Expert Grup
CENTRU ANALITIC INDEPENDENT

A Diagnostic Analysis of the Moldovan Banking System in the Context of Signing a Deep and Comprehensive Free Trade Agreement with EU

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Chișinău, 2011

This report is published as part of the project “EU-Moldova Relations – Monitoring the Progress within the Eastern Partnership”, implemented by the Independent Analytical Center “Expert-Grup” and the Association for Participative Democracy ADEPT with the financial support of Moldova Soros Foundation.

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1. INTRODUCTION

The banking system is deeply integrated into the national economy due to its double role of granting credits and aggregation of firms' or households' savings. As a result, it is very pro-cyclical, being one of the most vulnerable sectors to various macroeconomic shocks. A Deep and Comprehensive Free Trade Agreement (DCFTA) between Moldova and European Union entails a series of macroeconomic effects which, at least theoretically, should affect the local commercial banks. Hence, the scope of this study is to perform a diagnostic assessment of the Moldovan banking system and to estimate the impact of a DCFTA on commercial banks.

The study is based on a regional comparison with a group of countries: Albania, Belarus, Bulgaria, Croatia, Czech Republic, Estonia, Georgia, Hungary, Kosovo, Latvia, Lithuania, Macedonia, Moldova, Poland, Romania, Russia, Serbia, Slovakia, Slovenia and Ukraine. The comparative analysis was performed with a set of conventional indicators collected from the World Bank and IMF databases. At the same time, we tried to explain the causes of high credit costs, low banking efficiency and systemic deficiencies, as well as other major factors impeding a healthy and dynamic development to the Moldovan banking system. Additionally, the study contains a stress-test analysis of commercial banks to possible macroeconomic shocks generated by a DCFTA with EU.

We employed 2 econometric models which nowadays have a broad application in similar researches. Thus, we used Stochastic Frontier Analysis for measuring the banking sector efficiency and for depicting the main explanatory factors. It estimates cost and profit functions for each bank of analyzed countries. Then, the benchmarking method is used in order to identify the most efficient and inefficient banks. This model allows using a single methodological framework to assess the banks under different cultural, macroeconomic and legal circumstances. Thus, it can determine which of the analyzed factors are statistically significant in explaining the variations in banking efficiency among different countries. The stress-test analysis to macroeconomic shocks is performed using the vector autoregressive model (VAR), through its impulse-response function and forecasted error variance decomposition. Thus, we could estimate and visually compare the impact of various macroeconomic shocks on the quality of banking loan portfolios – the main transmission channel of changes in national economy on the banking system.

The study is structured as follows: the chapter 1 reveals an evaluation of the Moldovan banking sector based on regional comparison using a set of conventional indicators; the chapter 2 analyses the efficiency of commercial banks and its explanatory factors; in chapter 3 we performed a stress-test analysis of the banking system to a series of macroeconomic shocks; the last part is devoted to main conclusions and recommendations for key policy makers in this field.

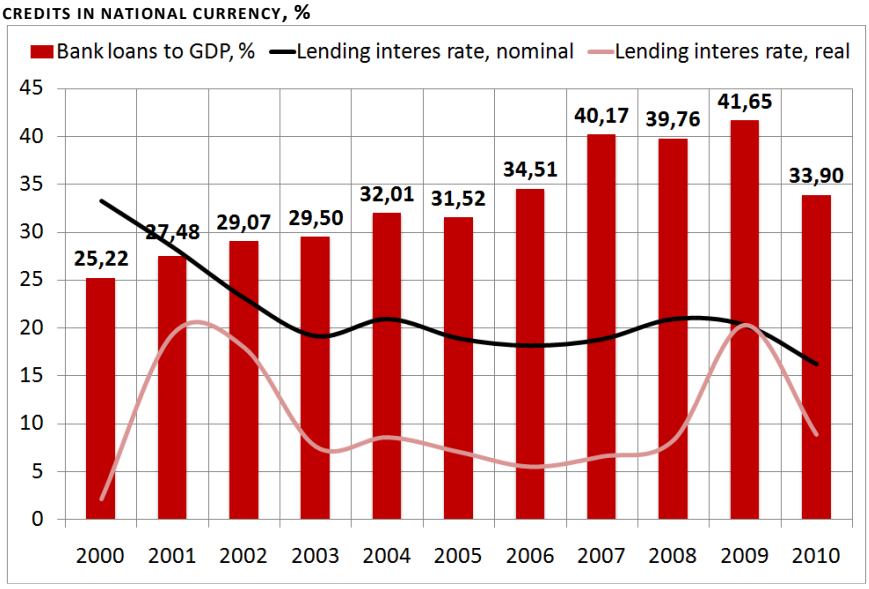
2. A DIAGNOSTIC ANALYSIS OF THE MOLDOVAN BANKING SYSTEM BASED ON A SET OF CONVENTIONAL INDICATORS: REGIONAL COMPARISON

In this chapter we compare the Moldovan banking system situation with other countries from the region. The analysis is performed based on a set of comparable conventional indicators. Thus, we tried to explain the causes of low integration of the banking system into the national economy, of high credit costs and other factors impeding companies' access to banking credits.

Main Trends

Taking into account the pro-cyclical behavior of commercial banks, the positive macroeconomic situation during the period 2000-2008 led to higher penetration of the banking system into the national economy. Thus, the share of banking credits in GDP increased from 25.2% in 2000 to 40.2% in 2007. It shrank to 39.8% in 2008 due to still robust economic growth paralleled with slowing crediting activity on the grounds of tighter monetary policy and worsening of macroeconomic expectations related to the unfolding world financial crisis. Although the movements from 2009 and 2010 seem counterintuitive, it can be explained by the purely arithmetic effect: deep slump in GDP and, respectively, of denominator, led to higher share of credit in 2009 (41.7%); the robust economic revival in 2010 caused the reverse effect and the share decreased to 33.9%. Taking into account the lag with which the banks adjust to new macroeconomic trends, in the following years we expect a consolidation of the banking system penetration into the national economy.

CHART 1. THE SHARE OF BANK LOANS IN GDP, NOMINAL AND REAL INTEREST RATES FOR BANK CREDITS IN NATIONAL CURRENCY, %



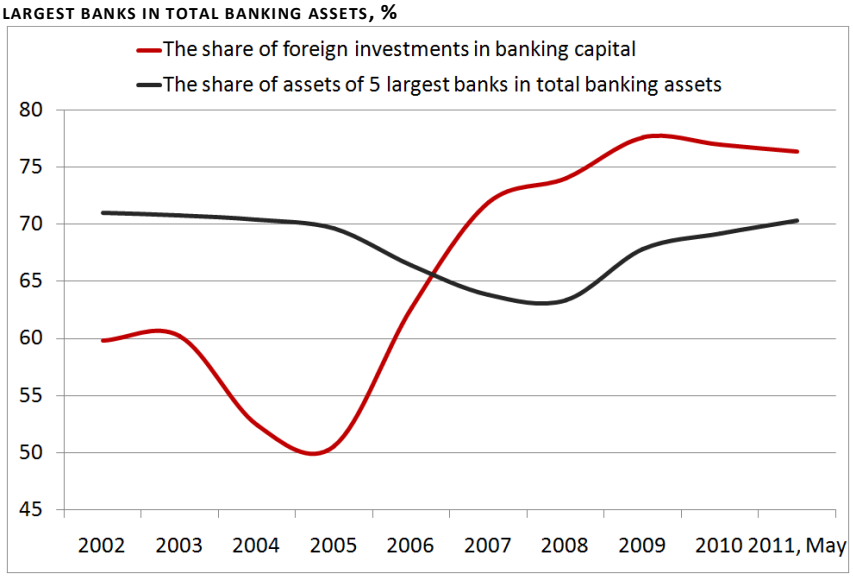
Source: NBM and EG calculations.

According to the Chart 1 the increasing integration of the banking system into the Moldovan economy during the analyzed period wasn't paralleled with a downward trend in credit costs. Thus, in 2003-2008, the lending interest rates remained relatively constant, both in nominal and real terms. During the recession of 2009,

which implied deflationary trends, the real interest rates reached new highs. Due to economic recovery and shrinking risk premiums, as well as still lax monetary policy, in 2010 the nominal lending rates reached the historical low of 16.25%. However, in real terms it was similar to the pre-crisis level. This trend continued during the 1st half of 2011, as the nominal lending interest rates decreased to 14.2%, while in real terms remained still high – 6.5%.

Another major factor which spurred the crediting activity was the intensification of competition in the banking sector, as a result of new international investors entering the market[1]. Hence, the share of foreign investments in total banks' capital increased from 50.6% in 2005 to 76.8% after the 1st half of 2011. At the same time, it made the market of banking services less concentrated: the asset share of 5 largest banks in total banking sector assets constantly decreased during 2005-2008 (Chart 2). However, during the crisis the concentration level reverted to the situation of 2002-2005. It's worth mentioning that it was also determined by the fact that the assets of the bank which bankrupted in 2009 were undertaken by one of the 5 largest banks – BC "Banca de Economii" S.A..

CHART 2. THE SHARE OF FOREIGN INVESTMENTS IN BANKS' CAPITAL AND THE SHARE OF ASSETS OF 5 LARGEST BANKS IN TOTAL BANKING ASSETS, %

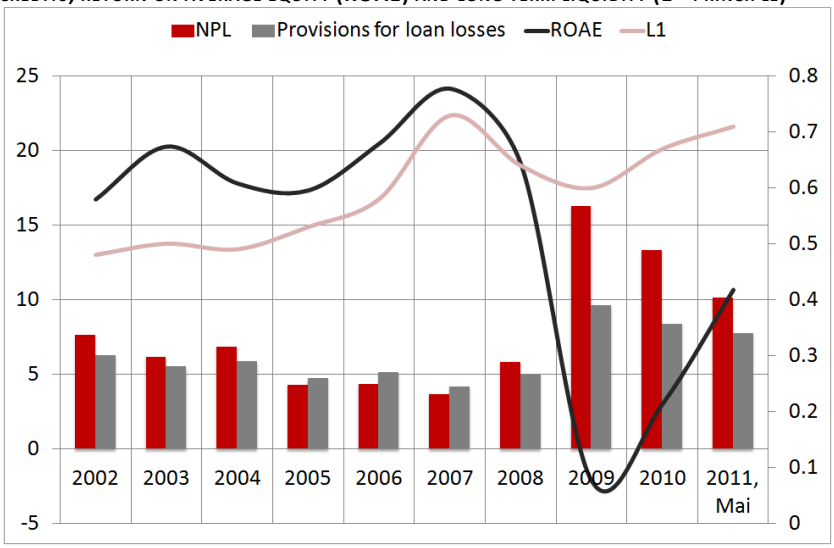


Source: NBM

Obviously, the recovery specific credit expansion fueled the profitability levels which where, also, associated with a slight decrease in liquidity indicators in the banking system. This trend can be considered as a positive one, since the commercial banks remain sufficiently capitalized and their efficiency indicators improved. Additionally, the commercial banks managed to enhance the quality of their loan portfolios, given the expanded balance sheets on the grounds of lending recovery. It was reflected in decreasing share of non-performing loans, as well as loan loss provisions in total credits.

