

# Stress Testing the Exposure of Austrian Banks in Central and Eastern Europe

Austrian banks are heavily engaged in Central and Eastern European (CEE) markets primarily by running local subsidiaries but also by extending cross-border loans. We give an account of the historical development and the status quo of these exposures and conduct a stress test for the Austrian banking system with respect to its credit exposure vis-à-vis the CEE region. Our test is based on an analysis of the current state of the local banking systems from a risk perspective, inter alia drawing on stress testing experiences gained by the national central banks and the International Monetary Fund. We use a stress scenario that (i) takes account of the differences in host country risks and (ii) represents a worst case that deliberately exceeds historical shocks. It turns out that, despite the dramatic worsening of the economic environment implied by the scenario, the Austrian banking system is not put at risk by the hypothesized crisis. The possible repercussions of a crisis in a single country via solvency problems of the Austrian parent institution turn out to be well limited.

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## 1 Introduction

Over the course of the last decade, Austrian banks<sup>2</sup> have successfully seized the opportunity to expand their presence in the CEE banking markets. Taking into account that almost 40% of the Austrian banking system's total profits are earned by CEE operations today,<sup>3</sup> the evolution of the CEE banking markets has had a substantial influence on the Austrian banking system. With a market share of almost 24% in CEE,<sup>4</sup> these operations have at the same time considerable influence on the stability of the

CEE banking markets. As much as CEE subsidiaries can profit from the stability of their parent banks, they could also be affected by their potential instability. If, for example, some exogenous shock in one particular market puts an Austrian parent bank into trouble, its presence in the region could transfer this shock into other CEE markets as well. Therefore, the issues of Austrian and regional financial stability are closely interlinked.

Based on a stress testing exercise this paper is intended to assess both

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<sup>2</sup> Throughout this paper, the term "Austrian banks" refers to banks or banking groups operating in Austria, irrespective of domestic or foreign ownership. Therefore e.g. Bank Austria Creditanstalt AG (BA-CA) is included in the analysis.

<sup>3</sup> The sample of countries for this paper has been chosen according to the exposure of Austrian banks and their fully consolidated subsidiaries in the region as reported to the OeNB as of December 2006. It includes Albania (AL), Belarus (BY), Bosnia and Herzegovina (BA), Bulgaria (BG), Croatia (HR), the Czech Republic (CZ), Hungary (HU), Poland (PL), Romania (RO), the Russian Federation (RU), Serbia (RS), Slovakia (SK), Slovenia (SI) and Ukraine (UA). The ongoing organizational changes of BA-CA are only included in case they are reflected in the year-end data reported to the OeNB.

<sup>4</sup> Excluding the Russian Federation and Turkey, but including the expected market shares after the reorganization of BA-CA; including the Russian and Turkish markets would lead to a market share of 14.5%.

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the impact of CEE banking operations on Austrian banks and the impact of Austrian financial stability on financial stability in CEE countries. The scenario used in the stress test (i) takes account of the differences in host country risks and (ii) represents a worst case that deliberately exceeds historical shocks.

Section 2 provides a review of the development as well as the status quo of Austrian banks' exposure in the region. Section 3 gives a succinct summary of recent trends in the region's banking systems, while section 4 briefly reviews the rationale behind stress testing in general as well as the stress testing experiences of the CEE central banks and the International Monetary Fund (IMF) in the region in particular. All three sections aim at establishing a proper understanding of economic circumstances as well as the reasons why national and international authorities stress test credit exposures in the CEE region. Section 5 presents the refined meth-

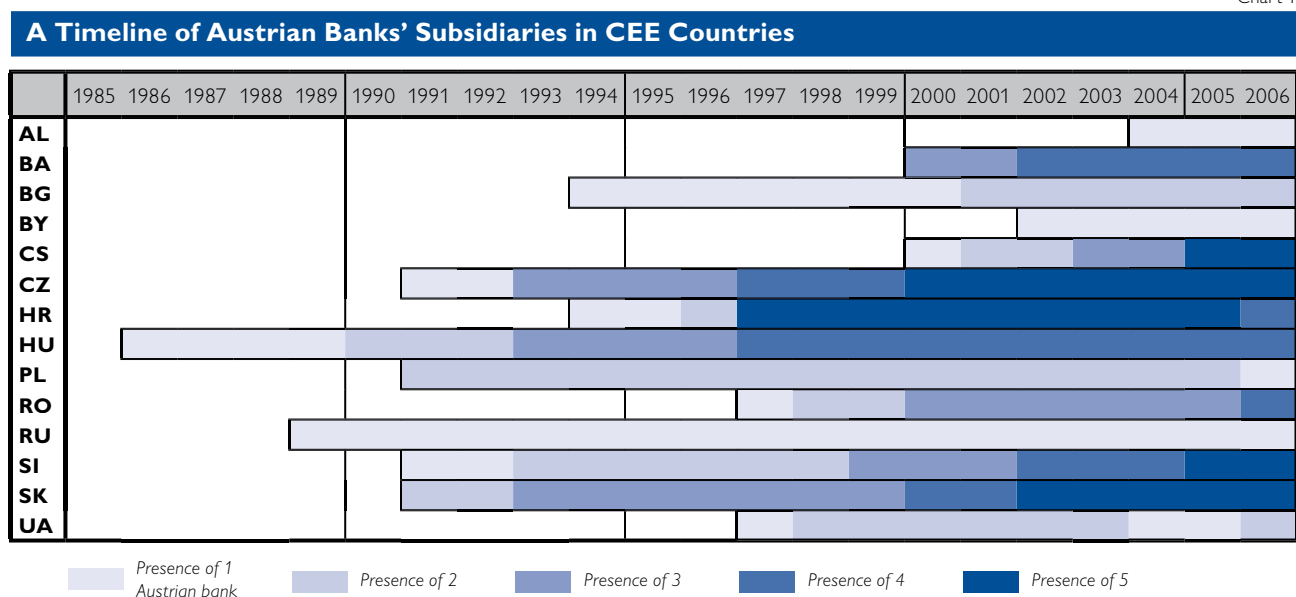
odology and results of stress tests conducted at the Oesterreichische Nationalbank (OeNB) for the Austrian banking system with respect to its credit exposure vis-à-vis the CEE region. Section 6 concludes.

## 2 Exposure of Austrian Banks in CEE

Austrian banks started to enter the CEE markets as early as in the mid-1980s to provide service to domestic clients (Austrian industrial companies) who expanded to CEE. By the early 1990s three Austrian banking groups (or their predecessors) had established subsidiaries in neighboring countries, but also in Poland and Russia (see chart 1).

During the recessions that struck most CEE countries in the 1990s, Austrian banks and their subsidiaries – contrary to many state-owned banks (SOBs) – steered clear of default, as at that time the subsidiaries were almost exclusively greenfield operations with less risky loan port-

Chart 1



Source: OeNB, banks' websites.

Note: The banks included are BA-CA, BAWAG P.S.K., Erste Bank, Hypo Alpe-Adria-Bank International, ÖVAG and RZB.

Table 1

**Presence of Austrian Banking Groups in CEE Countries**

	AL	BA	BG	BY	CS	CZ	HR	HU	PL	RO	RU	SI	SK	UA
BA-CA		X	X		X	X		X		X		X	X	
BAWAG P.S.K.						X						X	X	
Dexia Kommunalkredit Bank AG													X	
DenizBank AG											X			
Erste Bank					X	X	X	X		X			X	
RZB Oesterreich	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Raiffeisen Bausparkasse GmbH						X	X							
Österreichische Volksbanken-AG		X			X	X	X	X		X		X	X	
Hypo-Bank Burgenland AG								X						
Hypo Alpe-Adria-Bank International AG		X			X		X					X		
Porsche Bank AG								X		X				

Source: OeNB.

