



Danmarks  
Nationalbank

Stress Tests  
2nd Half

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N A T I O N A L  
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## Stress Tests, 2nd Half 2009

The small picture on the cover shows a characteristic section of Danmarks Nationalbank's building, Havnegade 5 in Copenhagen. The building, which was constructed in 1965-78, was designed by the architect Arne Jacobsen (1902-71).

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Explanation of symbols:

- Magnitude nil
  - 0 Less than one half of unit employed
  - Category not applicable
  - na. Numbers not available
- Details may not add due to rounding.

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## The Banks' Resilience

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*Over the last three quarters, most of the largest Danish banks have strengthened their capital base through the Credit Package, issuance of shares or capital injections from their parent companies. This has improved the resilience of the banks in question, as well as the sector overall, to the economic development in the coming years. Moreover, the banks' core earnings were high in the 1st half of 2009, and viewed in isolation this has increased their ability to absorb write-downs.*

*In the near future, the financial statements of the banks are still expected to be affected by large write-downs on loans, but the Danish banking sector as a whole is assessed to be sufficiently capitalised to withstand the expected economic development until the end of 2011. However, for some banks write-downs may be so large that they will need to strengthen their capital base further.*

*As a new element, Danmarks Nationalbank has performed stress tests in cooperation with the largest Danish banks in order to assess the resilience of the Danish banking sector in a baseline scenario and a number of stress scenarios. The stress scenarios are seen as low probability events and are applied to illustrate the banks' resilience to write-downs. The banks' calculations show that they have sufficient buffers to withstand worse-than-expected developments.*

*As previously, Danmarks Nationalbank has performed its own stress tests. In the most severe – and less probable – scenarios, write-downs will be so large that many banks will need to strengthen their capital base further towards the end of 2011.*

*Both types of stress test thus show that in the most probable scenario the banks are generally sufficiently capitalised. The difference between the two sets of calculations illustrate the uncertainty expected to be linked to estimates of write-downs two years ahead.*

*The results of the stress tests do not prompt Danmarks Nationalbank to propose new initiatives at present.*

Danmarks Nationalbank applies stress tests to assess the resilience of the Danish banking sector to both the expected economic development and scenarios in which the economy is subject to negative shocks. As a new element, in the autumn of 2009 Danmarks Nationalbank worked with the largest Danish banks to perform stress tests supplementing those performed by Danmarks Nationalbank on a regular basis. In accordance

with international practice, Danmarks Nationalbank's own stress tests are referred to as "top-down" stress tests, while the tests performed in cooperation with the banks are referred to as "bottom-up" stress tests. It is important to emphasise that the development in the banks' capitalisation, not their liquidity, is assessed.

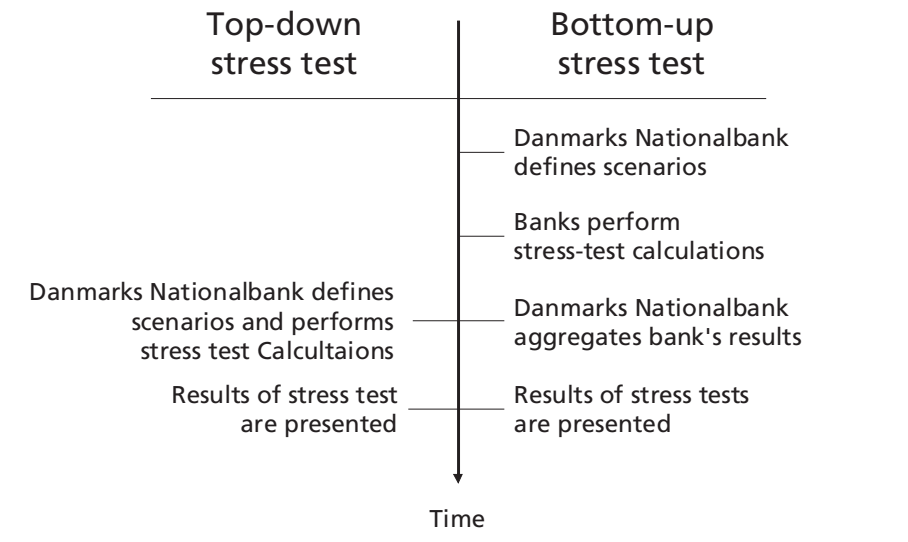
The following two chapters outline the results of the two sets of stress tests and the underlying assumptions. Finally, the procedure in relation to the bottom-up stress test is described in the last chapter.

Supplementing Danmarks Nationalbank's top-down stress tests with bottom-up stress tests based on the banks' own models gives a more complete and detailed picture of the resilience of the financial sector. The two sets of stress tests analyse the same issue from different angles and using different models, cf. Chart 1. No model can take real-life complexity into account and it is difficult to say which model is best at predicting future developments. Therefore it makes sense to base the assessment of the banking sector's resilience on different models. In the two sets of stress tests, the major difference between the calculations based on the banks' own models and those based on Danmarks Nationalbank's model is the volume of write-downs. In a situation such as the current one where no data is available for a similar period, it is extra difficult to assess the validity of the modelled predictions.

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DIFFERENCES IN WORKING PROCESSES FOR BOTTOM-UP AND TOP-DOWN  
STRESS TESTS

Chart 1



SCENARIOS IN TOP-DOWN AND BOTTOM-UP STRESS TESTS

Table 1

	Top-down				Bottom-up		
	Baseline scenario	Scenario 1	Scenario 2	Scenario 3	Baseline scenario	Scenario 1	Scenario 2
<i>2009</i>							
GDP, per cent, year-on-year ..	-4.5	-4.6	-4.7	-4.7	-3.2	-3.6	-3.7
Unemployment, per cent .....	3.4	3.4	3.5	3.5	3.5	3.7	3.7
<i>2010</i>							
GDP, per cent, year-on-year ..	1.2	-0.6	-1.3	-1.8	0.9	-1.2	-2.0
Unemployment, per cent .....	5.5	6.2	6.6	6.7	5.7	6.7	7.2
<i>2011</i>							
GDP, per cent, year-on-year ..	1.6	0.5	-0.1	-1.9	1.7	0.5	-0.3
Unemployment, per cent .....	6.0	7.7	8.7	9.7	6.2	8.2	9.5

The top-down and bottom-up stress tests test the resilience of the Danish banking sector to two economic stress scenarios: one is an isolated negative shock to the Danish economy, while the other combines a negative shock to the Danish economy with a negative shock to the international economy. In the top-down stress test, a scenario is also applied that represents an even more severe and, assumingly, even less probable negative shock to the Danish and international economies. All scenarios cover the period until end-2011. The point of departure is the baseline scenario, which represents the expected economic development. The stress scenarios have been developed in cooperation with the Danish Financial Supervisory Authority.

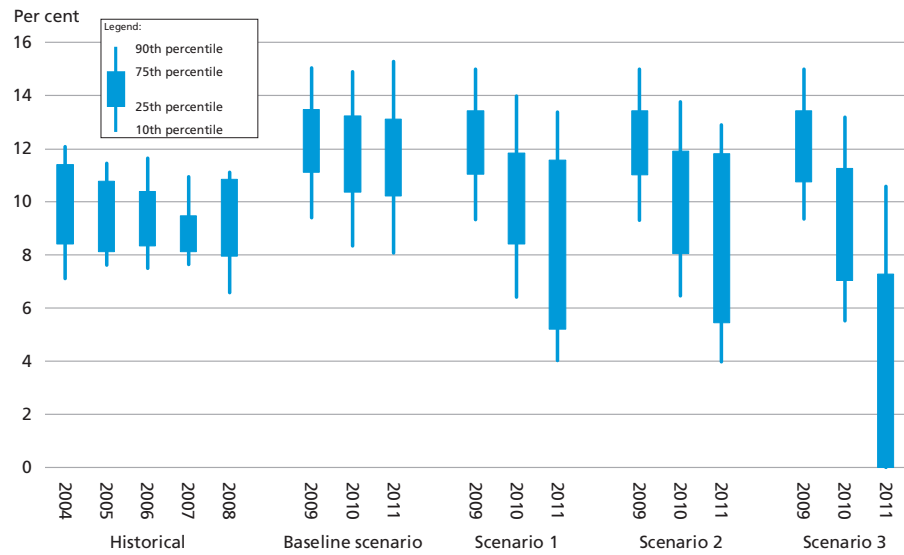
A bottom-up stress test takes longer time to conduct than a top-down stress test. The bottom-up stress test was initiated in September 2009 and was based on Danmarks Nationalbank's economic forecast at the time. The top-down stress test is based on an update of the forecast from September 2009, the main change being that the decline in GDP in 2009 is greater than predicted in September, cf. Table 1. This means that the two sets of results are not directly comparable.

In the baseline scenario used for the top-down stress test, the growth rate has been adjusted downwards compared to that applied in the bottom-up stress test for 2009, cf. Table 1.<sup>1</sup> For 2010 and 2011, growth rates are more or less unchanged in the baseline scenarios in the two sets of stress tests. The difference between unemployment rates in the top-down and bottom-up scenarios is modest. The update of the economic development in the baseline scenario is reflected in the top-down stress scenarios.

<sup>1</sup> However, in the top-down scenarios the economic development in 2009 still differs, as no national accounts for the full year were available when the scenarios were defined.

THE BANKS' TIER 1 RATIOS IN THE TOP-DOWN STRESS TEST

Chart 2



Note: Tier 1 capital must constitute at least 50 per cent of the base capital; hence the Tier 1 capital must constitute at least 4 per cent of a bank's risk-weighted assets. The Banks' Tier 1 ratios are at institution level.

Source: Danish Financial Supervisory Authority, banks' financial statements and own calculations.

### Top-down stress test

Danmarks Nationalbank's top-down stress test tests the resilience of the 14 largest Danish banks to further negative shocks to the economy.<sup>1</sup> For each of the 14 banks tested, the overall development is assumed to be in line with the sector average. Therefore the results are presumably imprecise for some banks. The estimates are likely to be more precise for the sector overall.

The top-down stress test shows that the Danish banking sector as a whole has sufficient buffers to withstand the expected economic development, cf. Chart 2. However, it cannot be ruled out that write-downs will be so large that some banks will need to strengthen their capital base further. According to the stress test, a much more severe economic development than expected would entail write-downs of a magnitude that would make it difficult for large parts of the banking sector to observe the statutory requirement towards the end of the period.

### Bottom-up stress test

The bottom-up stress test, which was performed in cooperation between the six largest Danish banks and Danmarks Nationalbank, also tests the resilience of the banks to negative economic shocks. Developments in

<sup>1</sup> Calculations in the top-down stress test include the capital injected into the 14 banks in 2009, cf. Box 2 in the chapter *Top-Down Stress Test*.

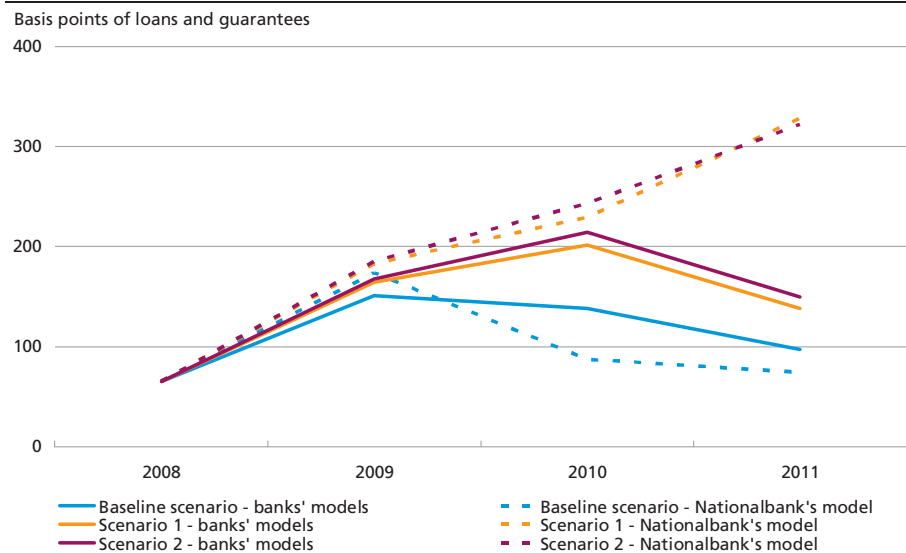


each of the six banks reflect their individual calculations of how they will be affected by the scenarios specified by Danmarks Nationalbank. As the banks' own calculations are based on their own portfolios and internal models, the results for the individual banks can be assumed to be more precise than those of the top-down stress test. At the same time, the results reflect the different models applied by the banks, and therefore the results may be less comparable than if the same model had been applied.

As stated above, the bottom-up stress test is based on an earlier forecast than the top-down stress test is. Consequently, the scenarios from the bottom-up stress have also been compiled using Danmarks Nationalbank's model for the six banks participating in the bottom-up stress test. References in this section to Danmarks Nationalbank's calculations are thus calculations based on the scenarios in the bottom-up stress test.

