Stress testing of real estate price decline risk in the Slovak banking sector

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Average prices of residential real estate in Slovakia have risen by 72% since 2002, according to figures from the National Association of Real Estate Offices of Slovakia. Since such properties are rising in price more sharply than any other assets, both households and companies are investing in them, and these investments are being partly financed by bank loans. That is why movements in real estate prices, upwards or downwards, also affect the banking sector. In this article, we will look at the scenario of a decline in real estate prices.

The Slovak banking sector is now linked to the real estate market by several direct and indirect channels. A direct channel is the use of real estate as collateral for loans. A majority of household loans are secured in this way, but so are many investment loans to companies or property development projects. Where a bank identifies impairment of a loan, provisioning is required, the amount of provisions will depend mainly on the amount of the exposure and the security. Should the value of the security decline, the bank will spend more on provisioning and this will be reflected in its profits. If the bank were to incur a loss, the amount of its own funds would decline and that would adversely affect its capital adequacy ratio.

An indirect channel is the effect of real estate prices on credit risk. This concerns mainly property development projects, where the real estate price (in this case the rental price) adversely affects the developer's capacity to generate sufficient cash-flow for repayment of the bank loan. In that case, the bank's loss would be caused by a combination of impairment of the loan and a drop in the value of the security. This article will focus solely on impacts related to the direct channel, in other words, the additional provisioning. It is likely, however, that the current test will in future serve as a platform for a more comprehensive version that incorporates stress changes in measures of transition between credit categories.

The subjects of stress testing were separately household loans and corporate loans, which, among other things, made it possible to take account of differences in price volatility between residential real estate and commercial real estate. The household lending concerned loans secured by residential real estate, most of which were mortgage loans. The corporate lending comprised investment loans secured by commercial property, such as a production hall or other building serving business purposes or a building being constructed by a developer for the purpose of renting.

The test was conducted in two variants corresponding to two values of a decline in real estate prices, by 30% and 50%.

HOUSEHOLD LOANS (SECURED BY RESIDENTIAL REAL ESTATE)

The basic input of the test was the outstanding amount of loans provided by banks over the given month t (PV_L^t). This amount was calculated as the difference between the original amount of the loan and the sum of repayments made since its provision. It was likewise necessary to determine the current value of the respective collateral in the form of real estate (PV_C^t), in relation to the loan from month t. That meant the original value of the property was adjusted according to developments in real estate prices.[1]

Take, for example, where a bank extended a loan of SKK 700,000 in 2002 and had it secured by real estate valued at SKK 1 million (a loan-to-value ratio of 70 %), the situation will now be quite different: part of the loan (e.g. SKK 100,000) has been repaid while the value of the security has risen on average by 23%, to SKK 1.23 million. The loan-to-value ratio (LTV ratio) has fallen to 49%. The situation has developed in favour of the bank since the degree of credit protection has increased. By such calculation, it was possible to divide the portfolio of each bank according to the LTV ratio, which is the basic parameter for the stress testing of real estate price decline.

It was therefore possible to apply the shock of real estate prices (s) and thereby obtain the value of the security for loans extended in particular months t ($_{(s)}PV_C^t$). We could then monitor how the LTV ratio changed in different parts of the portfolio. It is clear that loans provided in previous years were, owing to the decline in exposure and increase in value of the collateral over time, a lesser source of concern than new loans, where the value was close to 100% or even higher.

The decline in the value of the collateral to be-

1 *The index of the development of real estate prices was calculated from data provided by the National Association of Real Estate Offices of Slovakia (NARKS).*

low the exposure amount does not, however, represent an immediate problem for the bank, provided that the loan is being duly repaid. To calculate the losses arising from additional provisioning, it was necessary to use information on the portfolio quality of the given bank. Two ratios were therefore calculated as an assumption for the additional creation of provisions. The first was the ratio of non-performing loans (*NPL*) to total loans (*TL*), where a need for provisioning was assumed for the total unsecured part of the exposure. The second was the rate of impaired loans (*IL*) to total loans (*TL*), where the assumption was of 10% coverage of the unsecured part. In the calculation, the amounts of non-performing or impaired loans were adjusted for the estimated increase in these loans during one year (on the basis of historical data). With these assumptions, it was possible to calculate the costs of the additional provisioning separately for each group of loans provided in month t, for which the value of the collateral before or after the application of the stress scenario is lower than the current outstanding amount of the loan:

$$L^t = \left(\frac{NPL}{TL} - 0.1\,\frac{IL}{TL}\right) \left(\min(PV_L^t, PV_C^t) - \min(PV_{L,(s)}^t PV_C^t)\right)$$