Note: The table includes all banks or banking groups operating in Austria, irrespective of domestic or foreign ownership, that have at least one CEE subsidiary.

folios than many SOBs that struggled with bad loans inherited from communist times. While the restructuring and refinancing of SOBs proved costly and led many CEE governments to proceed with full or partial privatization, more Austrian banks expanded into CEE in the second half of the 1990s (see Barisitz, 2006). That period was marked by a significant departure from their formerly homogenous business models as their strategies diversified. Some banks stuck to their initial greenfield operations and a strategy of organic growth, whereas others acquired stakes in large SOBs in the first wave of privatization to accelerate their expansion.

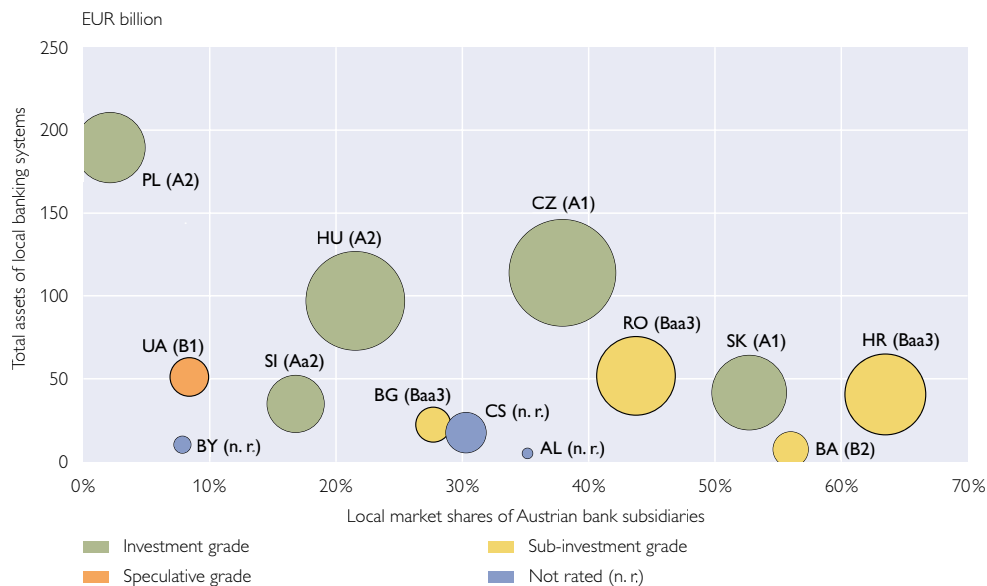
At the turn of the millennium, the economic environment in most CEE countries stabilized and banking activities entered a path of sustained expansion, boosted by robust economic growth and the anchor or prospect of EU integration (see Barisitz, 2006). EU-15 banks began to enter the markets in significant numbers,

taking advantage of further large-scale privatizations. Apart from the Hungarian OTP Bank and a few large domestically-owned national players or SOBs, the banking markets in CEE were dominated by EU-15 banking groups at that time. As the CEE countries began to prosper and EU membership negotiations started, three Austrian banks (BA-CA, Erste Bank and RZB) in particular had seized the opportunity of an early expansion into the region. They are among the largest foreign investors in terms of control over total banking assets in CEE.

The significance of the CEE countries for the Austrian banking system has increased continuously in parallel to the expansion of Austrian banking groups into the region. In addition to the organic growth of established subsidiaries and to further acquisitions, surging direct loans have contributed to an increasing exposure of Austrian parent institutions to the CEE markets. On a consolidated basis, the CEE business segment reports

Chart 2

**Exposure of Austrian Banks in CEE Countries at End-2006**



Source: OeNB, national central banks, Moody's.

Note: The x axis represents the market share of Austrian banks' subsidiaries in each country, the y axis represents total assets of each country's banking system and the size of the bubble displays the total exposure of Austrian banks in each country.

of the six major Austrian banks active in the region<sup>5</sup> show a steep absolute increase in total assets and an even steeper increase in pre-tax income.

At end-2006, CEE business accounted for 20.3% of total banking assets in Austria and 38.7% of all pre-tax income.<sup>6</sup> The overall exposure of Austrian banks in the region amounted to EUR 144.3 billion, of which EUR 52.5 billion was attributable to direct lending business and the remainder to indirect lending business via subsidiaries. Disaggregated data on the subsidiaries of the 11 Austrian banking groups active in the region (see table 1) reveals that they hold consid-

erable cumulated market shares in CEE that come to or above 40% in seven countries.<sup>7</sup> A detailed depiction of market sizes and shares is provided in chart 2. For the entire region (excluding Russia and Turkey), Austrian banks' market share reached 23.7%.

Although some markets contribute significantly to Austrian banks' overall exposure to the CEE markets – in terms of subsidiaries' aggregate total assets, the largest exposure is vis-à-vis the Czech Republic, followed by Hungary, Croatia, Romania and Slovakia – it is well diversified with no single country contributing more than 20%. The Herfindahl In-

<sup>5</sup> BA-CA, Erste Bank der oesterreichischen Sparkassen AG (Erste Bank), Raiffeisen Zentralbank Österreich AG (RZB), Bank für Arbeit und Wirtschaft und Österreichische Postsparkasse AG (BAWAG P.S.K.), Österreichische Volksbanken AG (ÖVAG), Hypo Alpe-Adria-International.

<sup>6</sup> Excluding special items due to the sale of subsidiaries.

<sup>7</sup> Albania, Bosnia, Croatia, the Czech Republic, Romania, Serbia and Slovakia.

dex is a means to assess the extent of diversification quantitatively.<sup>8</sup> With respect to Austrian subsidiaries, the Herfindahl Index has decreased substantially over time from 0.17 in 2002 to 0.07 at end-2006. More than one-half of total banking assets of Austrian subsidiaries in the region are held in countries with investment grade ratings.<sup>9</sup>

Given that the prospect of EU membership has been another important stabilization factor for the CEE banking systems, it is interesting to note that the new EU Member States (NMS)<sup>10</sup> account for roughly one-half of the aggregate total assets of the entire CEE banking system. Austrian banks' exposure, however, shows significantly higher concentration there. In terms of total assets of CEE subsidiaries, 74.9% are held in NMS, whereas the current presence in Russia, the largest individual CEE market, is fairly limited. The single most important market outside the NMS for Austrian banks is Croatia.

Although Austrian banks grow more rapidly outside the NMS, their main exposure is likely to remain within the NMS in the near future, as investment in countries like Romania has just recently picked up. As regards CEE subsidiaries' operating profits,

the share of NMS amounts to 70.6%. This share is about 4 percentage points lower than the share of NMS in total assets (see above), which points to a higher profitability of subsidiaries outside the NMS.

### 3 State of the CEE Banking Systems

Over the last years, the performance of banking systems in the CEE region has improved markedly reflecting dynamic economic activity. Banks have recorded a generally positive operating performance, with profitability increasing and efficiency improving.

