SUMMARY OF THE RESULTS OF STRESS TESTS IN BANKS[119]

The subject of this article is stress tests, which constitute one of the key quantitative tools for the assessment of financial stability. Under one of the approaches, financial stability may be viewed as a situation where the financial system, *inter alia*, shows a high degree of resilience to external shocks. Under this definition, so-called aggregate stress tests are prepared in order to capture the impact of various significant shocks and business risks. In model simulations, the domestic financial system is subject to hypothetical, unlikely, but plausible shocks. The article contains the results of updated basic tests according to the methodology presented in the 2004 Financial Stability Report.[120] In addition, the article newly presents the results of interbank risk testing and results of stress testing for scenarios based on a macroeconomic model.

As part of the quantitative assessment of financial stability, a series of stress tests were performed to examine the resilience of the banking sector to the impact of selected macroeconomic shocks. These tests focus on detecting risks in the credit, exchange rate and interest rate structure of portfolios and capturing the potential impacts of interbank contagion. The tests include scenarios of the impact of macroeconomic variables derived from the CNB macroeconomic forecasting model and the credit risk model as the basis for estimating future portfolio quality.[121] These tests serve as one of the inputs for considerations on increasing the capital and maintaining the solvency of banks. The stress tests were performed at the end of 2005 and concerned 24 banks that held the entire capital of the banking sector and 90.5% of its total assets (the remaining portion of assets comprise the balance sheets of 12 branches of foreign banks that do not hold any capital in the Czech Republic). The stress tests were based on the principles and procedures used by the International Monetary Fund and the World Bank in missions of the Financial Sector Assessment Program (FSAP). Similar tests are conducted also by numerous foreign central banks.[122]

1. UPDATE OF BASIC STRESS TESTS WITH HISTORICAL SCENARIOS

As the first step in this exercise, the basic stress tests were updated. These basic tests are based on the methodology of two scenarios (scenario I and scenario II) representing two different types of stress. The values of the parameters in each scenario were set in the same way as in the previous Financial Stability Report in order to allow for comparisons. Scenario I consisted in the combination of a hypothetical increase in interest rates of 1 percentage point, a depreciation of the exchange rate of 15% and an increase in the share of non-performing loans (NPLs) of 30% by reclassification of loans. Scenario II uses the combination of an increase in interest rates of 2 percentage points, a depreciation of 20% and an increase in the share of NPLs in total loans of 3 percentage points. These scenarios take into account the prevailing international practice and the Czech conditions. In choosing the parameters, historical shocks were also taken into account, specifically the Czech Republic's experience in 1997–1999.

In the course of the stress testing exercise, the banks' portfolios were exposed to shocks. The 2005 year-end data were used. The results of the stress tests were compared with the results of the tests performed under the same methodology for the previous period starting from 2000. The stress tests followed the "bottom-up" methodology, i.e. they were implemented on the financial statements, regular reports and data of individual banks and subsequently aggregated for the entire banking sector.

The impacts of these two scenarios were assessed by comparing the capital adequacy ratio (CAR) before the hypothetical shocks (the pre-test CAR) and after the impact of the model shocks on the banks' portfolios (the post-test CAR, see Table 1).

119 Jaroslav Heřmánek, Czech National Bank (CNB); Martin Čihák, International Monetary Fund (IMF).

120 The basic stress test methodology, including the results of the impact of the shocks in scenarios I and II, was published, for instance, in the CNB's Financial Stability Report for 2004 (www.cnb.cz) and in Čihák and Heřmánek (2005) and Čihák (2004).

121 These issues are addressed in the article *Macroeconomic Credit Risk Model* in the thematic part of this Report.

122 The Czech Republic features among the countries that prepare stress tests comprising combined scenarios of macroeconomic factors, including interbank contagion analysis. A survey of the use of tests around the world and the testing methodology are included in International Monetary Fund (2005), (2003).

The initial capital adequacy ratio entering the stress tests[123] declined by 0.8 percentage point between the end of 2004 and December 2005. This decline in the capital adequacy ratio was due to the fact that some banks used retained profits for the payment of dividends and also to an increase in risk weighted assets. The modelled post-test capital adequacy ratio was 11.3% under scenario I and 10.2% under scenario II. Thus the hypothetical post-test capital adequacy ratio decreased in year-on-year terms by 0.7 percentage point for scenario I and by 0.2 percentage point for scenario II compared to the figures for the end of 2004. The fact that this year-on-year decline in the modelled post-test capital adequacy ratio was lower than the decline in the actual capital adequacy ratio prior to the application of the hypothetical shocks suggests that the banks' exposure to basic types of risk also declined. The post-shock capital adequacy ratio declined, but remained well above the 8% regulatory minimum for the banking system as a whole (see Chart 1).

For some banks, the post-test capital adequacy ratio could decline below 8 percent, and reaching this minimum again would require a capital injection by their owners. The effects of adverse changes would have a negative impact on the payment of dividends and bonuses for these banks.

