

DANMARKS NATIONALBANK

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STRESS TEST

The largest banks satisfy capital requirements in stress test



A few systemic banks are close to the buffer requirement

The systemic banks have sufficient capital to withstand a severe recession. However, some systemic banks are close to their buffer requirements, even though the countercyclical capital buffer is assumed to be released.



Building capital adequacy in good times helps

None of the systemic banks would be close to the buffer requirements if they retained earnings instead of paying dividends in the first year of the stress test.



Scenarios reflect the cycle

Stress test scenarios should reflect the cycle. The analysis describes Danmarks Nationalbank's approach to ensuring that the scenarios are tougher in good times and milder in bad times.

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Danmarks Nationalbank performs a semi-annual stress test of the Danish banking sector. In the stress test, the banks' capital ratios under stress are compared with the current capital requirements. The stress test comprises the largest Danish banks.¹

The stress test shows that most banks have sufficient capital to withstand an adverse recession scenario. The systemic banks maintain a comfortable distance to the minimum capital requirement, but a few are close to exceeding the requirements to their capital buffers. In the adverse scenario, the systemic banks on average have excess capital adequacy of approximately 3 percentage points relative to the buffer requirements, cf. Chart 1. There is, however, considerable variation among banks in the degree to which they exceed the requirements.

If a bank's capital ratio falls below the buffer requirement, a number of restrictions will be imposed, e.g. in relation to dividend payments and interest payments on hybrid capital instruments. This could weaken the banks' access to external funding in the financial markets at a time when funding is already difficult to obtain.

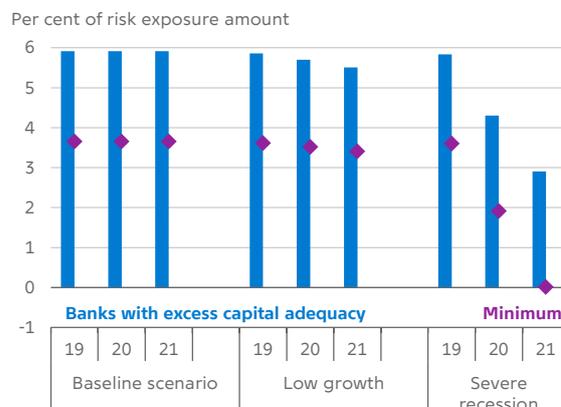
The banks' capital requirement consists of a minimum requirement and several buffer requirements, cf. Chart 2. From 2019, the capital conservation buffer and SIFI capital buffers are fully phased in, and after that time, the capital requirements are assumed to be constant. The countercyclical capital buffer is set at 0.5 per cent from the end of the 1st quarter of 2019, rising to 1.0 per cent at the end of the 3rd quarter of 2019. In the stress test, the buffer is assumed to be zero, as the buffer is presumed to be released in a stress scenario.

Several of the smaller, non-systemic banks face difficulties in the stress test. Some have insufficient capital to satisfy their capital buffer requirements, cf. Chart 3, and a few are close to breaching the minimum requirement. In 2021, the non-systemic banks are about kr. 650 million short of satisfying the buffer requirements.

Before the non-systemic banks hit the minimum requirement, breach of the buffer requirements will allow the authorities to intervene. If the solution is

A few systemic banks are close to the buffer requirement

Chart 1

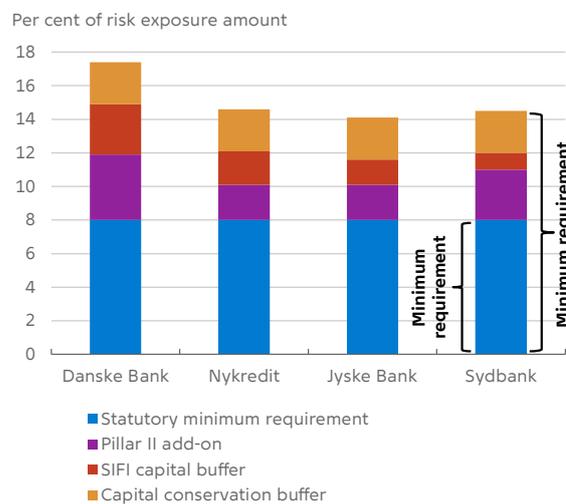


Note: The systemic banks' total excess capital adequacy as a percentage of the total risk exposure amount relative to the capital requirement including buffers. The minimum value is the excess capital adequacy for the bank with the lowest excess capital adequacy at the end of each year (the points therefore do not represent observations for the same bank).