The evolution of average individual bank ratings underscores a generally positive outlook for the region's banking systems. Out of the ten countries for which Moody's publishes average individual bank ratings, no country rating was downgraded with respect to the average ratings since 2002 (see Moody's, 2002 and 2007). In fact, the ratings of nine countries were upgraded, and the remaining one was a constant average bank financial strength rating. Even more recently (i.e. in the course of 2006), the ratings of only three out of ten banking markets (again based on their average individual bank rating) were downgraded. The assess-

<sup>8</sup> Herfindahl Indices for each year are computed as

$$HI = \left[ \sum_{i=1}^N \left( \frac{X_i}{\sum_{j=1}^N X_j} \right)^2 - \frac{1}{N} \right] / \left[ 1 - \frac{1}{N} \right]$$

where  $X_1, X_2, \dots, X_N$  denote the Austrian subsidiaries' assets in each of  $N$  countries. The index takes on values between 0 (representing perfect diversification) and 1 (total concentration, i.e. no diversification).

<sup>9</sup> Taking into account Moody's bank financial strength (BFS) rating instead of the country ratings, 42.1% of assets are currently held in countries with an average individual bank rating of C (adequate intrinsic financial strength), 42.6% in countries with an average rating of D (modest intrinsic financial strength) and only 15.3% in countries that are not rated at all or show an average rating of E (very modest intrinsic financial strength). As a comparison, Switzerland has an average BFS rating of B, Italy C+ and Germany and Austria C (see Moody's, 2007).

<sup>10</sup> This group includes the countries that joined the EU in 2004 plus Bulgaria and Romania.

ment by Fitch Ratings last autumn noted important improvements in the emerging markets' banking systems, thus underpinning the assessment by Moody's (see Fitch Ratings, 2006).

Over the last years, bank profitability in CEE has been consistently above EU-15 levels and has continued to improve. The asset-weighted return on assets (ROA) of EU-15 banks stood at 0.5% in 2005, whereas the ROA of CEE banks was markedly higher at 1.8%.<sup>11</sup> Furthermore, an upward tendency can be seen with regard to profitability, as the aggregate ROA across the region came to 1.2% in 2003 and to 1.4% in 2004. The standard deviation of banks' ROA has declined as well, indicating a homogeneous trend in this respect.<sup>12</sup>

Banks in the region also managed to raise their cost efficiency, which makes profitability increases more sustainable. A stochastic frontier analysis of banks' cost efficiency in the NMS indicates that CEE banks have increased their cost efficiency quite rapidly from 1999 onward, albeit starting from rather low levels. From 1999 to 2002 the cost efficiency of banks in the NMS augmented by 4.1%, whereas from 2002 to 2005, it increased by only 2.3%.<sup>13</sup> Despite this slowdown, the banks in the NMS seem well on track to shrink the effi-

ciency gap with respect to their EU-15 peers. The evolution in terms of cost efficiency is reflected in the development of cost-to-income ratios (CIRs), which decreased from 75% in 2002 to 63% in 2005. Additionally, the standard deviation of CIRs fell, too, in fact pointing to a homogeneous trend in this respect as well.<sup>14</sup>

Given the current profitability levels, banks in the region have a comfortable first line of defense in the face of potential loan losses before having to tap their capital buffers. Solvency ratios mostly remain in a double-digit range, although they are – not least owing to rapid loan growth – on the decline in most countries (see ECB, 2006).

Loan growth, however, continues to be a concern from the supervisory perspective. The total loan growth of the median bank in the region was 22.4% in 2005,<sup>15</sup> which raised fears that part of this growth comes at the cost of accumulating hidden credit risk (see Hilbers et al., 2005). Lending to private households grew considerably faster over the last years. Given the current level of intermediation depth, growth rates reflect a catching-up process to EU-15 levels (see ECB, 2006, or Backé and Walko, 2006). The speed of this process, however, is challenging for individual banks and for policymakers. A par-

<sup>11</sup> Source: Bureau van Dijk's BankScope database.

<sup>12</sup> For ROA data on individual NMS, see e.g. ECB (2006).

<sup>13</sup> For data from 1999 to 2002, see Rossi et al. (2005). Data for the period from 2002 to 2005 are the authors' calculations. All values are based on Stochastic Frontier Analysis (SFA) estimates with a Fourier flexible form for banks' production functions. The countries covered are all NMS for the period from 1999 to 2002 and all NMS plus Croatia for the period from 2002 to 2005.

<sup>14</sup> Source: Bureau van Dijk's BankScope database. This tendency is confirmed by ECB data on individual NMS, which shows that with the exception of Poland and Slovakia, CIRs declined in all NMS from 2002 to 2005 (see ECB, 2005, and ECB, 2006).

<sup>15</sup> Source: Bureau van Dijk's BankScope database.

ticular concern in the region is foreign currency lending,<sup>16</sup> which exposes the borrowers (households and corporations) to exchange rate risk, which may materialize in the form of (indirect) credit risk in banks' loan portfolios, and also entails reputation risk for heavily involved banks (see ECB, 2006).<sup>17</sup>

The close monitoring of loan growth has to be considered in conjunction with the currently low levels of loan loss provisions (LLPs) in a number of countries. The fact that loan loss provision ratios are low and/or falling does not come as a surprise in the face of rapid loan growth. Still, loan growth together with a potential rise in the currently low LLPs will certainly challenge the risk management of CEE banks in the medium term. As volumes expand rapidly, lending is likely to move away from prime categories. With the loan portfolio maturing, loan loss provision ratios and nonperforming loan ratios are bound to increase at some point in the future. In the long run, however, the soundness of the banking systems in question will depend on an adequate level of LLPs on the one hand, and on bank efficiency and bank profitability on the other. Current trends indicate that the CEE banking systems in fact have comfortable buffers in their operating results to cope with increasing LLPs. Material changes of LLPs will, however, also

have to be taken into account in ICAAP<sup>18</sup> considerations of banks. Stress tests are by all means an important tool for banks in assessing their credit risk in the long run. In this respect, bank risk management has improved in the region, with both the widespread presence of foreign banks and the introduction of Basel II acting as catalysts.

In terms of banking supervision, a considerable portion of the CEE banking market profits from the progress of EU integration and foreign bank ownership. Given the current implementation of several EU directives related to the Basel II framework, the supervisory frameworks in many CEE countries will strengthen further in addition to the progress already made in the course of EU accession. Given the substantial share of foreign bank ownership, the home supervisors of foreign-owned banking groups provide an additional layer of prudential supervision. The ongoing cooperation between home and host supervisors (e.g. by means of supervisory colleges) plays an important role in this respect.

#### 4 Stress Testing in CEE

One way to assess the credit risk inherent in Austrian banks' CEE exposures from a financial stability point of view is the implementation of stress tests to determine how Austrian banks weather shocks in these mar-

<sup>16</sup> See ECB (2006) and Standard&Poor's (2006) for more details on individual countries. Note that the Czech Republic and Slovakia are an exception to the general boom of foreign currency lending in CEE.

<sup>17</sup> See ECB (2006) on the reaction by the central banks and supervisory authorities in some countries to the increasing popularity of foreign currency lending. The final assessment of the risk exposure of an individual country, however, hinges on a number of factors such as the currency regime, the denomination of the loans (CHF or EUR), the economic policy mix of the respective country, individual banks' lending practices as well as the potential presence of natural hedges (e.g. income in the respective foreign currency).