The weight of individual risk factors changed in the period under review. In the context of an overall decline in risks, the negative impact of interest rate risk intensified (banks holding bonds to maturity would, conversely, reduce their credit risk exposure). Exchange rate risk had the opposite impact and the impact of credit risk stagnated. Some differences in the development of risks across the individual groups of banks can be identified. The large banks experienced a decline in their post-test CAR in both 2004 and 2005, but the banks are better prepared to absorb an adverse stress than previously under both scenarios. The small and medium-sized banks had an acceptable capital adequacy ratio even after the tests.

2. RESILIENCE TO AN INTEREST RATE SHOCK

Whereas the previous text presented the result of the model with a predefined shock size, including for the interest rate shock, the gradual stress approach may also be used. Under this approach, the maximum interest rate shock which the banking sector as a whole is capable of absorbing was examined. The effect of the stress induced by a gradual increase in the interest rate shock was examined in the result of scenario II, with the other parameters of the scenario remaining constant (see Chart 2). The banking sector was capable of absorbing the impact of an immediate increase in interest rates of up to 3.5–4 percentage points, especially if, under these adverse circumstances, the banks were to hold the 1-or-more-year bonds in their portfolios to maturity. For the estimated residual maturity[124] the robustness of the stress test would correspond to a parallel shift in the yield curve of up to 5 percentage points, without the capital adequacy ratio of the banking sector declining below 8%.

In scenarios I and II, the interest rate shock is modelled as a parallel shift in the entire yield curve. In reality, the yield curve may change its shape and slope. For instance, short-term rates may suddenly increase more than long-term rates, causing the yield curve to flatten, or expectations may arise of an increase in short-term interest rates in the near future concurrently with an assumption of stable long-term interest rates, which would result in a yield curve with a peak, and so on. The analysis of the impact of changes in the shape of the yield curve on the banking sector shows which interest rates the banks' portfolios are most sensitive to.

The hypothetical scenarios of changes in the shape of the yield curve, i.e. a twist, a change in peak and a parallel shift in the yield curve, were derived from extreme values of the historical variability of short-term, medium-term and long-term yields for the countries of the Central European region (the Czech Republic, Hungary, Poland and Slovakia) for the period 2000–2005. For instance, an analysis of short-term 3-month rates reveals that the maximum month-on-month change ranged between 40 (the Czech Republic) and 350 (Hungary) basis points. For our test, we used the average value (140 basis points). The other parameter values were derived in a similar way and are comparable to those used by other central banks (see Table 2).[125]

If we compare the sensitivity of Czech banks' portfolios to interest rate risk, the yield curve twist test would have bigger effect than the impact of a change in the peak of the yield curve, but it would be lower than the impact of a parallel shift in the yield curve in both scenario I and scenario II. The interest rate shock in scenario I does not go beyond the monitored historical variability in the Central European region in the period 2000–2005.

123 i.e. the actual capital adequacy ratio measured as the ratio of capital to risk-weighted assets of the banking sector.

124 Banking experts of commercial banks specify in their reports the estimated maturity of bonds and other financial instruments they are able to sell (or that will be redeemed) based on their estimates even prior to their formal contractual maturity.

125 Similar scenarios can be found in Deutsche Bundesbank (2005).

3. SIMPLE AND COMBINED INTERBANK CONTAGION TESTS

3.1 Interbank contagion test methodology

The interbank contagion stress tests are based on the exposures[126] described in section 4.4.4 *Interbank Relations*. The tests examine the extreme situation of one bank defaulting on its obligations to another bank or group of banks. This involves hypothetically capturing the impacts of contagion in the interbank market in the event of a bank's capital inadequacy. We test the extent to which banks are sensitive to interbank contagion risk and the banks' ability to cover by capital their own liabilities and outstanding claims vis-à-vis banks in default.[127]

The interbank contagion tests use as inputs data from exposure matrices (matrices of exposures between banks) for the banking and trading portfolios and loans and deposits received. Two testing methods are used to determine the net exposure of creditor and debtor banks. Under method 1, the test uses the greater of the values of assets and liabilities of interbank exposures that constitute the worst case scenario. This is the maximum outstanding amount over the entire duration of the contractual relations between the banks. Under method 2, the test uses uncollateralised loans and deposits received that represent the immediate outstanding amount from the exposures (their aggregate impact on banks is lower and so some of them are not reported separately in the summary of results of the individual tests). In the contagion tests the interbank exposure is re-assessed for each bank with respect to any other bank. Both tests use a 100% and 40% expected loss given default.

The interbank test is performed both as a simple test and as a combined test. Both tests are based on the same net exposures, but differ in whether or not they take into account the probability of default of individual banks.

The simple test examines the potential impact of the failure of each individual bank on the banking sector as a whole. This test does not examine the factors that might lie behind such a failure, whether it was caused by external factors or internal problems in the bank (for instance the failure of the bank's internal control systems). The test examines neither the probability of default of a particular bank nor whether the expected default is realistic. The test simply assumes that the bank will become insolvent ("primary insolvency") and stop meeting its obligations in the interbank market. The test consists in calculating how such a default may impact on other banks towards which this insolvent bank has uncovered liabilities. If one (or more) of these banks becomes insolvent ("secondary insolvency"), we need to perform a second iteration of the test and calculate how this secondary insolvency impacts on other banks in the system through their net uncovered credit positions vis-à-vis the banks facing secondary insolvency. If the test reveals that secondary insolvency leads to other banks becoming insolvent ("tertiary insolvency"), we need to perform a third iteration of the calculation and continue until this "domino effect" stops, i.e. until the insolvency induced in one bank or group of banks does not lead to the creation of other insolvent banks.