[1] Banca Comerciala Română, owned by Erste Bank, Veneto Vank purchased Eximbank in 2006, Societe Generale purchased Mobiasbanca in 2007 and Unibank was purchased by an austrain investment fund.

CHART 3. THE SHARES OF NON-PERFORMING LOANS AND PROVISIONS FOR LOAN LOSSES IN TOTAL CREDITS, RETURN ON AVERAGE EQUITY (ROAE) AND LONG TERM LIQUIDITY (1ST PRINCIPLE)[2]



Sursa: BNM

The Chart 3 clearly reveals the magnitude of the recent economic crisis repercussions on the banking system, as the quality of loan portfolios registered a 3-fold worsening and the profitability levels halved. This trend was spurred by the critical situation in the wine industry, which accounted an important share of banking portfolios. Since 2010 the situation in the banking sector is constantly improving. However, it still lags behind the pre-crisis level and a lot of effort should be employed before a full recovery will take place.

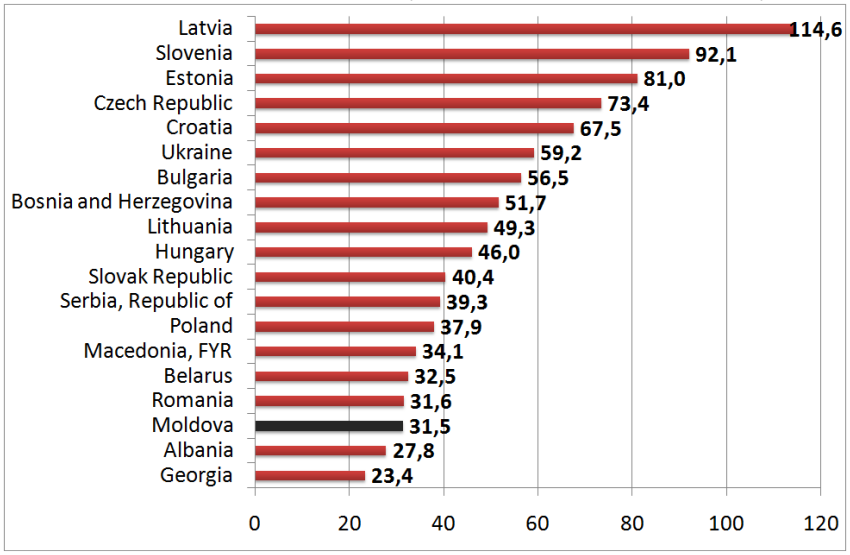
Assessment of the Intermediation Function of Moldovan Banks: Regional Comparison

Financial intermediation is the key function of any bank: aggregation of savings and channeling them to those who need liquidities. Thus, the banks' liabilities (sources of financing) are formed, mainly, of deposits, while the assets (types of investment) – of loans. Therefore, the banking sector usefulness, efficiency and integration into the national economy depends primarily on the speed of converting the savings in investments, as well as on the amount of these resources.

Despite the positive trend registered by the Moldovan banking sector before the crisis, the regional comparison for the period 2004-2010 denotes that it is one of the most poorly integrated in the national economy in the region (Chart 4). It confirms the narrow access of firms and households to banking credits.

[2] An increase reveals a decrease in liquidity level.

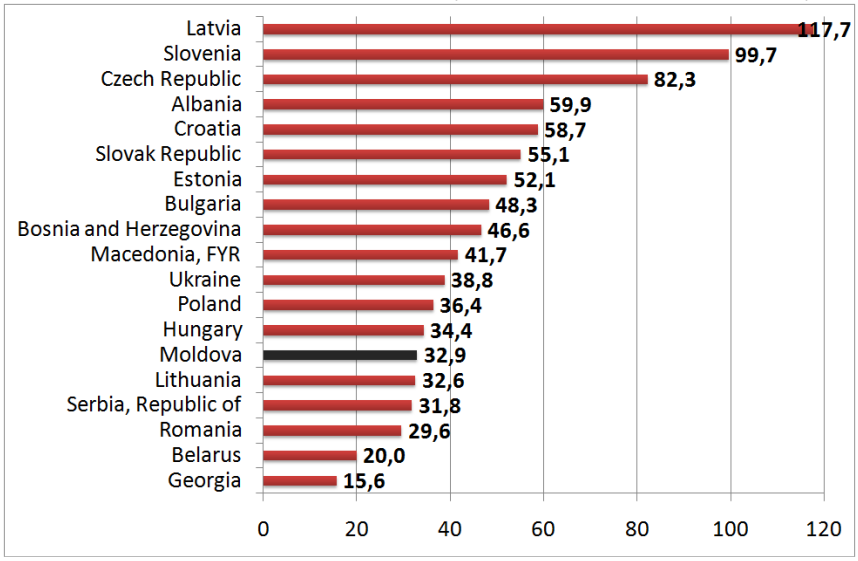
CHART 4: THE SHARE OF BANK CREDITS IN GDP, AVERAGE FOR THE PERIOD 2004-2010, %



Source: IMF, World Bank and EG calculations

Moldova is in a slightly better relative position regarding the share of banking deposits in GDP. However it is still among the lowest in the region (Chart 5). It reveals the limited confidence of firms and households in the banking system, as well as the relatively low level of incomes per capita due to poor and weak economy.

CHART 5: THE SHARE OF BANKING DEPOSITS IN GDP, AVERAGE FOR THE PERIOD 2004-2010, %



Sursa: FMI, calculele EG

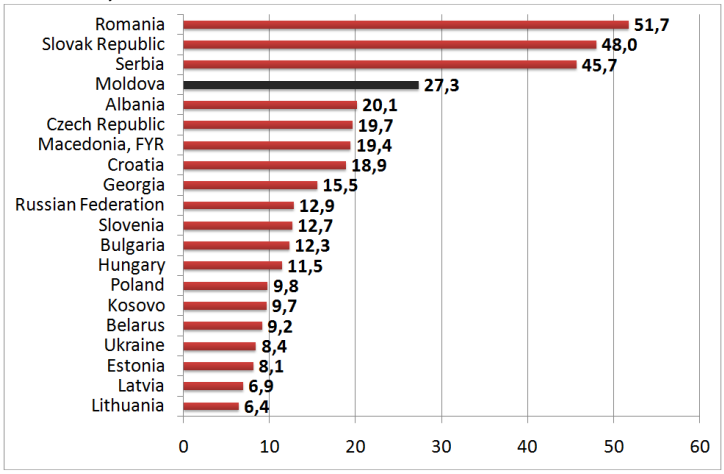
As a result, we conclude that the fundamental problem which hampers the financial intermediation function of Moldovan commercial banks is the reciprocal crisis of confidence: (a) the population's low confidence in the banking system; and (b) the limited confidence of banks in its potential debtors, given the high level of uncertainty and risk. It explains the commercial banks' conservative approach to risk management: strong reluctance in lending activity and keeping the balance sheets as liquid as possible. This conservative approach became even more visible during the recent economic crisis as the banks became even more risk averse. The economic recovery switched the bank's perceptions from bearish to bullish, which resulted into a healthy credit expansion during 2010 and the 1st half of 2011. However, the

problem of limited reciprocal confidence still persist, as the main causes are deeply nested into the systemic deficiencies of the national economy, which are typical for any transition period.

Explaining the Paradox: liquidity abundance paralleled with reluctance to lending

The activity of Moldovan commercial banks is characterized by a paradox: despite the fact that the liquidity level in the banking system is one of the highest in the region the banks are very reluctant in their lending activity (Chart 6). On the one hand, it denotes that the shortage of resources is by far the major cause of such a passive crediting of the real sector. On the other hand, the liquidity abundance can be a result of this reluctance of conservative behavior of commercial banks.

CHART 6: THE SHARE OF LIQUID RESERVES IN TOTAL BANKS' ASSETS, AVERAGE FOR THE PERIOD 2004-2009, %



Source: World Bank and EG calculations

Therefore, this paradox can be easily explained by the systemic deficiencies related to the way how the national economic functions, as well as to the macroeconomic instability and high uncertainty. It makes the commercial banks to be reluctant in their lending activity and households and firms in making deposits.

The main causes of such a poor reciprocal confidence are the following:

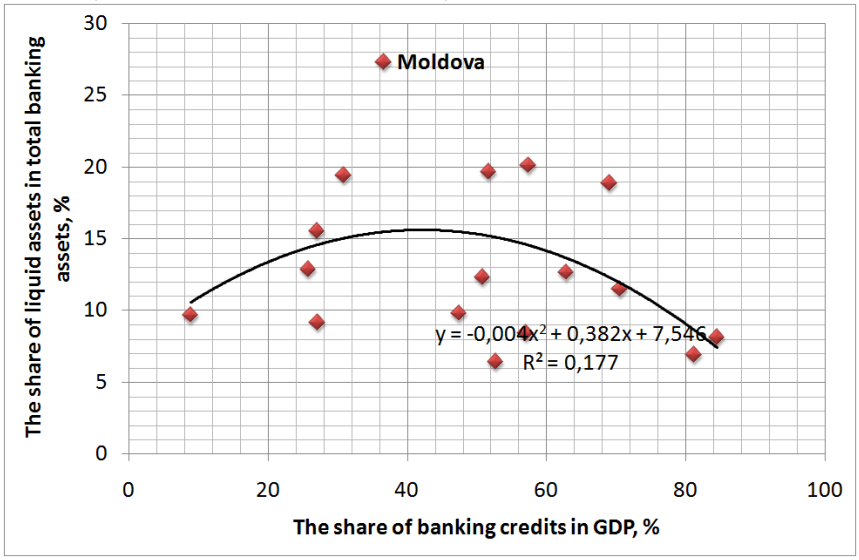
- *Macroeconomic instability,* which is confirmed by the fact that the standard deviation of GDP deflator for the period 2004-2009 in Moldova was one of the highest in the region (4.8% in comparison with the mean of 3.4%). This factor is amplified by the political instability, especially starting with 2009 till onwards.
- *Burdensome procedures for collateral execution.* In case of debtor's insolvency, the commercial banks waste a lot of time facing over-bureaucratized procedures for collateral execution which, by definition, favors the debtor. Particularly, it is caused by the possibility to attack the court decisions to hierarchically higher judicial instances. As a result, banks are very rigid about collateral requirements and apply high risk premiums to cover these losses.
- *Absence of well-functioning credit history bureaus* amplifies the impact of macroeconomic instability and deficiencies of local judicial system on banks' reluctance to their lending activity. Thus, the lack of a single database of credit histories of potential debtors makes the commercial

banks to give preference to bigger companies with ample and stable cash flows and, obviously, with positive credit history at the particular bank. At the same, the small and medium enterprises remain marginalized due to obvious reasons.