<sup>18</sup> ICAAP (Internal Capital Adequacy Assessment Process) refers to a process institutions should have for assessing their overall capital adequacy in relation to their risk profile and a strategy for maintaining their capital levels. ICAAP constitutes one of the four principles within the Supervisory Review Process as set forth by Basel II.

kets. Generally speaking, stress tests are tools for evaluating the effects that certain scenarios have on the financial condition of individual banks or the whole banking system. Stress scenarios comprise assumptions about the future development of banks' operational environment – especially of the credit, securities and foreign exchange markets – that potentially pose a risk for the credit institutions. In order to estimate the consequences of the initial shock represented by the scenario on other relevant risk factors, (macroeconomic) modeling can be used, which is usually referred to as macro(economic) stress testing or scenario analysis. Alternatively, in a sensitivity analysis only a subset of risk factors is “stressed” and all other risk factors remain at their actual levels. In any case, stress scenarios should describe events that are exceptional but still plausible. Examples for commonly used scenarios are a sharp slowdown in economic growth or a marked shift of the yield curve. Today, stress tests are used as valuable tools at the risk management units of banking institutions as well as at organizations responsible for safeguarding financial stability and for banking supervision (Blaschke et al., 2001).

#### **4.1 Stress Testing by Central Banks in CEE**

A growing number of CEE central banks publish the results of their own stress testing exercises in their regular publications on financial stability. Comparability of the results is certainly limited by data availability as well as confidentiality on the one hand, and by differences in individual

methodologies of stress tests on the other. While the remainder of this section covers information on stress testing by central banks (with a special focus on credit risk) that was published in financial stability reports and similar publications, section 4.2 gives an overview on stress tests that were developed in the course of the FSAPs<sup>19</sup> of the countries under consideration.

While Albania, Bulgaria and Croatia do not yet publish the results of their stress tests in their financial stability publications, they regularly conduct sensitivity analyses for banks' loan portfolios. Bălgarska Narodna Banka (BNB) bases its credit risk assessments on the FSAP exercise considering the historical experience of the BNB regarding the migration of loans from low to high risk categories. Hrvatska narodna banka (HNB) uses a historical worst-case scenario based on the experience made during the crisis of 1998 and 1999. In addition, it is currently developing macro stress tests for credit risk.<sup>20</sup>

In contrast, Belarus, Poland and Slovakia publish the results of sensitivity analyses in biannual or annual reports. The National Bank of the Republic of Belarus (NBRB) presents the results of two credit risk scenarios in its report on the development of the banking system (see NBRB, 2006). The first scenario assumes an increase in the share of problem assets, i.e. in the ratio of nonperforming loans to total loans, by 15 percentage points, while in the second scenario loans are shifted from lower to higher risk categories. In its most recent financial stability review (see

<sup>19</sup> *Financial Sector Assessment Program of the IMF.*

<sup>20</sup> *Information about the internal stress tests was provided by the respective central banks on an informal basis.*



NBP, 2006), Narodowy Bank Polski featured four simulations for assessing credit risk. The first simulation determines the percentage of loans extended by domestic commercial banks with a satisfactory rating that would have to be downgraded to doubtful so that the capital adequacy ratio (CAR) would fall to 8%. The second simulation measures the impact of a decrease of loan collateral on the CAR of the ten largest banks in Poland. The third and the fourth simulations were designed to assess the effect of bankruptcy of the three largest borrowers from the non-financial, respectively the financial sector, on financial stability. Additionally, interbank contagion risk is addressed in the Polish financial stability report and an econometric macro-model for stress testing is currently being evaluated internally. Národná banka Slovenska (NBS) has recently published research on two credit risk scenarios (see Jurca and Rychtárik, 2006, and NBS, 2006). The first scenario, a credit crunch, simulates a deterioration in the financial position of banks' clients, while the second scenario was derived from the increasing competitive pressure related to the relatively high pace of loan growth. It therefore simulated a situation in which banks striving to increase their market share extend a larger number of loans and also increase the share of loans provided to less solvent clients.

The central banks of Romania and Russia both publish results based on macro stress tests; while the Banca Națională a României (BNR) publishes the results in its annual financial stability report (see BNR, 2006), the Central Bank of the Russian Fed-

eration (CBR) does so in its annual banking supervision report (see CBR, 2006). In its latest report the BNR presents a credit risk stress test that takes into account second-round effects of a depreciation of the domestic currency and of interest rate movements for domestic currency lending. This macro stress test was designed on the basis of an approach developed by the Banque de France (see De Bandt and Oung, 2004). The CBR reports results of macro stress tests with respect to two different scenarios without providing details regarding the underlying methodologies.

The Czech Republic and Slovenia conduct both sensitivity analyses and macro stress tests. Banka Slovenije publishes stress test results in its annual financial stability report (see Banka Slovenije, 2005), the latest issue of which also contains a special feature on macro stress testing for the Slovenian banking system (see Kavčič et al. 2005). As the title suggests, it focuses on macro stress testing, but regarding credit risk an individual stress test is calculated within the so-called "piecewise approach." Česká národní banka (CNB) publishes stress test results in its annual financial stability report (see CNB, 2006) and has a history of publishing such results.<sup>21</sup> Sensitivity stress tests are calculated for two scenarios, which assume an increase in the NPLR by 30% and 3 percentage points, respectively. In addition, various more sophisticated stress tests are calculated. These include macro stress tests using consistent model scenarios and stress test for interbank contagion, as well as combinations of these two types of stress tests.

<sup>21</sup> For two recent examples see Cihák et al. (2007) or Jakubík (2007).

Finally, Magyar Nemzeti Bank (MNB) published an article on stress testing including the methodology used and the results as early as 2001 in their report on financial stability (see MNB, 2001). Since then, the MNB has addressed stress tests for credit and also contagion risk in the interbank market in various issues of its financial stability report. The latest issue for the year 2006 includes stress tests on credit risk for the household and the corporate sector.

#### **4.2 Stress Tests Performed under the FSAPs of the IMF**

As can be seen from the previous section, the comparability of the stress testing scenarios used in the CEE countries is limited, given the differences in the methodologies used and in the level of quantitative information available for the individual countries. However, in many cases the supervisory interest in stress tests was initially spurred in the course of an FSAP by the IMF. While FSAP stress tests can also differ quite substantially with respect to the underlying methodologies, they generally provide at least some degree of comparability.

Stress tests form an integral part of an FSAP exercise and, according to the IMF, have been performed for every IMF member (see Hilbers et al., 2004). Data availability is a key factor in determining the approach and sophistication of the stress tests. For this reason and owing to the short time frame available during FSAP missions, FSAP stress tests are predominantly sensitivity analyses for a

single risk factor or a group of risk factors<sup>22</sup> performed on a bank-by-bank basis. However, some FSAP participants have used macro models or included contagion risk and second-round effects into the exercise (see Hilbers et al., 2004).

Table 2 provides an overview of credit risk stress tests that have been performed by the IMF in the course of the FSAPs of the CEE countries under consideration. In some cases, these stress tests were recalculated during a subsequent Article IV Consultation. They often served as a starting point for the development of stress tests by the various national authorities, which were discussed in the previous section. In this table, we tried to achieve some degree of comparability of the credit risk stress tests performed in the various CEE countries. In general, all scenarios are based on the assumption that loan quality deteriorates through a downward shift in the classification of the loan portfolio. This classification contains the categories “standard” and “watch” (performing loans – Ps) and the categories “substandard,” “doubtful” and “loss” (nonperforming loans – NPs). Given the respective country’s provisioning scheme,<sup>23</sup> it is possible to calculate the loss associated with the scenario and its impact on the capital adequacy ratio.

