

**MONTENEGRO: Financial  
Sector Assessment Program  
Banking Sector Stress  
Testing—Technical Note**



# MONTENEGRO

## FINANCIAL SECTOR ASSESSMENT PROGRAM

### BANKING SECTOR STRESS TESTING—TECHNICAL NOTE

June 2016

This Technical Note on Banking Sector Stress Testing for Montenegro was prepared by a staff team of the International Monetary Fund. It is based on the information available at the time it was completed in June 2016.

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June 2016

# TECHNICAL NOTE

## BANKING SECTOR STRESS TESTING

Prepared By  
**Monetary and Capital Markets  
Department**

This Guidance Note was prepared in the context of a joint IMF-World Bank Financial Sector Assessment Program (FSAP) mission in Montenegro during September, 2015 led by Peter Löhmus, IMF and Alexander Pankov, World Bank, and overseen by the Monetary and Capital Markets Department, IMF, and the Finance and Private Sector Development Vice Presidency, World Bank. The note contains the technical analysis and detailed information underpinning the FSAP assessment's findings and recommendations. Further information on the FSAP program can be found at <http://www.imf.org/external/np/fsap/fssa.aspx>.

## CONTENTS

<b>GLOSSARY</b>	<b>4</b>
<b>EXECUTIVE SUMMARY</b>	<b>5</b>
<b>INTRODUCTION</b>	<b>8</b>
<b>BANKS' BALANCE SHEETS AND PROFITS</b>	<b>8</b>
<b>SOLVENCY STRESS TEST</b>	<b>10</b>
A. Risks and Vulnerabilities	10
B. Adjustments to Reported Capital Adequacy	12
C. Macroeconomic Scenarios	12
D. Macrofinancial Transmission	14
E. Results	18
<b>SENSITIVITY ANALYSES OF SOLVENCY</b>	<b>19</b>
A. Credit Concentration Risk	19
B. Market Risks	20
C. Operational Risk	21
<b>LIQUIDITY STRESS TEST</b>	<b>22</b>
A. Measures and Assumptions	22
B. Results	22
Contagion Risks And Spillover analysis	23
<b>REFERENCES</b>	<b>47</b>
<b>FIGURES</b>	
1. Real GDP Growth Projections	13
2. Market Risks and Historical Operational Risk Losses	21
3. Montenegro Banking Sector's Cross-Border Interbank Exposures	24
4. Cross-Border Spillovers to Montenegrin Banks: Credit and Funding Shocks	25
5. The Sequence of Successive Failures	26
6. Solvency Stress Test Results	27
7. Liquidity Stress Test Results	28

**TABLES**

1. Main Recommendations Based on the Stress Tests _____	<u>7</u>
2. Banks in Montenegro _____	<u>29</u>
3. Banking Sector Summary _____	<u>30</u>
4. Summary of the Banking Sector Loan Book in Montenegro _____	<u>31</u>
5. Macroeconomic Projections _____	<u>31</u>
6. Balance Sheet and Income Statement Projections _____	<u>32</u>
7. Data Availability to Estimate Relations Between Credit Losses and Macroeconomic Variables _____	<u>33</u>
8. Panel Data Model Estimation Output _____	<u>34</u>
9. Aggregate Capital Adequacy Ratio as a Function of Assumed GDP Growth Rates and Credit Loss Sensitivities _____	<u>35</u>
10. Summary Solvency Stress Test Results (No Provisioning Adjustments) _____	<u>36</u>
11. Summary Solvency Stress Test Results (With Provisioning Adjustments) _____	<u>37</u>
12. Results of Concentration Risk Test _____	<u>38</u>
13. Summary of the Liquidity Stress Test Results _____	<u>39</u>

## Glossary

AFS	Available-For-Sale
AQR	Asset Quality Review
ASF	Available Stable Funding
BCBS	Basel Committee on Banking Supervision
BU	Bottom-Up
CAR	Capital Adequacy Ratio
CPI	Consumer Price Index
EAD	Exposure at default
ELA	Emergency Liquidity Assistance
FDI	Foreign Direct Investment
FSAP	Financial Sector Assessment Program
FX	Foreign Exchange
GDP	Gross Domestic Product
G-RAM	Global Risk Assessment Matrix
HFT	Held-For-Trading
HQLA	High-Quality Liquid Assets
HTM	Hold-To-Maturity
LCR	Liquidity Coverage Ratio
LGD	Loss-Given-Default
MCO	Micro-Credit Organization
MNE	Montenegro
NPL	Nonperforming Loan
NSFR	Net Stable Funding Ratio
PD	Probability of default
RAM	Risk Assessment Matrix
RWAs	Risk-Weighted Assets
STeM	Stress Test Matrix
TD	Top-down

## EXECUTIVE SUMMARY

1. **The FSAP stress testing exercise was conducted in an environment of low profitability and low credit growth.** These trends cause vulnerabilities in the banking system due to low margins to absorb costs or losses. While GDP growth of 3.2 percent is projected for Montenegro under the baseline scenario, the stress test recognized the great uncertainty around growth estimates for the economy and tested the banking system's resilience to extreme, yet plausible economic shocks.
2. **Three one-year macroeconomic scenarios were considered.** In addition to the baseline scenario based on the latest IMF staff projections, two alternative scenarios were designed to assess banking system stability under stressed conditions:
  - **Adverse scenario 1:** A moderate scenario that illustrates an economic contraction driven mainly by a reduction of external demand caused by a protracted economic slowdown in the euro area, combined with economic deterioration in Russia and Ukraine. Besides reduced external demand impairing output in tourism and other sectors, this scenario encompasses the risk of reduced foreign direct investment (FDI) affecting economic growth and asset prices.
  - **Adverse scenario 2:** A severe scenario where underlying moderate scenario risks are compounded by a deterioration of global financial market conditions. With gross external debt in the private sector of 164 percent GDP and public debt at 60 percent of GDP in 2014 from 20 percent of GDP in 2008, the economy is vulnerable to changes in risk sentiment in the global financial markets. Therefore, while the global economy as a whole is affected, Montenegro—as a small economy—suffers from capital outflows and faces elevated funding costs due to increased risk aversion.
3. **Top-down solvency, liquidity, and contagion risk stress tests were conducted for the 12 banks that were active in Montenegro by end-2014.** The tests were carried out in close cooperation between the mission and CBM staff, using supervisory data and data submitted by banks. However, after consideration, the authorities chose not to conduct a bottom-down stress test based on banks' internal models.
4. **Solvency stress tests accounted for potentially inadequate loan-loss provisioning.** The mission found strong indications of inadequate provisioning on nonperforming loans (NPLs) in four banks. Parallel solvency stress tests were therefore conducted based on adjusted levels of capital adequacy. For three of the banks, the mission's assessment was based on qualified opinions by external auditors by end-2014.
5. **Adverse scenarios exposed vulnerabilities due to low capital buffers.** An increase of credit losses can severely impair capital adequacy. The moderate and adverse scenarios generate capital shortfalls of 1 percent and 3.5 percent of GDP, respectively, to meet a capital adequacy ratio (CAR) of 10 percent.

- 6. Low profitability makes the banks sensitive to funding cost volatility.** Even a modest funding shock could lead to negative profits among several of the banks, which undermines capital adequacy. In a stressed scenario, banks are likely to use deposit rates as a means to maintain attractiveness among depositors. The combination of these factors makes the banks vulnerable to stressed episodes.
- 7. Even though short-term liquidity resilience is high, long-term liquidity tests reflect structural issues.** With a large stock of nonperforming loans or low-quality loans, the stability of long-term funding could be threatened in a few banks. In case banks do not manage to improve the quality of their loan book, it may become difficult to attract funding at a viable cost in a stressed scenario.
- 8. Concentration risks may materialize in stressed episodes, with sudden and material impact on capital adequacy.** In a small country like Montenegro, it is not unexpected that banks have large exposures. However, the existence of such exposures may call for additional capital buffers in order to ensure a degree of resilience to credit risk shocks.
- 9. The Montenegro banking system has large foreign exposures, but limited domestic interconnectedness.** Domestic interbank transactions and the banking sector's exposure to nonbank financial institutions are limited. On the other hand, Montenegro banks are highly connected with foreign banking systems, reflecting both the ownership structure and investment strategies. The direct cross-border interbank exposures are mainly in the form of claims, with nearly half of the total external interbank claims being to Austria, Germany, and Hungary.
- 10. The banking systems of France, Germany, the United Kingdom, and the United States are systemically important for Montenegro, although the spillovers on Montenegro are second- and third-round impact.** A bank network analysis (based on Espinosa-Vega and Solé, 2010) was used to assess contagion risks by estimating spillovers from both asset and liability sides by considering the impact of both credit and funding shocks. Contagion risks from France, Germany, the United Kingdom, and the United States could lead to severe capital impairment of up to 10 Montenegro banks, and the loss of up to 83 percent of the total banking sector's regulatory capital. Such impact arises mainly from the credit shock and is not immediate, but rather a second- or third-round impact. A large shock to most home countries of foreign-owned banks in Montenegro caused a confined failure rather than a system-wide one, due to limited domestic interbank exposures.
- 11. The CBM should take action to address vulnerabilities caused by inadequate asset valuation in the banking system.** This would be achieved appropriately by conducting an Asset Quality Review (AQR) performed by external auditors. All banks should be assessed and focus should be given to the valuation of collateral. In addition, the CBM could improve its stress-testing practices by testing the system for more extreme events, and thereby further assess system resilience to economic shocks.



**Table 1. Montenegro: Main Recommendations Based on the Stress Tests**

<b>Recommendation</b>	<b>Timeline</b>
Conduct Asset Quality Review (AQR) of all banks with focus on the adequacy of loan loss provisioning and collateral valuation.	Short-term
Introduce more severe scenarios in CBM stress tests to assess the system's resilience to extreme but plausible shocks.	Short-term
Increase transparency around banking system capital adequacy by publishing information about regulatory reserves and own funds as memorandum items in the official quarterly bank-specific balance sheets.	Short-term
Develop stress testing techniques at CBM to make bank-specific stress tests taking into account all relevant credit, market and liquidity risks.	Medium-term
Regular compilation of bank-specific LCR in euro.	Medium-term
Regular compilation of bank-specific NSFR in euro.	Medium-term

Source: IMF Staff.

## INTRODUCTION

1. **The objective of the stress testing exercise is to test the banking system's resilience to extreme but plausible shocks.** The stress test is a tool to assess the vulnerabilities of the banking system through which it may be exposed to risks. While stress tests help identify policy actions to reduce risk exposures, the results of stress tests should not be interpreted as expected outcomes. Stress tests are rather designed to illustrate tail events.
2. **The tests were carried out in close cooperation between the mission and CBM staff.** The stress tests relied on bank-by-bank supervisory data provided by the authorities, and by the banks, as of December 31, 2014. After considerations, the CBM chose not to conduct a bottom-up stress test based on banks' models. Instead, the stress tests were based on models developed by the FSAP mission. The authorities shared internal satellite models with the FSAP mission, facilitating scenario and model design.
3. **Top-down solvency, liquidity, and contagion risk stress tests were conducted for the 12 banks that were active in Montenegro by end-2014.** The spillover and contagion risk assessment encompassed the entire financial system, including the banks, insurance companies, investment funds, leasing companies, microcredit organizations, and other financial institutions.
4. **This note is structured as follows:** Section II presents a description of the banking sector in Montenegro. Section III describes the solvency stress test conducted, involving the assessment of risks and vulnerabilities that formed the basis for scenario design, as well as how the scenarios were translated into banking system shocks. Section IV provides a complementary sensitivity analysis of banks' capital adequacy and vulnerabilities to specific risks. Section V describes the liquidity tests based on Basel III rules, as well as the outcomes of those tests under standard and tailored assumptions. Section VI describes and elaborates on the contagion and spill-over analysis, providing more depth and insight as to the sources of exposures and vulnerabilities.

## BANKS' BALANCE SHEETS AND PROFITS

5. **The financial system in Montenegro is dominated by the banking sector.** By end-2014 12 licensed banks operated in Montenegro, with total banking sector assets amounting to EUR 3.1 billion or 88 percent of total financial system assets and 92 percent of GDP (Table 3). As much as 79 percent of banking system assets comprises of subsidiaries of foreign-owned banks (Table 2).
6. **Profitability is low (Table 3).** With an aggregate return to total assets of 0.8 percent and two banks making losses, profitability in the banking system is low. The aggregate net interest and fee income margin to total assets is 3.6 percent, but is largely consumed by overhead expenses, which amount to 74.7 percent of the total net interest and fee margin.

**7. Banks' assets are dominated by loans to customers, but also contain a large stock of liquid and risky assets (Table 3).** Partially due to low credit growth combined with increasing deposits, the banks have accumulated cash, which, together with central bank reserves, constitute as much as 16 percent of total assets by end-2014. While net loans constitute 70 percent of the aggregate balance sheet, debt security holdings and other assets comprise about 14 percent of total assets. Domestic sovereign bonds and real estate, which are traded on small and relatively illiquid markets in Montenegro, constitute as much as 7.4 percent of total assets. While equity instrument holdings amount to 0.4 percent of total assets, commodity and foreign exchange positions are generally very small. No net foreign exchange exposure to a single currency amounts to more than 0.1 percent of total assets, according to reported data.

**8. External claims and liabilities are significant (Table 3).** With external claims amounting to 16 percent of total assets, the banks are vulnerable to foreign credit risk. Furthermore, external liabilities amount to as much as 21 percent of total assets. Given that foreign creditors are often seen as more flighty than domestic ones in times of financial stress, this observation gives cause for concerns about funding viability in a stressed scenario. However, parts of these concerns are mitigated by the fact that borrowings from parent banks and development funds, which may be seen as more stable funding sources, amount to as much as 7.9 percent of total assets.