The simple interbank contagion test is composed of 24 sub-tests, one for each bank in the system. The difference between the pre-test and post-test CAR of the banking system may be viewed as a measure of the bank's systemic significance: the greater the decline in the CAR, the bigger the impact on the capital adequacy ratio of the banking sector if the bank fails and is no longer able to service its claims (borrowings) in the interbank market.

The second possible way of applying the simple test is to consider the largest creditor exposure for each bank. In this alternative, default by the debtor bank is assumed for each of the creditor banks and their largest creditor exposures. The losses given default on these largest exposures are reflected in the capital of each creditor bank. The sum of these hypothetical losses given default is incorporated into the overall post-test capital adequacy ratio (see Table 3).

The combined test uses a similar calculation method as the simple test, but takes into account the different probabilities of default of the banks. This test examines changes in the external environment, specifically a macroeconomic scenario that affects all banks simultaneously. Unlike the simple test, then, this method does not use 24 separate sub-tests, but just one integrated test in which the probability of insolvency is higher in banks that are more sensitive to changes in the economic environment. Unlike in the simple test, it is possible that primary insolvency will occur in several banks simultaneously. Another different feature of this test is that the subsequent calculations of contagion are performed in a system that is already weakened by the effects of the initial macroeconomic stress scenario (see Table 4).

126 Exposures here mean the mutual claims monitored in a report on exposures and over-limit deposits and loans received. These are the claims of one bank against another in both the banking portfolio (interbank loans) and the trading portfolio (holdings of bank bonds). The statement does not include all interbank claims, only those which exceed a particular share of the bank's capital.

127 A similar approach was taken by Degryse and Nguyen (2004). The issue of interbank contagion is discussed by Upper and Worms (2002).

Bank default can be modelled in stress tests in various ways. The simpler method that was used in the above simple interbank test is based on the assumption that banks with negative capital will default and, conversely, that banks with positive capital will not default. In practice, however, even banks with positive capital can fail. In order to make it more realistic, the combined test – unlike the simple test – also took into account the fact that the probability of default of banks with positive capital is not zero. It was assumed that this probability decreases with increasing capital of each of the individual banks (Table 5).[128] The iterative calculation of the "domino effect" is performed along similar lines as in the case of the simple test, i.e. as long as the new iterations result in some other bank in the test being included in a worse CAR group (i.e. a group with higher probability of default) or ceasing to receive capital.[129]

3.2 Results of interbank contagion tests

In the simple test, for most banks the effect of their loss of solvency on the rest of the banking sector was negligible (impacts of up to 1 percentage point on the sector's capital adequacy ratio). For some banks, the impact of insolvency of each individual bank on the sector's capital adequacy ratio was 3 percentage points on average. Nevertheless, for the majority of these banks the capital adequacy ratio after the simple test stayed above the required minimum of 8%; only in one case was it slightly lower. The banking sector reached equilibrium after the second iteration in the simple test.

In the second alternative of the simple test (assuming default on the largest exposure for each creditor bank) for the worst case scenario[130] the resulting capital adequacy ratio of the banking sector after interbank contagion was 6.7%. This test assumes relatively extreme adverse impacts of default compared to other similar tests. The system stabilised after the second iteration (see Table 3).

In the combined test with the scenario II shocks incorporated, the resulting capital adequacy ratio would be 9.7% and the loss due to interbank contagion would be 0.5 percentage point in the capital adequacy ratio. The maximum loss of the banks in default could reach 1.7% of the total capital in the banking sector. The system reached equilibrium after the third iteration (see Table 4).

4. MACRO STRESS TEST USING CONSISTENT MODEL SCENARIOS

The macro stress test is based on testing macroeconomic variables and related outputs from the macroeconomic forecasting model and the credit risk model. Shocks to different scenarios of development of the sector's financial stability are tested on data on the portfolios of individual banks as at the end of 2005. This tool is used to assess the impact of possible external shocks on non-performing loans (NPLs) in the banking sector.

Scenarios I and II used in the basic tests are essentially ad hoc scenarios in which the macroeconomic and prudential shocks mostly reflect historical values but are only loosely interlinked. Consequently, the next logical step in the development of stress testing of the Czech banking sector was a transition to model scenarios where the individual variables entering the stress tests on the input side (interest rates, the exchange rate and the share of NPLs) are interconnected in the macroeconomic model.

The model scenarios were generated in two steps. In the first step, several consistent macroeconomic scenarios were obtained using the CNB forecasting model. These scenarios capture the development of key macroeconomic variables (GDP, inflation, interest rates, the exchange rate, etc.) in the near future and – except for the baseline scenario – reflect the response of the economy to an external shock or combination of macroeconomic shocks. In this way the first two main inputs to the stress testing were obtained, i.e. expected interest rates and the exchange rate.