Estimates of future write-downs are among the major differences between the results of the bottom-up stress test and Danmarks Nationalbank's own calculations of the same scenarios. Traditionally, this area is subject to considerable uncertainty. In the baseline scenario, Danmarks Nationalbank's model entails lower write-downs than the banks' own models, except in 2009, cf. Chart 3. In the two stress scenarios, Danmarks Nationalbank's model provides for significantly larger write-downs than

ESTIMATED WRITE-DOWNS IN BOTTOM-UP STRESS TEST SCENARIOS Chart 3



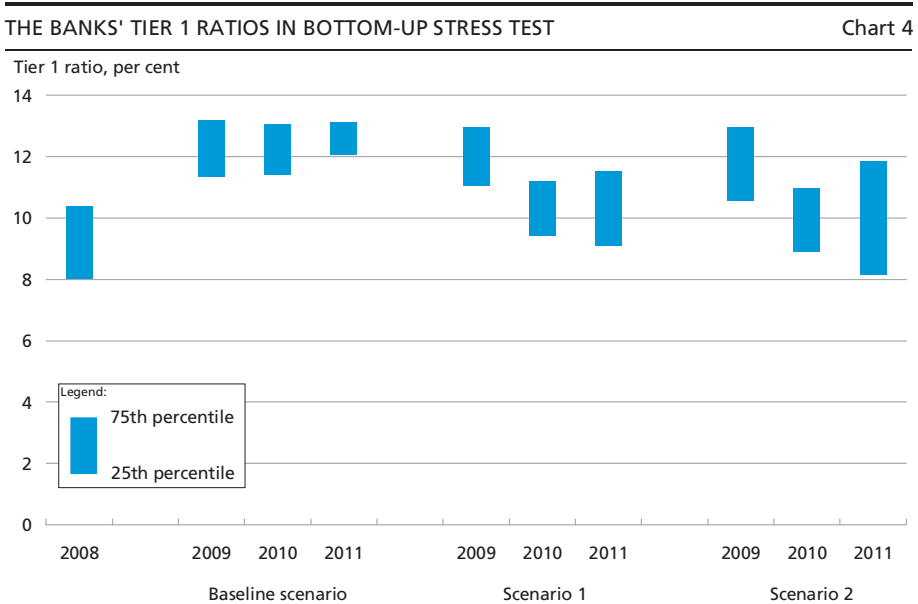
Note: The banks' estimated write-downs have been calculated at group level, but exclusive of write-downs and credit exposures in any subsidiary mortgage-credit institutes. Danmarks Nationalbank's calculations are at institution level for the six banks that participated in the bottom-up stress test.

Source: Banks' responses in bottom-up stress test, Danish Financial Supervisory Authority, banks' financial statements and own calculations.

the banks' own models. These differences are mainly seen in 2011, which is the last forecast year and therefore the most uncertain one. There are many possible explanations to the differences between the estimates of write-downs. One explanation could be that Danmarks Nationalbank's estimates are based on calculations for the sector overall, and that the largest banks have traditionally had smaller-than-average losses. Another explanation could be that the banks' estimates are based on information about exposures in their portfolios (and thus credit quality), while Danmarks Nationalbank's model only includes information on the sector breakdown of the banks' portfolios. Finally, the model structures and the data used may differ.

The bottom-up stress test shows that the banks by current standards are in a good position to resist the expected economic development as well as the considerably more severe stress scenarios, cf. Chart 4. In both stress scenarios, the banks estimate that their write-downs in 2010 will be so high that their capital base generally deteriorates. For 2011, write-downs in the stress scenarios are estimated to be at a level where some banks will see their Tier 1 ratios decline, while those of other banks will improve as a result of positive earnings.

Looking ahead, it is uncertain how much capital a bank will need in order to be seen as well capitalised. However, there cannot be any doubt that in the future both new regulation and the market will require banks



Note: Tier 1 capital must constitute at least 50 per cent of the base capital; hence the Tier 1 capital must constitute at least 4 per cent of a bank's risk-weighted assets. The banks' Tier 1 ratios are at group level.

Source: Banks' responses in bottom-up stress test.

to hold more capital of a better quality than they did prior to the onset of the crisis. Tighter regulation is not expected to enter into force until the end of 2012. However, banks and other market participants are likely to start preparing for more stringent requirements already at this stage.

### **Summary assessment**

The dialogue between the banking institutions and Danmarks Nationalbank in connection with the bottom-up stress test has proved to be useful for increasing both parties' understanding of the possible consequences of various scenarios for the financial sector. It has also underscored the uncertainty linked to any assessments made in the current situation. In future, this dialogue will be extended.

The banks' calculations of the sector's resilience are more positive than those of Danmarks Nationalbank, but they have much in common. The primary difference between the banks' results and those of Danmarks Nationalbank are related to the magnitude and timing of the banks' write-downs. This area is subject to considerable uncertainty.

The results of the stress tests do not prompt Danmarks Nationalbank to propose new initiatives at present. It is, however, important that the banks' capital planning take into account the uncertainty linked to future developments, the likelihood of more stringent regulation and the financial market requirements.



## Top-Down Stress Test

To gain a general view of the resilience of the financial sector, Danmarks Nationalbank has performed a top-down stress test based on the 14 largest banks in Denmark. Danmarks Nationalbank's stress test shows that the Danish banking sector as a whole has sufficient buffers to withstand the expected economic development. A few banks may, however, need to strengthen their capital bases. In the scenarios where economic developments are much more negative than anticipated, several banks will be struggling to meet the statutory solvency requirements. In the stress scenarios outlined this will not be the case until late 2011.

### SCENARIOS – TOP-DOWN STRESS TEST

Developments in the banking sector are modelled in four scenarios – a baseline and three stress scenarios – over the period from 2009 to 2011. For a description of Danmarks Nationalbank's top-down stress test model, see *Financial stability 2008*. The stress scenarios have been developed in cooperation with the Danish Supervisory Authority.

#### Baseline scenario

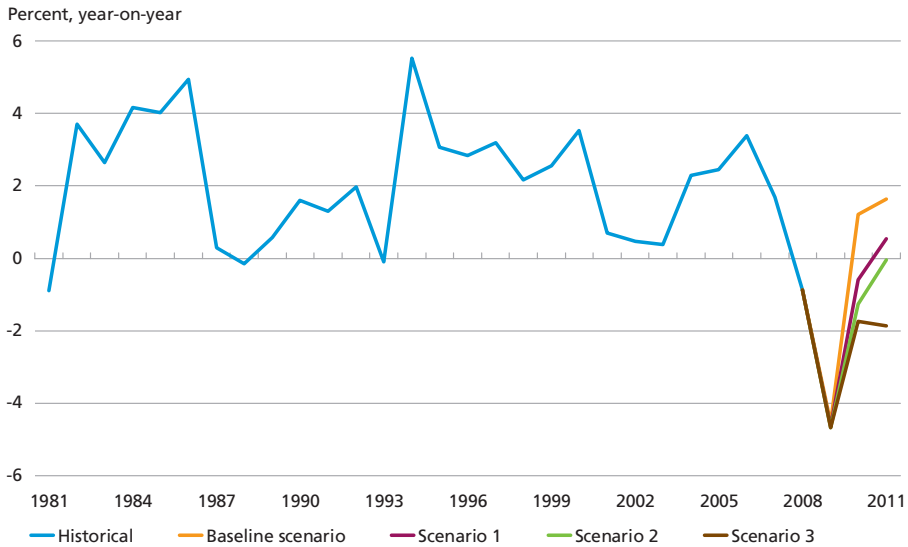
The baseline scenario is an update of Danmarks Nationalbank's most recent forecast as published in *Monetary Review, 3rd Quarter 2009*. The scenario reflects the main elements of the development in the Danish economy and in the financial sector that is assessed to be most probable.

BASELINE SCENARIO AND SCENARIOS FROM *FINANCIAL STABILITY 2009:1* Table 2

	Baseline scenario Top-down	Scenarios from <i>Financial stability 2009:1</i>		
		Baseline scenario	1: Negative shock to the Danish economy	2: L-scenario
<b>2009</b>				
GDP, per cent, year-on-year ....	-4.5	-2.4	-4.0	-4.5
Unemployment rate, per cent ..	3.4	4.5	5.6	6.1
<b>2010</b>				
GDP, per cent, year-on-year ....	1.2	0.5	-1.9	-2.9
Unemployment rate, per cent ..	5.5	6.5	8.9	10.2
<b>2011</b>				
GDP, per cent, year-on-year ....	1.6	1.5	-0.0	-0.6
Unemployment rate, per cent ..	6.0	6.3	9.6	11.8

GROWTH IN REAL GDP

Chart 5

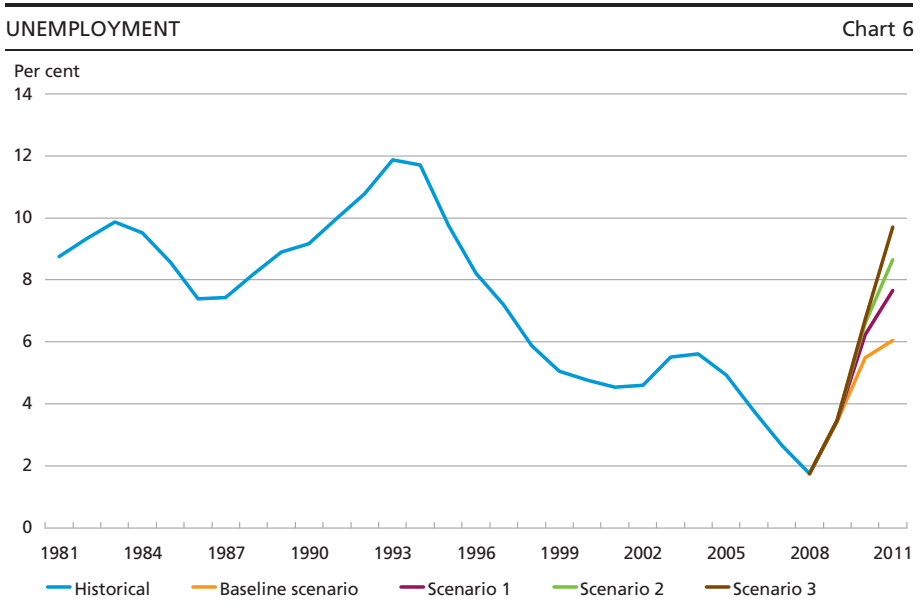


Source: Statistics Denmark and own calculations.

Like the international economy, the Danish economy was hit by a severe downturn in the wake of the financial crisis. Relative to the baseline scenario presented in *Financial stability, 1st half 2009*, GDP growth in 2009 has been adjusted downwards and is now expected to be -4.5 per cent, cf. Table 2. This is similar to the level in the spring stress scenarios, although unemployment did not actually reach the level operated with in those scenarios. On the other hand, the growth rates for 2010 and 2011 are a little higher, reflecting that elements of the recent downturn are of a temporary nature, including inventory reductions. However, GDP is expected to grow only moderately in the next few years, while the unemployment rate is expected to rise to 6 per cent in 2011, cf. Chart 5 and Chart 6.

### Stress scenarios

Two of the three stress scenarios are updates of those presented in *Financial stability, 1st half 2009*. The analysis is supplemented with an extra scenario in which the economy is hit by an even more negative shock. The scenarios test the robustness of the banks to possible, but not very probable economic shocks. The three scenarios are a negative shock to the Danish economy – scenario 1; a combination of a domestic recession and international stagnation – scenario 2; and a global recession – scenario 3. The latter is the most severe economic scenario, but is also assessed to be the least probable of the three stress scenarios.



Source: Statistics Denmark and own calculations.

### Scenario 1: Aggravated financial crisis and confidence crisis in the Danish economy

The Danish economy is hit by a further negative shock. Tight credit policies on the part of the banking institutions and continued pessimism among consumers lead to further declines in consumption, cash prices for houses and private investment. In this scenario, unemployment rises to 7.7 per cent in 2011, while house prices fall by a total of around 30 per cent over the three years.

### Scenario 2: Long Danish recession and international stagnation

The domestic crisis in scenario 1 is combined with international stagnation. The decline in the international economy seen in recent quarters returns, and export markets freeze at the current weak level. The downturn is sought to be countered by continuing the accommodative monetary policy. Unemployment rises to 8.7 per cent in 2011, and GDP growth is negative throughout the period. The low level of interest rates means that housing market developments are slightly less negative than in scenario 1.

### Scenario 3: Long and strong Danish and international recession

The third stress scenario represents a more severe and, it is assumed, even less probable development in the Danish economy than the two other scenarios. In this scenario, the international economy contracts

further at the end of 2010 and subsequently stagnates. The domestic credit and confidence crisis worsens and lengthens, and the housing market deteriorates further. Unemployment rises to 9.7 per cent in 2011, and housing prices fall by more than 35 per cent over the period from 2009 to 2011.