The total costs of the additional provisioning were represented by the sum of the costs corresponding to the loans provided in the given month t. These costs, representing the bank's loss from the decline in real estate prices, were subsequently deducted from the amount of the bank's own funds in order to determine the impact on the bank's capital adequacy ratio.

This stress test has the advantage that different assumptions can be used for time trends in regard to the LTV ratio, real estate prices, default rate, and so on, since the credit portfolio is broken down by loan provision period. That said, the main drawback of the stress testing arises from the aggregation of loans, where it is assumed that all loans provided in a given month have the same LTV ratio. It is not considered that some of the loans could have an LTV ratio of more than 100%. Where non-performing or impaired loans have an LTV ratio above 100%, any decline in real estate process will make the additional provisioning necessary. Account should also be taken of the simplified assumptions of a linear increase in the average LTV ratio, as well as the calculation of the amount of provisions.

CORPORATE LOANS (SECURED BY COMMERCIAL REAL ESTATE)

The output quantity in this test is the expected loss after a period of one year which the bank would incur whether as the result of a decline in real estate prices or by certain loans of the portfolio falling into a riskier credit category. The test is based on data from the Register of Bank Loans and Guarantees (RBLG). All banks participating in the register (19 in total), record in the register their data on all corporate loans extended as at the current date. For each loan there is stated its current outstanding amount, the value of the collateral and one of the three credit categories to which it belongs – standard, standard with impairment (other than non-performing) and non-performing). The actual calculation of losses resulting from a decline in real estate prices is made in accordance with the scheme set out in the following section.

The first stage is to calculate the transition matrix $\{p_{ij}\}_{i,j=1}^{3}$ for the given bank on the basis of historical data, where p_{ij} represents the probability that the loan will move from category i to category j during the course of the year. These matrices are further adjusted as follows: the component p_{ij}, $i>j$ is assigned a zero value (transition from a more risky to less risky category is not envisaged) and the components p_{ii} are increased by their original value. Based on the transition matrices thus acquired, a random p_{ij} percentage of loans that will be in category j within one year are selected for the bank and its i-th category of loans. This provides one possible future picture of the bank's credit portfolio in terms of their breakdown by credit category. On the basis of the actual and simulated future state of the portfolio, the amount of provisions in both the first and second case may be calculated. At the same time, it is assumed that the bank creates provisions in the amount of c_i per cent of the unsecured part of the loan (i.e. the difference between the outstanding value of the loan and the value of the collateral, in the case where this difference is positive), where c_i is taken as the average ratio of provisions to the value of the unsecured part of a loan in category i. For the amount of provisions (LLP^n) before and after application of the stress scenario ($_{(s)}LLP^n$), the following formulae then apply:

$$LLP^n = c_i \max\{PV_L^n - PV_C^n, 0\},$$
$$_{(s)}LLP^n = c_i \max\{PV_L^n - {}_{(s)}PV_C^n, 0\},$$

where PV_L^n is the value of the outstanding part of the loan, PV_C^n is the value of the collateral, n represents the loan's index, and $_{(s)}PV_C^n$ is the new value of the collateral corresponding to s per cent of the decline in real prices subject to the following:

$$_{(s)}PV_C^n = (1-s)PV_C^n.$$

For each loan of the given bank, the loss resulting from additional provisioning on the basis of the stress scenario is then calculated.

$$L^n = {}_{(s)}LLP^n - LLP^n.$$

By aggregating these partial losses for all loans of the respective bank, we obtain the total final loss caused by the decline in prices of the real estate pledged as collateral.

$$L = \sum_{n=1}^{N} L^n.$$

The calculation is made using a Monte Carlo simulation. This procedure is repeated 1,000 times to give 1,000 different loss values. Finally, the average of the losses under the individual simulations and its impact on capital adequacy ratio are calculated.

