of interest rate swaps, however.

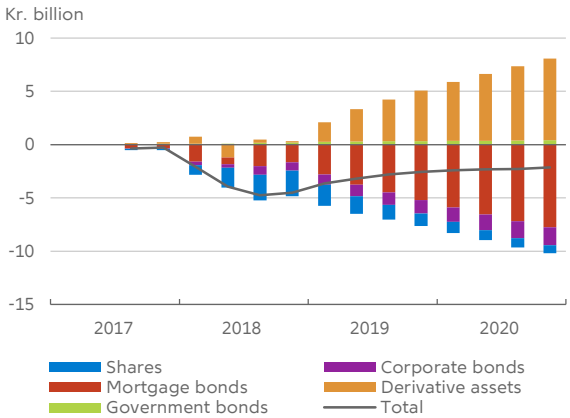
The banks invest to a lesser extent in corporate bonds, so they can increase their exposures to specific sectors. These investments are more affected by credit risks, i.e. the risk of price falls due to erosion of firms' credit standing.

Chart 5 presents a breakdown of the banks' losses and gains by various asset classes in the severe recession scenario of the stress test.

The SIFIs suffer losses primarily at the beginning of the stress test when they lose almost kr. 5 billion.

Large banks experience substantial losses on mortgage bonds and equities Chart 5

Cumulative value adjustments



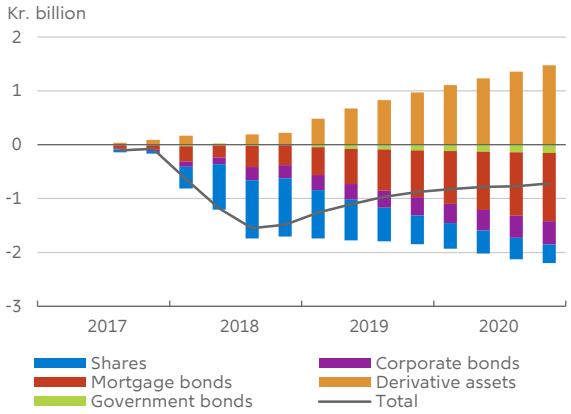
Note: The chart shows the SIFIs' total cumulative value adjustments broken down by equities, government, mortgage and corporate bonds and derivative assets by interest rate risk.
Source: Danish Financial Supervisory Authority and own calculations.

They are affected by a strong decline in equity prices and losses on mortgage bonds. They subsequently recover some of the lost ground when asset prices begin to rise again. Credit spreads widen considerably over the first year, after which they gradually narrow again. Interest rates increase over the three years in all scenarios, but the slope of the yield curve also shifts, leading to losses on mortgage bonds in particular.

The effect of value adjustments is relatively greatest for the smaller banks, because they have larger shares of equities. The smaller banks lose kr. 1.5 billion almost exclusively on equities, cf. Chart 6.[4]

Small banks experience substantial losses on equities Chart 6

Cumulative value adjustments



Note: The chart shows the smaller banks' total cumulative value adjustments broken down by equities, government, mortgage and corporate bonds and derivative assets by interest rate risk.
Source: Danish Financial Supervisory Authority and own calculations.

New model for market risk

Danmarks Nationalbank's model for market risk has changed materially in the latest stress test. On the basis of the scenarios for the macroeconomic variables, the model generates scenarios for financial variables such as equity prices, yield curves and credit spreads and then calculates the earnings effect of those changes for each bank.

The model is based on a breakdown of market risks into three categories: equity, interest rate and credit risk. Chart 7 provides an overview of the model components and their interaction.

The logic of the equity price model is as follows: Consumption falls in a recession. Since households want to maintain the level of consumption they are used to, this makes them more hesitant to hold risky assets such as equities.[5] As a result, equity prices fall. Investors with the strongest risk appetite hold the largest portfolios of equities, and they are most severely affected. Hence, more risk averse investors become relatively more dominant in the market. They demand a higher expected return as compensation for holding equities, which also dampens equity prices.

Chart 8 shows developments in equity prices in the three stress test scenarios. The model generates a substantial drop in equity prices in the severe recession scenario. The extent of the drop is comparable to the development during the financial crisis.

Steepening slope of yield curve affects value adjustments

The entire yield curve must be modelled in order to capture value adjustments from bonds and derivative assets. The yield curve is typically described by three factors: its level, slope and curvature.[6] Each factor is modelled as a function of macroeconomic variables, and separate models are estimated for government bond and swap rates.

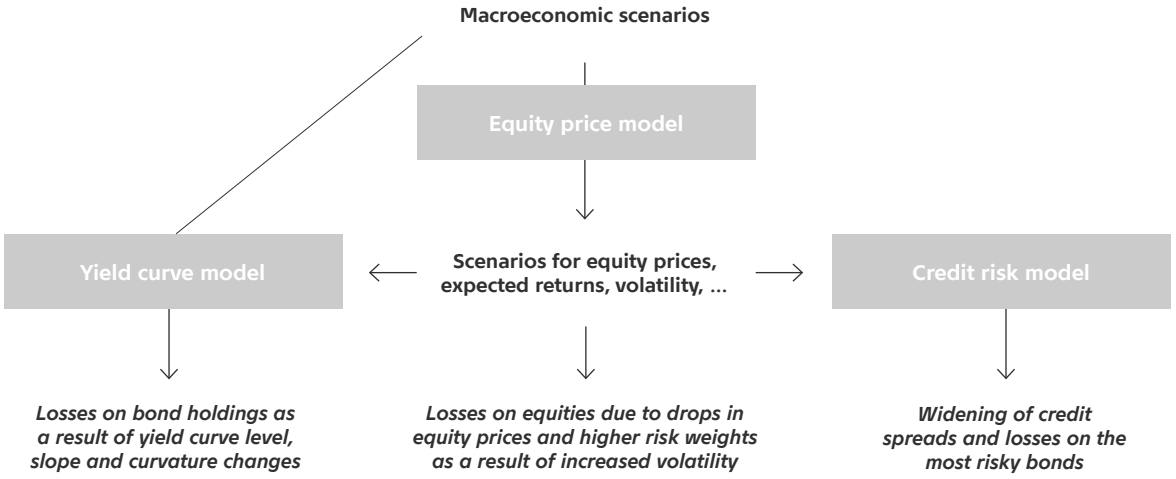
The yield curve for mortgage bonds follows the swap curve, but a term-dependent spread is added which is linked to the development in house prices, among other factors. This leads to a steepening