Macroeconomic developments in the baseline scenario and the three stress scenarios are specified in Table 3.

SPECIFICATION OF SCENARIOS FOR THE DANISH ECONOMY  
FORECASTS AS AT NOVEMBER 2009 – TO BE CONTINUED

Table 3

	Baseline scenario Top-down	Scenario 1 Top-down	Scenario 2 Top-down	Scenario 3 Top-down
<i>2009</i>				
GDP, per cent, year-on-year .....	-4.5	-4.6	-4.7	-4.7
Unemployment, thousands .....	100	101	101	101
Labour force, thousands .....	2,931	2,931	2,931	2,931
Unemployment rate, per cent .....	3.4	3.4	3.5	3.5
3-month money market interest rate, per cent p.a. ..	1.7	1.7	1.7	1.7
Average bond yield, per cent p.a. ....	3.8	3.8	3.8	3.8
House prices, per cent, year-on-year .....	-14.0	-14.7	-14.7	-14.8
Consumer prices (HICP), per cent, year-on-year ....	1.1	1.1	1.1	1.1
Imports, per cent, year-on-year .....	-13.1	-13.4	-13.5	-13.5
Exports, per cent, year-on-year .....	-10.3	-10.3	-10.5	-10.5
Business investment, per cent, year-on-year .....	-9.1	-10.1	-10.2	-10.2
Housing investment, per cent, year-on-year .....	-17.2	-18.8	-18.8	-18.8
Private consumption, per cent, year-on-year .....	-5.2	-5.4	-5.4	-5.4
Public consumption, per cent, year-on-year .....	1.8	1.8	1.8	1.8
Hourly wages, industry, per cent, year-on-year ....	2.9	2.9	2.9	2.9
Public-sector investments, per cent, year-on-year ..	14.5	14.5	14.5	14.5
Industrial exports, per cent, year-on-year .....	-15.9	-15.9	-16.3	-16.3
Disp. income, private sector, per cent, year-on-year ..	2.4	2.3	2.2	2.2
Employment, thousands .....	2,831	2,830	2,830	2,830
of which private sector .....	1,821	1,820	1,820	1,820
Inventory investments, contribution to GDP				
growth, percentage points .....	-1.7	-1.7	-1.7	-1.7
Money-market interest rate, T/N, per cent p.a. ....	1.7	1.7	1.7	1.7
Export market growth, per cent, year-on-year .....	-13.3	-13.3	-13.3	-13.9
Hourly productivity, private non-agriculture, per cent, year-on-year .....	-1.3	-1.4	-1.4	-1.4
Government budget balance, kr. billion .....	-54	-54	-55	-55
Net borrowing/net lending, private sector, per cent, year-on-year .....	107.4	110.4	109.6	109.6
B.o.p. current account, kr. billion .....	54	56	55	55
GDP, current prices, kr. billion .....	1,658	1,656	1,655	1,655



## RESULTS – TOP-DOWN STRESS TEST

### Bank earnings

The banks' core earnings were high in the first three quarters of 2009. High core earnings help to buffer the banks against write-downs on loans. In all scenarios, earnings are expected to remain high in 2010 and 2011. Moreover, contributions to Bank Rescue Package will cease on 1 October 2010.

SPECIFICATION OF SCENARIOS FOR THE DANISH ECONOMY  
FORECASTS AS AT NOVEMBER 2009 – TO BE CONTINUED

Table 3

	Baseline scenario Top-down	Scenario 1 Top-down	Scenario 2 Top-down	Scenario 3 Top-down
<i>2010</i>				
GDP, per cent, year-on-year .....	1.2	-0.6	-1.3	-1.8
Unemployment, thousands .....	160	182	192	196
Labour force, thousands .....	2,915	2,915	2,915	2,915
Unemployment rate, per cent .....	5.5	6.2	6.6	6.7
3-month money market interest rate, per cent p.a. .	1.5	1.5	0.7	0.9
Average bond yield, per cent p.a. ....	4.2	4.2	3.2	3.5
House prices, per cent, year-on-year .....	0.2	-9.8	-7.0	-14.8
Consumer prices (HICP), per cent, year-on-year ....	1.7	1.7	1.6	1.6
Imports, per cent, year-on-year .....	0.7	-2.3	-3.8	-4.8
Exports, per cent, year-on-year .....	0.1	0.2	-2.1	-2.5
Business investment, per cent, year-on-year .....	-5.5	-14.0	-14.2	-15.4
Housing investment, per cent, year-on-year .....	-5.0	-23.2	-21.9	-23.0
Private consumption, per cent, year-on-year .....	2.2	-0.2	-0.7	-2.1
Public consumption, per cent, year-on-year .....	1.5	1.5	1.5	1.5
Hourly wages, industry, per cent, year-on-year ....	2.8	2.6	2.5	2.5
Public-sector investments, per cent, year-on-year ..	16.0	16.0	16.0	16.0
Industrial exports, per cent, year-on-year .....	0.1	0.3	-2.7	-3.3
Disp. income, private sector, per cent, year-on-year .	5.3	4.0	3.0	2.8
Employment, thousands .....	2,756	2,734	2,723	2,719
of which private sector .....	1,739	1,716	1,706	1,702
Inventory investments, contribution to GDP growth, percentage points .....	0.5	0.5	0.5	0.5
Money-market interest rate, T/N, per cent p.a. ....	1.5	1.5	0.7	0.9
Export market growth, per cent, year-on-year .....	2.4	2.4	-1.9	-2.7
Hourly productivity, private non-agriculture, per cent, year-on-year .....	4.8	3.5	2.9	2.5
Government budget balance, kr. billion .....	-105	-122	-121	-127
Net borrowing/net lending, private sector, per cent, year-on-year .....	152.8	195.1	186.0	197.4
B.o.p. current account, kr. billion .....	47	73	65	70
GDP, current prices, kr. billion .....	1,702	1,670	1,657	1,649

### The banks' write-downs

Modelling bank write-downs is a core element of Denmark's National bank's stress test model, cf. Box 1. In both the baseline scenario and the stress scenarios the pressure on bank profits is attributable to large write-downs on loans. In the baseline scenario, total write-downs are expected to be in line with those in *Financial stability, 1st half 2009*, but with a different profile as write-downs in the baseline scenario peak in 2009 and decline in 2010 and 2011. The changes reflect economic growth in 2009

SPECIFICATION OF SCENARIOS FOR THE DANISH ECONOMY  
FORECASTS AS AT NOVEMBER 2009

Table 3

	Baseline scenario Top-down	Scenario 1 Top-down	Scenario 2 Top-down	Scenario 3 Top-down
<i>2011</i>				
GDP, per cent, year-on-year .....	1.6	0.5	-0.1	-1.9
Unemployment, thousands .....	175	222	251	282
Labour force, thousands .....	2,900	2,900	2,900	2,900
Unemployment rate, per cent .....	6.0	7.7	8.7	9.7
3-month money market interest rate, per cent p.a. ..	2.7	2.7	0.4	0.9
Average bond yield, per cent p.a. ....	4.8	4.8	2.7	3.5
House prices, per cent, year-on-year .....	2.0	-6.9	-1.6	-11.6
Consumer prices (HICP), per cent, year-on-year ....	1.5	1.5	1.4	1.4
Imports, per cent, year-on-year .....	3.1	2.0	0.5	-2.9
Exports, per cent, year-on-year .....	2.2	2.4	-0.6	-2.4
Business investment, per cent, year-on-year .....	-0.0	-4.6	-2.9	-9.0
Housing investment, per cent, year-on-year .....	-0.9	-8.6	-0.1	-8.1
Private consumption, per cent, year-on-year .....	2.6	0.8	0.2	-2.5
Public consumption, per cent, year-on-year .....	1.5	1.5	1.5	1.5
Hourly wages, industry, per cent, year-on-year ....	2.8	2.1	1.7	1.4
Public-sector investments, per cent, year-on-year ..	3.4	3.3	3.3	3.3
Industrial exports, per cent, year-on-year .....	2.8	3.2	-0.3	-2.2
Disp. income, private sector, per cent, year-on-year ..	2.4	2.1	0.8	-0.0
Employment, thousands .....	2,725	2,678	2,649	2,619
of which private sector .....	1,706	1,659	1,630	1,600
Inventory investments, contribution to GDP growth, percentage points .....	0.2	0.2	0.2	0.2
Money-market interest rate, T/N, per cent p.a. ....	2.8	2.8	0.5	1.0
Export market growth, per cent, year-on-year .....	4.1	4.1	0.0	-4.0
Hourly productivity, private non-agriculture, per cent, year-on-year .....	1.9	1.8	1.9	0.8
Government budget balance, kr. billion .....	-94	-126	-122	-150
Net borrowing/net lending, private sector, per cent, year-on-year .....	139.3	207.4	182.0	224.6
B.o.p. current account, kr. billion .....	44	81	59	74
GDP, current prices, kr. billion .....	1,756	1,704	1,678	1,638

## WRITE-DOWNS AND LOSSES IN DANMARKS NATIONALBANK'S STRESS TEST MODEL

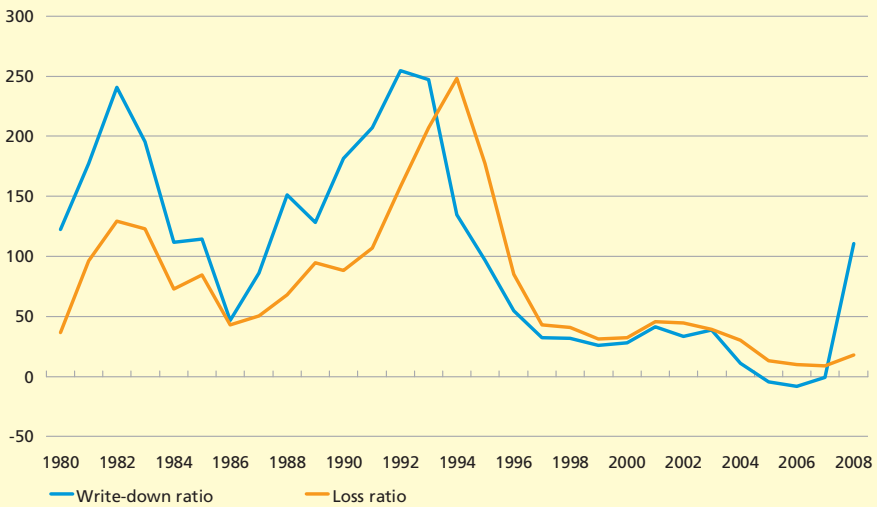
Box 1

The credit-risk module of Danmarks Nationalbank's stress test model is continuously developed and updated. In the near future, losses and write-downs are expected to be the key factors behind the development in bank profits, and therefore special focus is placed on assessing these items in the various scenarios.

In relation to the stress test model, the distinction between losses and write-downs is important as the net impact of write-downs on profits, and thus on capital structures, is what is initially interesting. Historically, write-downs have been booked 1-2 years before the losses are realised, cf. the Chart below. The accounting rules were changed in 2005. Consequently, it is uncertain whether previous relationships between losses and write-downs also apply in future. Write-downs increased very strongly in 2008, while losses rose only slightly, cf. the Chart below. This indicates that write-downs are still booked some time before the losses are realised.

### HISTORICAL WRITE-DOWNS AND LOSSES

Basis points of loans and guarantees



Source: Baldvinsson, Bender, Busck-Nielsen and Rasmussen (2005). Dansk bankvæsen (Danish Banking – in Danish only), 5th edition. Forlaget Thomsen, Danish Financial Supervisory Authority, banks' financial statements and own calculations.

The estimation of the banks' write-downs in the stress test model follows a 2-stage procedure. First, the banks' losses are estimated and projected. Then a relation is estimated for how write-downs have traditionally related to cyclical developments.

In terms of estimation, the major challenges are that data is available for a relatively short period only and that no periods with large losses have been seen while the current accounting rules have been in force. Consequently, large deviations in the projections of sector write-downs may occur as a result of small changes in the set of explanatory variables (as illustrated in Box 16 in *Financial stability, 1st half 2009*). Moreover, the economic situation at the onset of the crisis, e.g. unemployment and interest rates, was very different from the situation last time write-downs were large, i.e. during the crisis in the early 1990s. There are thus no naturally comparable situations in the past.

**WRITE-DOWNS AND LOSSES IN DANMARKS NATIONALBANK'S STRESS TEST MODEL – CONTINUED**

Box 1

In order to determine the link between losses and economic developments, the observed losses in 10 different sectors are regressed on a set of macrovariables. The losses for each of the modelled sectors are then projected on the basis of the projection for the economy. The advantage of modelling individual sectors separately rather than modelling one overall loss ratio is that in this way the model better captures differences in the sector exposures of the individual banks. Needless to say, the model cannot take into account the different qualities of the banks' lending portfolios.