In the second step, the macroeconomic credit risk model was used to estimate the expected evolution of NPLs in banks' portfolios based on the expected development of macroeconomic indicators (GDP growth, inflation and interest rates).[131] As the main output of the macroeconomic credit risk model is the quarterly change in NPLs, and given that the stress testing works with growth in NPLs over a one-year time horizon, it was necessary to annualise the results of the credit risk model.[132]

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128 The calculation of the expected loss E = Exp*LGD*PD, where Exp stands for the amount of the bank's exposure, LGD denotes the expected loss given default (100% or 40%) and PD stands for the probability of default of the bank. The probability of default parameters were calibrated based on experience from abroad.

129 A similar interbank exposure testing method is given in International Monetary Fund and World Bank (2003).

130 This test assumes a 100% loss given default (LGD) using method 1.

131 This model is described in the following article *Macroeconomic Credit Risk Model*.

132 This annualisation was performed as follows: The annual change in NPLs was estimated for four successive estimates of the quarterly default ratio, which were then summed. The dampening effect of monetary policy could thus manifest itself in the shock scenarios in the second to fourth quarters.

The baseline model scenario uses the official CNB forecast of April 2006 and serves as an estimate of the probable development of the Czech economy. The stress test results are consistent with this approach, as the official CNB forecast does not envisage any significant shocks for the period ahead. Besides the baseline model scenario, three alternative scenarios (A, B and C) were proposed which reflect less probable, but still plausible shocks. The shocks in these scenarios take into consideration the history of real economic growth and its links to other macroeconomic variables.

Baseline scenario

The baseline scenario is derived from the April CNB forecast[133], which expects real GDP growth of 6.1% in 2006 and 5.4% in 2007. Inflation will be below 3% in 2006 and edge up to 3.4% in 2007. Growth in regulated prices, changes to indirect taxes and a rise in inflation expectations will be the major factors contributing to the rise in inflation. Consistent with the forecast is interest rate stability initially and a gradual rise in rates thereafter.

The baseline scenario does not contain any risks that would pose an immediate threat to the financial sector and its stability. Low interest rates, the positive outlook for investment activity and GDP growth will further boost growth in lending to households and corporations. The low interest rate differential will prevent growth in debt in foreign currencies.

Alternative scenario A

Alternative scenario A analyses the potential response of the domestic economy to a significant global negative shock.[134] Such a shock might hypothetically occur in a situation where global imbalances associated with a loss of confidence in the main economic zones suddenly correct and interest rates of the main world currencies, i.e. the dollar and the euro, rise rapidly. The scenario also includes a large downturn in global economic activity and inflation, further intensified by a strong monetary restriction. The downturn in the economic activity of the Czech Republic's major trading partners would have a relatively sizeable impact on its macroeconomic situation and exports. GDP growth rates in 2006 and 2007 would be about 1–2 percentage points lower than in the case of the baseline scenario, and interest rates would be considerably higher.

The impact of alternative scenario A on the stability of the financial system would to some extent depend on the distribution of the decline in GDP across the individual sectors of the economy. In any event, however, it would influence the ability of economic agents to service their debts. The increase in interest rates would amplify this effect and would have an adverse impact on banking portfolios.

Alternative scenario B

Alternative scenario B combines the effect of two factors, the development of the nominal exchange rate and the development of inflation. The scenario assumes a sudden appreciation of the exchange rate and a negative supply shock (for instance, a poor harvest or some other shock to the supply of market goods and services) that would, ceteris paribus, result in a rise in prices. However, the stronger exchange rate would cause a slight decline in inflation and GDP growth compared to the baseline scenario. The monetary policy response would be to cut interest rates to a very low level.

The impact of alternative scenario B is, by contrast with the previous option, rather more favourable. The decline in GDP growth is temporary, and although disposable income falls, the monetary policy easing reduces the loan repayment burden, at least insofar as it allows debtors to swap their rates for lower ones. The decline in interest rates also means less pressure on banks' portfolios, although it might lead to lower interest margins and hence might also reduce banks' profitability.

Alternative scenario C

Alternative scenario C reflects the potential risks associated with a possible drop in domestic demand and assumes a gradual decline in GDP growth between 2006 Q2 and 2007 Q1. A drop in domestic demand, and hence also in economic activity, might be caused, for instance, by a sharp decline in corporate investment activity in a situation of investment outflows due to cost optimisation. This would lead to growth in unemployment and a fall in household consumption. A strong fiscal restriction might also foster a drop in domestic demand.

133 A detailed description of the CNB macroeconomic forecast is given in CNB Inflation Report (2006), available from www.cnb.cz.

134 The global negative shock should be generated in a global economic model describing a realistic and consistent trajectory for foreign interest rates, inflation, economic activity and, where appropriate, the cross-exchange rate. In this scenario, this is not the case. For reasons of simplicity and in order to achieve a really strong shock, a significant shock to euro area interest rates, German GDP and inflation is assumed.