**9. While aggregate NPLs amount to 16.8 percent of total assets, the dispersion of NPL ratios among the banks is high (Table 3).** By end-2014, the largest NPL ratio in the system was 36 percent, while the lowest was 7.9 percent of total gross loans.<sup>1</sup> Domestic legislation allows NPLs, as defined under the IFRS, to be classified as performing loans if they are backed by adequate collateral. In some cases, this causes an underestimation of NPLs according to IFRS standards. While the aggregate ratio of loans past due by more than 90 days is 13.9 percent, and thus lower than the aggregate NPL ratio, one of the banks has an NPL ratio of 6.3 percent and a ratio of loans past due by more than 90 days to total loans of 23.8 percent.

**10. Domestic legislation deducts additional regulatory reserves from equity to calculate own funds, which are used for the calculation of the CAR.** Regulatory reserves are calculated by the CBM based on rules deciding the allocation of loans to loan quality categories A–E, depending on the history of loan servicing performance and the underlying collateral. Following the loan classification, the amounts in each category are multiplied by regulatory provisioning rates. The main difference between Montenegro rules and the IFRS is the treatment of collateral. Under the IFRS, the expected value of collateral is deducted from the exposure amount, after which the net exposure is multiplied by a provisioning rate which depends on the credit quality of the borrower. Under Montenegro rules, the full exposure amount is multiplied by a provisioning rate that depends on both collateral quality and borrower credit quality.

<sup>1</sup> The NPL ratios of four banks have been excluded from the calculation of the minimum and maximum values, due to uncertainties around provisioning and assets quality reporting.

**11. Provisioning ratios cause concerns about collateral valuation.** Taking into account the regulatory reserves, actual total provisioning amounts to 87.5 percent of loans past due by more than 90 days. However, banks' own IFRS-based provisioning appears to be low in an international comparison, with only 47.8 percent of total provisions to loans past due by more than 90 days. Since provisioning is highly dependent on collateral valuation, the low provisioning ratios raise question marks about whether assets are being properly valued throughout the banking system.

**12. Capital adequacy buffers are low among some domestic banks (Table 3).** While the system aggregate CAR is 16.2 percent, four banks have CARs below 15 percent, with the two lowest ratios belonging to domestically owned banks. In a small and vulnerable country like Montenegro, this is a considerable initial observation, since capital buffers may be needed for resilience against economic shocks.

## SOLVENCY STRESS TEST

### A. Risks and Vulnerabilities

**13. Montenegro's financial sector faces both external and domestic risks.** The identified risks have been organized in the structure of the RAM in order to clarify and concretize the general areas of risk.

- *A protracted slowdown or the re-emergence of financial stress in the euro area (RAM Risk #1).* With 40 percent of total exports going to the EU, tendencies of economic contraction in the euro area could lead to reduced external demand affecting the real sector in Montenegro. Such developments could propagate through the important trade, construction and tourism sectors which represent about 15 percent, 9 percent, and 8 percent of GDP, and 20 percent, 5 percent, and 4 percent of total banking system loans, respectively. Furthermore, financial stress in the euro area could further increase risk aversion among foreign banks, which could impair credit growth.
- *Elevated costs of sovereign debt or uncertainty around sovereign debt sustainability (RAM Risks #1 and #2).* Public debt in Montenegro has risen from 20 percent of GDP in 2008 to more than 60 percent of GDP in 2014. Uncertainties about the creditworthiness of the Montenegro government could cause elevated funding costs for the government and for Montenegro as a whole, which could reduce credit demand and impair the balance sheets of banks' borrowers. Such uncertainties may erupt due to domestic developments, such as a failure to meet the projected economic objectives of on-going infrastructural projects. Importantly, the uncertainties around public finances may be elevated in case economic growth slows down or in case of financial stress in international capital markets.
- *A disorderly withdrawal of unconventional monetary policy in the United States (RAM Risk #2).* This could trigger global capital flows, risk aversion, and volatility in global financial markets. It could particularly weigh on emerging markets and cause euro depreciation, exposing real and financial

stability risks in the Montenegro economy. With gross external debt of 164 percent of GDP in only the private sector, the economy is vulnerable to changes in risk sentiment or funding costs in global financial markets.

- *Economic deterioration or a change of risk sentiment in Russia and Ukraine (RAM Risk #3).* While it appears that recent economic turmoil in Russia and Ukraine has not impacted the Montenegro economy significantly, a significant economic contraction in the two regions could cause a reduction of FDI, trade and tourism consumption.

#### **14. The risks are likely to affect the banking sector through the following vulnerabilities:**

- *Credit risk and low profitability.* With NPLs at 16.8 percent of total loans by end-2014, an aggregate banking system return on assets of 0.8 percent in 2014, and occurrences of negative credit growth in recent history, the banks are vulnerable not only to losses that are due to increased provisions, but also to the reduced interest income that would follow from negative credit growth and NPLs.
- *Limited capacity of liquidity support facility due to euroization.* The accumulation of deposits, in combination with low credit growth, has led to an accumulation of liquid assets in parts of the system. However, while the CBM has an emergency liquidity assistance (ELA) framework in place, its capacity in this regard is limited due to the inability to create money. Liquidity is therefore an important structural vulnerability, in particular for domestic banks that do not have supporting parent banks.
- *Significant use of nonresident deposits.* Foreign depositors are likely more sensitive to Montenegro risk than domestic creditors and, thus, more flighty in times of stress. The average percentage of nonresident deposits to total deposits in the banking sector was 19.6 percent by end-June 2015, while the ratio was 28 percent for domestically owned banks.
- *Sovereign exposures.* Gross credit exposures to the public sector amount to an average of 17 percent total assets by end-June 2015, or an average of 165 percent of own funds. These exposures cause direct vulnerabilities of the banking sector to sovereign finances.
- *Asset quality.* While the aggregate ratio of loan-loss reserves to total loans that are past due by more than 90 days amounted to 87.5 percent by end-2014, this ratio amounted to only 14 percent for one of the banks. In addition, several banks report IFRS provisions to total loans past due by more than 90 days of below 50 percent, or even below 40 percent. Since capital adequacy is highly reliant on asset quality, these observations cause concerns that collateral may be overvalued in parts of the Montenegro financial sector.

## B. Adjustments to Reported Capital Adequacy

**15. Solvency stress tests have been conducted with and without adjustments for an estimated provisioning shortfall.** While the first stress test was conducted based on non-adjusted CARs, a second stress test was based on CARs adjusted for estimated under-provisioning. The finding that past due loans were larger than NPLs was considered a strong indication of inadequate loan-loss provisioning in two banks. In the second stress test, the stocks of NPLs in these two banks were therefore increased to the amount of past-due loans, affecting loan-loss provisions by the difference between a provisioning ratio of 75 percent (category D) and a provisioning ratio of 7 percent (category B). In addition, IMF staff took into account the qualified opinions by external auditors regarding three banks by end-2014 that provisioning was inadequate on certain assets. The adjustments were made by increasing loan-loss provisions and by reducing equity, regulatory capital, and risk-weighted assets (RWA) by the sum of estimated provisioning shortfalls. In total, the adjustments amounted to EUR 35 million (1 percent of 2014 GDP) in four banks.

## C. Macroeconomic Scenarios

**16. Stress tests were conducted based on macroeconomic scenarios.** To assess the solvency of the banking sector, three scenarios were considered—one baseline and two alternative ones. While the adverse scenarios represent tail events with relatively low probability, they were designed to reflect plausible shocks. These alternative scenarios were developed by the FSAP team to test the resilience of the banking sector in the presence of adverse shocks.

**17. The baseline scenario was based on the latest IMF staff projections as of August 2014 (Tables 5 and 6).** The baseline projects positive growth of 3.2 percent in 2015, driven mostly by investments in infrastructural projects. Total credit is projected to decrease by almost 3 percentage points of GDP, no credit growth in combination with nominal GDP growth.

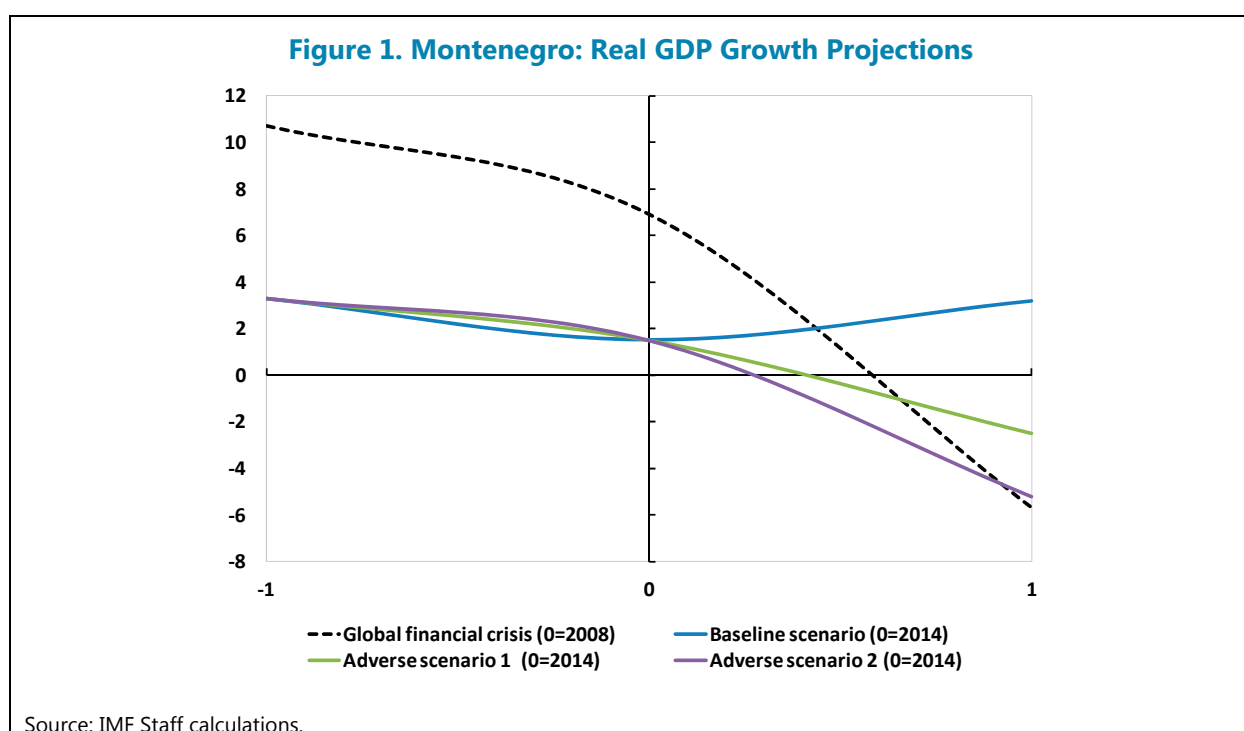
**18. The adverse scenarios reflect downside risks.** In general projections were made using one historical standard deviation of macro variables in the moderate adverse scenario, and two standard deviations in the severe adverse scenario. Expert judgment was applied occasionally to adjust projections to achieve scenario consistency. More specifically, the following projections were made:

- *GDP growth.* Mainly due to a protracted economic slowdown in the euro area, combined with economic deterioration in Russia and Ukraine (RAM Risks 1 and 3, Appendix I), Montenegro suffers a reduction in external demand and FDI leading to an economic contraction of -2.5 percent in the moderate adverse scenario (Figure 1).<sup>2</sup> The moderate scenario growth trajectory mimics the one in 2012. During this year real GDP in the EU contracted by

<sup>2</sup> With FDI amounting to 11.4 percent of GDP in 2014, it is an important contributing factor to economic output. It has also exhibited significant variation historically. However, as net FDI actually increased during 2009 and 2012 it is difficult to point to a particular numerical link between the scenarios and FDI developments.

-0.5 percent. This development was combined with a significant drop of output growth in the Montenegro tourism sector (more than 50 percent decrease in growth of number of foreign tourists' arrivals and nights) and other sectors, which reflects lower external demand.

In the severe adverse scenario, the developments of the moderate scenario are complemented by elevated uncertainty and risk aversion in global financial markets leading to GDP growth of -5.2 percent, equaling two standard deviations from the historical mean (RAM Risks 1, 2, and 3). The scenario reflects real economy developments due to reduced external and internal demand and was determined after a comparison to GDP growth in 2009 which was -5.7 percent in Montenegro and -4.4 percent in the EU. These real sector developments are partially caused by an assumed reduced confidence in sovereign finances, causing increased funding costs for the economy as a whole.



- *Credit growth.* The combination of reduced economic output, elevated funding costs, and increased risk aversion among banks, gross credit is projected to decline due to reduced demand and supply. The gross credit projections reflect declines of 3 percent of GDP and 6 percent of GDP under the moderate and severe adverse scenarios, respectively. These assumptions reflect developments following the financial crisis after 2008 when credit dropped by 6 percentage points from end-September 2008 to end-September 2009, after which the ratio of credit to GDP has been steadily declining.

- *Inflation, interest rates, and exchange rates.* As a result of declining inflation, interest rates are assumed to decrease due to further expansionary monetary policy.<sup>3</sup> Furthermore, the projected depreciation of the euro is consistent with a relatively larger economic contraction in Europe than in the United States. The exchange rate projections were based on one and two standard deviations of an equally weighted portfolio of exchange rates of the euro to the U.S. dollar, British pound, and Swiss franc. However, the standard deviation projections of inflation and interest rates were adjusted to less significant shocks, given the current economic low inflation environment.
- *Asset prices.* Credit spreads on bonds are assumed to rise, while equity and real estate prices are assumed to fall due to a combination of the economic downturn and reduced FDI. Using one and two standard deviations for the projections, the historical volatility of the Montenegro bonds and equities is clearly reflected in projections. Sovereign bond credit spread increases are especially intended to reflect a reduced confidence in sovereign finances under the two scenarios. For real estate prices, projections have been adjusted after taking into account estimates provided by the authorities and the banks during the FSAP mission.