- *Inefficiency of banking activity* which is one of the highest in the region (see the chapter "Efficiency of Moldovan Banks: A Regional Comparison").
- *Poor management of most companies applying for banking credits.* It undermines their profitability and, respectively, their credit absorption capacity without getting overly indebted (financial leverage effect). At the same time, very often the banks receive low quality credit proposals and business plans, lacking objective estimations of cash flows, market analysis and marketing strategy etc. As a result, the banks face higher risks, fueling the risk premiums and, finally, credit costs. Very often the banks simply reject such proposals. Again, this is mainly related to small and medium enterprises.

The Chart 7 reveals how far is Moldova comparing to other countries in the region, regarding the tradeoff between liquidity abundance and banking sector penetration in the national economy. It corroborates once again the idea that Moldovan banks are extremely reluctant in their lending activity and very conservative in their risk management.

CHART 7: CORRELATION BETWEEN THE BANKING LIQUIDITY LEVELS AND BANKING SYSTEM INTEGRATION INTO THE NATIONAL ECONOMY, CROSS-SECTIONAL DATA FOR THE REGIONAL COUNTRIES, AVERAGE FOR THE PERIOD 2004-2009, %



Source: EG calculations based on the World Bank data

At the same time, it's worth mentioning that this conservative behavior of commercial banks makes the system more immune to potential crises. Thus, the liquidity surplus serves as an airbag which mitigates the repercussions of exogenous shocks. The latest and the most plausible case is the economic recession from 2009 which had much milder effects on the Moldovan banking banks in comparison with most European countries. It confirmed that the level of integration of the banking sector into the national economy amplifies their pro-cyclical behavior. Thus, in Moldova case it acted as a barrier for a more healthy growth during the period 2000-2008 (which, for example, could imply more investments), while during the recent economic crisis it did not allow for a dramatic and persistent recession of the sector. At the same time, such a strong capitalization level will make the banking sector immune to possible negative shocks caused by a DCFTA with the EU (see chapter "A

Stress-test Analysis of the Moldovan Banking Sector to Potential Shocks caused by a DCFTA with EU").

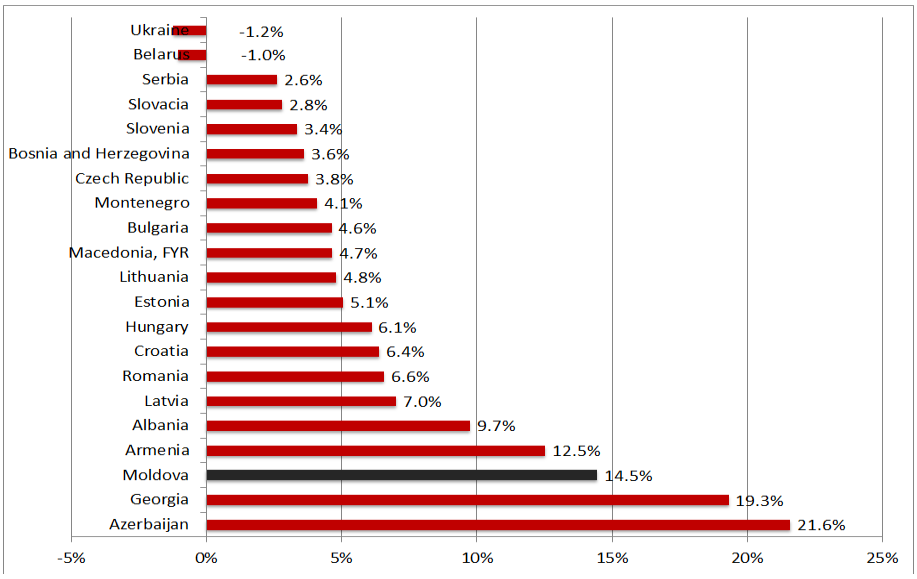
The causes of high credit costs

The high costs of the credits in Moldova remains a much discussed issue, primarily within the domestic business community which faces real difficulties in spotting sustainable sources of financing for their entrepreneurial activities. We will discuss the main causes of the high credit costs in Moldova in what follows.[3]

Cause no. 1: The cost of resources

The cost of attracted resources remains one of the highest in the region even after of the crisis. Moldova has one of the highest real interest rate in the region (Figure7 8). This has a direct impact on the high costs of financing for the banks, which being constrained to pay high interest on the deposits they seek projects with above average returns. This is an explanation for the high flow of resources directed towards financing trade activities rather than agricultural or small scale production activities. The concentration of the credits in certain sectors of the national economy, mainly in the sectors exposed to external shocks, determines the pro-cyclical nature of the banking activity. The pro-cyclicality has been attested mainly during the 2007-2009 crises. For some of the banks, with large exposures to the construction and trade sectors, the results were beyond the limits of a forecastble framework, and have tarnished the reputation of the whole banking sector, which by itself has a rather low degree of credibility among the population.

FIGURE7: AVERAGE REAL INTEREST RATES OF THE ANALYSED COUNTRIES FOR THE 2008-2009 PERIOD



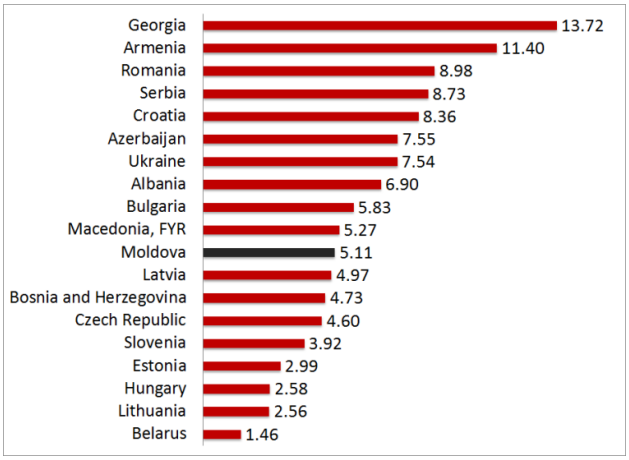
Source: World Bank and EG computations

Cause no. 2: Profit margin and competition

[3]The analysis is based on a previous study: "De ce creditele bancare sunt scumpe în Moldova și care sunt soluțiile?", Expert Grup, 2011, http://www.expert-grup.org/?go=biblioteca&n=182

Another important factor that determines the final price of the credits that is the profit margin at which it aims at. Obviously, the profit margin depends on a few factors, the most important being the degree of competition among banks in the process of deposit accumulation and credit issuance.

FIGURE 8: INTEREST RATE SPREAD: LENDING RATE MINUS DEPOSIT RATE, %, AVERAGE FOR 2004-2009 PERIOD



Source: World Bank and EG computations

The average interest rate spread for Moldova for the 2004-2009 period, Figure 8, is close to the mean for the analysed countries. This indicates that the degree of banking competition in Moldova is comparable to that of the analysed countries, particularly to Macedonia, Bulgaria, Latvia, Bosnia and Herzegovina and Czech Republic. Thus, from this point of view the Moldovan banks do not have any advantage or disadvantage. The same finding is supported by the analysis of the market concentration ratio as depicted by Herfindahl-Hirschman index[4].

However, for a complete image of the degree of competition on the domestic banking market we will estimate the H index, the so called Rosse-Panzar index.[5] The Rosse-Panzar index is nothing else than the sum of price elasticities from the following econometric relationship:

$$lnR = const + \beta_1 * lnw1 + \beta_2 * lnw2 + \beta_3 * lnw3 + \varepsilon$$

where:

- lnR – log of gross profit
- lnw1 - the ratio between interest costs and deposits
- lnw2 – the ratio between expenses on personnel and total assets
- lnw3 – the ratio between other operational expenses and fixed assets

A sample of 14 domestic banks with yearly observations for the period 2000-2009 was used. Thus a balanced panel is used and the model is a simple panel regression with fixed effects. The results of the regression are the following:

[4] Ibid

[5] In (Rosse & Panzar, 1987) the authors propose an econometric test to establish the level of competition in a given industry using the reduced form of the revenue function. The authors proposed the estimation of the function and the measurement of the impact of a change in input prices on the revenue of the companies. A value close to 1 for the estimated elasticities denotes a strongly competitive market. Whereas a value of 0 indicates, on the opposite, that the competition in the industry is very low or inexistent.

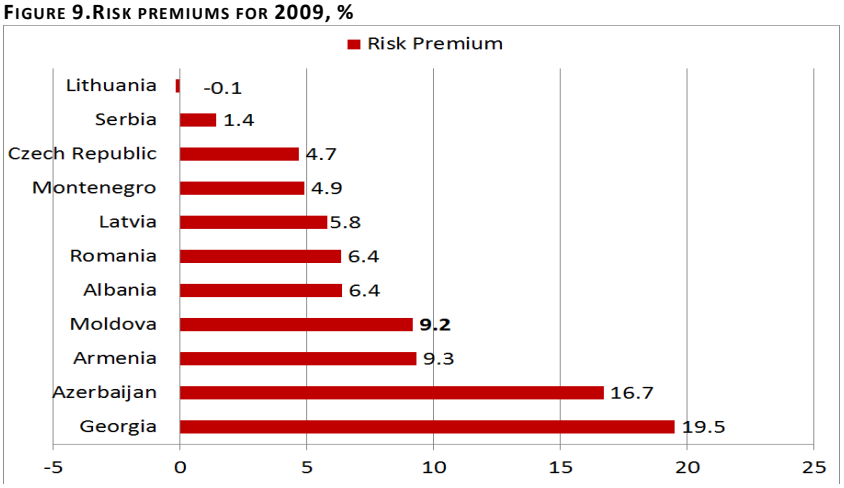
	Coeficientul	std. error	t-ratio	p-value
Const	17.6403	0.830004	21.25	2.76e-044***
w1	0.704596	0.133222	5.289	5.02e-07***
w2	-0.607123	0.181320	-3.348	0.0011***
w3	0.163280	0.127190	1.284	0.2015

The H statistic is computed summing up the elasticity of the prices from the above model. Thus the value we obtain is H=0.26 which statistically is equal to zero[6]. This value indicates that the degree of competition in the domestic banking sector is rather low. Theoretically a value of the index 0<H>1 indicates a monopolistic competition, H<0 indicates a monopoly or a perfect cartel, while a value close to one indicates a perfect competition. Thus, the estimated degree of competition is rather low, with the domestic banking industry resembling a monopolistic market. This conclusion comes in contradiction to the one formulated using the Herfindahl-Hirschman index and this is because the HH index is not sensible to the evolution of the prices of bank inputs and their impact on the revenue of the banks. This value for the Rosse-Panzar index could be the result of some environmental factors or some vicious and opaque practices which would have to be investigated by the corresponding authorities.