In order to determine the link between write-downs and losses as a result of economic developments, the relationship between the sector's aggregated write-downs and aggregated losses is regressed a set of macrovariables. The relationship between the banks' write-downs and losses is then projected on the basis of the projection for the economy. The write-downs are projected by multiplying the projected ratio by the projected losses.

The baseline scenario losses will exceed write-downs in 2010 and 2011, cf. the Table below. The reason is that the banks' expected losses are included in their write-downs in future. Consequently, the write-down ratio is high at the beginning of the recession and declines as the macroeconomy improves. Losses, on the other hand, are spread over the period and will to some extent be realised after the economy has begun to pick up again. In the baseline scenario, the economy will improve in 2010, and write-downs will be smaller than losses. In the three stress scenarios, the macroeconomy remains weak throughout the period, and write-downs are consistently higher than losses.

**ESTIMATED WRITE-DOWNS AND LOSSES IN THE TOP-DOWN STRESS TEST SCENARIOS**

Basis points of total lending exposure	2009	2010	2011	I alt
<i>Baseline scenario Top-down</i>				
Estimated losses .....	51	151	99	301
Estimated write-downs (applied) .....	161	129	93	382
<i>Scenario 1 Top-down</i>				
Estimated losses .....	52	170	183	405
Estimated write-downs (applied) .....	165	251	240	656
<i>Scenario 2 Top-down</i>				
Estimated losses .....	52	145	149	346
Estimated write-downs (applied) .....	166	247	225	638
<i>Scenario 3 Top-down</i>				
Estimated losses .....	52	159	251	462
Estimated write-downs (applied) .....	164	298	531	994

Note: In the estimations, the banks' (transformed) loss ratios are regressed on a number of explanatory variables. The loss ratios of different sectors are modelled separately. With the exception of the output gap, the explanatory variables are included in Table 3.

Source: Own calculations.

THE BANKING SECTOR'S AGGREGATED ANNUAL WRITE-DOWN RATIOS IN THE TOP-DOWN STRESS TEST

Chart 7



Note: 2009 observations are determined by the observed write-downs in the 1st half of the year and by the estimates for the 2nd half.

Source: Baldvinsson, Bender, Busck-Nielsen and Rasmussen (2005). Dansk bankvæsen (Danish Banking – in Danish only), 5th edition. Forlaget Thomsen, Danish Financial Supervisory Authority, banks' financial statements and own calculations.

that was more negative than anticipated, among other things. In the three stress scenarios, the write-down ratio rises sharply in 2010. Write-downs then fall marginally in scenarios 1 and 2, but increase further in scenario 3, cf. Chart 7. Write-downs increase to a level corresponding to that seen during the banking crisis in the early 1990s in scenarios 1 and 2 and to a considerably higher level in scenario 3.

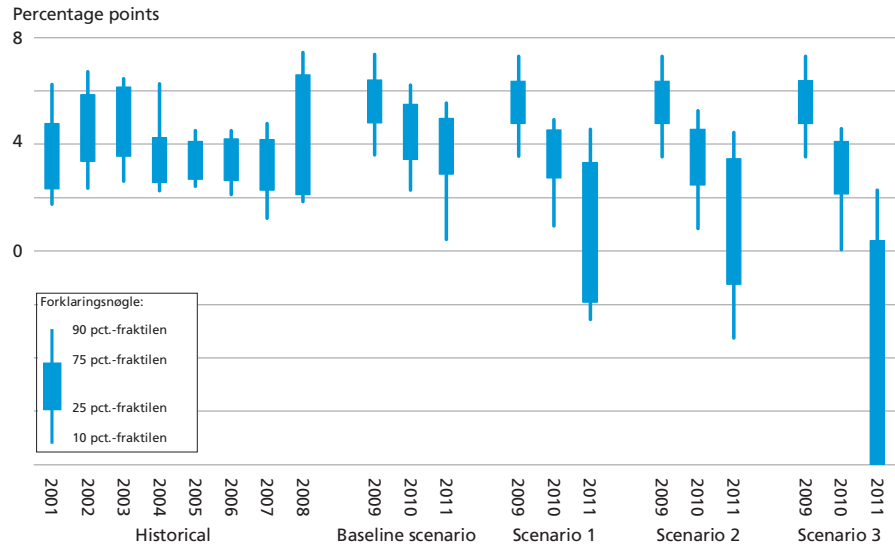
In the three stress scenarios, the sector distribution of write-downs is of major significance to the banks' bottom lines. In scenario 1, the property administration and building and construction sectors in particular are severely affected, so the more a bank is exposed to these sectors, the greater the pass-through to its profit will be. The same applies in scenario 2, in which primarily the property administration and transport and trade sectors are hit. In scenario 3 most sectors are severely affected.

### The banks' capitalisation

Generally, the banks increased their excess capital adequacy from 2008 to 2009, cf. Chart 8. Part of the explanation is that several banks have received government capital injections by way of hybrid core capital

THE BANKS' EXCESS CAPITAL ADEQUACY IN THE TOP-DOWN STRESS TEST

Chart 8



Source: Danish Financial Supervisory Authority, banks' financial statements and own calculations.

under the Credit Package, while others have raised new capital in the market or from a parent company, cf. Box 2.

In the top-down stress test, the banks' capitalisation shows a downward trend throughout the period. In the baseline scenario, the banks' excess capital adequacy gradually declines, but only few banking institutions are close to not observing the statutory solvency requirement.

The development in the banks' capital buffers differs considerably in the three stress scenarios, cf. Chart 8. In scenarios 1 and 2, just under half of the banks have problems observing the statutory requirement at the end of the period. In scenario 3, some banks are struggling at end-2010, while most banks fall below the statutory solvency requirement during 2011.

When assessing the banks' robustness it is important to bear in mind that several of the banks analysed are subsidiaries of large groups; these are Nordea Bank Danmark, Nykredit Bank, Forstædernes Bank and Alm. Brand Bank. The excess capital adequacy of these banks may be low because capital is placed in the parent company, and consequently the banks do not perform well in the stress test. The parent company is assumed to be ready to bail out the subsidiary if necessary, and therefore the subsidiaries may be more robust than they appear. Since it is uncertain to which extent the parent company, which is also expected to be affected by the stress scenarios, is able to support the subsidiary, the stress test does not take this possibility into account.

## CAPITALISATION ASSUMPTIONS IN THE TOP-DOWN STRESS TEST

Box 2

The banks' robustness reflects the development in their capital structures. Over the last six months it has become clear how large capital injections the individual banks will be receiving under the Credit Package. At the same time, a number of banks have strengthened their capital base, either by issuing new shares, by selling treasury shares or by receiving capital injections from their parent companies. Among the largest banks, Sydbank and Jyske Bank have taken advantage of the improved market conditions in the autumn of 2009 to increase their share capital, while rejecting the offer of hybrid core capital injections under the Credit Package.

Overall the capital expansions have been smaller than envisaged under the Credit Package, cf. the Table.

## CAPITAL INJECTIONS

Kr. million	Equity injected in 2009 <sup>1</sup>	Credit Package	Calculated potential injection under Credit Package, end-2008
<i>Group 1</i>			
Danske Bank .....		23,992	23,948
FIH Erhvervsbank .....		1,900	2,264
Jyske Bank .....	1,368		3,285
Nordea Bank Danmark <sup>2</sup> .....			8,878
Nykredit Bank <sup>3</sup> .....	3,200		4,113
Sydbank .....	1,286		2,228
<i>Gruppe 2</i>			
Alm. Brand Bank .....	900	856	0
Amagerbanken .....	710	1,106	1,471
Arbejdernes Landsbank .....			641
Forstædernes Bank <sup>4</sup> .....	1,150		883
Ringkjøbing Landbobank ...	60		452
Spar Nord Bank .....	24	1,265	1,317
Sparbank .....	2	480	651
Vestjysk Bank .....	7	1,438	1,907
<b>Total .....</b>	<b>8,707</b>	<b>31,037</b>	<b>52,038</b>

Note: The potential injection under the Credit Package is calculated as the difference between 12 per cent and the bank's Tier 1 ratio multiplied by the bank's risk-weighted assets if the Tier 1 ratio is between 6 and 9. If the Tier 1 ratio exceeds 9, the potential injection has been set at 3 per cent of the risk-weighted assets, while it has been set as zero if the Tier 1 ratio is below 0. Calculations are at an institution level.

Source: Company announcements, banks' financial statements and own calculations.

<sup>1</sup> In the calculation of equity injected in 2009, sales of treasury shares have only been included for Q1-3.

<sup>2</sup> Nordea Bank AB, the parent company of Nordea Bank Danmark, strengthened its capital base in 2009.

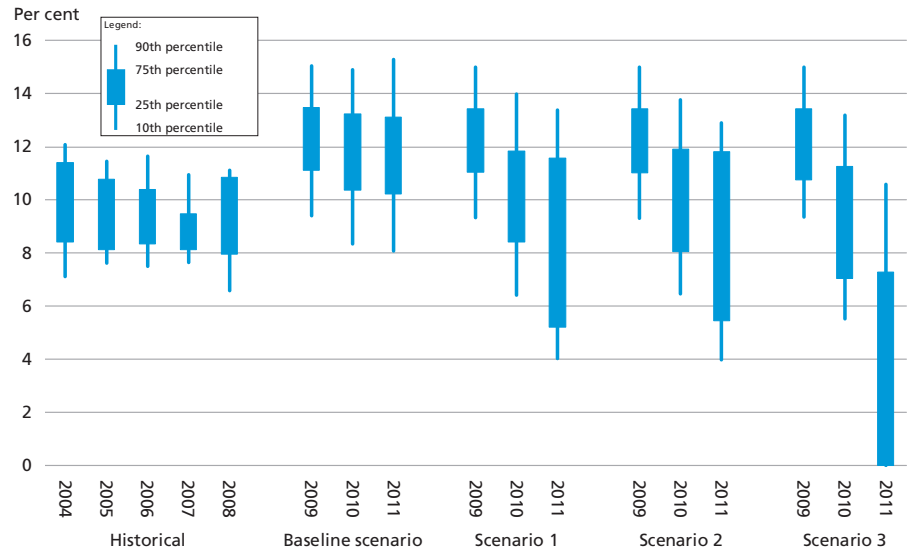
<sup>3</sup> Kr. 2.4 billion of the kr. 3.2 billion injected into Nykredit Bank as equity is a conversion of Nykredit Realkredit's subordinated capital injections.

<sup>4</sup> Kr. 0.35 billion of the kr. 1.15 billion injected into Forstædernes Bank as equity is a conversion of Nykredit Realkredit's subordinated capital injections.

The calculations do not take into account the option to convert capital injections under the Credit Package into share capital in some cases. The assumption reflects uncertainty as to how much of the capital will be converted into share capital.

BANKS' TIER 1 RATIOS IN TOP-DOWN STRESS TEST

Chart 9



Note: Tier 1 capital must constitute at least 50 per cent of the base capital; hence the Tier 1 capital must constitute at least 4 per cent of a bank's risk-weighted assets.

Source: Danish Financial Supervisory Authority, banks' financial statements and own calculations.

### Top-down stress test results and new regulations

Against the backdrop of the financial crisis, many forums are discussing the regulation of the financial sector. Among other things, the crisis has demonstrated that the capitalisation of the financial sector was not sufficient to counter the current economic development. Both in the EU and in broader forums work is underway to amend the capital-adequacy rules. The amendments have not yet been adopted, but are expected to include requirements of an increase in and improvement of the quality of the banks' capital.

Focus has already to a large extent shifted from the banks' capital base and excess capital adequacy to their Tier 1 capital and non-hybrid core capital.<sup>1</sup> In scenarios 1 and 2 only few banks have Tier 1 ratios below 6 per cent, cf. Chart 9. In scenario 3 the Tier 1 ratios of many of the 14 banks drop below 6 per cent.

<sup>1</sup> Tier 1 capital must constitute at least 50 per cent of a bank's capital base. Hybrid core capital must not exceed 50, 35 or 15 per cent of the Tier 1 capital (the sum of non-hybrid and hybrid core capital), depending, inter alia, on the bank's opportunity to convert hybrid core capital into share capital, cf. Box 17 in Financial stability, 1st half 2009.