However, the scenario definitions vary with respect to the precise characterization of the downward shift in the classification of the loan portfolio. While in some cases the migration of loans between categories is

<sup>22</sup> The stress levels of individual risk factors are often based on historical scenarios.

<sup>23</sup> The provisioning scheme specifies the percentage of loan loss provisions that banks have to make for the absolute amount of loans within each category according to the regulations in the respective country. For example, the provisioning scheme could require 2% for loans classified as “standard,” 5% for “mentioned,” 30% for “substandard,” 50% for “doubtful” and 100% for “loss.”

Table 2

**Credit Risk Stress Tests in CEE Countries Presented in the IMF's FSAPs**

	Description of Credit Risk Scenario according to FSAP <sup>1</sup>	Increase in NPLR <sup>2</sup>	IMF Country Report	Date
AL	10% deterioration in standard loans	9.5 pp <sup>3</sup>	No. 05/274	08/2005
BA	n.a.	n.a.	No. 06/371	10/2006
BG	All doubtful loans become loss loans, 50% of substandard loans become doubtful loans, 5% of "watch" loans become substandard loans and 1% of standard loans become "watch" loans.	n.a.	No. 02/188	08/2002
BY	Downward shift in classified loans by one category. 20% of standard loans are assumed to become substandard loans.	n.a. <sup>4</sup>	No. 05/216	06/2005
CS	The ratio of nonperforming loans to loans rises by 6.2 percentage points.	6.2 pp	No. 06/96	03/2006
CZ	62% increase in nonperforming loans	62% <sup>5</sup>	No. 01/113	07/2001
HR	Moving risk-weighted performing assets to nonperforming status	n.a.	No. 02/180	08/2002
HU	Increase in NPLs by 100%	100%	No. 05/212	2005
PL	Increase of 2.5% in the ratio of classified loans	2.5 pp <sup>6</sup>	No. 01/67 <sup>7</sup>	06/2001
RO	10% of loans become NPLs and provisioning for new NPLs comes to 50%	10 pp	No. 03/389	12/2003
RU	Increase in the NPL ratio by the peak value observed for each bank in the period from 1998 to 1999	10.8 pp <sup>8</sup>	No. 03/147	05/2003
SI	Deterioration of loan quality using a credit migration matrix	n.a.	No. 01/161	09/2001
SK	Credit risk shock with a 65% increase in NPLs	65%	No. 02/198	09/2002
UA	All doubtful loans become loss loans, 20% of substandard loans are downgraded to doubtful, 10% of "watch" become substandard, 10% of standard loans are downgraded to "watch" loans and standard loans increase by 10%	n.a.	No. 03/240	11/2003

Source: Compiled by the OeNB on the basis of IMF's FSAP country reports and of other sources specified in the note.

Note: n. a. = not available

<sup>1</sup> The description of the credit risk scenario was taken from the respective FSAP country report. In cases where more than one stress test was calculated, we present only the test that can be expressed in terms of an increase of the nonperforming loan ratio (NPLR). If no such stress test was calculated at all, we chose the scenario with the largest impact on the financial system.

<sup>2</sup> Relative or absolute increases in the NPLR in % or percentage points (pp), as indicated in the scenario description.

<sup>3</sup> Assuming an initial NPLR of 4.5% (which corresponds roughly to the average NPLR between the first quarter of 2004 and the first quarter of 2005) and a shift of 10% of loans classified as standard to nonperforming categories.

<sup>4</sup> In the NBRB's most recent report on the development of the banking system (NBRB, 2006) an increase of the NPLR by 15 percentage points is assumed.

<sup>5</sup> In Article IV, IMF Country Report No. 05/276 an increase of the NPLR by 30% and 3 percentage points, respectively, is assumed.

<sup>6</sup> The scenario description was interpreted as an increase of the NPLR by 2.5 percentage points.

<sup>7</sup> In spring 2006 Poland underwent an FSAP update. However, the respective results were not published before the editorial close of this publication and hence are not included here.

<sup>8</sup> Calculated as the change in NPLRs between end-1998 and 1999 for the aggregated banking system.

specified for each category separately, in others an increase in NPLs or the respective ratio to total loans (NPLR) is specified implicitly or explicitly through the definition of the scenario. In the latter case, an additional assumption has to be made regarding the amount of loan loss provisions associated with the increase in NPLs. One approach is to assume that the relative share of NPL categories remains constant before and after the shock. Given the respective provisioning scheme, it is possible to calculate the loss associated with the increase of NPLs. Another approach is

to simply assume that an increase in NPLs by a certain amount  $x$  leads on average to a fixed percentage increase in loan loss provisions, e.g. 50% of  $x$ .

In order to achieve maximum comparability between the different approaches, we try to translate each scenario into an absolute or relative increase in the NPLR. However, given the lack of data regarding the distribution of the loan portfolio over categories, this is not possible in cases where the migration of loans between categories is specified for each category separately. In addition, for some scenarios we had to make additional

assumptions (see notes to table 2) in order to interpret the described scenario in terms of an increase in the NPLR. In cases where more than one stress test was performed for a specific country, we present the test that can be expressed in terms of an increase of the NPLR. If more than one such stress test was available, we chose the scenario with the largest impact (see table 2). As can be seen from the table, the scenarios vary quite substantially across countries in terms of the increases in the NPLR, which range from 2.5 to 10.8 percentage points in absolute terms and from 62% to 100% in relative terms.

Despite the aforementioned problems, stress tests conducted by the IMF in the course of FSAP and Article IV missions (see table 2) as well as those of the national central banks<sup>24</sup> provide a valuable starting point for creating severe but still plausible scenarios for the purpose of stress testing Austrian banks' exposure in the region. Hence they serve as a benchmark for the definition of scenarios of the OeNB's stress test that is presented in the following section.

## 5 The OeNB's CEE Stress Test

By introducing a scenario that exposes the Austrian banking system to a both severe and plausible shock we want to answer two closely interconnected questions: On the one hand, we try to find out whether the current CEE exposure puts domestic financial stability at risk and, on the other hand, whether the impact of a shock on the capital buffers of Austrian banks active in the region threat-

ens or supports financial stability of the CEE markets. If Austrian parent banks e.g. had capitalization problems as a consequence of an exogenous shock in one particular market, they could transfer these shocks to other CEE markets as well, given their importance in the region.

### 5.1 Scenario

The OeNB developed a first stress test for the CEE exposure of Austrian banks as early as 2003 which consists of two scenarios that were originally drafted during the IMF's FSAP mission to Austria in 2003. The first scenario involved a cyclical shock entailing a rise of LLP ratios of Austrian banks' subsidiaries by the historical maximum relative year-on-year changes in the overall ratio of each country's national banking sector. The second scenario was one of structural change that assumed that the LLP ratios of Austrian banks' subsidiaries in CEE rise to the current overall ratio of each country's national banking sector (see Boss et al., 2004).<sup>25</sup> In subsequent regular stress testing exercises based on these two scenarios, an increase of LLP ratios for the whole region of 40% was assumed (see OeNB, 2006, for a summary of results over time).

Since then, the nature of the Austrian banks' exposure to the CEE markets has changed significantly. Not only has the size of the exposure increased, but also the number and importance of individual countries has changed (see also chart 1). Today the exposure of Austrian banks is spread across a larger number of countries in different stages of eco-

<sup>24</sup> Though to a lesser extent for reasons of the highlighted comparability problems.