Cause no. 3: Risk premium

The financial intermediation activity is inherently a risky activity due to a multitude of objective as well as subjective factors. Contract imperfection, asymmetric information, moral hazard and issues related to delegation and supervision of the employees of the bank by the management are just a small part of the whole lot of imperfections that the bank management has to face on a daily basis. Moreover, each bank is exposed to three broad categories of risks: credit risk, market risk and operational risk[7]. These risks determine the ultimate price for the products offered by the banks. In the Moldovan banking sector, as well as in almost all the banking sectors around the world, the credit risk accounts for, on average, 60%-80% from the total exposures of a bank. In this context the analysis of this component of the banking risk is compulsory.

FIGURE 9.RISK PREMIUMS FOR 2009, %



Source: World Bank and EG computations

[6]F (1, 131)= 1.03 and p value =0.31.

[7]These risks are defined and broadly discussed within the Basel II framework.

Figure depicts that for 2009 the Republic of Moldova had among the highest risk premiums in the region, Azerbaijan and Georgia being the only countries with higher premiums[8]. The domestic banks try and temper the expansion of the credit portfolio during the crisis and high uncertainty by demanding higher payoffs for higher levels of risk. At the same time this signals the lack of credibility between the creditors and the debtors, an issue discussed previously. Finally these premiums are included in the final price for the credits which ultimately affects the accessibility of the later.

[8]Risk premiums are computed as the difference between average interest on credits minus average interest on VMS

3. EFFICIENCY OF MOLDOVAN BANKS: A REGIONAL COMPARISON

Bank efficiency and its determinants have important implications for the regulatory and supervisory bodies in the process of reform and legal framework adjustment to the international standards and norms as well as in the diagnostic of the main problems that the banking system faces. Moreover bank efficiency is also an indicator of managerial capabilities of the banks as well as an indicator of general economic maturity. This study will allow us compare the efficiency of the domestic banks with those from the neighbouring countries. The comparison accounts for macroeconomic, political, legal and such microeconomic factors as the ownership structure, risk profiles and financing sources.

Methodology and Data

For a comprehensive understanding of the methodology we will define two concepts of efficiency: *cost efficiency* and *profit efficiency*. For cost efficiency we aim at minimizing them in the production process while for the profit efficiency we investigate the ability of companies to obtain maximum profits by providing a certain level of products and services using a given amount of inputs at given prices. Thus, the profit efficiency comprises both, the ability of a company to maximize sales and the ability to minimize the production costs. To determine the best performing banks which either attain the cost or the profit efficiency frontier we will employ the econometric method called Stochastic Frontier Analysis (SFA).This means that we have to estimate an efficiency frontier against which we will benchmark each bank individually. Thus, the estimated frontier depends on the individual sample of selected banks and might vary depending on its composition.

The most important advantage of this method is the comparability of efficiency scores of banks regardless of the size, country of origin, corporate structure, business model or the environment in which it activates. Moreover the method allows us determine the main causes of differences in efficiency and thus enables us to make regulatory as well as economic policy recommendations. However it has the disadvantage of computational complexity which also makes it susceptible to misspecifications.

To define the cost and profit functions of a bank we will use the following data regarding the cost of the resources and quantity of offered products and services.

- TC – total costs, the sum of interest expenses and non-interest expenses (thousands USD);
- PRO – operational profit (thousands USD);
- y1 – credit portfolio (thousands USD);
- y2 – Securities (thousands USD);
- y3 – Deposits (thousands USD);
- w1 – the ratio of personnel expenses to total assets;
- w2 – the ratio of operational expenses to total fixed assets.

Credit portfolio, securities and deposits are divided by total assets for normalization purposes and treatment against heteroskedasticity. We took the logs of all variables and computed the cross-products: y1y2, y1y3, y1w1, so forth. The last operation allows us to determine the interaction between different outputs as well as the outputs and input prices. Thus we can determine whether the outputs are complementary to each other. The „PRO" variable computation has been treated in the following manner in order to face the negative value issue. The minimum value for the entire sample was determined and then the following formula was applied:

$$PRO_i=\ln((pro_i+abs(\min(pro_i))+1)/\text{Total Active})$$

Thus we were able to include banks with losses in the regression[9]. The choice of the following outputs and inputs is in line with the „value added" theory which treats deposits as a bank output.[10] According to this theory the deposits can be counted as outputs because banks incur considerable costs, personnel expenses and financial, interest expenses.

Along with the traditional cost and profit function variables we will include some environmental and bank specific variables which will help us differentiate between the banks from different countries and individual characteristics. Their description is as follows.

Bank specific variables

- *GOV – represents the ownership structure and takes a value of* 1 (one) for banks owned by the government and 0 (zero) for privately owned banks - (source: Bankscope);
- *EQAS – equity to asset ratio* – is an indicator of banks' capacity to generate liquidity and their risk profile. The banks with a higher ratio being considered risk averse and conservative in their investment activity (source: Bankscope);
- *D_Assets* –asset growth ratio year over year – can be interpreted as managerial aggressiveness of a bank and its competitive ability (source: Bankscope);
- *D_Loans* –annual loans growth rate - as in the case of assets, it indicates the competitive edge of a bank (source: Bankscope);
- *L_D* – credit deposit ratio – the ability of banks to transform deposits into credits that is, to exercise the intermediation function and to create liquidity in the economy (source: Bankscope).

Country specific variables:

- *LIR* – nominal interest rate – allows us differentiate among countries with different financing costs. Theoretically, a higher nominal interest rate would imply higher costs for the banks, and, respectively lower efficiencies (source EBRD). A high interest rate could also have adverse effects on the risk management processes of a bank as it leads to increased uncertainties which could hamper the unbiased appraisal of the debtors;
- *IEBRD* – banking sector reform index – published in EBRD Transition Report. The index can take values within the 1 (one) to 4 (four) range, where 1 represents a socialist type, unreformed banking system while 4 represents a banking system with genuine market economy characteristics and complies with the regulatory and supervisory standards set by Basel Committee;
- *D_C_P* –private sector credit ratio expressed as the ratio of credits granted to the private sector to GDP (source EBRD);
- *Branches* –number of bank branches for 100000 adults, represents banking infrastructure of a country and the accessibility of banking services (source IMF, Financial Accessibility Survey). An under-developed network of branches could have as a consequence higher costs in the process of deposit mobilisation and credit issuing.
- *GDP* –per capita Gross Domestic Product expressed in USD (source IMF, World Economic Outlook). This indicator is a proxy for general level of development of a country, including institutional level of development and the quality of human capital.

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[9]For the function specification and a thorough discussion of the methodology see Annex A.

[10]SeeBerger, Hanweck and Humphrey (1987).

All the individual data for the banks was extracted from Bankscope, which represents a database covering 90% of banks internationally. The collected data which is included in this database are standardized, inflation adjusted and adjusted to any differences that might appear among different jurisdictions. Thus, we aggregated data for 430 banks from 22 countries for 2008; 9 banks from Albania, 18 from Armenia, 18 from Azerbaijan, 18 from Bosnia and Herzegovina, 22 from Bulgaria, 18 from Belarus, 21 from Czech Republic, 6 from Estonia, 12 from Georgia, 29 from Croatia, 27 from Hungary, 8 from Lithuania, 19 from Latvia, 14 from Moldova, 7 from Montenegro, 13 from Macedonia, 36 from Poland, 26 from Romania, 3 from Serbia, 18 from Slovenia, 18 from Slovakia and 43 from Ukraine.

We chose 2008 for the analysis as the data for 2010 was not available for the majority of banks while 2009 was a crisis year which had disproportionate effects on different banking systems which might had had undesirable implications on the final results of the analysis.

A remarkable characteristic of the dataset is its heterogeneity both in terms of the banks' size; the smallest bank has assets in amount of USD 5.5 million compared to USD 50 billion for the largest bank, and in terms of profit profile, the biggest loss being USD 280 million and the highest profit being USD 1.34 billion. On average the banks from the sample posted a profit of USD 43.58 million with a standard deviation of USD 136.5 million, which additionally confirms the heterogeneity of the sample in terms of operational performance. The same difference is valid for the credit portfolio, securities portfolio as well as personnel expenses, operational expenses, fixed assets and other categories. The country profiles are also varied and comprise countries with a high degree of liberalization of the banking market such as Czech Republic (with a bank reform index of 4.5), and countries with a centralized system as Belarus (with a value of 2). The nominal interest rate has a high variation as well, a minimum of 5.7% for Slovakia and a maximum of 21.2% for Georgia. The ratio of credits granted to the private to GDP highlights Azerbaijan and Estonia as countries with the lowest and highest ratios (16.5% and 91.7%) respectively. Number of bank branches to 100000 inhabitants has a mean value of 27 for the entire sample, with extreme values of just 3.73 branches per 100000 inhabitants for Ukraine and 92.56 for Bulgaria.

The heterogeneity of banks and of the environment in which they operate would enable us determine the factors that affect the bank efficiency and would also allow us formulate recommendations in the establishment of certain benchmarks in the process of legal framework reform and adjustment that should diminish the inefficiencies in the system.

Profit efficiency analysis

The results of the regression for the profit function are presented in Annex B. The estimated elasticity coefficients reveal a few interesting economic aspects. First, none of the elasticities of the outputs or input prices is significant, although the signs are as expected (with the sole exception of the sign of y2 - „securities"). Nevertheless some of the cross-product variables are significant. Thus y1y2 has a value of0.22 and indicates that there are scope economies arising from diversification, investment in credits and securities. In the same time an elasticity of -0.04862 of the cross product between the price of the fixed capital and the securities portfolio indicates that a rise in the price of fixed capital crowds out investment in securities.