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## Bottom-Up Stress Test

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*The bottom-up stress test performed by Danmarks Nationalbank in cooperation with the six largest Danish banks shows that the banks have sufficient buffers to withstand the expected economic development as well as a situation in which the economy deteriorates further. Large write-downs are expected in the near future. In the stress scenarios outlined, the estimated write-downs are so high that the banks' profits turn negative in 2010, thereby reducing their capital base. Nevertheless, the Tier 1 ratios of all banks are well above 4 per cent at the end of the scenarios.*

To contribute further to the assessment of the robustness of the financial sector in Denmark, Danmarks Nationalbank and the six largest Danish banks jointly performed a bottom-up stress test in the autumn of 2009. In the bottom-up stress test, each of the six banks has applied its own model for calculating how its exposures will develop in three economic scenarios prepared by Danmarks Nationalbank. Subsequently, Danmarks Nationalbank has aggregated the results of the six banks. Similar bottom-up stress tests have been conducted on the largest US banks by the Federal Reserve and on the largest European banks by the Committee of European Banking Supervisors, CEBS.<sup>1</sup>

The banks were guaranteed anonymity before the test started and consequently only the 25th and 75th percentiles are shown in the charts in this chapter. At the same time, some of the participating banks are members of financial groups so that their solvency ratios are not immediately comparable since part of their excess capital adequacy may be placed in the parent company, cf. the chapter *Stress Testing in Cooperation between Danmarks Nationalbank and Large Danish Banks*. Below, the banks' resilience is therefore illustrated by the development in Tier 1 ratios in the scenarios.

A major advantage of performing a bottom-up stress test in cooperation with the banks themselves is that they are in a better position to take into account the credit quality of their exposures – and their customers' reactions to the development specified in the scenarios. Furthermore, it must be regarded as an advantage that the calculations are based on the models used by the banks in their own risk manage-

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<sup>1</sup> See also Box 15 in *Financial stability, 1st half 2009*.

ment. The primary challenge is the comparability of results since different models are used for the calculations. Variations in the outcomes may therefore to some extent be model-related rather than reflecting differences in the quality of the banks' exposures. In addition, a bottom-up stress test requires the participant banks to have sophisticated models, which is why only the six largest Danish banks were involved in the exercise. The results cannot be applied to other banks in Denmark.

Details about the bottom-up stress testing procedure, the underlying calculation assumptions and further information about the results of the exercise can be found in the chapter *Stress Testing in Cooperation between Danmarks Nationalbank and Large Danish Banks*. The main results are summarised below.

## SCENARIOS – BOTTOM-UP STRESS TEST

The baseline scenario for the bottom-up stress test, which was performed during the autumn of 2009, was Danmarks Nationalbank's forecast from September 2009. A baseline scenario and two stress scenarios are analysed in the bottom-up stress test. One stress scenario – scenario 1 – can be seen as a negative shock to the Danish economy, while the other – scenario 2 – can be seen as a simultaneous shock to the Danish and international economies, cf. Table 4. The stress test scenarios have been developed in cooperation with the Danish Financial Supervisory Authority.

DEVELOPMENT IN SELECTED KEY RATIOS IN THE SCENARIOS FOR THE DANISH ECONOMY IN THE BOTTOM-UP STRESS TEST

Table 4

	Baseline scenario Bottom-up	Scenario 1 Bottom-up	Scenario 2 Bottom-up
<b>2009</b>			
GDP, per cent, year-on-year .....	-3.2	-3.6	-3.7
Unemployment rate, per cent .....	3.5	3.7	3.7
Average bond yield, per cent p.a. ....	3.8	3.8	3.7
House prices, per cent, year-on-year .....	-14.1	-16.3	-16.1
<b>2010</b>			
GDP, per cent, year-on-year .....	0.9	-1.2	-2.0
Unemployment rate, per cent .....	5.7	6.7	7.2
Average bond yield, per cent p.a. ....	4.1	4.1	3.0
House prices, per cent, year-on-year .....	-0.3	-11.4	-8.3
<b>2011</b>			
GDP, per cent, year-on-year .....	1.7	0.5	-0.3
Unemployment rate, per cent .....	6.2	8.2	9.5
Average bond yield, per cent p.a. ....	4.7	4.7	2.6
House prices, per cent, year-on-year .....	1.9	-8.0	-3.5

Note: For further specifications, see Table X in the chapter *Stress Testing in Cooperation between Danmarks Nationalbank and Large Danish Banks*.

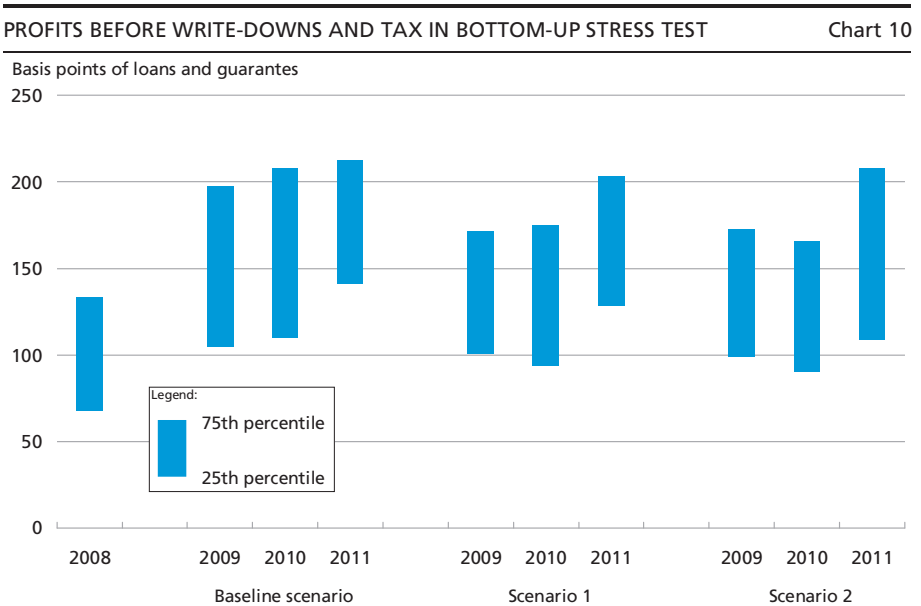
**RESULTS – BOTTOM-UP STRESS TEST**

**Bank earnings**

The banks' current earnings provide the first buffer against mounting write-downs. Higher current earnings mean that a bank can sustain greater write-downs before having to break into its capital base. The banks' estimates of their current earnings are to some extent based on their budgets, and the expected current earnings differ only slightly in the baseline scenario and the two stress scenarios.

A significant difference in relation to current earnings in the scenarios concerns the assumed contributions to Bank Rescue Package. In the baseline scenario, it is assumed that kr. 10 billion will be payable in addition to the kr. 15 billion payable in guarantee commission. In the two stress scenarios it is assumed that contributions reach their maximum (kr. 35 billion) level so that current earnings will be lower in the these two scenarios than in the baseline scenario, cf. Chart 10. In scenario 2, falling interest rates entail lower net income from interest than in the baseline scenario and scenario 1, particularly towards the end of the period.

The write-downs that the banks can absorb from their current earnings differ, cf. Chart 10. This difference is significant in terms of how robust the banks are to a prolonged period with regular write-downs.



Note: The banks' profits before write-downs and tax relative to loans and guarantees at group level. Write-downs on the value of goodwill, if any, are included in the profit before write-downs and tax.

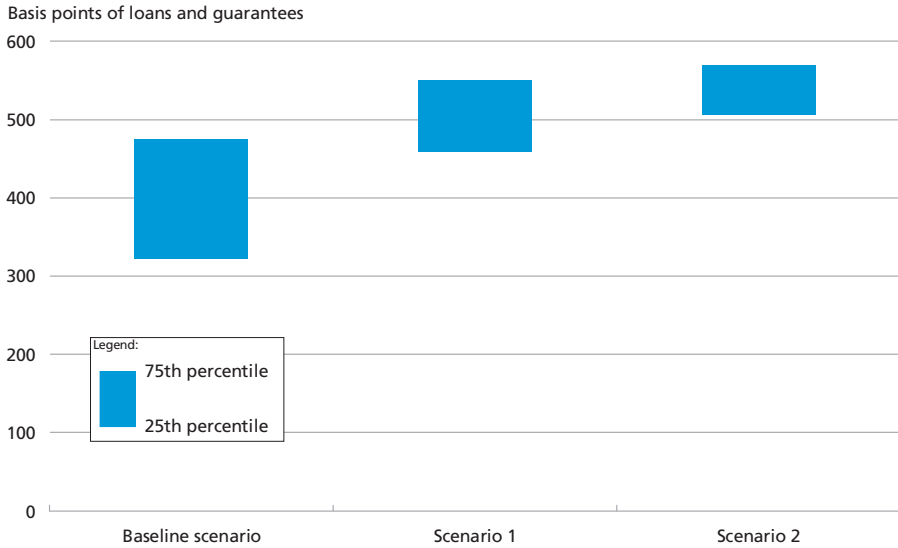
Source: Banks' responses in bottom-up stress test.

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**AGGREGATED WRITE-DOWNS FOR THE PERIOD 2009-11 IN BOTTOM-UP STRESS TEST**


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Chart 11



Note: The banks' estimated write-downs calculated at group level, but exclusive of write-downs and credit exposures in any subsidiary mortgage-credit institutes.

Source: Banks' responses in bottom-up stress test.

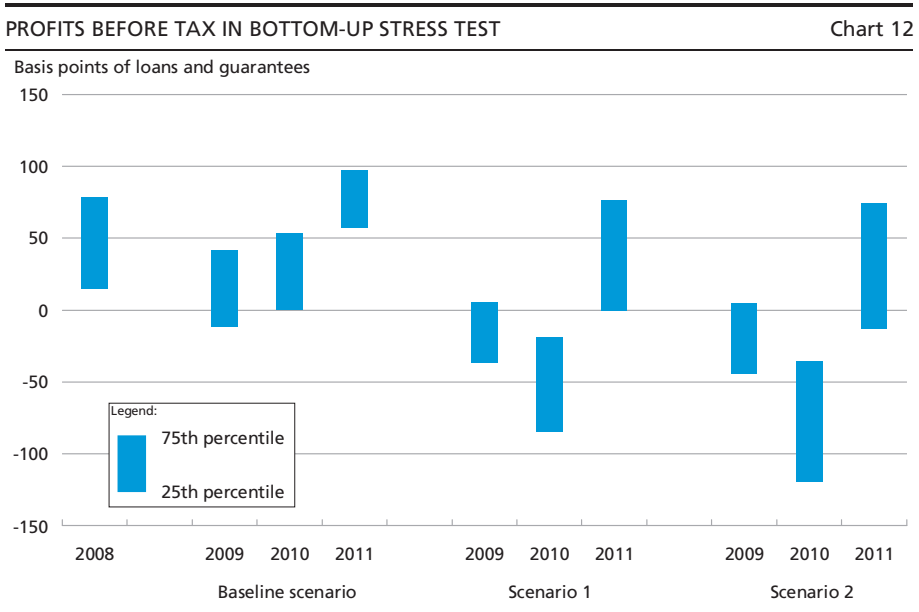
### The banks' write-downs

The banks' expect to post large write-downs in the near future. However, the magnitude of the write-downs is highly uncertain in all three scenarios.

The banks' expected write-downs vary substantially in the baseline scenario, cf. Chart 11, the largest being around twice as high as the lowest. In scenario 1 the aggregate expected write-downs are on average approximately 100 basis points higher than in the baseline scenario, while they are approximately 130 basis points higher in scenario 2. It is interesting to note that the spread between the banks' estimated write-downs is smaller in the two stress scenarios than in the baseline scenario. It might be expected that differences in the quality of the banks' exposures and in the sectors to which the banks are exposed would be reflected more strongly in write-downs in a situation where economic developments are significantly more negative than in the baseline scenario.

### The banks' financial results

In the baseline scenario, the banks generally expect profits to hover around zero, with a tendency to be in positive territory in both 2009 and 2010, cf. Chart 12. Significant improvements are expected in 2011. This reflects that the banks expects write-downs in 2010 to remain at a high



Note: The banks' profits (before tax) in basis points of loans and guarantees calculated at group level.  
 Source: Banks' responses in bottom-up stress test.

level, while a pronounced decline is expected in 2011, when the banks' contributions to Bank Rescue Package have also ceased.

In the two stress scenarios, profits in 2009 are also expected to hover around zero, but with a downward bias. 2010 will be a very negative year in both stress scenarios, while the profits of most banks are expected to be positive in 2011. This reflects that write-downs are generally expected to increase from 2009 to 2010 in the two scenarios before falling back to a lower level in 2011. The significant improvement of profits in 2011 also reflects that contributions to Bank Rescue Package will cease. In both stress scenarios the banks' expectations for 2010 and 2011 differ considerably more than in the baseline scenario.