<sup>25</sup> Like in the stress test presented in this contribution, direct cross-border lending was "stressed" in the course of the FSAP, too.

conomic development and financial deepening. This latter aspect is, inter alia, reflected in the diversity of shocks applied in the individual countries' FSAP stress tests. Furthermore, the rapidly expanding loan volume in numerous CEE countries has raised questions whether the shocks imposed by our former stress tests were sufficiently severe to cover extreme events. These circumstances made it necessary to adapt the stress testing scenarios presented in this contribution.

The scenario of our stress test is built on "shocking" nonperforming loans in the CEE banking markets. The size of the shocks is based on the experience we can draw from both the stress tests conducted by the IMF and the national authorities (see section 4). As a rule, we aim at introducing shocks that are on average as severe as the ones in the aforementioned stress tests.<sup>26</sup>

In order to produce severe but still plausible shocks, it has to be considered that historical fluctuations in nonperforming loans or loan loss provisions may underestimate the true risk exposure in a stress situation.<sup>27</sup> This insight led us to develop a shock that deliberately surpasses the historical maximum increases in some countries.

Furthermore, as already mentioned in section 3, the current levels of LLPs and bad debt are very low in a number of countries, not least due to the rapid loan growth witnessed

across the region. The scenario therefore assumes a shock that is the maximum of a relative and absolute increase in the NPL ratios, thus preventing the shock from being small only because of the currently low levels of NPLs.

Our new scenario takes into account the diversity of individual countries and proxies the different stages of economic and financial development by the state of integration into the EU. Although this proxy appears to be crude at a first glance, we believe it best reflects the institutional and regulatory advances made in individual countries. Even more importantly, this hypothesis is confirmed by data from e.g. the European Bank for Reconstruction and Development (EBRD) or commercial rating agencies like Moody's (see table 3).

The countries are thus grouped in accordance with their state of integration into the EU as a risk measure, which is adapted case by case owing to idiosyncrasies of some countries. For this stress test we divide the countries into three risk categories. Category 1 includes all countries that joined the EU in 2004 with the exception of Hungary, which is included in category 2, given the recent political and economic tensions. This decision is supported by Hungary's Macro Prudential Risk Indicator of 4 (see table 3) and more recent reports on Hungary's persistent fiscal difficulties, the increased volatility of the Hungarian forint and the ensuing

<sup>26</sup> *A few individual shocks are more severe than the ones we introduced in our scenario, which is attributable to the fact that we impose equal size shocks on groups of countries. Individual countries may therefore be exposed to larger shocks in the stress tests conducted by the IMF or the national central banks. Furthermore, the comparability of scenarios is sometimes difficult, if not impossible, owing to data limitations.*

<sup>27</sup> *Given the wide-ranging economic and political transformation process in CEE countries, past banking crises cannot be considered viable examples of potential future crisis situations. Furthermore, the characteristics of the ongoing process of rapid financial deepening have to be taken into account to determine the size of the shock. We therefore refrain from using a historical worst-case scenario.*

Table 3

Financial Strength Indicators for CEE Countries							
	EU membership status	Indicators from the EBRD Transition Report			Moody's Bank and Sovereign Credit Comments 02/2007		
		Transition <sup>1,2</sup>	Macro prudential <sup>3,4</sup>	# Systemic risks <sup>3</sup>	Sovereign Rating	Avg LT Deposit <sup>5</sup>	Avg BFS Rating <sup>6</sup>
CZ	member country since 2004	4	1	0	A1	A2	C-
HU	- " -	4	4	1	A2	A2	C-
PL	- " -	3,67	1	2	A2	A3	D+
SI	- " -	3,33	1	3	Aa2	A2	C-
SK	- " -	3,67	1	0	A1	A2	D
BG	member country since 2007	3,67	3	2	Baa3	Ba2	D-
RO	- " -	3	3	2	Baa3	Ba1	D-
HR	accession country	4	1	1	Baa3	n.a.	D+
AL	no status	2,67	2	4	n.a.	n.a.	n.a.
BA	- " -	2,67	2	2	B2	n.a.	n.a.
BY	- " -	1,67	2	7	n.a.	n.a.	n.a.
CS	- " -	2,67	2	4	n.a.	n.a.	n.a.
RU	- " -	2,67 (+)	2	6	Baa2	Ba2	E+
UA	- " -	3 (+)	3	5	B1	B2	E+

Source: OeNB, EBRD, Moody's.

<sup>1</sup> Data from the 2006 report.

<sup>2</sup> Ranging from 1 to 4, with 4 being the most favorable assessment.

<sup>3</sup> Data from the 2005 report; this indicator is no longer published by the EBRD.

<sup>4</sup> Risk assessment in a range from 1 to 4, with 4 indicating the highest risk.

<sup>5</sup> Average Long-Term Deposit Rating.

<sup>6</sup> Average Bank Financial Strength Rating.

Note: n. a. = not available.

threat of declining investor confidence documented e.g. in the EBRD's Transition Report (EBRD, 2006) or the IMF's Global Financial Stability Report (IMF, 2006). Category 2 includes Bulgaria and Romania as well as the only remaining accession country, Croatia, while category 3 consists of all other CEE countries. For countries in category 1, we chose an increase in the NPL ratio by a maximum of 6 percentage points in absolute terms and by 50% in relative terms. For category 2 countries, the respective numbers are 8 percentage points and 75%, and for category 3 countries, it is 10 percentage points and 100%.

The resulting scenario – applied on a single bank basis – constitutes a severe shock to Austrian banks' sub-

sidaries in CEE countries, as a doubling or even tripling of the aggregate NPL ratios can be observed in a number of countries (see table 4). The results indicate that on average, the absolute change of the NPL ratio (+6 percentage points, +8 percentage points and +10 percentage points, respectively) in the scenario clearly dominates the relative increase (+50%, +75%, +100%, respectively). It should be noted, however, that for some individual subsidiaries, the relative increases are more severe than the absolute ones.

## 5.2 Methodology

Broadly speaking, we apply the stress test to all nonbank lending exposures to the CEE countries using the scenario described above.<sup>28</sup> More specifi-

<sup>28</sup> Intra-group exposures to nonbank corporates are not excluded from the stress test.

Table 4

CEE Stress Test Scenario			Resulting relative change in aggregate NPLs of Austrian subsidiaries
Change of NPL ratios in scenario			
	absolute (percentage points)		relative (%)
AL			× 4 or more
BA			× 2 – 3
BY			× 2 – 3
CS			× 2 – 3
RU			× 2 – 3
UA	10	100	× 2 – 3
BG			× 2 – 3
HR			× 2 – 3
HU			× 3 – 4
RO	8	75	× 2 – 3
CZ			× 2 – 3
PL			× 1 – 2
SI			× 2 – 3
SK	6	50	× 2 – 3

Source: OeNB.

cally, these exposures include unsecured as well as securitized lending that was granted either indirectly by an Austrian parent institution's CEE subsidiary or directly as a cross-border loan by an Austrian bank to a debtor domiciled in the CEE region.<sup>29</sup> Consequently, a bank's loss implied by the stress scenario consists of two components: the loss resulting from indirect lending undertaken by subsidiaries in CEE countries ( $L_{indirect}$ ) and the loss resulting from direct cross-border lending to CEE countries ( $L_{direct}$ ). The shock is applied to consolidated data, as the focus is on the group level.