Source: Danish Financial Supervisory Authority and own calculations.

Composition of capital requirements for selected systemic banks

Chart 2



Note: Known capital requirements for selected systemic banks for the period 2019-21. The countercyclical capital buffer is set at zero due to the assumption that the buffer would be released in a stressed scenario.

¹ See Appendix A for an overview of the banks included in the stress test.

recovery or resolution, the authorities have the tools required to address such a situation, but the owners and creditors of the banks in question may suffer losses.

In recent years, non-performing loans to the agricultural sector have been a drag on the smaller banks' balance sheets. Impairment charges have been substantial for a number of years, with annual impairments typically between 3 and 4 per cent of banks' loans and guarantees to the agricultural sector.

The stress test's conclusions will not change if it is assumed that the impairment charges on loans to the agricultural sector remain at the same level as in recent years.² This is due to the fact that impairment charges related to the agricultural sector are already relatively high in the stress test, even though the scenarios do not specifically focus on stressing the agricultural sector. However, a few banks will be adversely affected in the stress test if it is assumed that impairment charges remain at high levels.

Building capital adequacy in good times helps

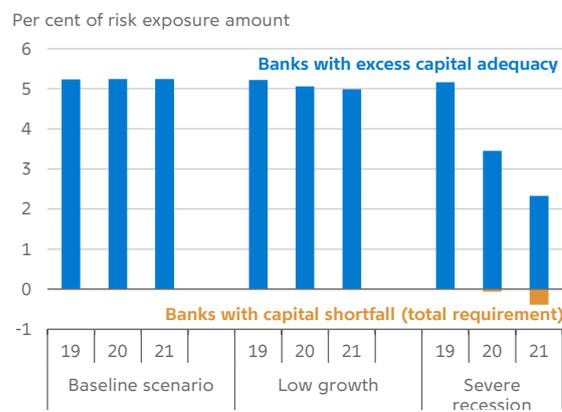
In the stress test, it is assumed that the banks pay out all of their earnings as dividends if they have positive earnings and their capital ratio exceeds the buffer requirement by more than 3 per cent. If earnings are positive and the capital ratio exceeds the buffer requirement by 1-3 per cent, the banks will pay out half of their earnings as dividends.

The actual stress only takes effect in the 3rd quarter of 2019. Therefore, the banks will generally continue making money in the first year of the stress test. If the banks were to retain earnings instead of paying dividends, none of the systemic banks would be close to the buffer requirement. And the non-systemic banks could reduce their capital need relative to the buffer requirement to about kr. 400 million.

² To examine this, we have also performed the stress test under the assumption that the banking sector's impairment charges on loans and guarantees related to agriculture are 4 per cent in every year of the stress test. The 4 per cent represent an average. Banks which have had large impairment charges in recent years (relative to other banks when taking into consideration the sectoral composition of their loans) have larger impairment charges in the stress test.

Most non-systemic banks meet buffer requirements, but a few are struggling

Chart 3



Note: The chart shows the non-systemic banks' excess capital adequacy or capital shortfall as a percentage of the total risk exposure amount relative to the capital requirement including buffers.

Source: Danish Financial Supervisory Authority and own calculations.

New impairment requirements (IFRS 9) may increase capital shortfall

The transition to IFRS 9 implies that impairments must, to a greater extent than in earlier requirements, reflect expected credit losses. This implies that a worsening of the macroeconomic environment may lead to an increase in impairment charges, before borrowers show concrete signs of defaulting on their loans. We have examined the effects of changing the time profile for impairment charges. Chart 4 shows the model's standard time profile for impairment charges as well as two alternative time profiles in which impairments peak earlier. The aggregate impairments are the same in all cases.