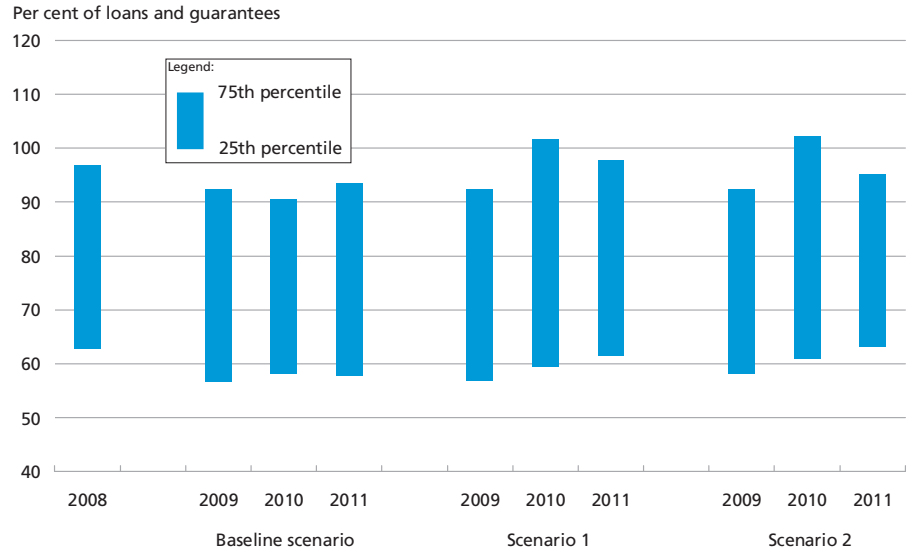
### The banks' capitalisation

Developments in the banks' capital ratios are determined by developments in risk-weighted assets and in the banks' capital bases. In the scenarios, it is assumed that no further liable capital will be injected. The development in bank solvency ratios is thus driven by the banks' risk-weighted assets and their profits.

In all scenarios, most of the banks expect the ratio of risk-weighted assets to lending at end-2011 to be at the same level as at end-2008, cf. Chart 13. Bank expectations of how average risk weights will develop vary

AVERAGE RISK WEIGHTS CALCULATED AS RISK-WEIGHTED ASSETS IN PER CENT OF LOANS AND GUARANTEES IN BOTTOM-UP STRESS TEST

Chart 13



Note: The banks' risk-weighted assets in per cent of loans and guarantees calculated at group level.  
Source: Banks' responses in bottom-up stress test.

considerably.<sup>1</sup> In the baseline scenario, risk weights are expected to either fall, remain unchanged or rise over the period, depending on the bank. In the two stress scenarios, the banks generally expect risk-weighted assets to increase from 2009 to 2010. Viewed in isolation, this means that the banks' capital ratios deteriorate. No major changes are expected from 2010 to 2011.

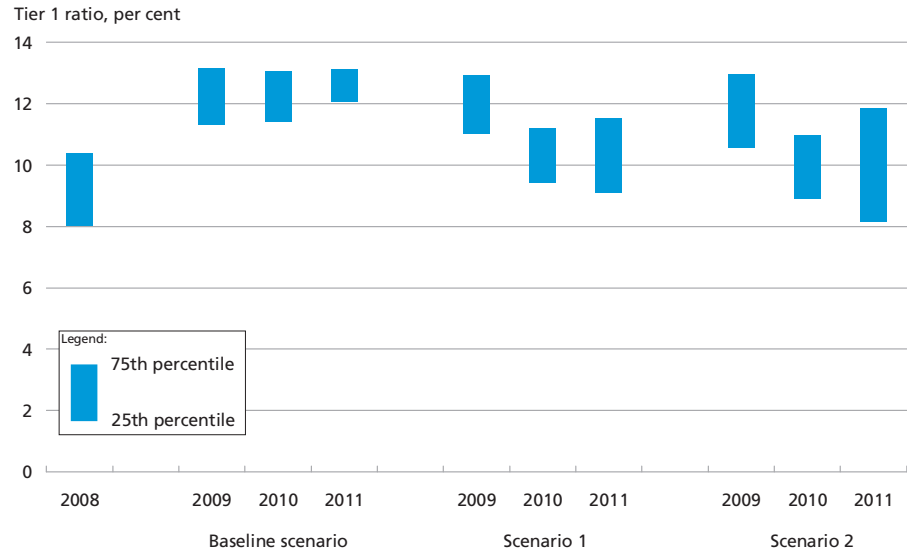
The banks' Tier 1 ratios generally show a positive trend over the baseline scenario, cf. Chart 14. From 2008 to 2009, the changes in the Tier 1 ratios are primarily attributable to capital injections, either from the central government, via the market or from the parent company; retained earnings are a secondary contributing factor. The Tier 1 ratio continues to rise in 2010 and 2011, reflecting the development in bank profits.

In the two stress scenarios, the banks' capitalisation is expected to deteriorate in 2010 as a result of very large write-downs. In 2011 the c improves for a few banks, but deteriorates for others. There is a tendency for the Tier 1 ratio to deteriorate for banks that already have a low ratio, while it strengthens for banks with a relatively high ratio. As a result, the spread between the banks with high and low Tier 1 ratios widens.

<sup>1</sup> Differences in the development in the average risk weights of the banks' exposures primarily reflect whether the banks apply the "point-in-time" or the "through-the-cycle" approach to calculating the probability of customers defaulting on their obligations to the bank.

TIER 1 RATIOS IN THE BOTTOM-UP STRESS TEST

Chart 14



Note: The banks' Tier 1 ratios are at group level.  
 Source: Banks' responses in bottom-up stress test.

Measured by the Tier 1 ratio, all banks have substantial excess cover relative to the statutory requirement at the end of the baseline scenario.<sup>1</sup> The Tier 1 ratios of all banks are substantially above 4 per cent – the statutory requirement for a capital need of 8 per cent – at the end of the two stress scenarios. In each of the two stress scenarios, five of the six banks have a Tier 1 ratio of more than 6 per cent at the end of the scenario.

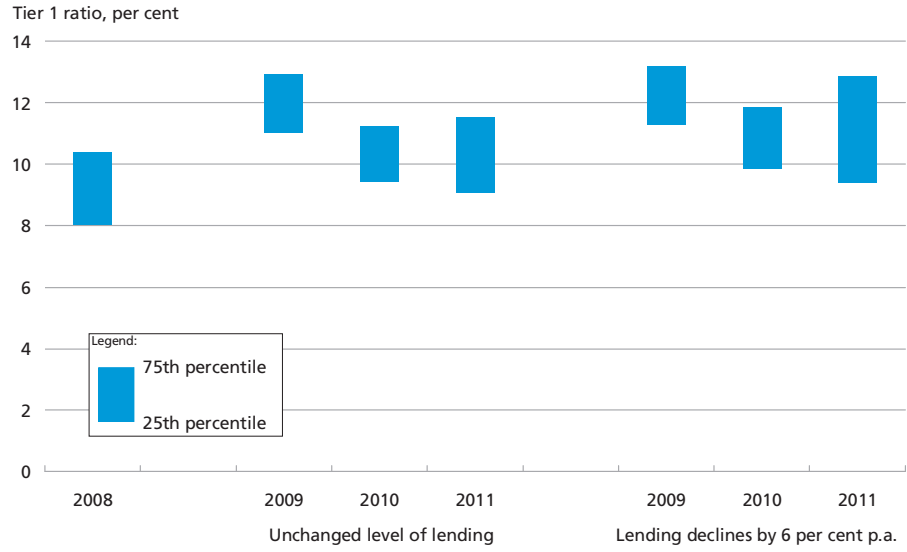
### Sensitivity analysis – effect of falling lending

In the calculations, the banks were to assume that lending in the scenarios remained unchanged relative to the 1st half of 2009. Several banks have pointed out that lending will, of course, show a downward trend in the severe stress scenarios. This may be attributable to falling demand for investment loans or other circumstances. In terms of the banks' capital, falling loans and guarantees will have opposite effects. Initially the effect on bank profits will mainly be negative as lower lending will reduce net income from interest and fees, while it can be more difficult to cut costs and reduce the credit exposures that will re-

<sup>1</sup> The average non-hybrid core capital ratio (simple average) is 11.2, 8.8 and 8.6 per cent at end-2011 in the baseline scenario, scenario 1 and scenario 2, respectively. The average Tier 1 ratio is 12.8, 10.1 and 9.9 per cent, respectively, in the three scenarios. The average solvency ratio is 14.4, 11.7 and 11.5 per cent, respectively, in the three scenarios.

DEVELOPMENT IN TIER 1 RATIOS IN SCENARIO 1 IF LENDING DECLINES BY 6 PER CENT P.A. IN BOTTOM-UP STRESS TEST

Chart 15



Note: The banks' Tier 1 ratios are at group level.

Source: Banks' responses in bottom-up stress test and own calculations.

sult in losses for the banks. On the other hand, lower lending will reduce the banks' risk-weighted assets, thereby improving their capital ratios.

In order to assess the net impact of the outlined fall in lending, Danmarks Nationalbank has used the data provided by the banks for scenario 1 to calculate how the banks' capital structure would have developed if lending had declined. It is assumed that the banks' loans and guarantees decrease by 6 per cent in each year of the scenario. Furthermore, it is assumed that net income from interest and fees and risk-weighted assets fall proportionally with lending, but that lending does not affect the banks' costs and write-downs on loans. Overall these assumptions are estimated to be conservative, so the banks' solvency ratios will presumably be higher than calculated.<sup>1</sup>

The impact of such a fall in lending on the banks' solvency ratios varies considerably, cf. Chart 15. For banks with a high Tier 1 ratio from the outset, deteriorating profits – and the resulting reduction in Tier 1 capital – will be more than offset by the fall in risk-weighted assets. The Tier 1 ratio will increase by more than 1 percentage point for the banks seeing the highest increase. For banks with a relatively low Tier 1 ratio from the

<sup>1</sup> The estimated Tier 1 ratio in the stylised calculations is almost 1 percentage point lower than in the estimates calculated by the two banks supplying results with alternative growth-pattern assumptions, cf. the chapter *Stress Testing in Cooperation between Danmarks Nationalbank and Large Danish Banks*.



outset, the effect on Tier 1 capital of the poor performance will more or less offset the reduction in risk-weighted assets, and the Tier 1 ratio will remain broadly unchanged.

### **POSSIBLE COURSES OF ACTION FOR THE BANKS**

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It is assumed that the banks do not react to the deteriorating economic situations in the stress scenarios. This is a stylised and not necessarily particularly realistic assumption that has been made in order to ensure comparability of results. If the economic situation does deteriorate, the banks must be expected to defend their earnings and capital structures. This will increase their robustness relative to the calculations in the bottom-up stress test.

The banks' options are mainly to increase interest margins, cut costs and reduce their balance sheets. Increasing interest margins and cutting costs boosts the banks' earnings, allowing them to absorb larger write-downs before they have to break into their capital. Reducing the balance sheet – e.g. lending – reduces the bank's risk-weighted items, and although the bank's performance may seem to be worse since its write-down ratio increases, this may improve its capital ratios.

### **SUMMARY**

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The banks' own analyses of the scenarios prepared by Danmarks Nationalbank show that the banks are well cushioned against further negative shocks to the economy. If one of the stress scenarios outlined should materialise, 2010 can be expected to be a tough year for the banks in profit terms, but their capitalisation is assessed to be sufficient to withstand such developments. If the banks' credit exposures are hit harder than expected, this may have a dual impact on the banks' solvency ratios by reducing their capital via larger write-downs while also increasing their risk-weighted assets.



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# Stress Testing in Cooperation between Danmarks Nationalbank and Large Danish Banks

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*Danmarks Nationalbank has performed a bottom-up stress test in cooperation with the six largest Danish banks in order to improve analysis of any vulnerabilities in the Danish banking sector. For the purpose of this exercise, Danmarks Nationalbank set up a baseline scenario and two stress scenarios as well as a number of assumptions to be included in the calculations by all participants. Based on their portfolios and internal models, the participating banks conducted impact analyses for each of the scenarios, and finally Danmarks Nationalbank aggregated the individual results*

This chapter describes the stress testing process, including Danmarks Nationalbank's instructions to the banks and the further process of the joint stress test exercise. Finally, the most important general impressions from the ongoing dialogue between the banks and Danmarks Nationalbank in the course of the exercise are described. The aggregate results of the banks' calculations can be found in the chapter entitled *Bottom-Up Stress Test*.

## INTRODUCTION

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In the autumn of 2009, Danmarks Nationalbank performed a stress test in cooperation with the six largest Danish banks – the joint stress test exercise. Danmarks Nationalbank set up three scenarios for economic development in Denmark – a baseline scenario and two stress scenarios – as well as a number of assumptions to be included in the calculations by all participants. Each bank calculated the impact the economic scenarios would have on its portfolio, and finally Danmarks Nationalbank aggregated the results.

The stress test provides a forward-looking assessment of the ability of the largest Danish banks to absorb shocks to the economy. It is important to bear in mind that stress tests are based on a number of stylised assumptions concerning both the economic development and the development in the banks' financial statements. At the same time, specifying a number of the assumptions to be made by the banks limits the manage-

ment response options available to the banks in the real world. This means that the banks had only limited opportunity to adapt their strategies to the development. It is also important to keep in mind that the stress test does not provide an exhaustive view of the risk factors faced by the banks, and that the full picture of risk factors varies from bank to bank.