## D. Macrofinancial Transmission

### Credit risk in the loan book

**19. Credit losses were modeled as a function of macroeconomic variables.** Owing to a lack of data on historical probabilities of default or loss-given default ratios, the estimation of projected credit losses took its starting point in single bank-by-bank and panel data model estimations of bank-specific NPL ratios. In order to reflect the actual amount of NPLs in the economy, the NPL ratios were adjusted to incorporate all NPLs that have been written off or sold during the historical time period. A number of macro variables and financial parameters with up to eight-quarter time lags were used as explanatory variables to factor in the possibility that the banks' loan portfolios are sensitive to different risk factors (see Table 7).<sup>4</sup> To ensure that the models would only produce NPL ratio projections between 0 percent and 100 percent, the following logit transformation was applied:

$$Y = \ln\left(\frac{\text{NPL}}{1-\text{NPL}}\right) \quad [1]$$

The logit transformed NPL ratio was assumed to be a linear function of macroeconomic and bank-specific variables. The estimation model can be expressed as:

$$Y_{i,t} = \alpha + \beta X_t + \mu_i + \epsilon_{i,t} \quad \text{for } t = 1, \dots, T \quad \text{and } i = 1, \dots, N \quad [2]$$

<sup>3</sup> Three-month Euribor is used as the measure of the "risk-free" interest rate.

<sup>4</sup> Explanatory variables were: a proxy of real GDP annual growth, actual annual GDP growth spline-transformed to a quarterly frequency, nominal GDP annual growth, CPI yearly inflation, unemployment rate, industrial production annual growth, credit to GDP ratio, quarterly equity index changes, foreign direct investment to GDP, EUR/USD exchange rate quarterly changes, investment to GDP ratio, bank-specific lending interest rates, four-quarter volatility of bank-specific lending interest rates, quarterly changes of real estate index and annual growth in gross wages. See further information in Table 7.



where  $Y_{i,t}$  is the logit transform of the NPL-ratio for bank  $i$  at time  $t$ ,  $X_t$  is a vector of macroeconomic variables,  $\mu_i$  is the individual banks fixed effects used in the panel data model estimation,  $\epsilon_{i,t}$  is the residual, and  $\alpha$  and the vector  $\beta$  are parameters to be estimated.

**20. Estimations showed weak relations between NPL ratios and explanatory variables.** The fourth quarter lagged quarterly change in equity prices, a proxy of annual real GDP growth and the ratio of foreign direct investment to nominal GDP were significant in explaining NPL ratios in the panel data model (see Table 8). However, due to the finding of autocorrelation in the estimated panel data model equation (Durbin-Watson statistic of 0.34), the first quarter lag of the dependent variable was introduced as an explanatory variable. It was found that the first lag of NPL ratios explained more than 89 percent of NPL developments in terms of adjusted R-squared, while only 1.5 percent was explained by the explanatory macro variables.

**21. The findings reflect data deficiencies.** As specified in Table 7, quarterly data on Montenegro real GDP is available only since 2011. The estimation therefore used a proxy of GDP based on industrial production and output in the tourism and construction sectors. This proxy exhibited very significant historical variation and only incorporates a sub-set of the constituents of GDP, which may impair the quality of the measure. In addition, the definition of NPLs in Montenegro could affect estimations. According to Montenegro law, de facto nonperforming loans may be excluded from the stock of NPLs if the loans are adequately collateralized. Therefore, the NPL ratio may provide a sub-optimal dependent variable. On the other hand, given that only NPLs, as defined by Montenegro law, are subject to elevated provisioning rates, projections of credit losses need to be based on estimated models of NPLs rather than, for example, past-due loans.

**22. Due to weak relations between NPL ratios and explanatory variables, adverse scenario credit-loss projections were based on experience and findings in similar countries.** The baseline scenario assumed the CBM's baseline bank-specific NPL ratio projections, owing to the similarity of macroeconomic baseline projections of the CBM and the FSAP team. For the adverse scenarios, the NPL ratio projections were derived by using sensitivities of credit losses during financial crises in emerging markets estimated by Hardy and Schmieder (2013).<sup>5</sup> The credit loss rate was multiplied by net loans after deducting regulatory reserves, according to the methodology used by Montenegro authorities in the calculation of own funds. Since credit losses should reflect the product of the probability of default, the loss-given default rate and the exposure at default, an assumed loss-given default of 60 percent was used to compute the stock of NPLs implied by the amount of credit losses.<sup>6</sup>

<sup>5</sup> Daniel C. Hardy and Christian Schmieder (2013). Rules of Thumb for Bank Solvency Stress Testing. IMF Working Paper WP/13/232.

<sup>6</sup> A loss-given default rate of 60 percent is the average for low-income markets and emerging markets, according to Hardy and Schmieder (2013). It is also in the range of provisioning rates for regulatory NPL categories in Montenegro (40 percent for category C, 75 percent for category D and 100 percent for category E).

**23. Credit-loss sensitivities to GDP growth differ between the two adverse scenarios.** As shown by Hardy and Schmieder (2013), credit loss rates have been on average 2.2 percent, 3.4 percent, 7.4 percent, and 14 percent, respectively, of credit outstanding in emerging markets during moderate, medium, severe, and extreme crises, respectively. Taking this into account, the stress test projections assume different sensitivities for the two adverse scenarios. Table 9 shows a matrix visualizing the system aggregate CAR implied by various assumptions of GDP growth and credit loss sensitivities. The chosen sensitivities are in the range of estimated sensitivities for emerging markets in moderate/medium and severe scenarios, respectively.

**24. Projected NPL ratios based on Hardy and Schmieder (2013) estimates were compared to recent FSAPs in peer countries and to CBM's internal projections.** While the projections for the moderate adverse scenario was broadly in line with the CBM's adverse scenario projections, the NPL ratios projected under the severe adverse scenario significantly overshoot the CBM's projections. The projections under the severe scenario however align well with recent NPL projections in stress test in FSAPs of neighboring countries. Given these findings, the broad evidence of credit loss sensitivities to GDP growth found by Hardy and Schmieder (2013) provided independent estimates that were comparable to the CBM's projections and peer-country scenarios.<sup>7,8</sup>

**25. System aggregate credit losses were allocated to banks, depending on risk management practices.** The system aggregate credit losses were allocated to banks using a percentage key based on each bank's share of total loans past due by more than 90 days in the system, and average annual loan portfolio growth during the most recent four quarters. Each bank's percentage share of total past-due loans to total loans was used as an indicator of the bank's willingness to take credit risk, and as an indicator of internal risk management practices. By adjusting the share of past-due loans by recent loan portfolio growth, banks that have exhibited recent credit expansion were allocated a larger share of the aggregate credit losses than others. This adjustment was made to reflect that banks choosing to take on risk in the current economic environment are likely to face higher credit losses in a stressed scenario.

### Funding cost and liquidity risks

**26. Deposit outflows were assumed in the adverse scenarios.** Due to deteriorated economic prospects and elevated risk aversion among investors and depositors, the adverse scenarios assume outflows of deposits. The scenarios particularly factor in that nonresident depositors usually tend to be flighty in times of financial stress. The gross outflow assumption for nonresident deposits in the severe adverse scenario is 46 percent, which reflects the aggregate outflow of such deposits from the banking system between March 2009 and March 2010. The severe adverse scenario assumes gross outflows of domestic deposits of 23 percent, which reflects the outflows of total deposits between

<sup>7</sup> CBM projections and projections in recent FSAPs are not disclosed here due to confidentiality.

<sup>8</sup> The FSAP team also conducted a loan migration analysis based on data on exposure amounts by loan quality categories A–E and the migration rates assumed by CBM in the Financial Stability Report. The projected NPL ratios tended to undershoot recent average projections in peer country FSAPs. A lack of data substantiating the assumptions underlying the assumed migration rates undermined the reliability of the analysis.

June 2008 and June 2009. While nonresident net deposit outflows did not occur in 2012, the stress test assumes that half of the outflows in the severe adverse scenario would occur in the moderate scenario. Furthermore, the scenarios assume that 50 percent of the gross deposits outflows are replaced by funding at a similar cost, e.g., from parent banks or development funds. These assumptions translate into net deposit outflows of 6 percent of domestic deposits and 12 percent of nonresident deposits in the moderate scenario, and 12 percent of domestic deposits and 23 percent of nonresident deposits in the severe scenario.

**27. Funding cost projections are affected by assumed deposit outflows.** Due to reduced confidence and capital outflows, banks are assumed to counter the adverse shocks by increasing deposit rates to remain attractive and to compete for depositors. However, given the pressures on profitability they would be hesitant to raise rates to very high levels. Therefore, the deposit rate hikes are contained at the projected levels which were based on increased aggregate deposit rate spreads above three-month Euribor by one and two standard deviations. Following the crisis after 2008, the spread between Montenegro deposit rates and Euribor 3M increased by 3 to 4 percentage points. This development corresponds well with the projection of 3.2 percentage points (two standard deviations) in the severe adverse scenario. In the moderate scenario, half of this shock is assumed, corresponding to one standard deviation of 1.6 percentage points. This projection corresponds well to the developments in the reference year of 2012, when the spread between deposit rates and Euribor 3M increased by about 1.5 percentage points.

**28. Deposit outflows that are not covered by liquid assets are financed at elevated funding costs.** To cover deposit outflows, banks are assumed to use their cash balances and sell liquid assets at haircuts of 15 percent and 25 percent in the moderate and adverse scenarios, respectively. In the event that liquid assets do not cover all deposit outflows, domestic banks are assumed to meet an increased funding cost of 2 percentage points and 4 percentage points above the current cost in the two scenarios, respectively. These shocks correspond to a 50 percent and 100 percent increase of estimates of the country risk premium. Foreign-owned banks are assumed to fund uncovered outflows at half the cost using parent bank funding.

### Other assumptions

**29. Net interest income reflects the previous year's result adjusted for credit growth, loan losses, and deposit outflows.** Projected interest income and expense were derived from the previous reporting period's income statement as a percentage of total net loans and total liabilities, respectively. The derived percentages of income and expense were multiplied by the projected amount of net loans and liabilities, which were adjusted to reflect projected credit growth, increases in loan-loss provisions, and deposit outflows.

**30. Operational risk losses were assumed to double and triple in the two scenarios.** Banks historical operational risk losses exhibit some volatility (see section IV.C). Therefore, these losses were assumed to increase in the adverse scenarios, in order to factor in the effect of mistakes made as part of banks' crisis management. The tripled losses amounting to 0.21 percent of total assets can be compared to the highest annualized loss of 0.15 of total assets occurred in the period of 2010–2014

for which data is available (excluding one outlier). Other income statement constituents (net fee and commission income and other non-interest income) were assumed to follow the economic activity of the bank measured as gross credit growth.

**31. Stress tests were conducted under assumptions ensuring a consistent treatment of banks.** Some of the main behavioral assumptions include: the weighting of assets for regulatory capital adequacy measurement purposes remains constant; banks do not raise capital; apart from assumed credit growth affecting the stock of loans and bond holding and changes to the ratio of nonperforming loans, the composition of the loan book remains unchanged; managerial actions to optimize bank portfolios are not assumed; and loan write-offs are not assumed. In the adverse scenarios, it is assumed, however, that equity, commodity, and foreign exchange positions contract by the nominal GDP growth, in order to align with the general growth rate of the balance sheet.

## E. Results

**32. Adjustments for provisioning shortfalls immediately cause capital needs before stress is applied (Tables 8 and 9).** The capital shortfall amounts to 0.7 percent of 2014 GDP, out of which 0.2 percentage points are needed to bring undercapitalized banks to solvency. The provisioning adjustments to four banks in total reduce the banking system aggregate CAR from 16.2 percent to 14.7 percent.

**33. The solvency stress test shows that capital shortfalls in the banks could range between 2.8 percent and 3.5 percent of 2014 nominal GDP in the severe adverse scenario.** After adjustments to loan-loss provisioning, the capital needs to bring the banks to 10 percent CAR amount to 3.5 percent of 2014 GDP, out of which 1.1 percent of GDP is needed to bring undercapitalized banks to solvency. If no adjustments to provisioning are made, capital needs to meet 10 percent CAR are 2.8 percent of GDP, out of which 0.3 percent of GDP is needed to bring undercapitalized to solvency.

**34. The moderate scenario also causes undercapitalization of banks.** With provisioning adjustments, capital needs to bring the banks to 10 percent capital adequacy could be 1 percent of GDP, out of which 0.4 percent of GDP would be needed to bring undercapitalized banks to solvency. Without provisioning adjustments, 0.2 percent of GDP would be needed to meet 10 percent CAR, while all banks would be solvent.

**35. An accumulation of profits would outweigh credit losses and cause an increased system aggregate CAR in the baseline scenario.** However, in the case of one of the banks, capital adequacy would be reduced despite an assumed minor 0.8 percentage point increase of the NPL ratio. As this development is due to negative profits, this example points to risks related to low profit margins among banks.

**36. In general, the main drivers behind the results are (see Figure 7 and Tables 10–11):**

- **Credit losses.** While the system as a whole is able to off-set credit losses with net income in the moderate scenario, credit losses drive the decline of the system aggregate CAR in the severe adverse scenario. In addition, the credit losses reduce net loans and thereby interest income, reflecting the dynamics between credit risk and profitability.
- **Funding risk.** Increased funding costs contribute to the overall aggregate change in the CAR by about -1.8 and -3.6 percentage points in the moderate and adverse scenarios, respectively. Given already low profit margins of 0.5 percent of assets by end-June 2015, funding risk could be material for Montenegro banks in terms of capital adequacy. The risks of outflows and increased funding costs need to be particularly considered by the authorities, especially in case of banks with no access to parent bank funding or other public or private sector liquidity support mechanisms. However, under the assumed deposit outflow assumptions in the adverse scenarios, all except three domestic banks manage to cover outflows by selling liquid assets. For the three banks, the uncovered outflows amount to no more than 6 percent of total liabilities, causing a limited effect on their aggregate funding cost of 0.4 percentage points at the most.
- **Asset prices.** The total contribution of increased interest rate spreads and declining stock and real estate prices on the change in the system-wide CAR is approximately -1.2 percentage points and -2.8 percentage points in the two adverse scenarios, respectively. This illustrates the vulnerabilities caused by banks' open positions in relatively risky assets.