If the banks recognise impairment charges early on, they face a larger capital shortfall at an earlier stage of the stress test. This is because the ordinary income of the banks, which normally is sufficient to cover some impairment losses, is insufficient to cover the higher losses occurring early on. The situation reverses in the final year of the stress test when impairment charges are lower and banks return to profitability and are able to retain earnings and increase capital levels. The capital shortfall is largest when impairments are recognised early in the process, as shown in Chart 5 for the non-systemic banks. In that case, some of the banks will breach the minimum capital requirement.

The largest banks also satisfy capital requirements in European stress test

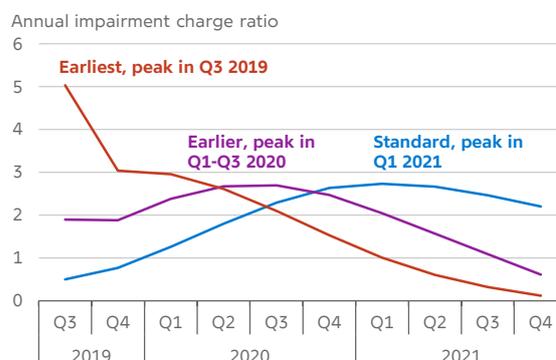
On 2 November, the European Banking Authority, EBA, published the results of a stress test comprising many of Europe's largest banks. In the EBA stress test, the banks perform the calculations based on their own, internal models.³ Danske Bank, Nykredit and Jyske Bank were included in the EBA stress test, while Sydbank performed a similar stress test at the request of the Danish Financial Supervisory Authority.

All of the Danish banks satisfy their capital requirements in the adverse macroeconomic scenario in the EBA stress test. The banks' capital ratios decline by 4-5 percentage points, but all remain above the capital requirements due to high capital ratios at the outset, cf. Table 1.

In spite of having higher capital ratios to start with, the banks, except Nykredit, come closer to their buffer requirements than in the EBA stress test from 2016. This reflects a scenario for Denmark, which is considerably more severe than in 2016 – and also marginally more severe than the scenario in Denmark's Nationalbank's stress test.

Time profiles of impairments

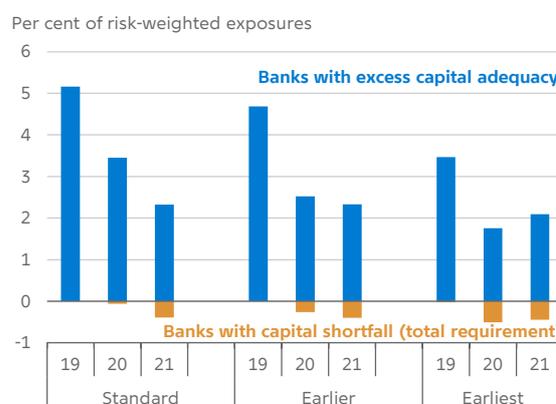
Chart 4



Note: Three time profiles of impairment charges. The impairment rates have been annualised, and the cumulative impairment charges are identical (and equal about 5 per cent of loans and guarantees) for each of the time profiles.

Early impairment charges may increase capital shortfall

Chart 5



Note: The chart shows the capital shortfall of the non-systemic banks in the severe recession scenario for each of the three time profiles of impairments shown in Chart 4.

While the EBA stress test is a Europe-wide stress test, it is difficult to meaningfully compare results across countries. Among the EU member states, only Sweden faces a more adverse scenario than Denmark, and the EU-wide averages for changes in e.g. GDP, unemployment, and house prices are considerably smaller than the Danish ones.

³ National authorities perform quality checks of the banks' calculations.

Scenarios should reflect the cycle

The scenarios in a stress test should reflect the cyclical position. An extended upturn is at risk of being followed by a more pronounced downturn, and the stress should therefore be more severe. Conversely, it would be harsh to assume an equally severe stress in the middle of or following a downturn when various risks have already materialised.

Danmarks Nationalbank has developed a systematic approach to determining the severity of the severe recession scenario used in the stress test.⁴ The purpose of the approach is in part to make the scenarios countercyclical, i.e. more severe in good times and milder in bad times, and in part to make it transparent how the scenarios are developed.