Several advantages can be harvested from performing a stress test in cooperation with the banks to be tested – i.e. a bottom-up stress test – rather than performing the entire stress test centrally – i.e. a top-down stress test. The most important advantage is that the banks make the calculations based on their own models, which they also use for risk management purposes. Hence, the results will better reflect any differences in the quality of each bank's credit books and risk profile. In principle, the calculations also allow for the impact of large exposures and concentration risk in general on write-downs.

Conversely, a number of factors increase the uncertainty concerning bottom-up stress tests compared to top-down stress tests, making it potentially more difficult to interpret the results. The key challenge of bottom-up stress tests is the use of different models to evaluate the banks' portfolios, as each bank uses its own model. This can make data aggregation difficult, as there will be quantitative differences between the results because different models respond differently to different types of stress. The results of a bottom-up stress test should therefore be seen as a supplement rather than as a substitute for a top-down stress test.

An overview of the banks participating in the joint stress test exercise is given below. The procedure and the instructions received by the banks are subsequently explained. The most important impressions from the dialogue between Danmarks Nationalbank and the participating banks are then described, followed by a summary of the results of the exercise.

## **THE PARTICIPATING BANKS**

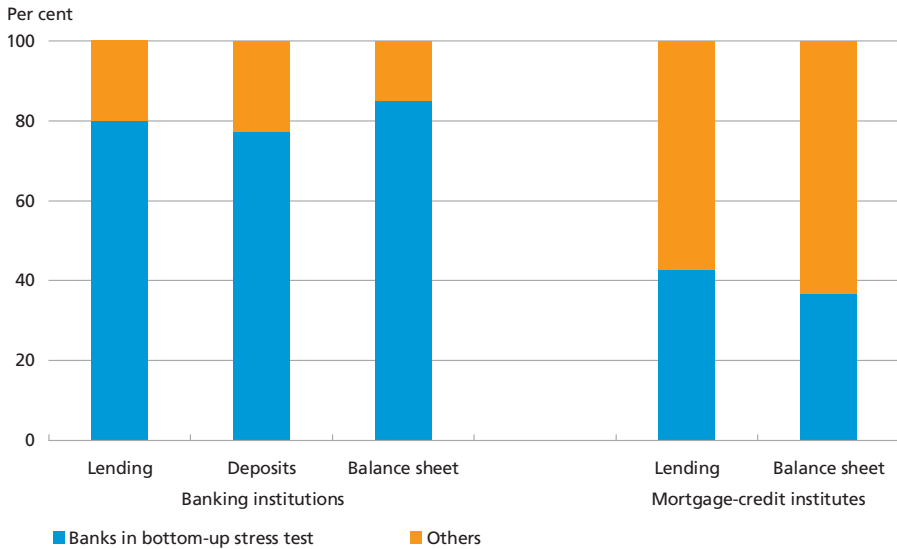
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In the autumn, Danmarks Nationalbank asked the largest Danish banking institutions to participate in a joint stress test exercise. Participation in the exercise was voluntary, but all the invited banks decided to participate. The participating banks are the banks under Danish supervision with a working capital of more than kr. 50 billion, i.e. Danske Bank, FIH Erhvervsbank, Jyske Bank, Nordea Bank Danmark, Nykredit Bank and Sydbank.

Lending by the six participating banks accounts for 80 per cent of the total lending by Danish banking institutions, and their balance sheets likewise account for 85 per cent of the total balance sheet, cf. Chart 16. At the same time, the population covers 43 per cent of lending by mortgage-

MARKET SHARES OF PARTICIPATING INSTITUTIONS, 1ST HALF OF 2009

Chart 16



Source: Danish Financial Supervisory Authority, banks' and mortgage-credit institutes' financial statements.

credit institutes, as Realkredit Danmark and Nordea Kredit, which are subsidiaries of Danske Bank and Nordea Bank Danmark, respectively, are also included in the calculations. On the other hand, Nykredit Realkredit as the parent company in the Nykredit group is not included, as Nykredit Realkredit was not asked to participate in the exercise.

Two of the participating banking institutions belong to large financial groups. These are Nykredit Bank, a subsidiary of Nykredit Realkredit, and Nordea Bank Danmark, a subsidiary of Nordea Bank AB. For Nykredit Bank and Nordea Bank Danmark alike this means that they have traditionally been operating with lower excess capital adequacy than the other banks in the population, as the excess capital adequacy of the groups is placed in the parent company from which it is then allocated to the subsidiaries. As the parent companies are not included in the stress test exercise, it is difficult to assess how the scenarios will impact the groups and the extent to which the parent companies are able to support the subsidiaries.<sup>1</sup>

The primary risk factor for the six participating banks is currently assessed to be the development in write-downs. This is reflected in the choice of stress scenarios.

<sup>1</sup> Nykredit Realkredit is further exposed to the banking sector through its ownership of Forstædernes Bank, which was acquired by the group in October 2008, and which is planned to be merged into Nykredit Bank. At the end of the 1st half of 2009, Forstædernes Bank's lending amounted to kr. 20 billion, its total balance sheet amounted to kr. 33 billion and its risk-weighted assets to kr. 24 billion. Forstædernes Bank had a Tier 1 ratio of 11.2 per cent and a solvency ratio of 17.0 per cent at the end of the 1st half of 2009. Forstædernes Bank is not included in the calculations.

**SELECTED BALANCE-SHEET ITEMS AND THE COMPOSITION OF RISK-WEIGHTED ASSETS, END OF 1ST HALF OF 2009**

Table 5

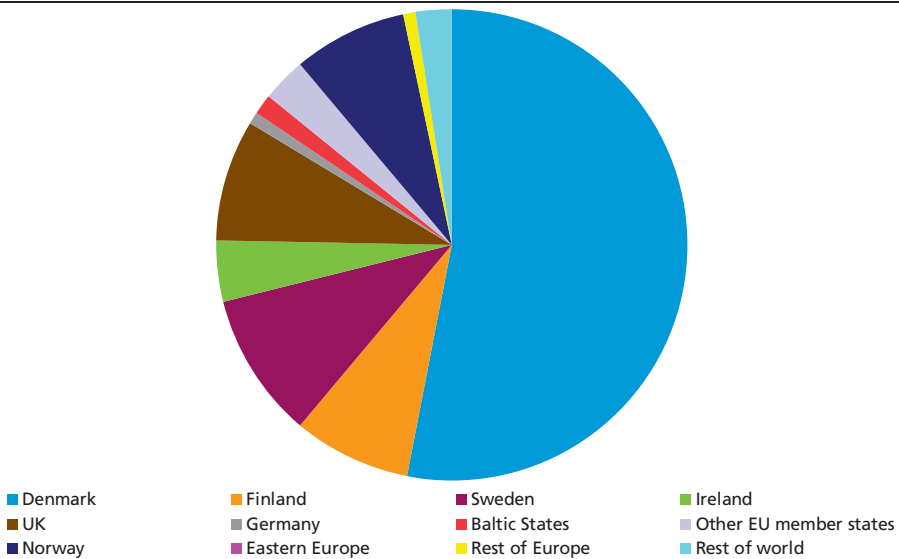
	Danske Bank	FIH Erhvervsbank	Jyske Bank	Nordea Bank DK	Nykredit Bank	Sydbank
<b>Selected balance-sheet items (kr. billion)</b>						
Lending .....	1,898	68	117	680	69	89
Balance sheet .....	3,240	136	226	1,014	199	160
Risk-weighted assets .....	961	87	98	290	75	74
<b>Composition of risk-weighted column 1 assets (pct. of RWA)</b>						
Credit risk .....	86	na	80	86	82	81
Market risk .....	6	na	9	6	14	10
Operational risiko .....	9	na	10	8	4	9

Source: Banks' financial statements.

Danske Bank is by far the largest bank in the population, cf. Table 5. At the same time, Danske Bank is the only bank that in its response to the bottom-up stress test explicitly takes into account credit exposure to foreign economies, cf. Chart 17. Just over half the bank's credit exposure is to Danish customers, but it also has significant credit exposures to customers in Finland, Sweden, Ireland, the UK and Norway. Danske Bank's units in Finland, Northern Ireland and Luxembourg are subsidiaries, while the rest are branches.

**GEOGRAPHICAL BREAKDOWN OF DANSKE BANK'S CREDIT EXPOSURE**

Chart 17



Source: Danske Bank's interim report 2009.

CAPITAL STRUCTURE BEGINNING OF 1ST HALF OF 2009

Table 6

	Danske Bank	FIH Erhvervsbank	Jyske Bank	Nordea Bank DK	Nykredit Bank	Sydbank
Capital structure:						
Tier 1 ratio .....	12.2	11.1	12.2	7.6	9.4	11.4
Solvency ratio .....	16.1	13.8	14.0	10.0	12.5	13.8
Profit before write-downs and tax (bp of loans and guarantees)						
Profit as in 2005-2007 .....	119	173	233	123	263	249
Profit as in 2008 .....	71	95	180	91	78	156
Profit as in 1st half 2009 .....	175	127	231	129	182	234

Note: The profit before tax and write-downs is relative to the average lending of the period. Any write-downs of goodwill are included in the result before tax and write-downs. Banks that have written down the value of goodwill may therefore appear to be less able to absorb write-downs than would otherwise be the case.

Source: Banks' financial statements.

At the baseline, the six banks have a considerable buffer to absorb write-downs. Four out of six have a Tier 1 ratio of more than 11 per cent, the two exceptions being Nordea Bank Danmark and Nykredit Bank. As previously mentioned, this can reflect their group relations. This results in a considerable buffer in relation to the statutory requirement.

The banks will primarily experience a decline in their excess capital adequacy if they record losses. Current earnings serve as the first bulwark against write-downs. There is a remarkably large difference between the extent to which the banks can write down their lending before the write-downs exceed their current earnings, i.e. profit before write-downs and tax, and begin to eat into their capital. This applies both across banks and over time, cf. Table 6. In 2008, profit before write-downs and tax was lower than before. Conversely, profit before write-downs and tax was relatively high in the 1st half of 2009. It is clear that differences in the current earnings of the banks greatly affect their ability to absorb write-downs in the near future.

## THE PROCESS

The banks' participation in the common stress test exercise was voluntary and based on the premise that rather than publishing the results for individual banks, Danmarks Nationalbank would only publish results in an anonymised form.

The common stress test exercise was subject to a tight schedule. In mid-September 2009, Danmarks Nationalbank issued a set of draft instructions to the six banks. The instructions were to form a common basis for the calculations. The banks were then invited to comment on them before the

final instructions were issued at the end of September. The primary objective of the banks' comments was to clarify uncertainties, to identify the needs of individual banks and to point out any bank-specific issues that should be taken into account in order to increase the comparability of the results. As far as possible, and to the extent this would not compromise the principle of the exercise, the comments were incorporated into the final instructions. The stress level of the scenarios was determined by Danmarks Nationalbank.

The results of the calculations were supplied to Danmarks Nationalbank at the end of October. Danmarks Nationalbank, jointly with the Danish Financial Supervisory Authority, subsequently engaged in a dialogue with each of the participating banks to achieve the best possible understanding of what drives the results and to ensure maximum comparability. The results were subsequently aggregated by Danmarks Nationalbank. The participating banks had the opportunity to review the results before publication.

While it was Danmarks Nationalbank's responsibility to set up the economic stress scenarios and aggregate the results, the banks were responsible for the calculations. The fact that the calculations were made decentrally and based on different models makes data aggregation a challenge. It is not given that different models react in the same way to different types of shocks, which is necessary if the results are to be fully comparable. In order to ensure the greatest possible comparability across banks, Danmarks Nationalbank set up a number of assumptions – in addition to the macroeconomic scenarios – to be made by each bank. The most significant assumptions concern lending growth, the composition of exposures and the development in the capital of the banks. Accordingly, the banks' results will reflect both the exercise instructions and circumstances specific to each bank. The advantage of these instructions is that they ensure better comparability of results. The drawback is that they limit the realism of the calculations.

## **INSTRUCTIONS**

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The calculations were based on the banks' interim reports for 2009, although some banks also included the actual development in the 3rd quarter. The economic scenarios run until the end of 2011. This means that the banks estimate the development in their profit and balance sheet over a period of 2½ years under the given assumptions. The banks' calculations are made on a consolidated basis, i.e. including subsidiaries. Moreover, the calculations are based on current legislation and do not include expected legislative amendments.



## Scenarios

The stress test included three scenarios: a baseline scenario and two stress scenarios. The baseline scenario is the scenario considered by Danmarks Nationalbank at the start of the stress test exercise to be representative of the most likely development in the Danish economy.<sup>1</sup> The two stress scenarios include a scenario where the Danish economy is exposed to shocks while the development in the international economy corresponds to the development in the baseline scenario, and a scenario exposing both the Danish and the international economy to shocks.

The macroeconomic variables defining the scenarios of the development in the Danish economy are for GDP, unemployment, labour force, money-market interest rates and bond yields, house prices, HICP, imports and exports, business and residential investments, private and public consumption and hourly wages on an annual basis, cf. Table 7. Danmarks Nationalbank also made historical series available to the banks requesting this.