## SENSITIVITY ANALYSES OF SOLVENCY

### A. Credit Concentration Risk

**37. Concentration risk is high in parts of the banking system.** With the highest concentration of corporate loans in the wholesale and retail sector (17 percent of total loans), there are limited indications of sectoral concentration risk in the aggregate loan book of the banking system (Table 4). There is, however, loan book concentration to single non-sovereign borrowers. While the average largest exposure in the system remains below 25 percent of regulatory capital, a number of banks have exposures to single debtors above the threshold. Importantly, large exposures are defined as the net exposure after "credit mitigation", taking into account collateral and guarantees. Credit exposure, as reported, therefore relies on collateral valuation, while several single gross exposures in the system amount to almost or more than twice the regulatory limit of 25 percent of regulatory capital.

**38. The default of several of the largest non-sovereign borrowers could cause significant capital shortfalls (Table 10).** If the largest borrower in each of the banks was to default with no recovery on net loans, the capital needs would be 0.3 percent of GDP to bring undercapitalized banks' CARs back to 10 percent. In the more severe case where the five largest borrowers in each of the banks default, capital needs would amount to 3.2 percent of GDP to bring the banks back to

10 percent CAR, out of which 0.3 percentage points would be needed to bring undercapitalized banks back into solvency.

**39. Credit exposures to the public sector are substantial in a number of banks.** In a handful of banks, the public sector exposures exceed 15 percent of total assets at an average of 36 percent.<sup>9</sup> While these exposures are not subject to local regulatory limits on large exposures, they constitute an important risk factor given the risk of a loss of confidence in sovereign credit quality.

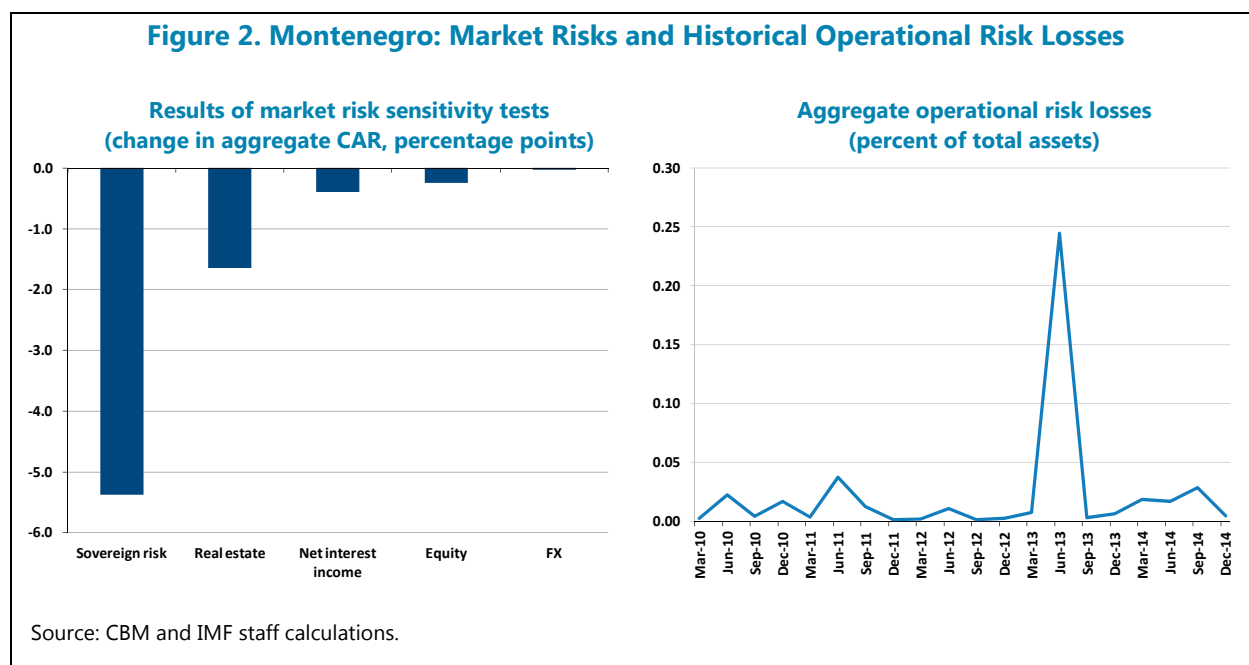
## B. Market Risks

**40. Targeted sensitivity tests were conducted to test banks' resilience to single-factor shocks.** In order to examine identified vulnerabilities the sensitivity tests included sovereign bond and public sector loan exposure losses, a decline real estate prices, a decline equity prices, the one-year effects on interest income of interest hikes, and an appreciation of the euro. To ensure comparability between the tests, RWA was assumed to remain constant throughout the shock, while only regulatory capital was affected. The results are as follows (Figure 2):

- *Haircut on domestic sovereign exposures.* Haircuts of 10 percent and 20 percent were applied to the reported book values of sovereign bonds and loan exposures to the public sector. The losses caused by these haircuts would amount to 1.5 percent and 3.1 percent of GDP and reduce the system aggregate CAR from 16.2 percent to 13.5 percent and 10.8 percent, respectively. The total capital shortfall caused by these haircuts would amount to 0.4 percent of GDP and 1.5 percent of GDP, respectively.
- *Real estate price decline.* The sensitivity test was conducted by mimicking a 35 percent drop in real estate values. While the losses on open real estate positions would amount to 0.9 percent of GDP, the system aggregate CAR would decline from 16.2 percent to 14.5 percent.
- *Interest rate hike.* Using data on net interest rate sensitive assets by five buckets of time to repricing, the sensitivity test approximated the one-year effects on net interest income if interest rates would rise by 500 basis points. The net amount of assets in each bucket was multiplied by the interest rate change to calculate the net income or expense in each bucket. The aggregate effect of the shock would be a loss amounting to 0.2 percent of GDP, reducing the aggregate CAR from 16.2 percent to 15.8 percent. However, it should be noted that the assumption that banks' lending rates and funding costs increase by the same magnitude may not hold in practice. In order to avoid adverse effects on borrowers' credit quality, or due to intra-bucket time to repricing mismatches, banks may choose not to increase lending rates by the same magnitude as the increase of funding costs.

<sup>9</sup> Public sector exposures include both sovereign bonds and loans to the public sector.

- *Equity price decline.* The sensitivity tests assessed the losses stemming from a decline of 35 percent in equity prices. The losses due to this shock would amount to 0.1 percent of GDP and reduce the aggregate CAR from 16.2 percent to 15.9 percent.
- *Euro appreciation.* With reported net assets in foreign currency for most banks, the system is sensitive to euro appreciation. However, given the very small open foreign exchange positions, losses due to a 30 percent appreciation would not impact the aggregate CAR by more than a few basis points.



## C. Operational Risk

**41. Operational risk losses have been sizable in single banks, but should not impair aggregate capital adequacy.**<sup>10</sup> Historical developments in banks' aggregate operational risk losses have, on average, been 0.01 percent of total assets since 2010 (Figure 2). Apart from a spike in losses during 2013, banks do not exhibit remarkable volatility in these losses. Some banks tend to exhibit higher losses in relation to total assets than others. The materiality of these losses should, however, not be significant. Assuming operational risk losses of two standard deviations above the mean would cause losses of 0.02 percent of GDP, reducing the banking system aggregate CAR from 16.2 percent to 16.1 percent.

<sup>10</sup> Operational losses are due to events such as internal and external fraud; business disruptions; business disruption and system failures; damage to physical assets; and execution, delivery, and process management.



## LIQUIDITY STRESS TEST

### A. Measures and Assumptions

**42. Liquidity stress tests used a setup informed by LCR and NSFR.** The short-term liquidity ratio used for the stress test was informed by LCR as defined by the Basel Committee. LCR measures the banks' potential net outflows over the next 30 days, and the banks' capacity to cover these potential outflows using high-quality liquid assets. To measure longer term liquidity, the long-term liquidity ratio of the stress test was informed by the NSFR as defined by the Basel Committee. NSFR measures the bank's capacity to fund its assets with stable sources of funding over one year. In both measures, assets and liabilities are weighted to reflect liquidity risk. Both measures are part of the Basel III regulatory capital adequacy framework (BCBS, 2013 and BCBS, 2014).

**43. Banks are reliant on external funding sources.** With external liabilities amounting to 21 percent of total assets (see Table 3), Montenegro banks are reliant on funding from other countries. This exposure can become costly or even difficult to refinance in the event that global financial market conditions deteriorate, risk aversion rises, and investors become hesitant to provide Montenegro banks and companies with funding, such as in the severe adverse scenario.

**44. Standard assumptions of the Basel III framework were therefore complemented with assumed deposit outflows.** The default risk weights of the LCR and NSFR measures were used to compute estimated standard measures for the banking system. However, to complement this analysis, the ratios were also calculated assuming the deposit outflows in the severe adverse scenario and after assuming no liquidity in domestic sovereign bonds. In accordance with the Basel III framework, the stress test requires that both ratios should equal or exceed 100 percent.

### B. Results

**45. Banks generally are resilient enough to meet a short-term liquidity run (Figure 8).** With an aggregate reported short-term liquidity ratio of 863 percent, and no banks failing to meet the 100 percent threshold, the banking system generally appears to have buffers to withstand a loss of liquidity. However, while the default assumptions of the LCR assign domestic sovereign securities to the most liquid category of noncash assets, government bond market participants in Montenegro generally state that liquidity can vary greatly, and is often low in the secondary market. However, even after excluding domestic sovereign bonds from HQLA, the aggregate 629 percent of projected net outflows.

**46. Short-term liquidity is even enough to withstand assumed deposit outflows.** The reported short-term liquidity ratios were adjusted by increasing projected outflows by the share of deposit outflows projected under the severe adverse scenario that would fall due in 30 days.<sup>11</sup> The results show that banks would be able to withstand this shock, since none of the banks' short-term

<sup>11</sup> Adjustments for outflows were made assuming an initially assumed average run-off rate of 7.5 percent of deposits.



ratios fall below 100 percent. The main drivers of the results are a large stock of high quality liquid assets, as well as a large amount of expected inflows from financial institutions within 30 days.

**47. Long-term system resilience to funding shocks is however less robust (Figure 8).** While the system aggregate long-term liquidity ratio is 123 percent, two banks failed to meet the 100 percent threshold. The driver behind these banks' relatively low long-term ratios is mainly low asset quality, and a higher portion of unstable funding than in other banks. These two vulnerabilities cause an elevated uncertainty about whether or not assets can be expected to actually generate future cash flows, and whether or not funding can actually be rolled over at a viable cost in times of stress.

**48. More severe assumptions about deposit outflows expose long-term liquidity vulnerabilities.** After reducing the amount of available stable funding by the deposit outflows assumed under the severe adverse scenario, the aggregate long-term ratio drops to 108 percent, with seven banks below the 100 percent threshold.<sup>12</sup> Similarly to the estimation of the short-term liquidity ratio, adjustments were made to the long-term ratio to reflect a possible exclusion of domestic sovereign bonds from the HQLA. These adjustments, however, had a very marginal effect on the results and did not cause any additional banks to fall below the 100 percent threshold.

## CONTAGION RISKS AND SPILLOVER ANALYSIS

**49. The Montenegro banking system has limited domestic interconnectedness.** While there are some cross-exposures between commercial banks, insurance companies, and investment funds, gross claims and liabilities of the banking sector to nonbanks averaged only about 2 percent of total assets. Domestic interbank transaction volumes are very small, only 0.2 percent of the banking sector's total assets. There is no interbank market and the instruments to support interbank transactions are not developed. Moreover, surplus liquidity in the system has also lessened incentives for interbank transactions.

**50. Insurance companies have considerable exposures to the banking sector, but the exposures have been well distributed across banks.** About 22 percent of the insurance industry's assets are in the form of deposits at commercial banks. Most insurance companies distribute their deposits across a large number of banks. Only a few insurance companies, with relatively small amounts of deposits, would deposit their funds in only a few banks.

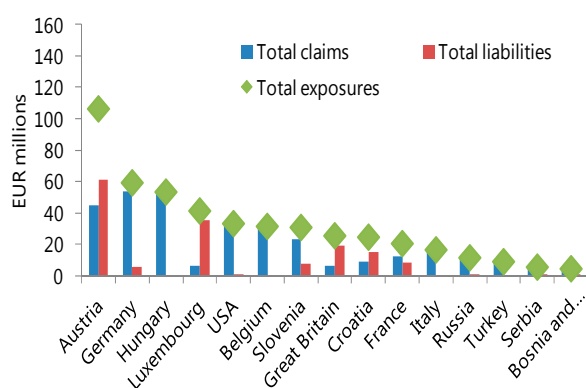
**51. The banking sector has high cross-border interbank exposures, which reflects foreign ownership as well as investment and hedging strategies.** Banks' foreign claims and liabilities account for over 115 percent and 50 percent of total regulatory capital, respectively, as of end-2014. Exposures to the foreign banks are mainly in the forms of claims, with about 47 percent of total interbank external claim to Austria, Germany, and Hungary. Exposures to Austria and Hungary reflect close linkages with the parent banks. In addition, without viable and safe alternatives within the

<sup>12</sup> Adjustments for outflows were made assuming an initially assumed average weight of 90 percent of deposits.

country, Montenegro banks invest in foreign government securities and deposit part of their excess liquidity in EU banks, particularly in Germany. Some banks have also invested in higher-yield sovereign bonds in the region, although the exposures are still limited (Figure 4).

**52. A network analysis was used to assess contagion risks from cross-border interconnectedness.** The analytical framework is based on the methodology proposed by Espinosa-Vega and Solé (2010), which simulates the hypothetical failure of the banking system in a given country and tracks its spillover effects on other countries. Spillovers are estimated from both the asset and the liability sides by considering the impact of two separate shocks: (i) the impact of a banking system defaulting on its liabilities to foreign banks (credit shock); and (ii) the impact of a banking system deleveraging by withdrawing funding from foreign banks, triggering fire sales of the latter's assets (funding shock). The analysis is based on bilateral exposures among the 12 banks and the banking systems of 35 foreign countries provided by the central bank, and exposures among foreign banking systems obtained from (restricted) BIS locational statistics.