The approach focuses on three key variables: GDP growth, unemployment, and house prices. The change in each of these variables is constrained to lie in an interval. As an example, real GDP is constrained to decline by 3-7 per cent. If GDP has risen sharply in the years preceding the stress test, the decline will be larger and closer to 7 per cent. If, on the other hand, GDP growth has been sluggish, the decline will be smaller. The change in GDP, which would have resulted from using our rule for GDP in earlier stress tests, is shown in Chart 6.

As the figure shows, the stressed GDP is close to the lower bound of the interval in the years preceding the financial crisis (see point a in the Chart). If a stress test had been performed using this approach prior to the financial crisis, the predicted GDP decline would have been comparable to the actual decline during the crisis.

When Danmarks Nationalbank actually conducted a stress test in 2008, the scenarios were not nearly as severe. In the most adverse scenario, GDP only fell by 2 per cent over a 3-year period. The decline was, in retrospect, much too small.

The Chart also highlights that the stress would have been relatively mild in the years following the crisis, when GDP had already declined considerably (see point b in the Chart 6).

Danish banks have more capital, but face larger losses than in 2016

Table 1

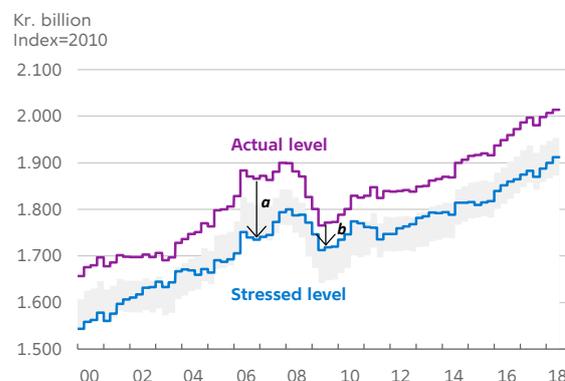
Per cent of REA	Danske Bank	Nykredit	Jyske Bank	Sydbank
EBA stress test 2018				
Capital ratio, end-2017	22.6	25.3	19.8	20.8
Capital ratio, worst year	17.6	19.4	14.7	16.0
Capital surplus, worst year	0.4	4.4	0.5	1.4
EBA stress test 2016				
Capital ratio, end-2015	21.0	23.9	17	17.6
Capital ratio, end-2018	18.9	17.8	14.5	15.3
Capital surplus, end-2018	3.9	2.5	0.9	2.9

Note: Capital refers to the total capital of the bank, while the surplus refers to the excess capital adequacy relative to the capital requirement including buffers (the countercyclical capital buffer is assumed to be zero). All numbers are percentages of the banks' risk exposure amounts (REA).

Source: EBA and Danish Financial Supervisory Authority.

The projected GDP decline prior to the financial crisis is close to the actual decline

Chart 6



Note: The grey band shows the interval for possible declines in real GDP.

Source: MONA statistics and own calculations.

⁴ The approach has been developed in cooperation with the Danish Financial Supervisory Authority.

Similar approaches are used for the unemployment rate, cf. Chart 7, and for house prices, cf. Chart 8.

In previous recessions, the unemployment rate has typically increased by 3-5 percentage points. The increase in the stress test will, as a default, fall somewhere in that interval, depending on changes in unemployment in the years preceding the stress test. In recent years, however, unemployment has been at a low level by historical standards. In periods when gross unemployment is below 5.5 per cent, we allow unemployment to increase by up to 1.5 percentage points more than the default.⁵ The increase in unemployment can therefore reach up to 6.5 percentage points.

For house prices, the approach does not focus on house prices per se, as they tend to increase over time, but rather on house prices deflated by disposable income. In the severe recession scenario, this quantity declines by 20-30 per cent, with the magnitude of the decline depending on the development in house prices over the preceding 12 quarters. The approach would also have produced a considerable decline in house prices in a stress test performed prior to the financial crisis, and the decline would have been comparable to the actual decline during the crisis. In the aftermath of the crisis, when house prices had already declined, the projected fall in house prices would be smaller.