A negative shock to GDP growth would cause the output gap to widen and inflation to fall. The monetary policy response would be a significant easing, which would help to revive economic activity, in particular in 2007. The lower interest rates compared with other countries would also foster a slight depreciation of the exchange rate, which, in turn, would further ease the monetary conditions.

Scenario C is a highly imperfect picture of the impact of an outflow of direct foreign investment on the Czech economy, since any major outflow would probably have more permanent implications for the structure of the economy, potential output and export performance, which monetary policy would be unable to reverse in just one or two years. However, it may serve as the first step in the analysis of the Czech economy's dependence on foreign direct investment for the purposes of assessing the impact on financial stability.

Test results for the model scenarios

The capital adequacy ratio in the baseline scenario would be 11.6% in 2006 (on the December 2005 banking sector data). The share of new non-performing loans in the given volume of claims would be 3.7%. The capital adequacy ratio would be 2 percentage points lower in scenario A, at the same level in scenario B and 0.1 percentage point lower in scenario C than in the baseline scenario for 2006. The new non-performing loans of the banking sector in the pessimistic scenarios A, B and C would be 4.2%, 4.4% and 5.2% respectively at the one-year horizon (see Chart 3 and Chart 4).

5. CONCLUSIONS

The resulting post-test capital adequacy ratio of the banking sector was above 8%, except in one simple test, which, however, was based on relatively extreme assumptions. The banking sector as a whole proved to be essentially resilient to the effects of the macroeconomic and prudential shocks, with some banks showing greater sensitivity to interest rates and interbank contagion. The banking sector was capable of withstanding the stress of shocks, including movements in exchange rates, in model scenarios simulated as alternatives to the baseline macroeconomic scenario.

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Tab. 1 – Summary of results of stress tests, 2004–2005: Banking sector
(data in % unless stated otherwise)

	December 2004	June 2005	December 2005
Pre-test CAR [1]	**12.6**	**13.0**	**11.9**
… large banks	11.2	11.8	10.8
… medium-sized banks	16.8	16.6	15.4
… small banks	18.9	17.3	15.4
Scenario I			
Total effect of shocks (percentage points)	-2.3	-2.2	-1.9
Interest rate shock	-1.6	-2.0	-1.7
Exchange rate shock	1.0	1.5	1.4
Credit shock	-1.7	-1.7	-1.6
… of which indirect effect of exchange rate shock	-1.1	-1.0	-1.0
Profit allocation (percentage points) [2]	1.7	1.4	1.3
Post-test CAR	**12.0**	**12.2**	**11.3**
… large banks	11.2	11.8	10.8
… medium-sized banks	15.2	14.9	14.0
… small banks	17.0	16.0	14.7
Capital injection (percentage of GDP) [3]	0.04	0.12	0.1
Share of banks with negative capital after shock [4]	0.0	1.1	1.2
Impact on dividends and bonuses [5]	-53.9	-77.5	-81.2
Scenario II			
Total effect of shocks (percentage points)	-5.0	-5.0	-4.4
Interest rate shock	-3.3	-4.0	-3.5
Exchange rate shock	1.4	2.0	2.0
Credit shock	-3.1	-3.0	-2.8
… of which indirect effect of exchange rate shock	-1.5	-1.4	-1.3
Profit allocation (percentage points) [2]	2.8	2.6	2.7
Post-test CAR	**10.4**	**10.6**	**10.2**
… large banks	10.2	10.8	10.3
… medium-sized banks	13.5	13.2	12.2
… small banks	15.5	14.9	13.9
Capital injection (percentage of GDP) [3]	0.5	0.6	0.5
Share of banks with negative capital after shock [4]	10.7	5.9	5.4
Impact on dividends and bonuses [5]	-95.3	-100.0	-100.0

Notes:
1) CAR: capital adequacy ratio, defined in accordance with the relevant CNB regulations (in particular those governing the capital adequacy of banks and other prudential rules).
2) Both scenarios assume that in the absence of shocks each bank would generate profit (loss) equal to the average for the previous five years and that it would use any profit as a first line of defence against a reduction in its CAR.
3) The capital needed to ensure that each bank in the system has a post-test CAR of at least 8%.
4) Market share of banks with negative capital following the assumed shocks (as a percentage of total assets).
5) As a percentage of dividends and bonuses of the previous calendar year.

Tab. 2 – Comparison of the effect of a change in the interest rate

Tested portfolios Scenarios Shape of yield curve	Short-term up to 1 year	Medium-term 1 - 5 years	Long-term over 5 years	Interest rate shock 2005 % of CAR
		Change in basis points (+)		
Twist	140	70	40	-1.28
Change in peak	0	60	0	-0.20
Parallel shift Scenario I	100	100	100	-1.72
Scenario II	200	200	200	-3.46

Tab. 3 – Summary of results of simple interbank contagion test, 2005
Contagion test for each bank after default by another bank (with no link to macroeconomic stress testing)