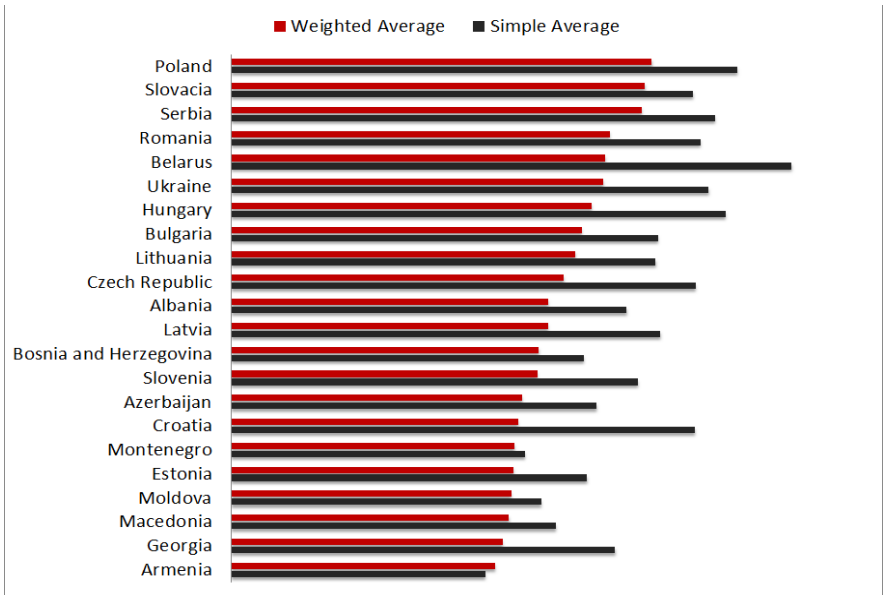
Analysing the factors that can affect the value of profit efficiency of banks the following remarks have to be made. The ownership structure dummy variable (GOV) has a negative impact on the profit efficiency, although this specification yields an insignificant coefficient from a statistical point of view. The equity to assets ratio is

positive and significant. An increase of the ratio, leads to an increase in the bank's profits, although not necessarily to an increase in efficiency. This result seems counter-intuitive at first. Apparently the banks with a lower ratio and thus more aggressive in their investment strategy should have higher profits. The only explanation for such a result is that 2008 might have already been a crisis year for some of the banks, and thus, banks with a more conservative management and expansion strategy had better results than their more aggressive counterparts. Hence, the coefficient indicates that a higher ratio of equity to assets could be beneficial for the bank's profitability. Moreover these banks could serve as stability pillars for the entire banking system.

The asset growth coefficient (D_Assets) and that of credit portfolio growth (D_Loans) have no significant impact on the profit efficiency of banks, as well as the nominal interest rate (LIR), the ratio of credits granted to the private sector (D_C_P), ratio between credits and deposits (L_D) and the number of branches per 100000 inhabitants (Branches).

The only statistically significant coefficients in the regression are (IEBRD) and (GDP) which represent the index of banking reform and the GDP per capita respectively. Both of them are negative which means that a banking system from a developed country with a liberalized banking market has on average banks that operate at lower profitability ratios but at higher profit efficiency. This can be explained through the high degree of competition among banks and their willingness to operate at low profit margins than banks from countries with distorted banking market structures. In the same time the fact that banks from more developed countries have lower profits than banks from developing countries also hints to potential structural problems and the urgent need to address them through comprehensive reforms.

FIGURE 11: PROFIT EFFICIENCY SCORES



Source: Authors' computations based on Bankscope data

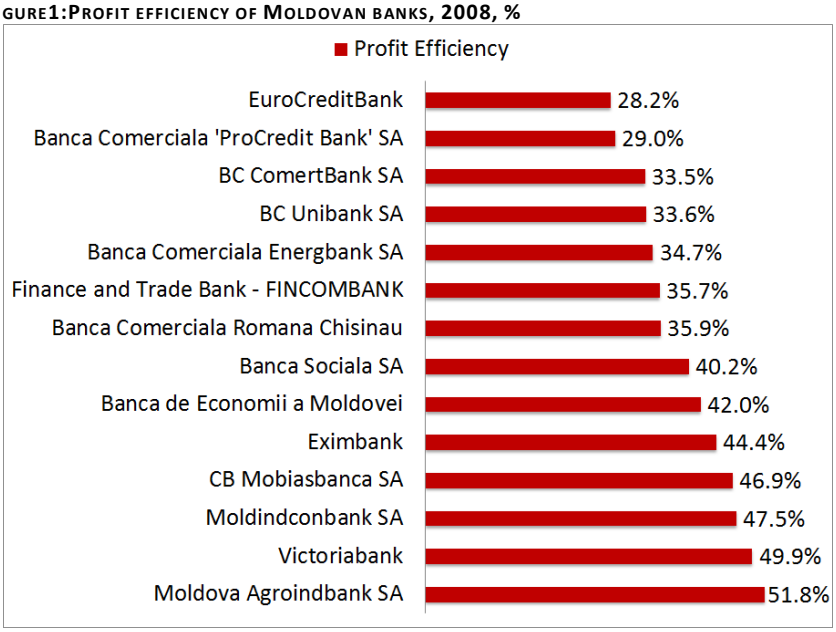
Profit efficiency scores by country are presented in Figure 11.For comparison and analysis two scores were used: total assets weighted efficiency and simple average efficiency. Weighted efficiency has the advantage of reflecting in an unbiased way the profit efficiency of certain banking systems taking into account the weight each bank has in the system. The simple average is just a comparison tool that has to help us determine the banking systems in which the large banks have a better performance.

From the figure we can easily infer that the Moldovan banking system is among the most inefficient in terms of profit efficiency. In 2008 the weighted score was only 43.74%, being comparable with Armenia (35.84%), Georgia (38.3%), Estonia (39.85%), Montenegro (41.44%), Croatia (40.47%) and Macedonia (45.83%).

Among the countries of Central and Eastern Europe but that are not EU members Moldovan banking system lags behind in terms of profit efficiency. Thus such banking systems as Albanian, Bosnian, Croatian, Serbian and Ukrainian have higher profit efficiency than the Moldovan banking system. At the same level with the Moldovan banking system are the Macedonian and that of Montenegro. If we compare the domestic banking market with that of the countries of Central and Eastern Europe, but members of the EU, the picture is even worse. Moldova has the most inefficient banking system in the region. This conclusion is worrisome the more so in the context of EU accession. If, on the other hand, we discuss the efficiency of the Moldovan banking system in comparison with the countries of the Eastern Partnership the situation is less clear, although even among these countries Moldova does not excel with a banking system with profit efficiencies above the average.

At an individual level, for the Republic of Moldova the difference between the weighted average and the simple average is approximately 8 percentage points that is larger banks have higher profit efficiency. This is also confirmed by Figure 12. Hence, larger banks have higher efficiency than smaller banks. The only exception is EuroCreditBank which scored a profit efficiency of 44.38% and is among the most efficient banks. The most inefficient banks in 2008 were BCR Chişinău and BC "ProCredit Bank" with 28.24% and 28.99% respectively. The rest of the small and medium banks are among the worst performers according to the efficiency scores.

FIGURE1:PROFIT EFFICIENCY OF MOLDOVAN BANKS, 2008, %



Source: Authors' computations using Bankscope data

Cost Efficiency

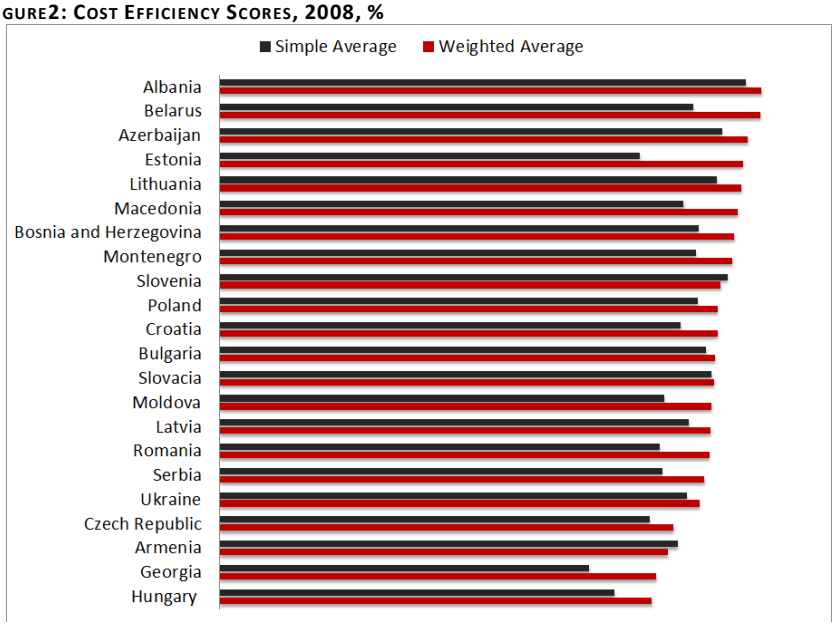
The results of the regression are presented in Annex B. The elasticity coefficients of the outputs are all statistically significant. The elasticity coefficient of the credit is 0.23899, of the securities is 0.22101 and of the deposits is0.76716. It is remarkable that the deposit accumulation is the costliest of the activities for the banks, the deposits having the biggest elasticity coefficient. Some of the cross product term are also significant and have an intuitive interpretation. The product between securities and deposits yields a positive and significant value (y2y3 – 0.03) which indicates that

the combined production of these two outputs leads to higher costs, and that the resources obtained through the deposits have to be found a better allocation than security investments. The other terms of the trans-logarithmic function show that an increase in the offered products and services can be attained only by an increase in the price paid for the human capital or by expanding the fixed capital through new purchases of offices and enlargement of the existing space. Moreover, the negative sign of w1w2 term indicates that banks make a sensitive distinction between personnel and fixed capital expenses, depending circumstances. Thus the increase of personnel expenses in one period crowds out the expenses on fixed capital and vice versa. There is, hence, some kind of substitution between human and fixed capital that a bank holds.

Among the factors that affect the cost inefficiency only two terms are noticeable. The first one is the ownership structure (GOV) which has an elasticity of 0.00097, positive and significant on a 99% confidence level. Although the coefficient is rather small, the conclusion is that banks held by states incur higher costs than privately owned banks, and have higher cost inefficiency.