**Figure 3. Montenegro: Montenegro Banking Sector's Cross-Border Interbank Exposures**



Source: CBM and IMF staff calculations.

**53. A network analysis could help identify key systemically important banking systems for each bank in Montenegro.** The key assumptions are the following: (i) for the credit shock, a loss-given default of 100 percent is assumed on interbank exposures, based on difficulties in assets recovery; and (ii) for the funding shock, a haircut of 50 percent is assumed on asset fire sales and 65 percent on the roll-over ratio of interbank debt. The analysis is also extended by calculating the number of bank 'failures' in Montenegro associated with each foreign banking system failure. The 'failure' of a bank is based on undercapitalization defined as its capital-to-RWA falling below the CAR requirement (i.e., 10 percent in Montenegro).

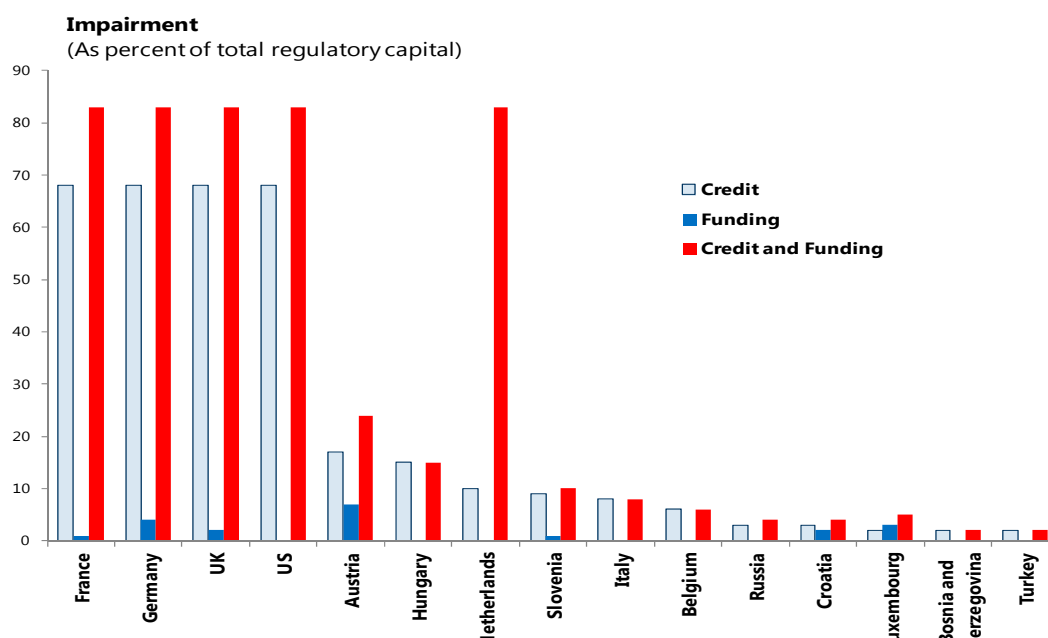
**54. The cross-border spillover exercise points to dominance of the credit shock over the funding shock.** Figure 5 shows the impact of the credit shock, the funding shock, and the combination of both shocks. It is clear that the credit shock has a significantly larger impact on

Montenegro banks than the funding shock. This is consistent with the earlier observation that the Montenegro banking system's exposures to foreign banks are mainly in the forms of claims.

**55. There are large contagion risks from France, Germany, the United Kingdom, and the United States.** Based on a network analysis, the impact of the two credit and funding shocks would lead to severe capital impairment (capital would fall below the minimum required level) in 7 and 10 Montenegro banks, respectively. Up to 83 percent of the overall banking system's regulatory capital would be lost.

**56. A large shock to most home countries of foreign-owned banks caused a confined rather than a system-wide failure.** Except for France, credit and funding shocks to the banking systems in home countries (Austria, Croatia, Hungary, Serbia, and Slovenia) do not necessarily trigger the failure of their subsidiaries in Montenegro—partly due to the diversified funding and portfolio structures. In the case of Austria, Hungary, and Slovenia, where the impact of the shock caused bank failures, severe capital impairment was confined to the subsidiaries and/or other Montenegro banks with relatively large exposures to these countries. This was mainly due to limited domestic interbank transactions.

**Figure 4. Montenegro: Cross-Border Spillovers to Montenegro Banks: Credit and Funding Shocks**



Sources: CBM; BIS Locational Statistics Databases; IMF Financial Soundness Indicators Database; and IMF staff calculations.

**57. Large spillover impact from systemically important countries on the Montenegro banking system is primarily a second- or third-round impact.** Although direct exposures to France, the United Kingdom, and the United States were relatively small, their indirect impact was large due to the interconnectedness with countries that have direct exposures to Montenegro. The failure of Montenegro banks is generally triggered in the second and third round. Among other countries, Belgium and Luxembourg generally took the hit from the first round of impact as a consequence of bank failures in France, Germany, and the United Kingdom. The close linkage between the U.K. and the U.S. banking systems was reflected in the U.K. banking system's failure in the first round of impact from a banking system shock in the United States. Figure 6 illustrates the sequence of successive failures as contagion spreads from the failure of four systemically important countries.

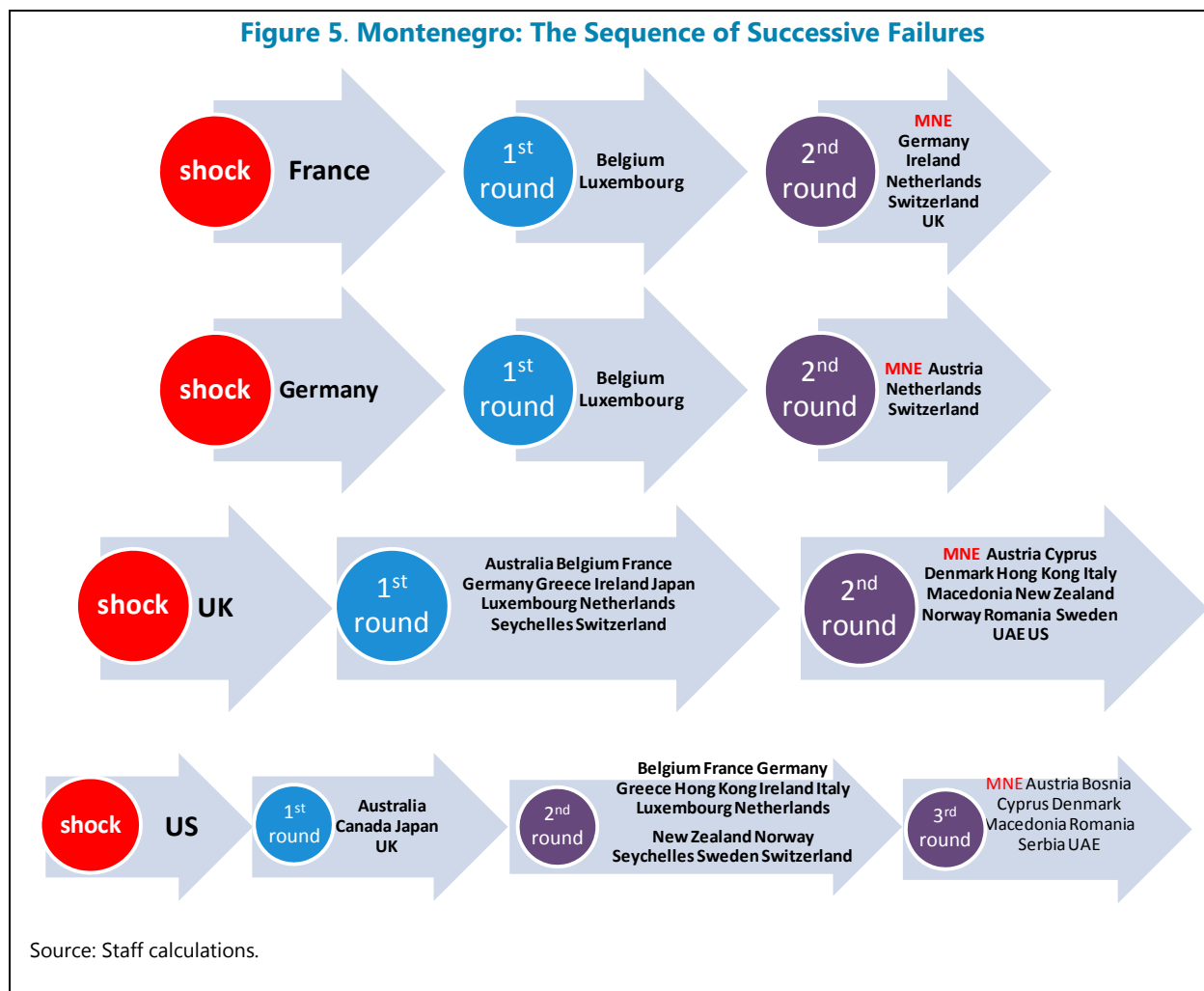
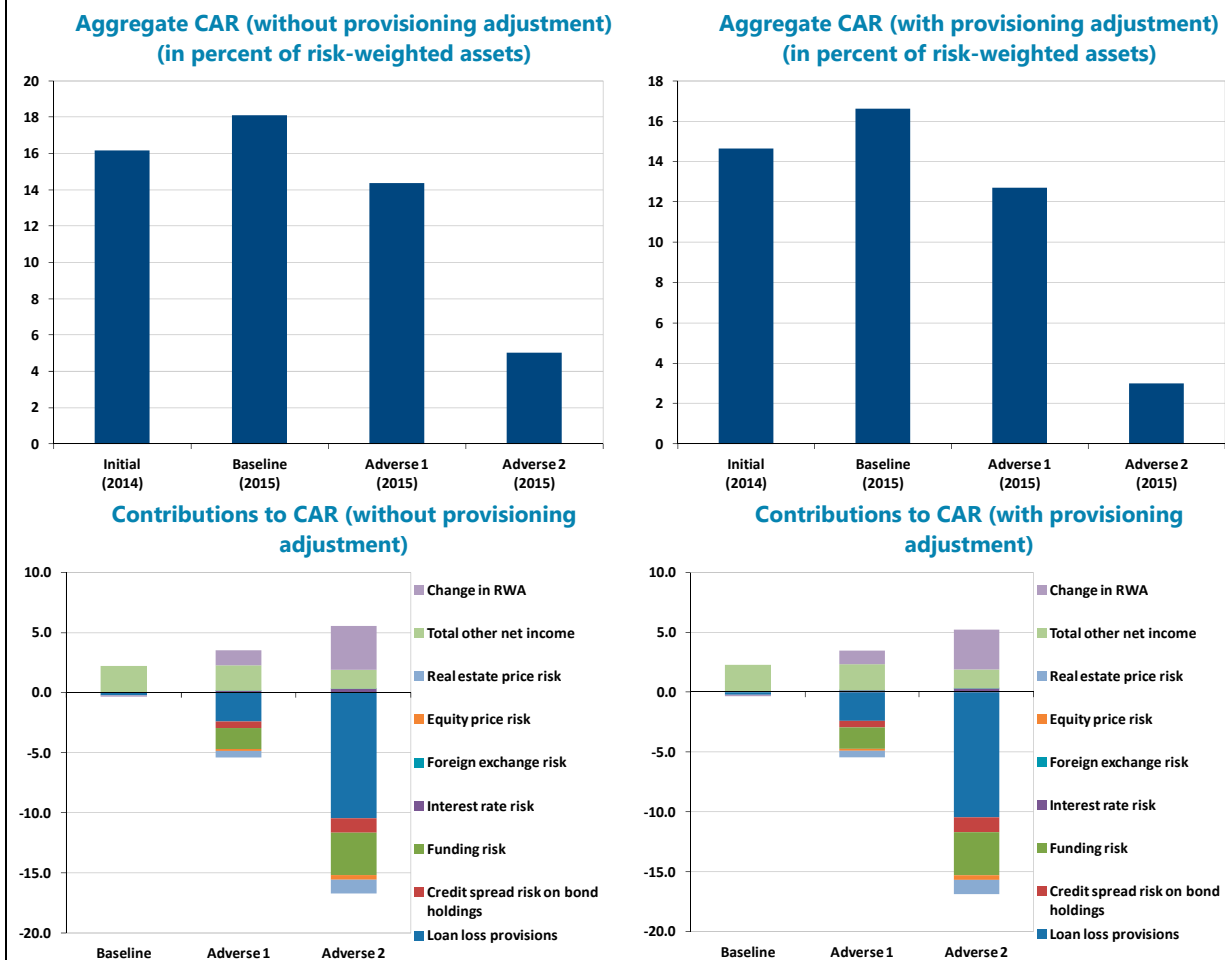


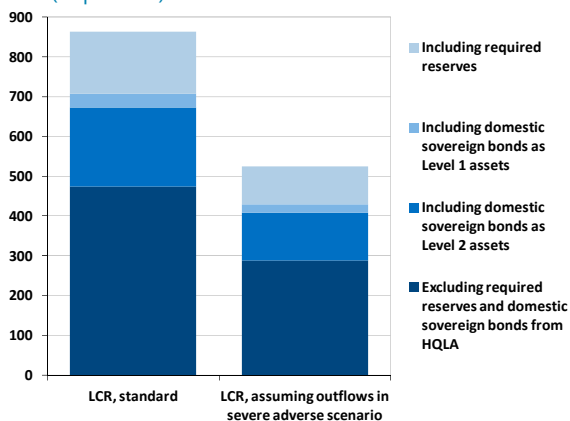
Figure 6. Montenegro: Solvency Stress Test Results



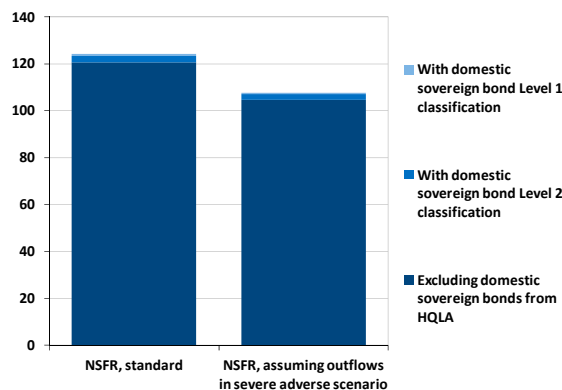
Source: CBM and IMF staff calculations.