A strength of the scenario is that it works with practically a complete database of corporate loans and their classification into credit categories (knowledge of transition matrices). It should be noted, however, that the method considered for the creation of provisions is exceptionally simple. Another slight shortcoming is that the outstanding amount in the register of loans does not quite correspond to the actual outstanding amount of these loans in the balance sheet (according to the RBLG, the aggregate outstanding amount of corporate loans was around SKK 421 billion in June 2006, while the balance sheet of that same group of loans represented only SKK 385 billion). This implies that the need for the provisioning in the stress test is partially overestimated. Also questionable is the extent to which the valuation of real estate in the register corresponds to actual market prices. The last and more serious drawback is that the examination of the impacts caused by a decline in real estate prices does not take into account the credit risk of property developers in relation to such an event. The ratios of provisions to the unsecured part of a loan were calculated from data for the whole sector and are therefore common to all banks included in the test. Their values are $c_1 = 0\%$, $c_2 = 10\%$ and $c_3 = 100\%$.

RESULTS

The results obtained are relatively clear and indicate a low degree of risk related to the stress scenario. Even with the really exceptional assumption of prices falling by half, not a single bank identified a serious problem. This is demonstrated in Chart 1, which shows the distribution of capital adequacy decline in the sector and from which it is clear that most banks fall within the two lowest bands where the decline does not exceed 0.2%.

The impact of stress testing was less significant in household lending than in corporate lending. With a 30% decline, there was Table 1 The loan-to-value ratio in 2004ital adequacy of most banks did not decrease by more than 1 percentage point (Chart 2).

These results should, however, be treated as indicative and be considered within the context of all the assumptions and shortcomings mentioned in the previous parts. There are two main reasons for the weak impact of a decline in real estate prices on the Slovak banking sector.

Firstly, banks pursue a relatively conservative policy when setting the LTV ratio, which is particularly the case with older loans (Table 1). The ratio set in this way has created a sufficient cushion to ensure that banks will not be adversely affected by a decline in real estate prices. That is also why older loans would hardly be affected if real estate prices fell.

Table 1 The loan-to-value ratio in 2004

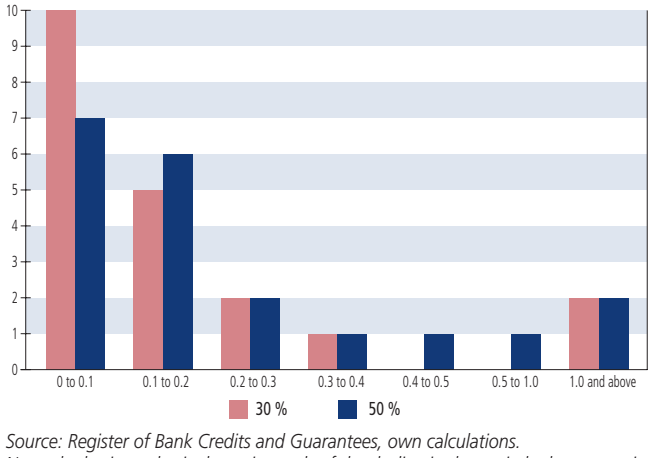
Loan-to-value ratio	Loans provided in 1H 2004	Loans provided in 2H 2004
Average	60.36 %	66.24 %
Median	61.16 %	63.19 %
Average weighted amount	48.65 %	54.98 %

Source: Register of Mortgage Loans.

Nevertheless, the average LTV ratio is rising and several banks are now offering loans exceeding the value of the collateral (i.e. with an LTV ratio of more than 100 %), according to the findings of questionnaire on lending market developments. It is therefore quite likely that an ever larger part of the credit portfolio of the Slovak banking sector will in time become sensitive to real estate prices.