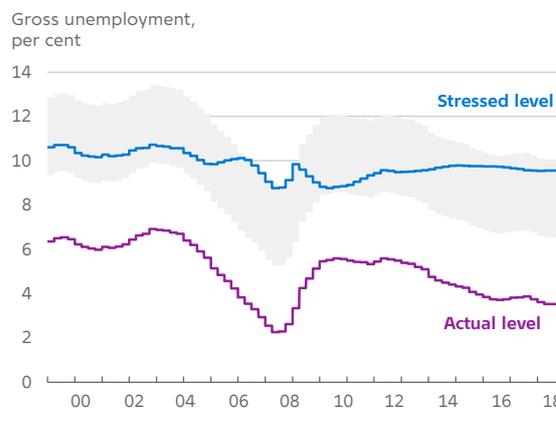
The rules for the three key variables are mechanical and backward-looking.⁶ In future stress tests, it may be necessary to adjust the scenarios in order to take into account forward-looking risks which are not accounted for by the rules. No adjustments have been applied in this stress test, cf. Table 2.

⁵ The median value for gross unemployment after 1996 is 5.5 per cent. We focus on the period after 1996 because of the labour market reforms of the late 1990s.

⁶ For a technical description of the rules, see Appendix C.

Unemployment almost reaches 10 per cent

Chart 7

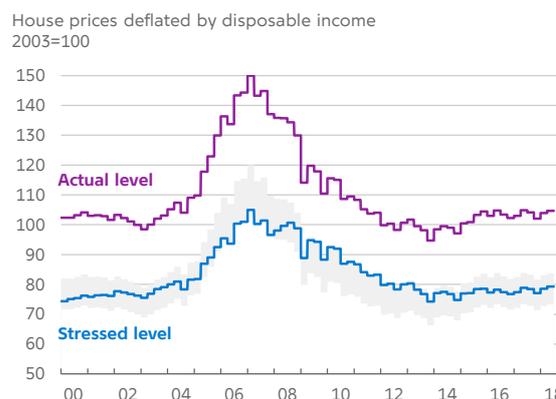


Note: The grey band shows the interval for possible increases in gross unemployment.

Source: MONA statistics and own calculations.

Step increases in house prices are followed by larger declines

Chart 8



Note: The grey band shows the interval for possible decreases in house prices deflated by disposable income.

Source: MONA statistics and own calculations.

Change in key variables

Table 2

Variable	Rule	Adjustment
Increase in gross unemployment	6.0 percentage points	0.0
Decline in real GDP	-5.1 per cent	0.0
Decline in house prices over disposable income	-24.2 per cent	0.0

Note: See appendix C for a technical description of the rules used to calculate the changes in the key variables.

Source: MONA statistics and own calculations.

Appendix A: Stress test population

Table A1

Systemic banks

Danske Bank

Nykredit Realkredit

Jyske Bank

Nordea Kredit

Sydbank

DLR Kredit

Spar Nord

Non-systemic banks

Arbejdernes Landsbank

Ringkjøbing Landbobank

Sparekassen Kronjylland

Vestjysk Bank

Lån & Spar Bank

Jutlander Bank

Sparekassen Sjælland-Fyn

Den Jyske Sparekasse

Sparekassen Vendsyssel

Appendix B: Stress test scenarios

Key variables	Table B1		
	Baseline scenario	Low growth	Severe recession
2019			
GDP, per cent year-on-year	1.8	1.5	1.1
Private consumption, per cent year-on-year	2.2	1.7	1.6
Export market growth, per cent year-on-year	4.2	4.2	2.8
House prices, per cent year-on-year	3.1	2.4	1.2
Gross unemployment, per cent of labour force	3.2	3.3	3.4
Bond yields	0.8	0.8	0.8
2020			
GDP, per cent year-on-year	1.7	-0.6	-5.0
Private consumption, per cent year-on-year	2.3	-1.3	-3.7
Export market growth, per cent year-on-year	3.6	3.6	-8.4
House prices, per cent year-on-year	2.7	-4.5	-15.4
Gross unemployment, per cent of labour force	3.0	4.0	5.9
Bond yields	1.1	1.1	1.1
2021			
GDP, per cent year-on-year	1.6	0.8	-1.3
Private consumption, per cent year-on-year	1.9	-0.7	-2.4
Export market growth, per cent year-on-year	3.2	3.2	-0.4
House prices, per cent year-on-year	2.2	-1.6	-7.1
Gross unemployment, per cent of labour force	2.8	4.7	9.4
Bond yields	1.4	1.4	1.4
Note: Annual averages. House prices are cash prices of single-family houses.			