Figure 7. Montenegro: Liquidity Stress Tests Results

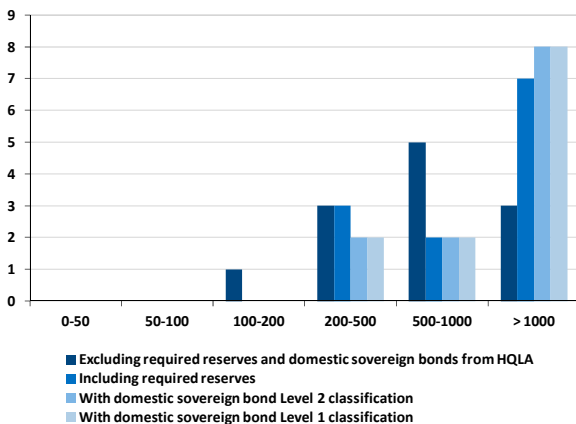
Aggregate short-term liquidity ratio  
(In percent)



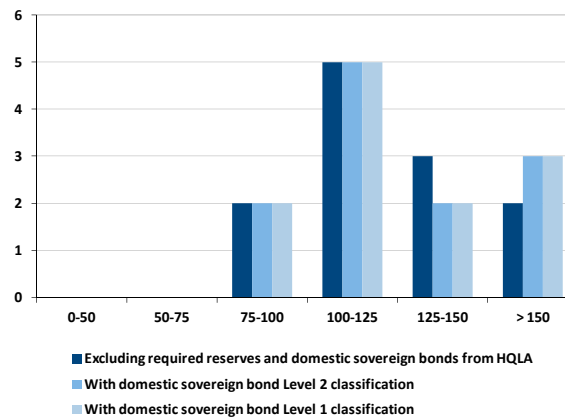
Aggregate long-term liquidity ratio  
(In percent)



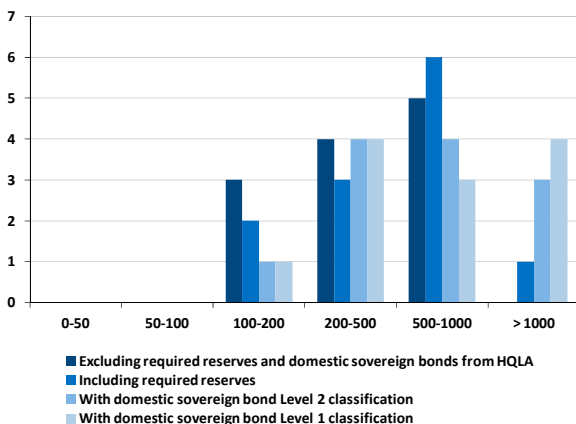
Distribution of short-term liquidity ratio  
(Number of banks)



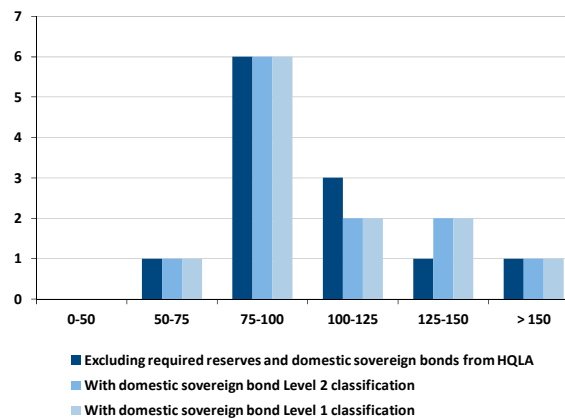
Distribution of long-term liquidity ratios  
(Number of banks)



Distribution of short-term liquidity ratios (with outflow assumption)  
(Number of banks)



Distribution of long-term liquidity ratios (with outflow assumption)  
(Number of banks)



Source: CBM and IMF staff calculations.

**Table 2. Montenegro: Banks in Montenegro  
(As of June, 2015)**

Bank name	Share of total banking system assets	Majority ownership country
<b><i>Domestic-owned</i></b>	<b>21.4</b>	
Prva Banka	8.7	Montenegro
Atlas Banka	8.0	Montenegro
Universal Capital Bank	2.3	Montenegro
Invest Banka Montenegro	1.4	Montenegro
Lovcen Banka	1.0	Montenegro
<b><i>Foreign-owned</i></b>	<b>78.6</b>	
Crnogorska Komercijalna Banka	17.4	Hungary
NLB Montenegro Banka	15.4	Slovenia
Erste Bank	11.5	Austria
Societe Generale Banka Montenegro	11.7	France
Hipotekarna Banka	11.3	Italy
Hypo Alpe Adria Bank	7.4	Austria
Komercijalna Budva Banka	3.6	Serbia
Zapad Bank	0.3	Ukraine

Source: CBM.

**Table 3. Montenegro: Banking Sector Summary**  
(As of end-2014)

	Reported data (mln EUR unless stated otherwise)	in percent of banking system assets	in percent of financial system assets	in percent of GDP
<b>Number of banks</b>	12			
<b>Assets</b>	<b>3,136</b>	<b>100.0</b>	<b>87.6</b>	<b>91.6</b>
Cash and central bank reserves	499	15.9	13.9	14.6
Customer loans	2,367	75.5	66.1	69.1
Loan impairments	-173	-5.5	-4.8	-5.0
Net loans	2,195	70.0	61.3	64.1
Securities	243	7.7	6.8	7.1
Other assets	236	7.5	6.6	6.9
Impairment on other assets	-35	-1.1	-1.0	-1.0
Total assets				
<b>Liabilities and equity</b>	<b>3,136</b>	<b>100.0</b>	<b>87.6</b>	<b>91.6</b>
Deposits from customers	2,308	73.6	64.5	67.4
- of which protected by deposit insurance	1,064	33.9	29.7	31.1
Loans from parent banks and development funds	249	7.9	6.9	7.3
Issued securities	15	0.5	0.4	0.4
Other liabilities	120	3.8	3.4	3.5
Equity capital	444	14.2	12.4	13.0
- Regulatory reserves, total	-291	-9.3	-8.1	-8.5
- Own funds, total	315	10.0	8.8	9.2
- Capital adequacy ratio (CAR), percent	16.2			
<b>Asset quality</b>				
Total NPLs	402	12.8	11.2	11.7
NPLs to total gross loans, percent	16.8			
Total past due loans, > 90 days	332	10.6	9.3	9.7
Past due loans (>90 days) to total gross loans, percent	13.9			
IFRS provisions to total NPLs, percent	39.5			
IFRS provisions to total past due loans, percent	47.8			
Regulatory reserves to total NPLs, percent	72.3			
Regulatory reserves to total past due loans, percent	87.5			
<b>Risk exposures</b>				
External claims	503	16.0	14.0	14.7
External liabilities	645	20.6	18.0	18.8
Own sovereign bond holdings	140	4.5	3.9	4.1
Foreign sovereign bonds holdings	83	2.6	2.3	2.4
Corporate bond holdings	16	0.5	0.5	0.5
Net open foreign exchange position	2	0.1	0.1	0.1
Net open position in equity instruments	14	0.4	0.4	0.4
Net open position in real estate assets	92	2.9	2.6	2.7
Net open position in commodities (gold)	0	0.0	0.0	0.0
<b>Profitability</b>				
Return on assets, percent	0.8			
Return on equity, percent	5.4			
Net interest and fee income to average assets	4.6			
Overhead expenses to net interest and fee income	74.7			

Source: CBM and IMF staff calculations.



**Table 4. Montenegro: Summary of the Banking Sector Loan Book in Montenegro  
(In millions of euros as of end-2014)**

	Gross loans	% of total loans	Non-performing loans	% of total loans
Household loans, residents	880	36.7	92	3.8
Corporate loans, residents	989	41.3	284	11.9
Agriculture, forestry and fishing	28	1.2	2	0.1
Manufacturing	109	4.5	54	2.2
Wholesale and retail trade; repair of motor vehicles and motorcycles	407	17.0	120	5.0
Construction	111	4.6	43	1.8
Transport and warehousing	49	2.1	19	0.8
Accommodation, food, arts, recreation and other services	73	3.1	15	0.6
Public administration and defence	131	5.5	12	0.5
Real estate	24	1.0	5	0.2
Financial and insurance sector	16	0.7	2	0.1
Professional, scientific and technical activities	40	1.7	12	0.5
Loans to non-residents	434	18.1	12	0.5
Other loans	94	3.9	14	0.6
<i>Total</i>	<i>2,396</i>	<i>100.0</i>	<i>402</i>	<i>16.8</i>

Source: CBM.

**Table 5. Montenegro: Macroeconomic Projections**

	2010	2011	2012	2013	2014	Baseline 2015 Proj.	Adverse scenario 1 Proj.	Adverse scenario 2 Proj.
Real GDP growth (%)	2.5	3.2	-2.5	3.3	1.5	3.2	-2.5	-5.2
CPI inflation (%)	0.7	2.8	5.1	0.3	-0.3	1.7	-0.3	-0.6
Risk-free interest rate	1.0	1.4	0.2	0.3	0.1	0.1	-0.5	-1.1
Exchange rate 1/	0.90	0.93	0.94	0.91	0.98	1.11	1.13	1.16
Stock price index	100	64	68	68	78	78	61	44
Real estate price index	100	105	91	97	81	82	73	65

Source: CBM and IMF staff calculations.

1/ Exchange rate is expressed in EUR as the equally-weighted average price of USD, GBP and CHF.

**Table 6. Montenegro: Balance Sheet and Income Statement Projections**

	2010	2011	2012	2013	2014	Baseline 2015	Adverse scenario 1 2015	Adverse scenario 2 2015
						Proj.	Proj.	Proj.
Non-performing loans, percent of gross loans	21.0	15.5	17.6	18.4	16.8	16.9	19.9	27.4
Credit losses, percent of loans net of regulatory reserves	-0.4	-2.3	1.9	3.1	-0.8	0.2	2.0	7.8
Gross credit, percent of GDP	76.3	69.8	70.1	66.9	64.1	61.2	61.1	58.1
Growth rate of non-interest bearing assets, percent	-	-	-	-	-	0.0	-28.7	-56.7
Growth rate of open position in equity, percent	-	-	-	-	-	0.0	-2.5	-5.1
Growth rate of open position in commodity, percent	-	-	-	-	-	0.0	-2.5	-5.1
Growth rate of open positions in foreign currency, percent	-	-	-	-	-	0.0	-2.5	-5.1
Funding cost, spread above Euribor 3M, percent	2.3	1.9	3.0	2.3	1.8	0.0	1.6	3.1
Net outflows of deposits, percent of initial total deposits	-	-	-	-	-	0.0	7.3	14.7
<i>Net outflows of non-resident deposits, percent of initial deposits</i>	-	-	-	-	-	0.0	11.5	23.0
Haircut on liquid assets sold to cover deposit outflows, percent	-	-	-	-	-	0.0	15.0	25.0
Spread of domestic sovereign bonds above Euribor 3M, percent	0.4	0.5	3.4	0.2	-0.8	-0.8	3.6	7.9
Spread of foreign sovereign bonds above Euribor 3M, percent /1	4.0	4.8	3.9	3.4	2.0	2.0	3.3	4.6
Spread of corporate bonds above Euribor 3M, percent	-	-	-	-	43.9	43.9	48.6	53.4
Net fee and commission income, annual change, percent	5.0	-11.9	-16.0	32.4	4.1	0.0	-7.1	-14.3
Other non-interest income, percent	13.8	649.5	-46.6	-68.1	-48.2	0.0	-7.1	-14.3
Non-interest expense, annual change, percent	2.4	3.3	6.2	-102.6	-1.4	0.0	8.3	16.4
<i>Operational risk losses, annual change</i>	-	17.2	-70.0	1501.3	-72.6	0.0	105.2	207.8
Tax rate, percent	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
Dividends paid/shares issued, percent of net profits	-	-	-	-	-	0.0	0.0	0.0

Source: CBM and IMF staff calculations.

1/ Foreign sovereign bond spreads were estimated based on an equally weighted portfolio of euro area government bonds.

**Table 7. Montenegro: Data Availability to Estimate Relations Between Credit Losses and Macroeconomic Variables**

<b>Variable</b>	<b>Frequency</b>	<b>Start of data series</b>
Bank-specific NPLs and NPL ratios	Quarterly	3/31/2004
Bank- and sector-specific NPLs and NPL ratios	Quarterly	6/30/2012
Credit to GDP ratio	Quarterly	12/31/2002
EUR/USD exchange rate	Daily	12/19/1999
Net foreign direct investment to GDP ratio	Quarterly	3/31/2005
Real GDP growth	Annual	12/31/2000
Real GDP growth	Quarterly	3/31/2011
Proxy of nominal and real GDP based on industrial production and output in the tourism and construction sectors	Quarterly	3/31/2004
Unemployment rate	Monthly	1/31/2004
CPI	Monthly	1/31/2001
Wages, gross	Monthly	1/31/2003
Wages, net	Monthly	1/31/2003
Industrial production	Monthly	1/31/2001
Investment to GDP ratio	Quarterly	12/31/2001
Bank-specific lending interest rates	Quarterly	9/30/2007

Source: IMF staff and CBM.

**Table 8. Montenegro: Panel Data Model Estimation Output 1/**

Dependent Variable: LOGIT\_NPL\_RTO\_  
 Method: Panel Least Squares  
 Date: 10/22/15 Time: 10:55  
 Sample (adjusted): 2005Q1 2014Q4  
 Periods included: 40  
 Cross-sections included: 11  
 Total panel (unbalanced) observations: 419

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGIT_NPL_RTO_(-1)	0.884376	0.018327	48.25546	0.0000
LOG_D_EQT_INX_(-4)	-0.271751	0.094578	-2.873290	0.0043
LOG_D_REAL_GDP_	-0.574935	0.235812	-2.438109	0.0152
LOG_FDI_	-0.094513	0.040536	-2.331583	0.0202
C	-0.490345	0.148041	-3.312234	0.0010

#### Effects Specification

#### Cross-section fixed (dummy variables)

R-squared	0.909064	Mean dependent var	-2.214830
Adjusted R-squared	0.905913	S.D. dependent var	1.361435
S.E. of regression	0.417602	Akaike info criterion	1.126565
Sum squared resid	70.45397	Schwarz criterion	1.271119
Log likelihood	-221.0153	Hannan-Quinn criter.	1.183705
F-statistic	288.4781	Durbin-Watson stat	1.895259
Prob(F-statistic)	0.000000		

Source: IMF staff calculations.