Method	Actual values [1]	Method 1: Exposure (Ab+Ao-P)		Method 2: Exposure (-P)	
Expected loss given default (LGD)	~20%	40%	100%	40%	100%
Capital adequacy ratio (CAR)	pre-test	post-test	post-test	post-test	post-test
CAR					
Average (weighted)	11.9	9.8	6.7	10.7	9.0
Average (non-weighted)	22.6	14.7	6.5	16.8	11.0
Median	12.4	8.1	5.9	10.5	8.4
Number of banks	24	24	24	24	24
with CAR < 0%	0	2	5	1	2
with CAR < 8 %	0	12	15	6	10
with CAR < 10 %	6	13	17	10	14
Share of banks with CAR < 0 % (banks in default)					
total banks' net exposure in the sector's assets	x	0.2	1.5	0.1	0.5
loss on banks' net exposure in the sector's capital [2]	x	-1.8	-8.3	-1.4	-5.4
loss on banks' net exposure in the sector's assets [2]	x	-0.1	-0.5	-0.1	-0.3
total share of banks' assets in the sector's assets	x	1.7	7.3	0.7	3.6

Notes:
1) Under a CNB Decree. this involves coverage of the net credit exposure risk and inclusion of the trading portfolio exposure. The sources of the data are banks' reports submitted on a regular basis to CNB Banking Supervision, including large exposures and over-limit exposures of the banking and trading portfolios between resident banks.
2) Sum of losses of creditor banks on the largest (net) exposure given default by each debtor bank.
Ab – banking portfolio exposure (assets)
Ao – trading portfolio exposure (assets)
P – loans and deposits received (liabilities)

Tab. 4 – Summary of results of the combined (macro) stress test for interbank contagion, 2005
Contagion test for each bank with incorporated probability of default of the bank and link to macroeconomic stress testing

Stress test		Scenario I		Scenario II	
Method	Actual values [1]	Method 1: Exposure (Ab+Ao-P)		Method 1: Exposure (Ab+Ao-P)	
Expected loss given default (LGD)	~20%	40%	100%	40%	100%
Capital adequacy ratio (CAR)	pre-test	11,3 post-test	11,3 post-test	10,2 post-test	10,2 post-test
CAR					
Average (weighted)	11.9	11.1	10.8	10.1	9.7
Average (non-weighted)	22.6	18.8	17.6	9.0	6.9
Median	12.4	10.3	9.6	8.8	8.1
Number of banks	24	24	24	24	24
with CAR < 0 %	0	1	1	3	5
with CAR < 8 %	0	9	9	11	12
with CAR < 10 %	6	11	12	14	14
Share of banks with CAR < 0 % (banks in default)					
total banks' net exposure in the sector's assets	x	0.0	0.1	0.2	0.5
loss on banks' net exposure in the sector's capital [1]	x	0.0	-0.1	-0.2	-1.7
loss on banks' net exposure in the sector's assets [1]	x	0.0	0.0	0.0	-0.1
total share of banks' assets in the sector's assets	x	1.0	1.0	4.2	7.9

Notes:
1) Sum of losses of creditor banks on (net) exposures given default by debtor banks.

Tab. 5 – Explicit combination of capital adequacy ratio and probability of default of the bank in interbank contagion stress testing

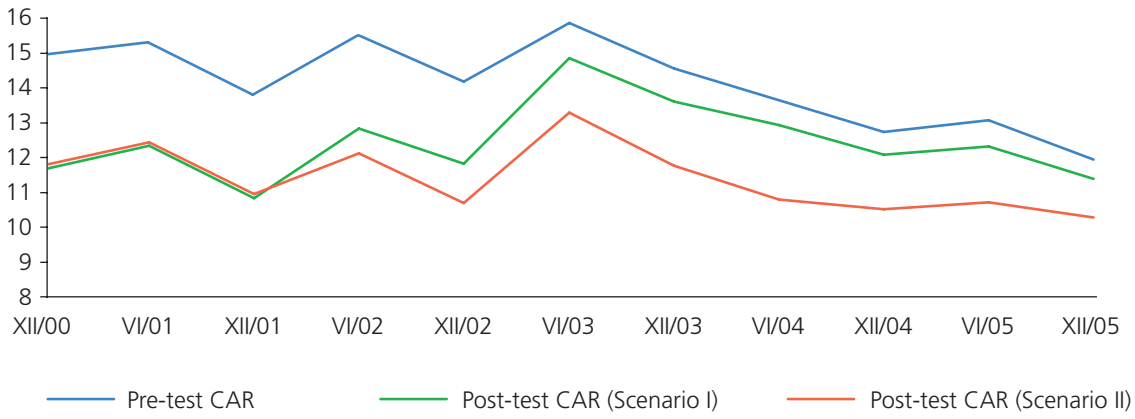
CAR	Probability of default (PD)
< 0 %	100%
0 – 5 %	25%
5 – 8 %	15%
8 – 10 %	5%
> 10 %	0,5%

Tab. 6 – Summary of results of stress tests, 2005: Banking sector
(data in % unless stated otherwise)