Appendix C: Approach to determining changes in key variables

The scenarios in Danmarks Nationalbank's stress test are generated by adding shocks to the bank's macro-economic model, MONA. The shocks are chosen such that the development in three key variables – gross unemployment, real GDP and house prices divided by disposable income – equals selected countercyclical "targets".⁷

The targets include a countercyclical element and, if possible, an adjustment based on expert judgement. The mechanical element depends mechanically on the development in the key variables in the period leading up to the stress test. The expert judgement provides an opportunity to incorporate a forward-looking element into the development of the scenarios, e.g. due to concrete risks which have been identified.

The mathematical formulation of the shocks is as follows:

$$x_t^{st} = f(x_t)[1 + e^x(E_t\{x_{t+1}\})]$$

$$u_t^{st} = m(u_t) + e^u(E_t\{u_{t+1}\})$$

where f and m are functions, which determine the countercyclical shock, and e^x and e^u are unspecified, forward-looking expert judgements. x_t^{st} is used to determine the stress related to real GDP and house prices divided by disposable income, whereas u_t^{st} is used to determine the stress to gross unemployment. In practice, e^x and e^u are chosen subsequent to $f(x_t)$ and $m(u_t)$.

For each of the three key variables, there are "adjustment bounds", i.e. limits to how large the adjustments from expert judgement ought to be, cf. Table C1.

Key variables and adjustment bounds

Table C1

Key variable	Adjustment bounds, per cent
Gross unemployment	[-2; 2]
Real GDP	[-2; 2]
House prices deflated by disposable income	[-5; 5]

⁷ It may be the case that changes in the key variables deviate somewhat from the targets. The variables are related in MONA, and one therefore cannot choose targets that are completely inconsistent with each other.

The countercyclical shock is determined based on a weighted average of changes in data in the period preceding the stress test. The shocks to real GDP and house prices deflated by disposable income are calculated as follows:

$$\tilde{x}_t = \frac{\Delta^4 x_t}{x_{t-4}}$$

$$g(\tilde{x}_t; K) = \frac{\sum_{k=1}^K (K - k + 1) \sum_{i=1}^4 \tilde{x}_{t-4k+i}}{4 \sum_{k=1}^K k}$$

$$\gamma(\tilde{x}_t; K, \bar{\gamma}, \underline{\gamma}) = \frac{\min\{\bar{\gamma}; \max\{g(\tilde{x}_t; K), \underline{\gamma}\}\}}{\bar{\gamma} - \underline{\gamma}}$$

$$f(x_t) = \{1 + [\gamma(\tilde{x}_t)\bar{\lambda} + (1 - \gamma(\tilde{x}_t))\underline{\lambda}]\}x_t.$$

The parameter values are shown in Table C2.

The shock to gross unemployment is calculated in a similar fashion, but with an additional change of up to 1.5 per cent when the unemployment rate is less than $\underline{u} = 5.5$ per cent, which is the median value for gross unemployment since 1996. Instead of \tilde{x}_t we use \tilde{u}_t , while m is used instead of f . The shock is therefore determined through:

$$\tilde{u}_t = 1 - \Delta^4 u_t$$

$$h(u_t) = u_t + \gamma(\tilde{u}_t)\bar{\lambda} + (1 - \gamma(\tilde{u}_t))\underline{\lambda}$$

$$m(u_t) = \min\{\bar{u}; h(u_t) + \max\{\underline{u} - u_t, 0\}\}.$$

Parameter values

Table C2

Parameter	Real GDP	House prices / disposable income	Unemployment
K	2	3	2
$\bar{\gamma}$	3 pct	10 pct	102 pct
$\underline{\gamma}$	1 pct	-6 pct	98 pct
$\bar{\lambda}$	-3 pct	-20 pct	3 pct
$\underline{\lambda}$	-7 pct	-30 pct	5 pct
\underline{u}			5,5 pct
\bar{u}			6,5 pct

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.

The analysis consists of a Danish and an English version. In case of doubt regarding the correctness of the translation the Danish version is considered to be binding.

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