1/ LOGIT\_NPL\_RTO is the logit-transformed NPL ratio. LOG\_D\_EQT\_INX is the quarter-on-quarter logarithmic change in the equity index. LOG\_D\_REAL\_GDP\_ is the year-on-year logarithmic change in the proxy measure of real GDP. LOG\_FDI\_ is the log-transformed ratio of FDI to GDP. C is a constant.

**Table 9. Montenegro: Aggregate Capital Adequacy Ratio as a Function of Assumed GDP Growth Rates and Credit Loss Sensitivities 1/**

		Sensitivities of changes to the GDP growth rate														
		-0.1	-0.2	-0.3	-0.4	-0.5	-0.6	-0.7	-0.8	-0.9	-1.0	-1.1	-1.2	-1.3	-1.4	-1.5
GDP growth rate	1.0	16.1%	16.1%	16.0%	16.0%	15.9%	15.9%	15.9%	15.8%	15.8%	15.7%	15.7%	15.6%	15.6%	15.5%	15.5%
	0.5	16.1%	16.0%	15.9%	15.8%	15.7%	15.6%	15.5%	15.4%	15.4%	15.3%	15.2%	15.1%	15.0%	14.9%	14.8%
	0.0	16.0%	15.9%	15.8%	15.6%	15.5%	15.4%	15.2%	15.1%	14.9%	14.8%	14.7%	14.5%	14.4%	14.2%	14.1%
	-0.5	16.0%	15.8%	15.6%	15.4%	15.3%	15.1%	14.9%	14.7%	14.5%	14.3%	14.1%	13.9%	13.8%	13.6%	13.4%
	-1.0	15.9%	15.7%	15.5%	15.3%	15.0%	14.8%	14.6%	14.3%	14.1%	13.8%	13.6%	13.4%	13.1%	12.9%	12.6%
	-1.5	15.9%	15.6%	15.4%	15.1%	14.8%	14.5%	14.2%	13.9%	13.7%	13.4%	13.1%	12.8%	12.5%	12.2%	11.9%
	-2.0	15.9%	15.5%	15.2%	14.9%	14.6%	14.2%	13.9%	13.6%	13.2%	12.9%	12.5%	12.2%	11.8%	11.5%	11.1%
	-2.5	15.8%	15.4%	15.1%	14.7%	14.3%	13.9%	13.6%	13.2%	12.8%	12.4%	12.0%	11.6%	11.2%	10.8%	10.4%
	-3.0	15.8%	15.4%	14.9%	14.5%	14.1%	13.7%	13.2%	12.8%	12.3%	11.9%	11.4%	11.0%	10.5%	10.0%	9.6%
	-3.5	15.7%	15.3%	14.8%	14.3%	13.8%	13.4%	12.9%	12.4%	11.9%	11.4%	10.9%	10.4%	9.8%	9.3%	8.8%
	-4.0	15.7%	15.2%	14.7%	14.1%	13.6%	13.1%	12.5%	12.0%	11.4%	10.9%	10.3%	9.7%	9.2%	8.6%	8.0%
	-4.5	15.6%	15.1%	14.5%	13.9%	13.4%	12.8%	12.2%	11.6%	11.0%	10.4%	9.7%	9.1%	8.5%	7.8%	7.1%
	-5.0	15.6%	15.0%	14.4%	13.8%	13.1%	12.5%	11.8%	11.2%	10.5%	9.8%	9.2%	8.5%	7.7%	7.0%	6.3%
	-5.5	15.5%	14.9%	14.2%	13.6%	12.9%	12.2%	11.5%	10.8%	10.0%	9.3%	8.6%	7.8%	7.0%	6.2%	5.4%
	-6.0	15.5%	14.8%	14.1%	13.4%	12.6%	11.9%	11.1%	10.4%	9.6%	8.8%	8.0%	7.1%	6.3%	5.4%	4.6%
-6.5	15.4%	14.7%	13.9%	13.2%	12.4%	11.6%	10.8%	9.9%	9.1%	8.2%	7.4%	6.5%	5.6%	4.6%	3.7%	
-7.0	15.4%	14.6%	13.8%	13.0%	12.1%	11.3%	10.4%	9.5%	8.6%	7.7%	6.7%	5.8%	4.8%	3.8%	2.8%	

Source: IMF staff calculations, using sensitivities from Hardy and Schmeider (2013)

1/ Green marks the moderate scenario assumptions, while red marks the severe scenario assumptions.

**Table 10. Montenegro: Summary Solvency Stress Test Results (Without Provisioning Adjustments)**  
(In millions of EUR, unless stated otherwise)

	Baseline scenario	in % of GDP	Adverse scenario 1	in % of GDP	Adverse scenario 2	in % of GDP
<b>Before stress, 12/31/2014</b>						
Regulatory capital	315	9.2	315	9.2	315	9.2
Tier 1 capital	270	7.9	270	7.9	270	7.9
Tier 2 capital	45	1.3	45	1.3	45	1.3
Risk-weighted assets (RWAs)	1,947	56.9	1,947	56.9	1,947	56.9
Total assets	3,136	91.6	3,136	91.6	3,136	91.6
Capital Adequacy Ratio (CAR), percent	16.2		16.2		16.2	
Capital shortfall to meet 12 percent CAR	4	0.1	4	0.1	4	0.1
Capital shortfall to meet 10 percent CAR	0	0.0	0	0.0	0	0.0
Capital shortfall to meet 0 percent CAR	0	0.0	0	0.0	0	0.0
<b>Stress test losses</b>						
<b>Credit risk</b>	<b>-4</b>	<b>0.1</b>	<b>-53</b>	<b>1.5</b>	<b>-185</b>	<b>5.4</b>
Loan loss provisions	-4	0.1	-43	1.3	-166	4.8
Credit spread risk on bond holdings	0	0.0	-10	0.3	-19	0.6
<b>Market and liquidity risk</b>	<b>1</b>	<b>0.0</b>	<b>-41</b>	<b>1.2</b>	<b>-75</b>	<b>2.2</b>
Funding risk	0	0.0	-32	0.9	-56	1.6
of which caused by deposit outflows	0	0.0	0	0.0	1	0.0
Interest rate risk	0	0.0	2	0.1	5	0.1
Foreign exchange risk	0	0.0	0	0.0	0	0.0
Equity price risk	0	0.0	-3	0.1	-6	0.2
Real estate price risk	1	0.0	-9	0.3	-18	0.5
Commodity price risk			0		0	
<b>Other net income</b>	<b>42</b>	<b>1.2</b>	<b>39</b>	<b>1.1</b>	<b>25</b>	<b>0.7</b>
Total other net income	42	1.2	39	1.1	25	0.7
of which are operational risk losses	-2	0.1	-4	0.1	-6	0.2
<b>After stress, 12/31/2015</b>						
Regulatory capital	354	10.3	260	7.6	80	2.3
Tier 1 capital	309	9.0	214	6.3	34	1.0
Tier 2 capital	45	1.3	45	1.3	45	1.3
Risk-weighted assets (RWAs)	1,957	57.1	1,808	52.8	1,590	46.4
Total assets	3,157	92.2	2,755	80.4	2,290	66.9
Capital Adequacy Ratio (CAR), percent	18.1		14.4		5.0	
Capital shortfall to meet 12 percent CAR	3	0.1	17	0.5	122	3.6
Capital shortfall to meet 10 percent CAR	0	0.0	5	0.2	95	2.8
Capital shortfall to meet 0 percent CAR	0	0.0	0	0.0	10	0.3

Source: CBM and IMF staff calculations.

**Table 11. Montenegro: Summary Solvency Stress Test Results (With Provisioning Adjustments)**  
(In millions of EUR, unless stated otherwise)

	Baseline scenario	in % of GDP	Adverse scenario 1	in % of GDP	Adverse scenario 2	in % of GDP
<b>Before stress, 12/31/2014</b>						
Regulatory capital	280	8.2	280	8.2	280	8.2
Tier 1 capital	235	6.9	235	6.9	235	6.9
Tier 2 capital	45	1.3	45	1.3	45	1.3
Risk-weighted assets (RWAs)	1,913	55.8	1,913	55.8	1,913	55.8
Total assets	3,136	91.6	3,136	91.6	3,136	91.6
Capital Adequacy Ratio (CAR), percent	14.7		14.7		14.7	
Capital shortfall to meet 12 percent CAR	28	0.8	28	0.8	28	0.8
Capital shortfall to meet 10 percent CAR	24	0.7	24	0.7	24	0.7
Capital shortfall to meet 0 percent CAR	8	0.2	8	0.2	8	0.2
<b>Stress test losses</b>						
<b>Credit risk</b>	<b>-4</b>	<b>0.1</b>	<b>-52</b>	<b>1.5</b>	<b>-182</b>	<b>5.3</b>
Loan loss provisions	-4	0.1	-43	1.2	-163	4.8
Credit spread risk on bond holdings	0	0.0	-10	0.3	-19	0.6
<b>Market and liquidity risk</b>	<b>1</b>	<b>0.0</b>	<b>-41</b>	<b>1.2</b>	<b>-76</b>	<b>2.2</b>
Funding risk	0	0.0	-32	0.9	-57	1.7
<i>of which caused by deposit outflows</i>	0	0.0	0	0.0	1	0.0
Interest rate risk	0	0.0	2	0.1	5	0.1
Foreign exchange risk	0	0.0	0	0.0	0	0.0
Equity price risk	0	0.0	-3	0.1	-6	0.2
Real estate price risk	1	0.0	-9	0.3	-18	0.5
Commodity price risk	0					
<b>Other net income</b>	<b>42</b>	<b>1.2</b>	<b>39</b>	<b>1.1</b>	<b>25</b>	<b>0.7</b>
Total other net income	42	1.2	39	1.1	25	0.7
<i>of which are operational risk losses</i>	-2	0.1	-4	0.1	-6	0.2
<b>After stress, 12/31/2015</b>						
Regulatory capital	320	9.3	225	6.6	47	1.4
Tier 1 capital	274	8.0	180	5.3	2	0.1
Tier 2 capital	45	1.3	45	1.3	45	1.3
Risk-weighted assets (RWAs)	1,922	56.1	1,776	51.9	1,562	45.6
Total assets	3,121	91.1	2,728	79.6	2,269	66.3
Capital Adequacy Ratio (CAR), percent	16.6		12.7		3.0	
Capital shortfall to meet 12 percent CAR	27	0.8	43	1.2	149	4.3
Capital shortfall to meet 10 percent CAR	24	0.7	33	1.0	122	3.5
Capital shortfall to meet 0 percent CAR	7	0.2	15	0.4	37	1.1
Source: CBM and IMF staff calculations.						

**Table 12. Montenegro: Results of Concentration Risk Test**  
(In millions of EUR, unless stated otherwise)

	Default of the largest borrower	Default of the largest 5 borrowers	Default of the largest 10 borrowers
<b>Before losses</b>			
Regulatory capital ratio (CAR), percent	16.2	16.2	16.2
Capital shortfall to meet 12 percent CAR	4	4	4
Capital shortfall to meet 10 percent CAR	0	0	0
Capital shortfall to meet 0 percent CAR	0	0	0
<b>Assumed recovery rate of 70 percent</b>			
Capital Adequacy Ratio (CAR), percent	15.3	13.2	11.6
Capital shortfall to meet 12 percent CAR	5	19	43
Capital shortfall to meet 10 percent CAR	1	7	20
Capital shortfall to meet 0 percent CAR	0	0	0
<b>Assumed recovery rate of 35 percent</b>			
Capital Adequacy Ratio (CAR), percent	14.3	9.4	5.7
Capital shortfall to meet 12 percent CAR	13	75	137
Capital shortfall to meet 10 percent CAR	4	46	108
Capital shortfall to meet 0 percent CAR	0	0	15
<b>Assumed recovery rate of 0 percent</b>			
Capital Adequacy Ratio (CAR), percent	13.2	5.3	-1.1
Capital shortfall to meet 12 percent CAR	21	140	236
Capital shortfall to meet 10 percent CAR	10	110	208
Capital shortfall to meet 0 percent CAR	0	10	86

Source: IMF staff calculations.



**Table 13. Montenegro: Summary of the Liquidity Stress Test Results**

	Total	With domestic sovereign bond Level 2 classification	Excluding domestic sovereign bonds	Excluding domestic sovereign bonds and required reserves
<b>LCR, standard</b>	863	828	629	474
Implied liquidity shortfall /1	0	0	0	0
Number of banks below 100 percent	0	0	0	0
<b>LCR, assuming outflows in severe adverse scenario</b>	525	503	382	288
Implied liquidity shortfall /1	0	0	0	0
Number of banks below 100 percent	0	0	0	0
<b>NSFR, standard</b>	124	123	121	-
Implied liquidity shortfall	10	10	10	-
Number of banks below 100 percent	2	2	2	-
<b>NSFR, assuming outflows of deposits in severe adverse scenario</b>	108	107	105	-
Implied liquidity shortfall	95	98	109	-
Number of banks below 100 percent	7	7	7	-

Source: IMF staff calculations.

1/ The LCR implied liquidity shortfall is the amount of system wide liquidity needs (in terms of HQLA) so that the LCR of each bank is at least 100 percent.

2/ The NSFR implied liquidity shortfall is the amount of system wide liquidity needs (in terms of ASF) so that the NSFR of each bank is at least 100 percent.