Scenario type	Baseline	Scenario A	Scenario B	Scenario C	Scenario I	Scenario II
Pre-test CAR [1]	**11.9**	**11.9**	**11.9**	**11.9**	**11.9**	**11.9**
… large banks	10.8	10.8	10.8	10.8	10.8	10.8
… medium-sized banks	15.4	15.4	15.4	15.4	15.4	15.4
… small banks	15.4	15.4	15.4	15.4	15.4	15.4
Results for the chosen scenario type						
Total effect of shocks (percentage points)	-2.0	-5.2	-1.7	-1.7	-2.0	-4.9
Interest rate shock	0.0	-2.8	1.4	1.0	-1.7	-3.5
Exchange rate shock	0.0	0.4	-0.7	0.2	1.4	2.0
Credit shock	-1.9	-2.4	-2.2	-2.7	-1.6	-2.8
… of which indirect effect of exchange rate shock	0.0	-0.3	0.0	-0.1	-1.0	-1.3
Interbank contagion [2]	-0.2	-0.4	-0.2	-0.2	-0.2	-0.5
Profit allocation (percentage points) [3]	1.7	2.9	1.5	1.3	1.4	2.8
Post-test CAR	**11.6**	**9.6**	**11.6**	**11.5**	**11.2**	**9.7**
… large banks	10.8	9.1	10.7	10.8	10.8	10.0
… medium-sized banks	14.6	13.4	14.4	13.9	14.0	12.1
… small banks	14.6	13.9	14.2	14.0	14.6	13.5
Capital injection (percentage of GDP) [4]	0.0	0.6	0.0	0.1	0.1	0.6
Share of banks with negative capital after shock [5]	0.0	9.0	0.0	0.0	1.2	10.1
Impact on dividends and bonuses [6]	-91.9	-100.0	-66.9	-50.2	-82.8	-100.0

Notes:
1) CAR: capital adequacy ratio, defined in accordance with the relevant CNB regulations (in particular those governing the capital adequacy of banks and other prudential rules).
2) Test integrated with the interbank contagion for Method 1, expected level of loss given default (LGD) 100% and chosen probability of default of the banks on the basis of the CAR.
3) Both scenarios assume that in the absence of shocks each bank would generate profit (loss) equal to the average for the previous five years and that it would use any profit as a first line of defence against a reduction in its CAR.
4) The capital needed to ensure that each bank in the system has a post-test CAR of at least 8%.
5) Market share of banks with negative capital following the assumed shocks (as a percentage of total assets).
6) As a percentage of dividends and bonuses of the previous calendar year.
Scenarios: baseline, A, B and C are based on the macroeconomic forecasting model of the Czech National Bank and the credit risk model.
Scenario I and Scenario II are based on the chosen hypothetical and historical shocks (see the methodology in the Financial Stability Report for 2004).
They differ from the results set out in Table 1 since they include the effect of interbank contagion.

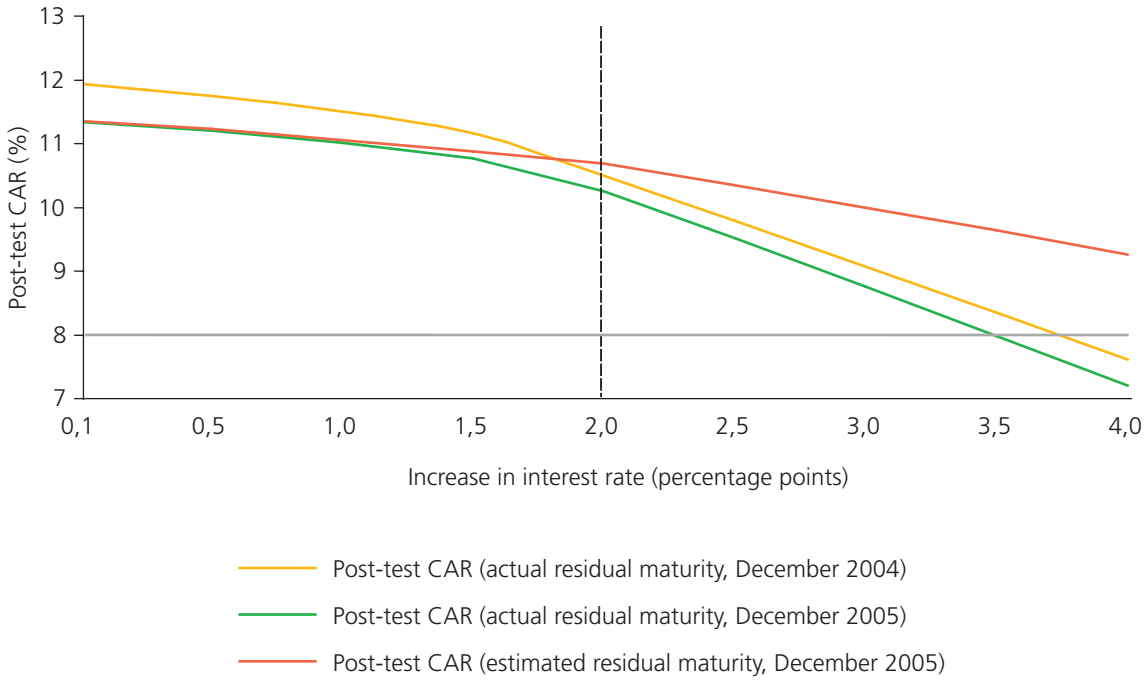
CHART 1 – Results of stress test scenarios for the banking sector of the Czech Republic
(capital adequacy; %)



Note: The scenarios differ due to the fact that they use different methodologies for the growth in non-performing loans (NPLs), hence the resulting CAR for each scenario develops differently over time for each scenario.