International economic developments in the baseline scenario are assumed to follow the OECD's forecast from June 2009 to end-2010.<sup>2</sup> Overall guidelines were provided for the way the international economy was to be assumed to develop in order to be consistent with the other parts of the scenarios. However, banks with direct exposure to the development in foreign economies have had a high degree of autonomy in their assessment of the stressed development in those economies.

## Assumptions

In addition to the specification of the economic development, a number of assumptions to be included in the calculations by all the banks were specified. The required assumptions may deviate from the assumptions the banks themselves would have made. Hence, the results may provide a different picture of their resilience than the banks themselves would have achieved. To ensure as much comparability as possible it was necessary to specify a number of stylised assumptions, however.

Basically, lending is assumed to be constant over the period concerned so that by the end of 2011, the level of lending of each bank will be the same as in the bank's interim report 2009. Especially in the two stress scenarios, the demand for loans must be expected to reflect the negative economic development. As a result, the banks in the scenarios may look less resilient than they actually are. The banks were therefore allowed to calculate the scenarios under alternative assumptions concerning lending growth. Under the alternative lending assumptions, lending declines by 6

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<sup>1</sup> The scenario is described in further detail in Danmarks Nationalbank, *Monetary Review, 3rd Quarter 2009*.

<sup>2</sup> OECD (June 2009), *Economic Outlook*, No. 85.

SPECIFICATION OF SCENARIOS FOR THE DANISH ECONOMY IN THE BOTTOM-UP  
STRESS TEST

Table 7

	Baseline scenario	Scenario 1	Scenario 2
<i>2009</i>			
GDP, per cent, year-on-year .....	-3.2	-3.6	-3.7
Unemployment, thousands .....	102.8	106.5	107.3
Labour force, thousands .....	2,897.6	2,897.6	2,897.6
Money-market interest rate (day-to-day), per cent .....	1.8	1.8	1.8
Average bond yield, per cent .....	3.8	3.8	3.7
House prices, per cent, year-on-year .....	-14.1	-16.3	-16.1
Consumer prices (HICP), per cent, year-on-year .....	1.1	1.1	1.1
Imports of goods and services, per cent, year-on-year ...	-10.7	-11.5	-11.7
Exports of goods and services, per cent, year-on-year ....	-8.8	-8.8	-9.2
Business investment, per cent, year-on-year .....	-10.6	-13.4	-13.4
Housing investment, per cent, year-on-year .....	-11.0	-16.0	-16.0
Private consumption, per cent, year-on-year .....	-4.2	-4.7	-4.7
Public consumption, per cent, year-on-year .....	1.8	1.8	1.8
Hourly wages, industry, per cent, year-on-year .....	3.1	3.1	3.1
<i>2010</i>			
GDP, per cent, year-on-year .....	0.9	-1.2	-2.0
Unemployment, thousands .....	163.0	193.7	208.6
Labour force, thousands .....	2,881.3	2,881.3	2,881.3
Money-market interest rate (day-to-day), per cent .....	1.8	1.8	0.8
Average bond yield, per cent .....	4.1	4.1	3.0
House prices, per cent, year-on-year .....	-0.3	-11.4	-8.3
Consumer prices (HICP), per cent, year-on-year .....	1.4	1.4	1.4
Imports of goods and services, per cent, year-on-year ...	-1.4	-4.7	-6.7
Exports of goods and services, per cent, year-on-year ....	-2.2	-2.1	-5.5
Business investment, per cent, year-on-year .....	-5.3	-14.6	-14.9
Housing investment, per cent, year-on-year .....	-3.1	-22.7	-21.1
Private consumption, per cent, year-on-year .....	2.3	-0.3	-0.7
Public consumption, per cent, year-on-year .....	1.5	1.5	1.5
Hourly wages, industry, per cent, year-on-year .....	2.9	2.6	2.4
<i>2011</i>			
GDP, per cent, year-on-year .....	1.7	0.5	-0.3
Unemployment, thousands .....	178.1	233.8	272.6
Labour force, thousands .....	2,867.3	2,867.3	2,867.3
Money-market interest rate (day-to-day), per cent .....	3.2	3.2	0.5
Average bond yield, per cent .....	4.7	4.7	2.6
House prices, per cent, year-on-year .....	1.9	-8.0	-3.5
Consumer prices (HICP), per cent, year-on-year .....	1.5	1.4	1.3
Imports of goods and services, per cent, year-on-year ...	2.8	1.8	0.6
Exports of goods and services, per cent, year-on-year ....	2.9	3.1	-0.6
Business investment, per cent, year-on-year .....	3.5	-0.8	6.1
Housing investment, per cent, year-on-year .....	1.1	-5.6	1.4
Private consumption, per cent, year-on-year .....	1.5	-0.1	-1.1
Public consumption, per cent, year-on-year .....	1.5	1.5	1.5
Hourly wages, industry, per cent, year-on-year .....	3.0	2.2	1.7

per cent annually in scenario 1 and 8 per cent annually in scenario 2. No alternative lending assumptions were specified for the baseline scenario. All three scenarios assume that the composition of the bank's lending portfolio will remain unchanged during the scenario period.

It was also specified that the value of the collateral pledged as security for the banks' credit exposures must be assumed to follow the development in house prices in the scenarios. The exception was financial assets that must be assumed to follow market developments. The banks' securities portfolios must also be assumed to follow market developments.

It was assumed that raising additional core capital, hybrid core capital and subordinated loan capital is not possible. It was also to be assumed that hybrid core capital and subordinated loan capital would be repaid at the time of an interest step-up, if any.<sup>1</sup> One exception was made to this assumption in that it was assumed to be possible to replace internally issued subordinated loan capital by a similar new loan.

In relation to the capital structures shown in Table 6, the banks were able to recognise in their calculations any changes in their capital bases that were known for certain before the provision of final results. Accordingly, Sydbank was able to recognise kr. 1,286 million as a result of an increase of the share capital and the sale of own shares. Nykredit Bank was able to recognise kr. 800 million as a result of a new capital injection from Nykredit Realkredit and a conversion of further supplementary capital in the amount of kr. 2,400 million into share capital. Finally, Jyske Bank was able to recognise kr. 1,368 million as a result of a capital increase and the sale of own shares.

The banks' appetite for market risk was to be assumed not to change over the period. Operational risk was not included as part of the scenario specification.

In the baseline scenario, it is assumed that the costs of the Financial Stability Company will reach a level so that the banks participating in Bank Rescue Package must pay kr. 10 billion in addition to the guarantee commission of kr. 15 billion. The sector's total costs for the Financial Stability Company will thus amount to kr. 25 billion. The two stress scenarios assume that the banks must pay kr. 20 billion in addition to the guarantee commission. The sector's total costs in connection with Bank Rescue Package thus amount to kr. 35 billion under stress. For the banks that have received capital injections from the Credit Package, the injected capital is assumed to be able to replace funding at 4 per cent p.a. It is assumed that hybrid core capital cannot be converted into share capital

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<sup>1</sup> Calculation of a bank's capital base and thus its solvency ratio may include two types of subordinated debt, hybrid core capital and subordinated loan capital. If subordinated debt is to be repaid prematurely, the repayment must be approved by the Danish Financial Supervisory Authority. The normal market convention is for the business enterprise to repay a subordinated loan in connection with an interest step-up. If it fails to repay the loan in connection with an interest step-up, it would therefore signal that the business enterprise is weak. Even during the turbulent development in the financial sector in recent years, there are only few examples of banks that have not repaid their loans in connection with a step-up, Deutsche Bank probably being the most prominent example. In Denmark, the Danish Financial Supervisory Authority did not allow Max Bank to repay subordinated debt in February 2009 (Max Bank was allowed to repay subordinated loan capital at a later time).

unless such a conversion is required. No further public intervention is assumed in any of the scenarios.

The banks were instructed to allow for economic developments in the scenarios when calculating their adequate base capital. This means that the development in the individually calculated capital need should be taken into account in the scenarios.

### **Output from the banks**

The instructions to the banks contained a specification of the output to be provided to Danmarks Nationalbank. The groups with mortgage-credit institutes as subsidiaries were requested to provide the results both including and excluding the mortgage-credit activities. This makes it possible to compare the bank activities of the groups.

The banks were asked to present their expectations of the development in income and costs, write-downs, capital structure, risk-weighted assets and adequate base capital for each scenario. In addition, they must include a breakdown by industry of the write-downs. The banks with significant exposures to other countries than Denmark were asked to specify the geographical distribution of their total write-downs. This is of particular interest for Danske Bank, as just under half of its lending is provided to customers outside Denmark.

The instructions specified that the net operations impact of the bank's write-downs and losses must be reported. The net operations impact is of interest in terms of whether they will have problems meeting the statutory capital requirement. The fact that the final losses may turn out to be considerably lower than what is written down is of no significance if the bank is closed down before that time.

Finally, each bank had to supply a brief but adequate description of the methods used in the scenario calculations. They formed the basis for Danmarks Nationalbank's assessment of the effect the method may have had on the results and thus also formed the basis for the dialogue with the banks.

The banks were able – and indeed encouraged – to state whether the specified assumptions would result in a misleading view of the resilience of the bank concerned. The most questionable assumption was zero lending growth. As mentioned, it was also possible to calculate alternative assumptions concerning lending growth.

## **RESPONSES, METHODS AND DIALOGUE**

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One objective of the common stress test exercise was to obtain a more nuanced picture of the resilience of the Danish financial sector to further

negative shocks to the economy. This was achieved by presenting the results of the exercise in the chapter Bottom-Up Stress Test. Another objective was to increase the knowledge of the methods used by the banks and to better understand the set-up of economic stress scenarios. The key general issues discussed are described in this section.

Several of the banks' models are based on data from the same publicly available sources. This can be necessary in order to obtain data series that are sufficiently long to be able to model the development of e.g. the probabilities of failures in certain sectors as a result of macroeconomic developments. On the other hand, this may also mean that some of the differences in the banks' results reflect differences in the banks' methods rather than differences in their portfolios. The results may therefore represent actual portfolio differences to a lesser extent than what could be expected.

Two of the six banks chose to supply results including the assumption of unchanged lending and including the alternative lending assumptions where loans and guarantees are reduced in the two stress scenarios. The dialogue with the banks has shown that the banks have very different expectations of how their lending will develop during the period. Some banks expect a natural decline in their lending, especially if the economy is subjected to further stress. Others expect their lending to increase. The differences in the banks' expectations reflect inter alia differences in their views of how economic developments will impact the demand for loans and their strategies in the coming years.

Many of the banks stated that some of the assumptions specified by Danmarks Nationalbank for the stress test calculations gave a less true and fair view of the results than would have been the case if the banks had been given a free choice of methods. The argument is that the view of each bank is distorted when it is forced to use calculation assumptions for the sector that do not match the bank concerned. It is a balancing act to obtain comparable results on the one hand and to work with customised assumptions on the other. It can be argued that it is desirable for banks to present stress test results in their external communication based on both standardised assumptions and the assumptions which, according to the bank, describe the bank's development.

In terms of methods, the technical level of the banks' approach to stress tests of their exposures varies greatly. Obviously, the technical complexity is closely related to their size. The exercise demonstrated that at present banks that are smaller than the participating banks are likely to be unable to perform stress tests based on economic scenarios.

The scenarios set up were read by the banks – and written by Danmarks Nationalbank – as general shocks to the economic development. The dia-

logue with the banks raised the issue of whether such stress may trigger other more specific risk factors. A case in point might be that further shocks to the world economy may lead to devaluations in some economies that are already vulnerable. Another example might be that the combination of rising interest rates and lack of competitiveness in the scenario with an isolated negative shock to the Danish economy may have a stronger impact on agriculture than is otherwise to be expected. Both examples may lead to larger write-downs than normally warranted by the models.

Finally, the results and the dialogue with the banks demonstrated differences in what is taken into account in the banks' statements of their adequate base capital. These differences must be assumed to be even more pronounced when compared to smaller banking institutions. This may reduce the comparability of the capital needs to be published by banks in connection with the annual reports for 2009 onwards. The capital needs of individual banks contain important information for the market, however.

## **SUMMARY**

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Viewed from the perspective of Danmarks Nationalbank, the dialogue concerning the stress test assumptions, scenarios, results and the methods used has been open and constructive. The banks have made a significant effort. In future, Danmarks Nationalbank will extend its dialogue with the Danish Financial Supervisory Authority and the sector in relation to stress testing.

The bottom-up stress test contributes significantly to the assessment of the resilience of the financial sector. But it is important to bear in mind that the results of the exercise are subject to considerable uncertainty. Neither Danmarks Nationalbank's stress test model nor any other type of model can by any means model the complexity of the world. In particular, stress test scenarios will never be realised, as the relevant decision-makers will react if the stress test shows outcomes they wish to avoid. The overall assessment of the resilience of the financial sector is presumably improved by weighting together the development in different indicators and the results of different models.