The last coefficient that yields significance in the regression is the index of banking reform of EBRD (IEBRD). For the cost function as in the case of the profit function the coefficient has a negative value and is significant. It yields a value of -0.28027 and indicates that an increase of the index leads to a decrease in the incurred costs by banks. Thus liberalized banking systems and those that apply the Basel II recommendations have more efficient banking systems than the rest. This conclusion points out the direction in which the reforms have to be carried out by the majority of banking systems that are in transition.

FIGURE2: COST EFFICIENCY SCORES, 2008, %



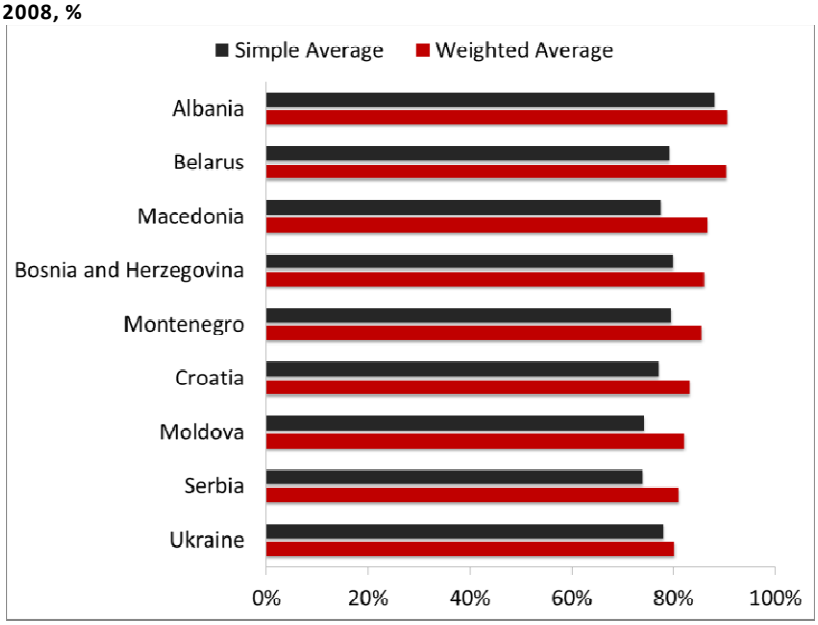
Source: Authors' computations using Bankscope data

According to the mean values of cost efficiency Moldova has a weighted score of 82.17% and a simple score of 74.27%. That is, Moldovan banks attain the average value of cost efficiency for the entire sample (the mean values for the sample being 82.75% and 77.31% respectively). (Figure23)

However, when we compare the average efficiency score of Moldovan banks with those from Central and Eastern European countries which are not EU members we find that Moldovan Banking system is among the worst performers (Figure34), being

the 3rd worst. Thus Albania, Bosnia and Herzegovina, Croatia, Montenegro and Macedonia, all have higher cost efficiency scores than Moldova.

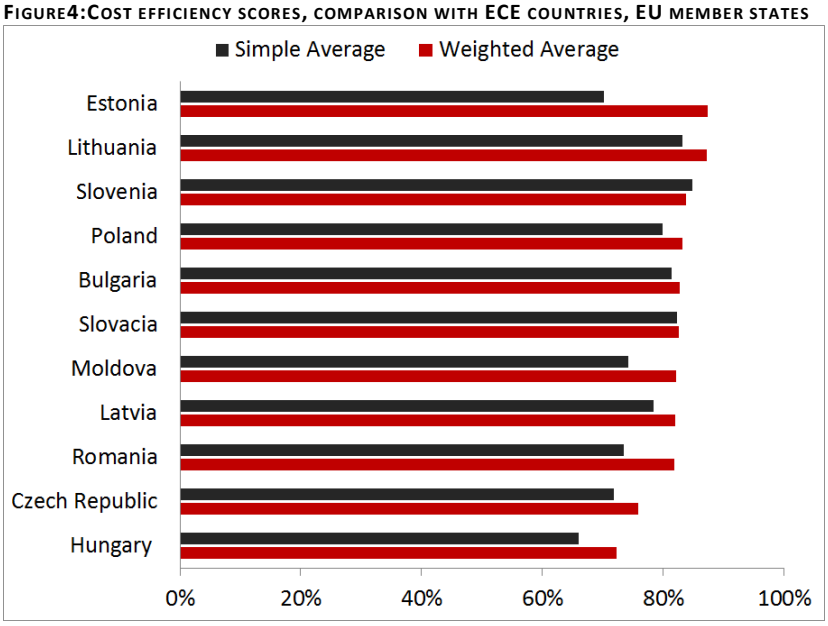
FIGURE3:COST EFFICIENCY, COMPARISON WITH ECE COUNTRIES, NON-MEMBER STATES, FOR 2008, %



Source: Authors' computations using Bankscope data

When analysing the performance of the Moldovan banking system with that of the countries from Central and Eastern Europe members of the EU we find that the scores are among the best in the region (Figure 15). From this point of view Moldovan banks are performing as well as Bulgarian, Latvian, Polish, Romanian and Slovak banks.

FIGURE4:COST EFFICIENCY SCORES, COMPARISON WITH ECE COUNTRIES, EU MEMBER STATES



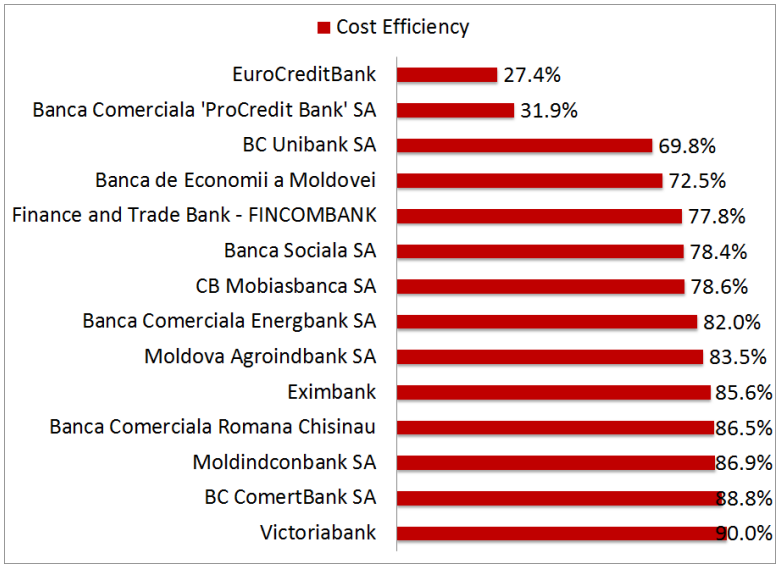
Source: Authors' computations using Bankscope data

Among the countries of the Eastern Partnership Moldova is a leader in terms of bank cost management, being ahead of Armenia, Georgia and Ukraine and behind

Azerbaijan and Belarus. We can thus affirm that Moldovan banks yield average efficiency scores comparable with the European mean, which is a positive finding.

Individual banks scores of Moldovan banks (Figure 16) yield some special attention.

FIGURE5: COST EFFICIENCY SCORES OF MOLDOVAN BANKS



Source: Authors' computations using Bankscope data

Figure 16 depicts a rather bad performance of the Banca de Economii S.A. which is among the worst in terms of cost management (a score of just 72.55%). This indicates that the management of the bank could increase the level of its outputs by approximately 27.45 percentage points maintaining the costs at the same level. This conclusion bears high significance given that the state owns the bank.

In conclusion, the Moldovan banking system has significant deficiencies in the process of profit generation. The whole system could possibly up to 50 percentage points more profits using the same amount of resources, but just intensifying the use of the capital at its disposal. The conservative banks, with a higher than average equity to assets ratio, have a particular potential in this sense. A part of the profit inefficiency can also be explained by the existence, in the process of cost management of a rather high level of inefficiency. According to the results we can say that the Moldovan banking system could produce the same level of products and services by lowering the production costs by approximately 18 percentage points.

Moreover, these results indicate that there is a rather high potential for improvement of the performance of the national banking system by following the European standards. The most important factor that could boost the national banks' performance to new levels is the liberalization of the banking system and the facilitation of free competition among the banks. This will shrink the profit margins but would ensure a higher level of efficiency of profit generation.

The analysis also finds that the government should give up its banking assets, which would again lead to an increase in efficiency, both cost and profit efficiency. A prospective ALSAC with EU would determine banks to switch from purely quantitative methods of risk measurement to qualitative methods which would free additional capital for new higher return investments. Moreover the qualitative methods of risk management would allow banks more flexibility in its estimation, which could boost new bank products and finally the development of the national capital market.

4. A Stress-test Analysis of the Moldovan Banking Sector to Potential Shocks Caused by a DCFTA with EU

Due to its financial intermediation function (aggregation of population's savings and fueling the economy with liquidities), the banking sector is, by definition, the most vulnerable sector to economic cycles. Therefore, in this chapter we will test the banks' reactions to various macroeconomic shocks (real sector, monetary policy, inflation, exchange rate, foreign demand and fiscal policy). In this way, we could estimate the impact of a potential DCFTA between the Republic of Moldova and European Union on the banking system.

Methodology and Data

A DCFTA between our country and EU implies a series of macroeconomic effects: strengthening of the national currency, decrease in prices, shrink in public revenues, boost in light industry and exports to EU and development of the economy as a whole[11]. Since the credit risk is the most important banking risks, the stress-test analysis will be performed taking into account the quality of loan portfolios. It is denoted by the share of non-performing loans in total bank loans. This indicator is used in a large number of similar studies as a proxy for the default rate. For example, in case of a recession registered in a sector accounting for a significant share in banking loan portfolios, the debt repayment becomes troublesome for the affected companies, which turns into higher share of bad loans and losses for creditors.

The simulation of macroeconomic shocks is made with the vector autoregressive (VAR) model. This econometric technique is one of the most popular methods for time series analysis and forecast. VARs are formed of a system of simultaneous equations in which each variable is regressed on its lagged values and the contemporaneous and lagged valued of all other variables included in the system, all of them being endogenous. The regression results can be analyzed through the impulse-response function which illustrates how the shocks are spread through the entire system of equations. Annex B contains a detailed description of this model.

We employ monthly frequency data for the period 2005-2010. The share of non-performing loans in total loans (NPL) reveals the quality of credit portfolios and the financial health of commercial banks. This is the core indicator which will measure the banking system sensitivity to a set of macroeconomic shocks[12] which are expressed in the following variables:

- *GDP_gap*: Difference between GDP and its potential level, y-o-y growth rate. The potential GDP is defined as the maximal GDP the economy can generate without causing inflationary pressures during a certain period of time. It is proxied by the detrending the time series of y-o-y growth of current GDP with the Hodrick-Prescott filter (λ=14400). Source: National Bureau of Statistics.
- *Comert:* Monthly retail sales by commercial units can be used as a proxy for domestic trade. It is expressed in y-o-y growth. Source: National Bureau of Statistics.