4 The stress test focuses on the banks' portfolios of listed equities.

5 Specifically, the equity price model is based on Yeung Lewis Chan and Leonid Kogan (2002) Catching up with the Joneses: Heterogenous preferences and the dynamics of asset prices, *NBER Working Paper*, No. 86+7, 2002.

6 Our model is based on C. R. Nelson and A. F. Siegel. Parsimonious modeling of yield curves. *Journal of Business*, 1987.

Overview of market risk in Danmarks Nationalbank's stress test Chart 7



slope of the mortgage curve under stress. The value of the banks' derivatives is assumed to depend on the development in the swap curve.

As a result, despite having hedged their interest risks, banks with mortgage bond holdings may suffer losses due to differences in the mortgage and swap curves. In the model, mortgage yields rise more than swap yields, leading to losses for the banks.

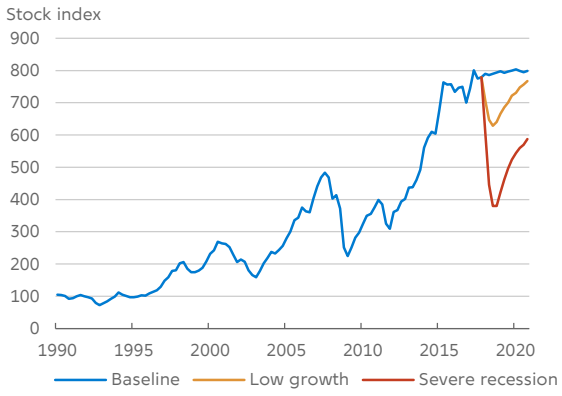
Credit spreads and risk weights increase

In the model, the credit spreads increase, especially for the riskiest bonds.

The development in credit spreads is linked to the development in equity prices in the model.[7] Falling equity prices reflect that the firms' total assets are worth less relative to the firms' debt. This increases the estimated failure rate, and it will have the greatest impact on firms already in difficulties. Hence, investors require a higher return as compensation for holding the now riskier bonds.

The last component in the market risk model is risk weights. The largest Danish banks – Danske Bank and Nykredit – apply internal models to calculate risk-weighted assets in the trading book. The risk weights are closely linked to market volatility, so the banks experience higher risk weights due to heightened volatility.

Equity prices under stress Chart 8



Note: The chart shows equity prices historically and in the three scenarios.
Source: Own calculations.

7 The credit spread model is based on H. E. Leland and K. B. Toft, Optimal capital structure, endogenous bankruptcy, and the term structure of credit spreads. *The Journal of Finance*, 1996.

Appendix 1: Stress test population

Systemic banks
Danske Bank
Jyske Bank
Sydbank
Nykredit Bank

Non-systemic banks
Spar Nord Bank
Arbejdernes Landsbank
Ringkjøbing Landbobank
Sparekassen Kronjylland
Vestjysk Bank
Nordjyske Bank
Lån og Spar Bank
Jutlander Bank
Sparekassen Sjælland
Den Jyske Sparekasse
Sparekassen Vendsyssel

Appendix 2: Scenarios in Danmarks Nationalbank's accounts-based stress test

Appendix 2: Scenarios in Danmarks Nationalbank's accounts-based stress test

Table 1

	Baseline scenario	Low growth	Severe recession
2018			
GDP, per cent year-on-year	1.8	-0.6	-4.5
Private consumtion, per cent year-on-year	2.0	-2.2	-3.4
Export market growth, per cent year-on-year	3.7	3.7	-9.8
House prices, per cent year-on-year	2.9	-4.0	-12.5
Gross unemployment, per cent of labour force	2.9	3.6	4.7
Bond yields	0.8	0.8	0.8
2019			
GDP, per cent year-on-year	1.7	0.9	-1.7
Private consumtion, per cent year-on-year	2.1	-0.5	-1.9
Export market growth, per cent year-on-year	3.7	3.7	-3.3
House prices, per cent year-on-year	2.8	-2.0	-7.7
Gross unemployment, per cent of labour force	2.9	4.2	7.7
Bond yields	1.1	1.1	1.1
2020			
GDP, per cent year-on-year	1.6	1.8	1.1
Private consumtion, per cent year-on-year	2.1	2.0	0.3
Export market growth, per cent year-on-year	3.6	3.6	3.1
House prices, per cent year-on-year	1.9	1.2	-0.5
Gross unemployment, per cent of labour force	2.9	4.3	9.0
Bond yields	1.5	1.5	1.5

Note: Annual averages. House prices are cash prices of single-family houses.

ABOUT ANALYSIS

As a consequence of Danmarks Nationalbank's role in society we conduct analyses of economic and financial conditions.

Analyses are published continuously and include e.g. assessments of the current cyclical position and the financial stability.

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