For each bank, the indirect loss  $L_{indirect}$  is calculated by assuming that an increase in NPLs by 100 units increases LLPs by 50 units.<sup>30</sup> Given the lack of data on the exact distribution of the loan portfolio across different categories, we cannot calculate the additionally required LLPs for the shares of the substandard, doubtful and loss loan categories in total NPLs together with the respective provisioning scheme. Our approximation for the additional LLPs required is based on the assumption that an increase of NPLs by an amount  $x$  requires additional LLPs in the amount of 50% of  $x$  on average.<sup>31</sup>

<sup>29</sup> Data on indirect lending were obtained from the supervisory reports on foreign subsidiaries which provide a compressed version of balance sheet and income statements of foreign banks representing an affiliated company of an Austrian parent institution. For a list of Austrian banks with fully consolidated subsidiaries in CEE, see table 1. Data on direct lending were obtained from the OeNB's Major Loans Register. As this register contains only exposures above a reporting threshold per bank and borrower of EUR 350,000, not all direct exposures are included. However, since larger volumes tend to dominate in cross-border lending, we may assume that the bulk of direct exposures is covered. Given the restricted data availability, credit exposures arising from off-balance sheet items (both for direct and indirect lending) are not included in the data.

<sup>30</sup> An increase in the NPL ratio by 6 percentage points corresponds to an increase of 3 percentage points in the LLP ratio. Relative changes are, however, unaltered.

<sup>31</sup> This approximation is also used by the IMF in some cases (e.g. Romania) for FSAP stress testing (see table 2).

From the supervisory reports we have data on every subsidiary's LLP ratio for nonbank lending.<sup>32</sup> These ratios are increased in a country-specific way in accordance with the stress scenario described above. The resulting additional LLPs are weighted by the respective parent institution's share in the subsidiary. The sum of weighted additional LLPs across all CEE subsidiaries gives the indirect loss for the parent institution (for banks without CEE subsidiaries, the indirect loss is zero).

The direct loss  $L_{direct}$  incurred by a bank in the stress scenario is calculated as follows: The bank's exposures and the associated LLPs reported in the Austrian Major Loans Register are aggregated per country. The resulting LLP ratios are increased country-wise in accordance with the stress scenario. The implied additional LLPs are added up across all CEE countries, giving the direct loss of the bank.<sup>33</sup>

In order to relate the loss implied by the stress scenario to the risk-bearing capacity of a bank, we calculate a capital adequacy ratio ( $CAR_{stress}$ ) for the scenario by reducing a bank's regulatory capital (RC)<sup>34</sup> by the implied loss:<sup>35</sup>

$$CAR_{stress} = \frac{RC - L_{indirect} - L_{direct}}{RWA} .$$

The stress test is conducted for every single credit institution. Due to confidentiality reasons, the results are published only on an aggregated basis – for the overall banking system (all banks) as well as for a sample of the six major Austrian banks most active in the region (see section 2) that represent 65% of consolidated total assets of the Austrian banking system. This sample covers 98% of all Austrian CEE subsidiaries in terms of total assets. We aggregated the data by simply adding losses, regulatory capital and risk-weighted assets across all banks included in the respective sample and subsequently calculating the capital adequacy ratio for the actual situation and for the stress scenario.

### 5.3 Results

The outcome of the stress test indicates that the Austrian banking system copes well with an adverse shock to the CEE region. Table 5 shows aggregate results for both the banking system and the sample of six major banks for year-end 2004 through 2006. For both aggregates the reduc-

<sup>32</sup> As only aggregated LLP data are available (for overall lending of a subsidiary to banks and nonbanks), we have to make assumptions about the proportion of LLPs allocated to nonbank lending. We assume that the bulk of LLPs is allocated to nonbank lending; more precisely, the proportion of LLPs allocated to nonbank lending is 9 to 1 in our scenario. The sensitivity of results to this assumption is very small.

<sup>33</sup> This is done on a bank-by-bank basis in a first step. For group consolidation, direct losses of an Austrian subsidiary are assigned to the group's parent without weighting (i.e. with 100%) in a second step. This second step has an effect only on the result of the sample of the six major players (see below), but not on the overall banking system.

<sup>34</sup> Defined as eligible tier 1 and tier 2 capital.

<sup>35</sup> The risk-weighted assets (RWA) in the denominator include off-balance sheet items. Note that the loss implied by our scenario would in principle also lead to a reduction of RWA. The size of this reduction is, however, unclear as it depends on the risk weights associated with the assets that are impaired. These may differ by country e.g. owing to a different treatment of nonbank financial intermediaries with respect to risk weighting. Therefore we chose to remain on the safe side and not deduct any loss from the RWA. This of course leads to a more severe reduction in CARs.



Table 5

## CEE Stress Test Results

		Total assets (EUR billion)	Actual capital ratio (%)	Stressed capital ratio (%)	CAR change in scenario (percentage points)	Share of indirect loss (%)
All banks	end-2004	733	12.15	11.36	0.79	59
	mid-2005	789	12.35	11.55	0.81	56
	end-2005	848	11.69	10.79	0.89	59
	mid-2006	874	12.37	11.44	0.92	58
	end-2006	918	11.61	10.66	0.95	60
Sample - 6 banks	end-2004	452	11.01	9.86	1.16	65
	mid-2005	490	11.08	9.95	1.13	64
	end-2005	542	10.22	8.98	1.25	65
	mid-2006	569	11.08	9.82	1.25	64
	end-2006	600	10.07	8.80	1.27	66

Source: OeNB.

Note: The share of indirect loss represents the share of indirect losses through subsidiaries' lending in the overall losses implied by the scenario.

tion in the CAR is in the range of 1 percentage point, leaving “stressed” ratios above 8% in both cases, although particularly the ratio of one banking group operating close to the 8%-threshold falls well below the mandatory capital adequacy ratio. At year-end 2006, the individual decline in the CAR for the six banks most active in CEE ranges from 0.34 percentage point to 2.14 percentage points.

It has to be noted however, that reported year-end CARs are biased downward, as they do not yet include plowed back earnings from the previous years, the reason being that regulatory reporting requires CARs to be reported at a time when audited profit data is not yet available (i.e. at the end of January).<sup>36</sup> Profits from CEE operations, however, constitute a signif-

icant first line of defense against potential loan losses. In 2006, for example, the profits from CEE subsidiaries alone would suffice to absorb one-half of the indirect lending loss resulting from our stress scenario.<sup>37</sup> Taking into account all profits from the CEE business segment of the six Austrian banks most active in CEE,<sup>38</sup> almost 70% of the shock for these banks is absorbed. Looking at the entire banking system, its 2006 earnings would cover the loss in the stress scenario 1.7 times.

From table 5 it becomes even more evident than by judging from the banks' exposure that lending through CEE subsidiaries is much more important than direct cross-border lending: For the entire banking system indirect losses account for 60.2% of total losses. The sample of

<sup>36</sup> See also table 5, which reveals a pattern of lower CARs at year-end and relatively higher CARs at mid-year. This pattern is *inter alia* attributable to the consideration of retained profits in CARs at mid-year.

<sup>37</sup> Just as with losses, also subsidiaries' profits are weighted by the share held by the parent institution.

<sup>38</sup> Earnings before taxes not considering earnings from the sale of CEE subsidiaries, which would distort earnings upward.

six major Austrian CEE players unsurprisingly accounts for almost all indirect losses (98%) and still for 74.7% of direct losses. Nevertheless, the stress test reveals a loss potential of EUR 452 million through direct lending that is distributed across several smaller institutions.