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[11] "Free Trade Agreement between the Republic of Moldova and the European Union: Feasibility, Perspectives and Potential Impact", Expert-Grup, 2009.

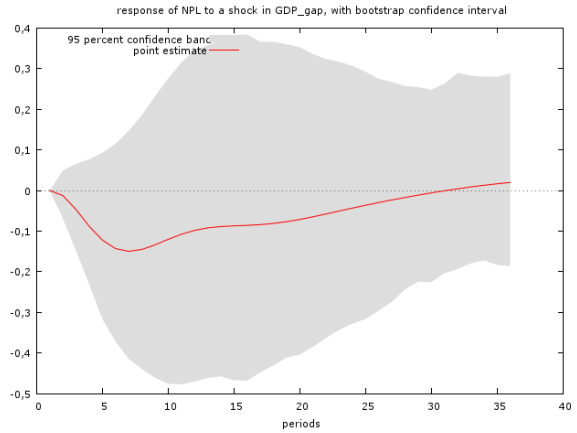
[12] Similar approaches were employed by Baboucek & Jancar (2005), Filaso (2007), Marcucci & Quagliariello (2005), Roy & Bhattacharya (2011).

- *Servicii:* Monthly volume of services (with charge) supplied to population by firms. The indicator is used as a proxy for the state of the services sector and is expressed in y-o-y growth. Source: National Bureau of Statistics.
- *IPI:* Industrial production index – stands for the evolution of the local industrial sector. It is expressed in y-o-y growth. Source: National Bureau of Statistics.
- *Agr:* Agricultural production index – stands for the evolution of the agricultural sector. The data were interpolated using the quadratic-match average procedure in order to transform the quarterly into monthly frequency. It is expressed in y-o-y growth. Source: National Bureau of Statistics.
- *Repo* and *REZ*: refinancing rate and required reserves rate – stands for the central bank's monetary policy stance. Source: National Bank of Moldova.
- *IPC:* Consumer Production Index is used as a measure of inflation rate. It is expressed in y-o-y growth. Source: National Bureau of Statistics.
- *MDL_gap:* Deviation of the current exchange rate MDL/USD from the potential one measured by detrending with the Hodtrick-Prescot filter (λ=14400). It is expressed in y-o-y growth. Source: National Bank of Moldova.
- *Ex_UE* și *Ex_CSI:* Value of Moldovan exports to EU and CIS, expressed in y-o-y growth. Source: National Bureau of Statistics.
- *Ven_r* și *Chel_r:* Budgetary incomes and expenditures, expressed in y-o-y growth. Source: Ministry of Finance.

Stress-test Analysis to Shocks in Real Sector

One of the most important macroeconomic impacts as a result of signing a DCFTA between Moldova and European Union is the acceleration of economic growth as a result of intensification of FDI inflows and improvement in the institutional framework. Thus, it implies higher corporate profits and of population's incomes, which improves the financial situation of debtors and, correspondingly, reduces the share of non-performing loans in total banks' portfolios. At the same time, due to the 2nd round effects of an economic expansion associated with a decrease in credit risks, the banks reduce their risk weighted capital ratio. As a result, it allows channeling a bigger amount of resources for lending which accelerates the investment activity and economic growth. Finally, it amplifies the positive effects of the economic expansion on banking portfolios. The Chart 1 reveals this pro-cyclical behavior of the banking system: a positive shock in GDP growth implies a decrease in non-performing loans share in the banking portfolios. Thus the biggest impact is felt after 7-8 months and the shock is memorized for a period of over 30 months.

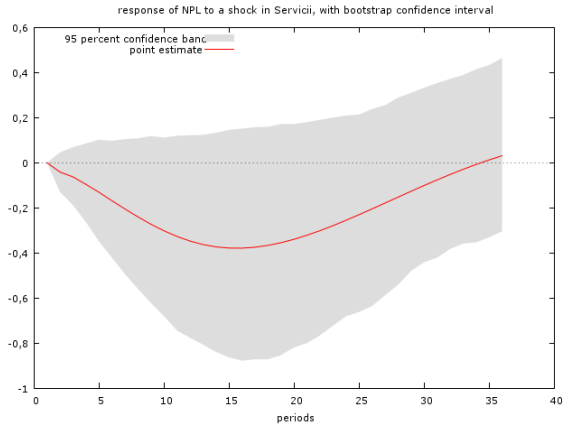
CHART 17. THE IMPACT OF 1 P.P. INCREASE IN GDP GAP ON BANKING LOAN PORTFOLIO QUALITY



Source: EG calculations based on NBM and NBS data.

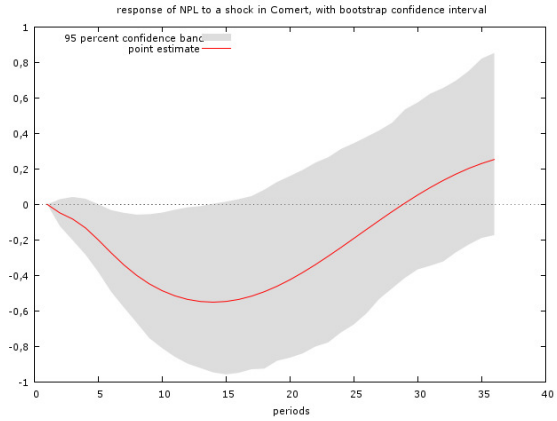
Obviously, the banking sector sensitivity varies from one economic sector to another. It depends on the degree of integration of commercial banks in particular sectors through their lending activity. Since the biggest share of all banking credits belong to trading activities with goods and services, the banking system is more vulnerable to shocks generated especially in these sectors. It is confirmed by the Chart 1 and Chart 18 which also reveal that the trade with goods has a stronger impact on banks' portfolios while the shock in services has a milder effect.

CHART 1. THE IMPACT OF ACCELERATION BY 1 P.P. IN ANNUAL SERVICES GROWTH ON THE BANKING PORTFOLIOS QUALITY



Source: EG calculations based on the NBS and NBM data.

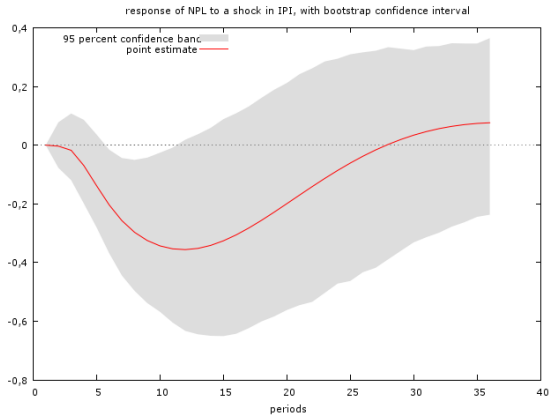
CHART 18. THE IMPACT OF ACCELERATION BY 1 P.P. OF DOMESTIC TRADE WITH GOODS ON THE BANKING PORTFOLIOS QUALITY



Source: EG calculations based on the NBS and NBM data.

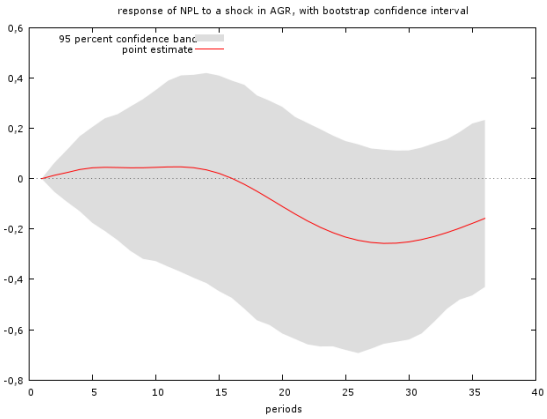
A shock in the industrial sector has a similar impact with that of services. However it is not so persistent (Chart 9). It is mostly represented by light industry branches which posted a robust growth before the recent economic crisis. Thus, it explains the increase in the share of loans contracted by firms from this sector during the pre-crisis period. Our simulations illustrate that the banking system is almost neutral to shock generated by the agricultural sector (Chart 10). It is explained by the limited access of agricultural companies to banking loans which created a relatively low interdependence between this sector and the banks.

CHART 9. THE IMPACT OF ACCELERATION BY 1 P.P. OF THE ANNUAL GROWTH OF INDUSTRIAL PRODUCTION ON THE BANKING PORTFOLIOS QUALITY



Source: EG calculations based on the NBS and NBM data.

CHART 10. THE IMPACT OF ACCELERATION BY 1 P.P. OF THE ANNUAL GROWTH OF AGRICULTURAL PRODUCTION ON THE BANKING PORTFOLIOS QUALITY



Source: EG calculations based on the NBS and NBM data.

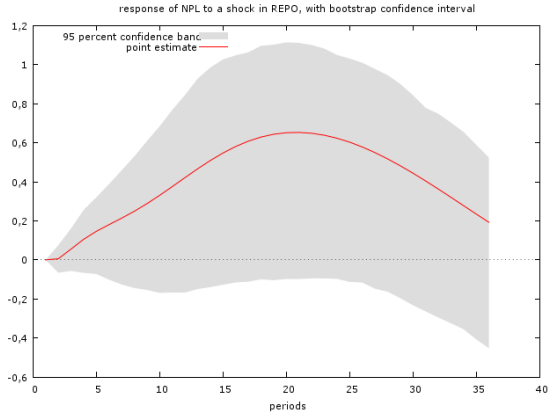
According to Expert-Grup estimates[13], a DCFTA with EU could lead to a 0.7% contraction in domestic trade with goods and a 1.0%-2.2% contraction in large scale agricultural production (there is no significant impact for small scale agriculture). However, the impact of these negative shocks on the Moldovan banking system will be compensated by a healthy growth in light industry production (+43.0%-57.2%) which is likely to be the main direct beneficiary of a DCFTA with EU. Therefore, due to the peculiarities of the interdependence between the Moldovan banking sector and the real sector, a potential DCFTA will improve the financial situation of commercial banks, mainly due to the light industry.

However, for a more comprehensive stress-test analysis of the banking system it is necessary to assess the impact of a bigger number of macroeconomic variables which can influence the banks' activity.