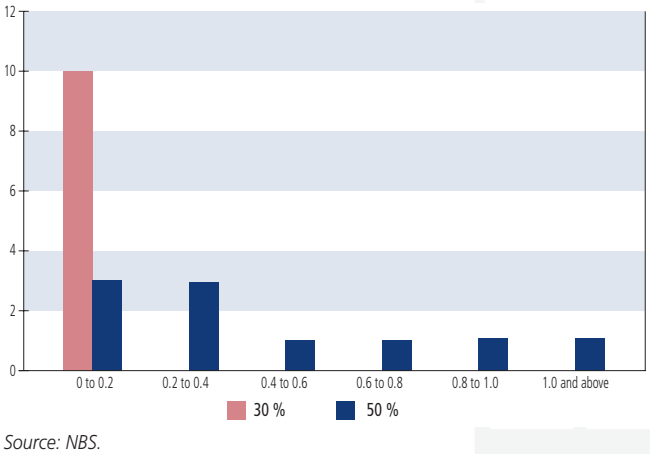
Secondly, the sharp rise in real estate prices is continually raising the value of the collateral used for bank loans (Chart 3). Although current real

Chart 1 The impact of a decline in commercial real estate prices



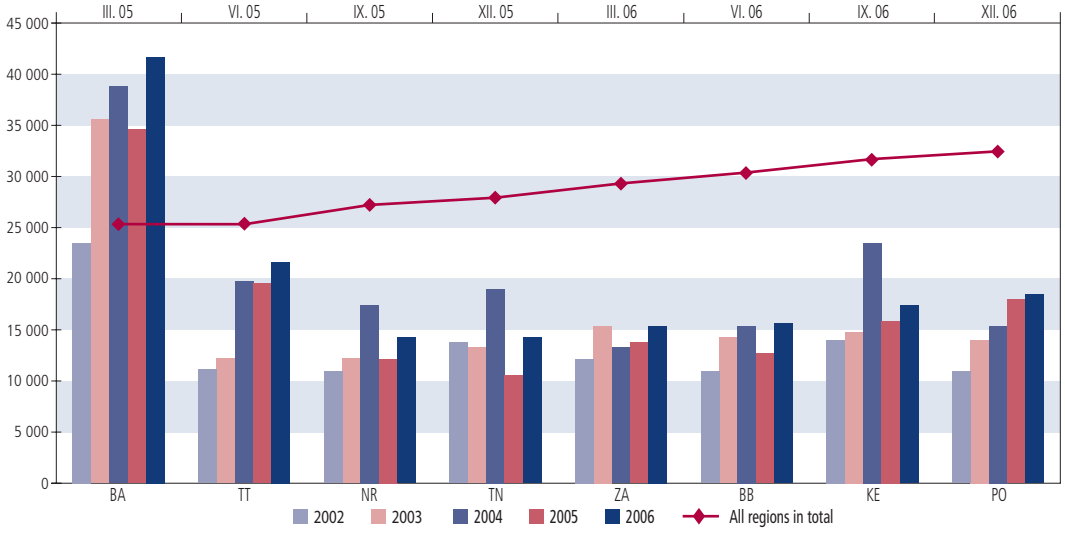
Source: Register of Bank Credits and Guarantees, own calculations.
Note: the horizontal axis shows intervals of the decline in the capital adequacy ratio; the vertical axis shows the number of banks falling within the respective intervals.

Chart 2 The impact of a decline in residential real estate prices



Source: NBS.

Chart 3 Residential real estate prices per m² by region



Source: NARKS.
Note: the values in the columns represent real estate prices by region in the given years; the line shows the average price of real estate in the years 2005 and 2006.

estate prices were significantly reduced in the stress test, their fast growth over recent years has generated sufficient coverage, especially for older loans. It is logical to suppose that banks assume the continuation of this trend and are therefore motivated to provide loans where the value of the collateral is lower than the amount of the loan. In normal circumstances, the ratio will shift in favour of the security after a few months and the risk undertaken by the bank will diminish over time.

Both reasons for the relatively low impact of the stress test on the Slovak banking sector are at the same time the main risk factors for the future. The assumption that real estate prices will continue to rise, leading banks to provide loans with relatively low-value collateral in the form of real estate, is making Slovak banks increasingly sensitive to any adverse development in the real estate market.