## Appendix I. Preliminary Risk Assessment Matrix

	Overall Level of Concern	
	Likelihood of Severe Realization of Threat in the Next 1–3 Years ( <i>high, medium, or low</i> )	Expected Impact on Financial Stability if Threat is Realized ( <i>high, medium, or low</i> )
1. Protracted growth slowdown in the Euro area and neighboring countries	<b>Staff assessment: High</b> (G-RAM, June 2015)	<b>Staff assessment: High</b> <ul style="list-style-type: none"> <li>Adverse impact on external demand and internal demand combined with further “lowflation” imported from the euro area.</li> <li>Credit contraction due to low demand and tightened supply resulting from banks’ risk aversion and foreign subsidiaries’ reduced presence in the Montenegro market.</li> <li>Reduced income among banks’ borrowers, leading to further credit quality deterioration.</li> </ul>
2. Spillovers from a deterioration of global financial market conditions	<b>Staff assessment: High</b> (G-RAM, June 2015)	<b>Staff assessment: High</b> <ul style="list-style-type: none"> <li>External financial market turmoil exposes domestic vulnerabilities affecting domestic economic output and financial stability. Importantly, the government has large external financing needs, averaging around 9 percent of GDP over 2016–2020. The stock of debt is large (nearly 70 percent of GDP) and expected to increase, absent policy measures. A sharp increase in international risk premiums and/or a loss of market access would have significant negative economic and financial sector spillovers. Triggers could include a loss of confidence in the authorities’ economic reform program, a tightening of U.S. monetary policy, and a general reassessment of risk amidst the increase in risk aversion affecting emerging markets.</li> <li>Banks raise deposit rates to avoid deposit outflows, further reducing their profitability.</li> <li>Banks suffer deposit outflows from withdrawals by external creditors, such as nonresident depositors and by domestic depositors, to repay external creditors and to avoid exposure to the domestic banking system. Besides the use of liquid assets, banks completely rely on market and foreign-parent bank funding at elevated interest rates, due to the lack of an LOLR mechanism.</li> <li>The combination of a reduction in external and internal demand, and increased funding costs, causes a significant reduction in banks’ borrowers’ credit quality.</li> </ul>
3. Geopolitical and macroeconomic events associated with Russia/Ukraine tensions and Greece’s negotiations with creditors.	<b>Staff assessment: Medium</b> (G-RAM, June 2015)	<b>Staff assessment: Medium</b> <ul style="list-style-type: none"> <li>Reduction in FDI inflows and growth prospects cause a reduction in the credit quality among banks’ borrowers.</li> <li>Real estate prices decline due to reduced demand from Russia and Ukraine, causing direct losses due to asset revaluation and indirect losses due to a reduction of credit quality.</li> <li>Direct financial links to Greece are negligible, but fallout through secondary channels could undermine banks’ borrowers’ credit quality.</li> </ul>

Domain		Assumptions		
		Bottom-Up by Banks	Top-Down by Authorities	Top-down by FSAP Team
<b>BANKING SECTOR: SOLVENCY RISK</b>				
1. Institutional perimeter	Institutions included	N/A	N/A	<ul style="list-style-type: none"> <li>All banks (12 banks) as of end-2014.</li> </ul>
	Market share	N/A	N/A	<ul style="list-style-type: none"> <li>100 percent of total banking sector assets by end-2014.</li> <li>99.7 percent of total banking sector assets by mid-2015.</li> </ul>
	Data and baseline date	N/A	N/A	<ul style="list-style-type: none"> <li>Bank-by-bank supervisory data as of end-2014.</li> <li>Data especially requested from banks.</li> </ul>
	Consolidation	N/A	N/A	<ul style="list-style-type: none"> <li>Consolidated basis stress test of domestic-owned banks, and foreign-owned bank subsidiaries active in Montenegro.</li> </ul>
2. Channels of risk propagation	Methodology	N/A	N/A	<ul style="list-style-type: none"> <li>IMF solvency stress testing balance sheet framework.</li> </ul>
	Satellite Models for Macrofinancial linkages	N/A	N/A	<ul style="list-style-type: none"> <li>Panel data model (fixed effects) estimation of logit-transformed bank-specific NPL ratios as a function of macroeconomic variables using up to eight quarterly lags. Given the finding of an insufficient statistical significance of the relation between NPL ratios and macroeconomic variables, global rules-of-thumb sensitivities of credit losses to GDP growth were used to estimate credit losses and project NPL ratios.<sup>1</sup> A peer group analysis of the projected NPL ratios implied by the rules-of-thumb credit loss sensitivities was conducted based on a comparison to results of FSAP stress tests in neighboring countries and to results of internal CBM stress testing models. The analysis showed that Adverse 1 scenario projections are comparable to internal CBM model outcomes, while Adverse 2</li> </ul>

<sup>1</sup> Hardy, D. C., and Schmieder, C. Rules of Thumb for Bank Solvency Stress Testing. IMF Working Paper. November 2013.

Domain		Assumptions		
		Bottom-Up by Banks		Bottom-Up by Banks
				projections are comparable to stress test results of recent FSAPs in neighboring countries.
				<ul style="list-style-type: none"> <li>Expert judgment to estimate pre-impairment income sensitivities to macroeconomic events.</li> </ul>
	Stress test horizon	N/A	N/A	<ul style="list-style-type: none"> <li>1-year horizon was chosen because of (i) the significant uncertainty around macroeconomic projections in Montenegro, (ii) the lack of historical time series of macro variables, and (iii) the low reliability of some historical data.</li> </ul>
3. Tail shocks	Scenario analysis	N/A	N/A	<ul style="list-style-type: none"> <li><b>Baseline scenario.</b> IMF's macroeconomic projections as of August 2015.</li> <li><b>Moderate adverse scenario.</b> A protracted slowdown in the euro area causing a reduction in external demand and FDI. Projections were generally estimated as one standard deviation from the historical mean, with expert judgment adjustments for consistency purposes (real GDP growth of -2.5 percent; gross credit growth of minus 3 percentage points of GDP; funding cost of banks rise by 1.6 percent; general interest rates decrease by 60 basis points; domestic-sovereign bond, foreign-sovereign bond and corporate bond credit spreads increase by 4.4, 1.3, and 4.7 percentage points, respectively; stock prices fall by 22 percent, real estate prices fall by 10 percent).</li> <li><b>Severe adverse scenario.</b> Developments of the moderate scenario are complemented by elevated uncertainty and risk aversion in global financial markets. Projections were generally estimated as two standard deviations from the historical mean, with expert judgment adjustments for consistency purposes (real GDP growth of minus 5.2 percent; gross credit growth of -6 percentage points of GDP; funding cost of banks rises by 3.1 percent; general interest rates</li> </ul>

Domain		Assumptions		
		Bottom-Up by Banks		Bottom-Up by Banks
				<ul style="list-style-type: none"> <li>decrease by 120 basis points; domestic-sovereign bond, foreign-sovereign bond and corporate bond credit spreads increase by 8.7, 2.6, and 9.5 percentage points, respectively; stock prices fall by 43 percent, real estate prices fall by 20 percent).</li> </ul>
	Sensitivity analysis	N/A	N/A	<ul style="list-style-type: none"> <li>Single-factor shocks: haircut on public sector loans and sovereign securities; interest rate hike; exchange rate; equity price decline; real estate price decline.</li> <li>Credit concentration risk based on local regulatory standards.</li> </ul>
4.Risks and buffers	Risks/factors assessed	N/A	N/A	<ul style="list-style-type: none"> <li>Credit risk: Household, corporate and public sector loan exposures, as well as domestic-sovereign, foreign-sovereign and corporate bond exposures.</li> <li>Market risk: Interest rate risk impact on net interest income due to risk-free interest rate shock; credit spread risk impact due to increased risk premiums on bond holdings; FX risk impact due to exchange rate depreciation; equity price risk impact due to adverse price shock; real estate price impact due to adverse price shock.</li> <li>Funding risk: Impact on net interest income due to increased funding cost. Net deposit outflows of 6 percent of domestic deposits and 12 percent of nonresident deposits were assumed in the moderate scenario, while net outflows of 12 percent of domestic deposits and 23 percent of nonresident deposits were assumed in the severe scenario. To cover the outflows banks were assumed to use their cash balances and sell liquid assets at haircuts of 15 percent and 25 percent in the moderate and adverse scenarios, respectively. In the event that liquid assets did not cover all deposit outflows, domestic banks were assumed to meet an increased funding cost of 2 and 4 percentage points above the current cost in</li> </ul>

Domain		Assumptions		
		Bottom-Up by Banks		Bottom-Up by Banks
				the two scenarios, respectively (approximately a 50 percent and 100 percent increase of the country risk premium). Foreign-owned banks were assumed to fund uncovered outflows at half the cost using parent bank funding.
				<ul style="list-style-type: none"> <li>Operational risk: Losses due to operational risk were set at twice and three times the 2014 level in the moderate and severe scenarios, respectively. The shocks were determined after an analysis of historical bank-specific operational risk losses.</li> </ul>
	Behavioral adjustments	N/A	N/A	<ul style="list-style-type: none"> <li>Evolution of total assets and liabilities reflected behavioral assumptions made to counter deposit outflows as described above.</li> <li>Evolution of RWAs based on constant balance sheet assumption, i.e. adjusting projected RWA by loan loss provisions at a 100 percent risk weight.</li> <li>No other management actions considered.</li> <li>Other net income items, dividends, and taxes, based on pre-determined rule of evolution in line with economic activity measured as gross credit growth.</li> </ul>
5. Regulatory and market-based standards and parameters	Calibration of risk parameters	N/A	N/A	<ul style="list-style-type: none"> <li>Estimation of expected credit losses using global rules of thumb, as described above.</li> </ul>
	Regulatory/Accounting and Market-Based Standards	N/A	N/A	<ul style="list-style-type: none"> <li>Basel II regulatory standard.</li> <li>Hurdle rates based on local regulatory minimum Capital Adequacy Ratio (CAR) of 10 percent.</li> </ul>
6. Reporting format for results	Output presentation	N/A	N/A	<ul style="list-style-type: none"> <li>CAR and capital shortfall under the 10 percent and a 12 percent hurdle rate.</li> <li>System-wide sum of gross capital shortfall, i.e. without off-setting.</li> <li>Contribution of each source of losses to aggregate capital shortfall.</li> </ul>

Domain		Assumptions		
		Bottom-Up by Banks	Top-Down by Authorities	Top-down by FSAP Team
<b>BANKING SECTOR: LIQUIDITY RISK</b>				
1. Institutional perimeter	Institutions included	<ul style="list-style-type: none"> <li>All banks (12 banks) as of end-2014.</li> </ul>		
	Market share	<ul style="list-style-type: none"> <li>100 percent of total banking sector assets by end-2014.</li> <li>99.7 percent of total banking sector assets by mid-2015.</li> </ul>		
	Data and baseline date	<ul style="list-style-type: none"> <li>Supervisory data.</li> <li>Data especially requested from banks.</li> </ul>		
2. Channels of risk propagation	Methodology	<ul style="list-style-type: none"> <li>Short-term measure informed by the Basel III LCR setup.</li> <li>Long-term measure informed by the Basel III NSFR setup.</li> </ul>		
3. Risks and buffers	Risks	<ul style="list-style-type: none"> <li>Deposit outflows.</li> <li>Market liquidity.</li> <li>Maturity mismatches.</li> </ul>		
	Buffers	<ul style="list-style-type: none"> <li>Counterbalancing capacity (HQLA, ASF).</li> </ul>		
4. Tail shocks	Size of the shock	<ul style="list-style-type: none"> <li>Haircuts and run-off rates as defined in Basel III for LCR and NSFR.</li> <li>Additional deposit outflows as assumed in the severe adverse scenario, as described above.</li> <li>Exclusion of required central bank reserves.</li> <li>Exclusion of government bonds from HQLA.</li> </ul>		
5. Regulatory and market-based standards and parameters	Regulatory standards	<ul style="list-style-type: none"> <li>LCR proxy should exceed 100 percent (not a legal/regulatory requirement).</li> <li>NSFR proxy should exceed 100 percent (not a legal/regulatory requirement).</li> </ul>		
6. Reporting format for results	Output presentation	<ul style="list-style-type: none"> <li>Aggregate LCR and NSFR proxies.</li> <li>Aggregate gross liquidity shortfalls, i.e. without off-setting.</li> <li>Number of banks that fail.</li> </ul>		

Domain		Assumptions		
		Bottom-Up by Banks	Top-Down by Authorities	Top-down by FSAP Team
<b>BANKING SECTOR: CONTAGION RISK</b>				
1. Institutional perimeter	Institutions included	N/A	N/A	<ul style="list-style-type: none"> <li>All banks (12)</li> <li>4 insurance companies</li> <li>6 investment funds</li> <li>1 microcredit institution</li> <li>46 other financial institutions</li> </ul>
	Market share	N/A	N/A	<ul style="list-style-type: none"> <li>Percentage of total sector assets: 100 percent</li> </ul>
	Data and baseline date	N/A	N/A	<ul style="list-style-type: none"> <li>Supervisory data.</li> <li>Banks' own data.</li> <li>Publicly available data.</li> </ul> Baseline date: Dec 31, 2014
2. Channels of risk propagation	Methodology	N/A	N/A	<ul style="list-style-type: none"> <li>Network analysis, using Espinosa-Vega and Solé (2010) methodology.</li> </ul>
3. Tail shocks	Size of the shock	N/A	N/A	<ul style="list-style-type: none"> <li>Stress scenario with a credit shock: a severe stress in a bank or a banking system, causing a default on all of its liabilities to domestic institutions or foreign banks.</li> <li>Stress scenario with a joint credit and funding shock when the default of a bank or a banking system also leads to a liquidity squeeze for those institutions funded by the defaulting bank or banking system.</li> </ul>
4. Reporting format for results	Output presentation	N/A	N/A	<ul style="list-style-type: none"> <li>Capital impairment to domestic banking system, number of failed banks, and remaining buffers (at both banking-system level and bank level).</li> <li>Capital impairment to domestic insurance sector, number of failed insurance companies, and remaining buffers (at both sector-wide level and company level)</li> </ul>
Source: IMF staff.				



## References

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