The temporal development of stress test results reflects different events and tendencies that have taken place over the past two years. To begin with, unstressed CARs are declining slightly, mirroring the rapid growth in total assets held in the CEE region. This development is even more evident for the subsample of the six banks most active in the region. The growing importance of the CEE business segment for the Austrian banking system is also reflected in the steadily increasing impact of the stress test scenario on CARs (measured in percentage points). Whereas the impact was 79 basis points in 2004, it went up to 95 basis points in 2006.<sup>39</sup> The share of direct vs. indirect lending loss, however, remains by and large constant over time.

It has to be noted that the employed scenario represents a worst case insofar as the shock is applied to all CEE countries simultaneously. Still, given the possibility of a shock affecting the entire region, this might be a severe but realistic setting. Another scenario consists in assuming that the shock is idiosyncratic to one country or occurs only within a limited geographical region and does not spread to other countries. This is of special relevance for evaluating, from a single bank perspective, whether an

adverse shock in one country could spread to other countries by way of a solvency problem at the parent bank. We therefore test each of the six major Austrian banks, hypothesizing that our scenario only occurs in that country where it implies the largest loss for the respective bank. In general, the Herfindahl Indices of the six banks are quite low, ranging from 0.04 to 0.31, which points to a high degree of diversification of exposures across CEE countries in most cases. Therefore it comes as no surprise that Austrian banks cope well with this “single country” scenario. The decline in CAR ranges from 0.12 percentage point to 1.09 percentage points, with only the aforementioned bank (which operates close to the minimum regulatory capital requirements) falling below the 8% CAR limit. The results remain much the same if we subject – on a bank-per-bank basis – a set of three countries with the largest loss contribution to our stress scenario, replicating a locally limited crisis. In this case the CARs of the six major banks stay above 8%, of course with the exception mentioned initially. The decline of individual CARs ranges from 0.29 percentage point to 1.80 percentage points.

## 6 Conclusions

Austrian banks were among the first and largest investors in the CEE financial sector. Given the ensuing importance of the region for the Austrian banking system, Austrian banks benefit from the advantages of a rapidly growing and highly profitable market. The flipside, however, is a

<sup>39</sup> The only decrease with respect to the impact of the stress scenario happened for the subsample of the six banks most active in CEE. It is ascribable to the listing of Raiffeisen International on the Vienna Stock Exchange. As losses are weighed by the share that an Austrian mother institution holds in its subsidiary, this listing reduced the ultimate exposure of the Austrian banking system accordingly.

potentially highly correlated risk exposure vis-à-vis a number of CEE countries, which raises two important questions: How strong is the impact of CEE countries for Austrian financial stability and to what extent do Austrian banks contribute to regional financial stability in CEE by prudent lending practices? We conducted a stress test which assumes a perfect correlation between the respective countries and raises NPLs by a maximum of absolute and relative changes that considerably surpass historical fluctuations. The results show that, despite the dramatic worsening of the economic environment implied by the scenario, the Austrian banking system on an aggregate level is not at risk as a result of the hypothesized crisis. With the exception of one bank operating close to the minimum regulatory capital requirements, Austrian banks will in all likelihood be able to absorb shocks in individual countries without transferring them to other countries, independent of

whether the shock is idiosyncratic to one country or correlated among several countries. From a bank-by-bank perspective, the stress testing exercise shows that the CEE exposure is manageable, indicating that the effect of a shock on the capital adequacy of Austrian banks will not endanger financial stability in CEE. The six banks most active in the CEE region are, however, called for to consider their rapidly expanding lending exposure in CEE in the planning of their own funds strategy. Moreover, the results show that the major part of total loss is in the form of indirect lending, i.e. comes from bank subsidiaries. The importance of direct lending must not be neglected, though. For the entire banking system it amounts to 39.8% of total loss. Although the six largest banks present in the region account for 74.6% of the direct lending exposure, those banks not present via subsidiaries in fact also have a non-negligible CEE exposure via direct cross-border lending.

## Bibliography

- Backé, P., Z. Walko. 2006.** Bank Intermediation in Southeastern Europe: Depth and Structure. In: Focus on European Economic Integration 2/06. OeNB.
- Banka Slovenije. 2005.** Financial Stability Report. June.
- Barisitz, S. 2006.** The Transformation of the Banking Sector in Central and Eastern European Countries: From the Communist Era until the Present Time. Mimeo.
- Blaschke, W., M. Jones, G. Majnoni and S. Peria. 2001.** Stress Testing of Financial Systems: Overview of Issues, Methodologies, and FSAP Experiences. IMF Working Paper 01/88.
- Boss, M., G. Krenn, M. Schwaiger and W. Wegscheider. 2004.** Stress Testing the Austrian Banking System. In: Österreichisches Bankarchiv 11/2004.
- Banca Națională a României. 2006.** Financial Stability Report 2006.
- Ceská Národní Banka. 2006.** Financial Stability Report 2005.
- Central Bank of the Russian Federation. 2006.** Banking Supervision Report 2005.
- Cihák, M., J. Hermánek and M. Hlaváček. 2007.** New Approaches to Stress Testing the Czech Banking Sector. Czech Journal of Economics and Finance 1–2/2007. 41–59.
- De Bandt, O. and V. Oung. 2004.** Assessment of 'Stress Tests' conducted on the French Banking System. Banque de France Financial Stability Review November 2004.

- European Bank for Reconstruction and Development. 2006.** Global Transition Report. October 2006.
- European Central Bank. 2005.** Banking Structures in the New EU Member States.
- European Central Bank. 2006.** EU Banking Sector Stability. November 2006.
- Fitch Ratings. 2006.** Bank Systemic Risk Report. September 2006.
- Hilbers, P., M. Jones and G. Slack. 2004.** Stress Testing Financial Systems: What to Do When the Governor Calls. IMF Working Paper 04/127.
- Hilbers, P., I. Otter-Robe, C. Pazarbasioglu and G. Johnsen. 2005.** Assessing and Managing Rapid Credit Growth and the Role of Supervisory and Prudential Policies. IMF Working Paper 05/151.
- International Monetary Fund. 2006.** Global Financial Stability Report. September 2006.
- Jakubík, P. 2007.** Macroeconomic Environment and Credit Risk. Czech Journal of Economics and Finance 1-2/2007. 60–78.
- Jurca, P. and S. Rychtárik. 2006.** Stress Testing of the Slovak Banking Sector. Národná banka Slovenska. BIATEC XIV 4/2006.
- Kavčič, M., T. Košak, F. Ramšak and T. Šuler. 2005.** Macro Stress Tests for the Slovenian Banking System. Banka Slovenije Financial Stability Report. June 2005.
- Latvian Banka. 2006.** Financial Stability Report 2/2005.
- Magyar Nemzeti Bank. 2001.** Report on Financial Stability. February.
- Moody's. 2002.** Bank & Sovereign Credit Comments. March 2002.
- Moody's. 2007.** Bank & Sovereign Credit Comments. February 2007.
- Narodowy Bank Polski. 2006.** Financial Stability Review. First Half of 2006.
- Národná Banka Slovenska. 2006.** Financial Stability Report. 2005.
- National Bank of the Republic of Belarus. 2006.** Report on the Development of the Republic of Belarus Banking System and Banking Supervision in 2005.
- Oesterreichische Nationalbank. 2006.** Financial Stability Report 11. June.
- Rossi, S., M. Schwaiger and G. Winkler. 2005.** Managerial Behavior and Cost/Profit Efficiency in the Banking Sectors of Central and Eastern European Countries. OeNB Working Paper 96.
- Standard & Poor's. 2006.** The Foreign Currency Gamble – Rising Risks For Banks In Central And Southeast Europe.