Source: **CNB – single methodology for stress testing 2005**

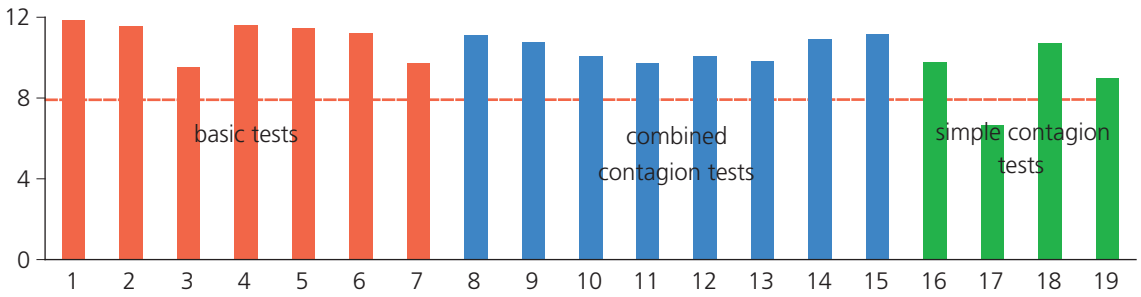
CHART 2 – Robustness of the stress test under scenario II for the interest rate shock
(capital adequacy; %)



Note: Estimated residual maturity is based on estimate of banking experts of individual commercial banks.

Source: **Calculation based on CNB data**

CHART 3 – Capital adequacy in individual tests
(%)

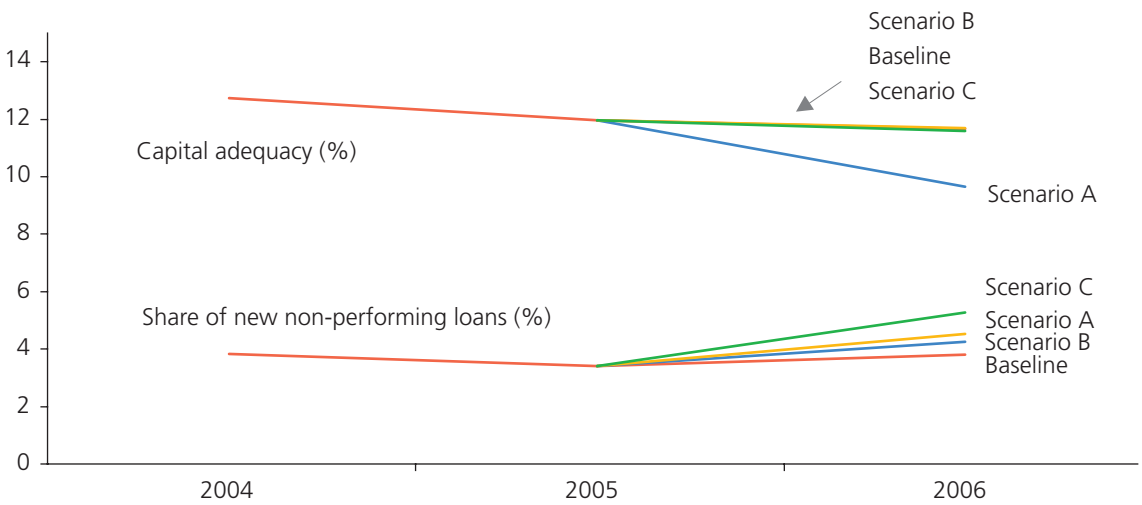


Explanatory notes:
1 – Pre-test CAR
2 – Baseline scenario
3 – Scenario A
4 – Scenario B
5 – Scenario C
6 – Scenario I
7 – Scenario II
8 – combined, scenario I, 40% LGD, method 1
9 – combined, scenario I, 100% LGD, method 1
10 – combined, scenario II, 40% LGD, method 1
11 – combined, scenario II, 100% LGD, method 1
12 – combined, scenario II, 40% LGD, method 2
13 – combined, scenario II, 100% LGD, method 2
14 – combined, scenario II, 100% LGD, twist of the yield curve
15 – combined, scenario II, 100% LGD, peak of the yield curve
16 – simple, 40% LGD, method 1
17 – simple, 100% LGD, method 1
18 – simple, 40% LGD, method 2
19 – simple, 100% LGD, method 2

Simple – interbank contagion test for each bank after default by another bank (no link to macroeconomic stress testing).
Combined – interbank contagion test for each bank with incorporated probability of default of the bank and link to macroeconomic stress testing.
Method 1 – interbank exposures representing maximum outstanding amount over the entire duration of interbank contractual relations.
Method 2 – interbank exposures representing immediate outstanding amount on exposures.

Source: **Calculation based on CNB data, December 2005**

CHART 4 – Results of scenarios of macro stress testing



Note: The share of new non-performing loans (NPLs) is related to the given volume of loans at the end of 2005.

Source: **CNB**