Stress-test Analysis to Monetary Policy Shocks

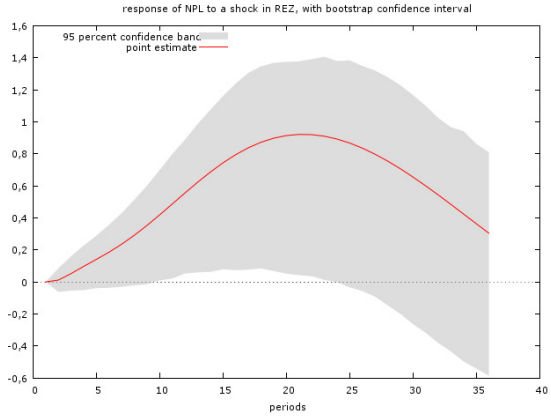
Despite the fact that on the long run the monetary policy can influence only the price level, on the short and medium run it can have a significant impact on the real sector through its transmission channels. Thus, a monetary policy tightening might imply a worsening of banking loan portfolios quality through 2 main channels: 1) increase in cost of credits which erodes the debtors' capacity to meet its payment obligations; and 2) shrink in supply of credits and direct increase in the share of non-performing loans. The Chart 11 and Chart 12 corroborate the importance and persistence of this type of shocks. At the same time, we can notice that the required reserves rate produces a sharper and more persistent impact in comparison with the REPO rate. The main cause lies in thin money market and liquidity abundance of the banking sector which essentially constraints the impact area of any conventional monetary policy. Therefore, the central bank is bound to use more intensively instruments with a stronger impact on the system.

CHART 11. THE IMPACT OF 1 P.P. RAISE IN REPO RATE ON THE BANKING PORTFOLIOS QUALITY



Source: EG calculations based on NBM data

CHART 12. THE IMPACT OF 1 P.P. RAISE IN REQUIRED RESERVES RATE ON THE BANKING PORTFOLIOS QUALITY



Source: EG calculations based on NBM data

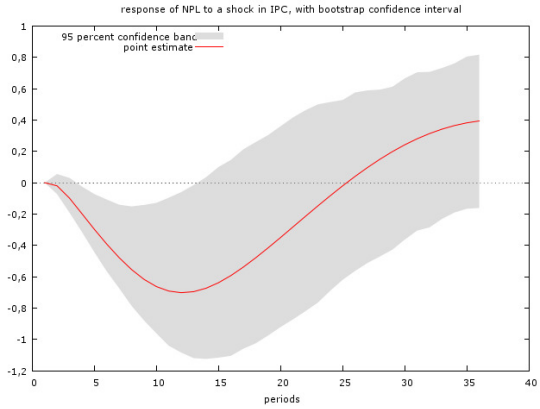
Stress-test Analysis to Shocks in Prices and Exchange Rate

According to Expert-Grup estimates[14], a DCFTA with EU implies a strengthening of the national currency with 3.7%-4.5% in real terms, given the surge in exports.

[13] Ibid.
[14] Ibid

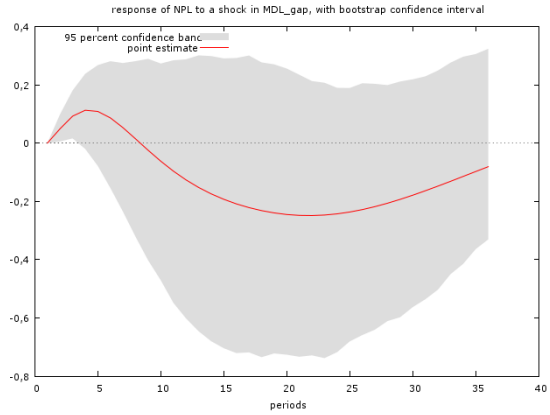
Moreover, the national currency could appreciate even stronger on the grounds of a potential rise in FDI. At the same time, the price level could decrease given the intensification of competition on various market segments. The Chart 13 and Chart 14 reveal the banking system's sensitivity to variations in these macroeconomic variables.

CHART 13. THE IMPACT OF 1 P.P. INCREASE IN INFLATION ON THE BANKING PORTFOLIOS QUALITY



Source: EG calculations based on NBM data

CHART 14. THE IMPACT OF 1 P.P. NATIONAL CURRENCY DEPRECIATION ON THE BANKING PORTFOLIOS QUALITY



Source: EG calculations based on NBM data

Thus, we can notice that for a maximum period of 25 months the banks react positively to price increase due to higher sales and, respectively, better payment capacity of debtors. Still, on the long run, inflation has adverse effects as it distorts the economic activity. Therefore, the negative impact of a price decrease as a result of DCFTA on the banks' activity is likely to be felt on the short and medium terms, while on the long-run the decrease in prices will have positive effects.

The shock in exchange rate is negligible as the regression coefficients are very low. Still, the Chart 24 denotes that a potential strengthening of the national currency will have positive effects only during a period of 8-10 months. On the long run, it erodes the competitiveness of Moldovan exporters which is mirrored into worsening of financial situation of these companies. As a result, it could deteriorate the banks' credit portfolios.

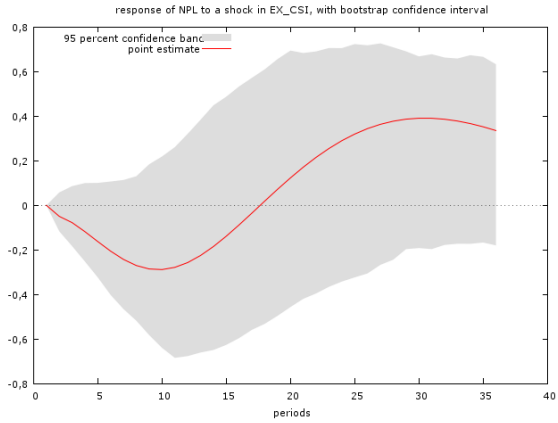
A Stress-test Analysis to Shocks from Foreign Demand

A DCFTA with EU will give a fillip to exports by 1.2%-4.3%, with an increasing share of exports to EU[15]. The Chart 16 reveals that the realization of this estimation will have a positive impact on the financial situation of the banking system. Thus, the pickup in profits of exporting companies will improve their financial health and, respectively, the quality of banking portfolios.

Interestingly, the Moldovan banking system is twice sensible to variations in exports to EU in comparison with the exports to CIS (Chart 15). It could be explained by the fact that, usually, companies oriented to the European market have better profitability indicators. Therefore, they have a bigger absorption capacity of banking loans. At the same time, these companies are more creditworthy as they imply lower risks for banks, which explains why they have a better access to banking loans. As a result, the credits contracted by exporters to the EU market account for a bigger share in banks' portfolios, making the banks more dependent on these firms.

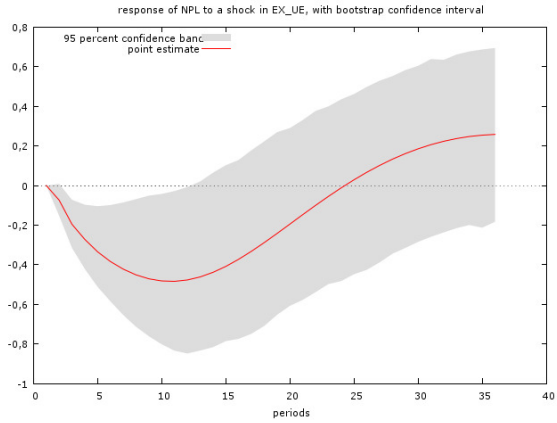
[15] Ibid

CHART 15. THE IMPACT OF 1 P.P. ACCELERATION IN EXPORTS' ANNUAL GROWTH TO CIS COUNTRIES ON THE BANKING PORTFOLIOS



Source: EG calculations based on NBM and NBS data

CHART 16. THE IMPACT OF 1 P.P. ACCELERATION IN EXPORTS' ANNUAL GROWTH TO EU COUNTRIES ON THE BANKING PORTFOLIOS



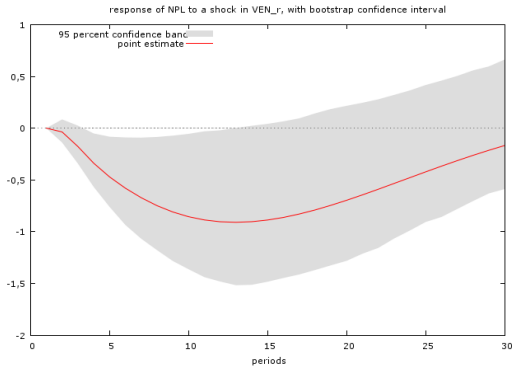
Source: EG calculations based on NBM and NBS data

A Stress-test Analysis to Shocks in Fiscal and Budgetary Policies

A DCFTA with EU could lead to a contraction of public revenues due to the elimination of custom duties which Moldova currently collects on the imports from EU. Respectively, it will make the fiscal and budgetary policies to adjust. Thus, it is worth analyzing how the commercial banks are going to react to this type of shocks. The Chart 17 reveals a negative relationship between the real growth in public revenues and the share of non-performing loans in banking portfolios. It can be explained by the fact that the fiscal policy cannot be considered as a major constraint for the economic activity in Moldova. Hence, the variations in budgetary revenues are determined rather by the economic growth model, which being strongly reliant on consumption, is highly correlated to the increase in public revenues through collections of indirect taxes. Therefore, the reduction in budgetary incomes caused by the DCFTA will not negatively affect the banking system because this shock will have administrative and not economic foundations.

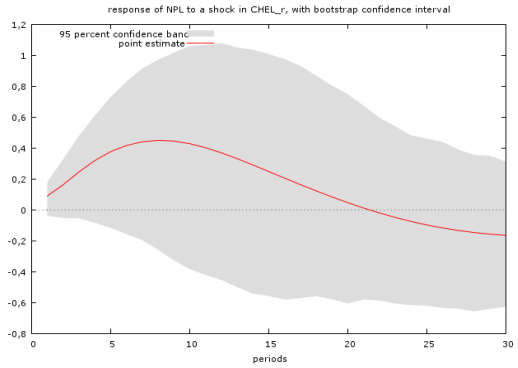
In our opinion, the banking system could be rather negatively affected by the public expenditures policy and the way how the deficit is financed. Taking into account that the share of social expenditures in total budget is about 70%, the adjustments to potential decrease in public revenues will be very slow. As a result, it will make the Government to resort more intensively to deficit financing through t-bills market. It will negatively affect the banking system because the Government enters into a direct competition with the real sector for banks' resources. Usually, it fuels the cost of credits, eroding the payment capacity of debtors. Finally, it turns into worsened quality of banking portfolios, which is confirmed by the Chart 18.

CHART 17. THE IMPACT OF 1 P.P. ACCELERATION IN REAL ANNUAL GROWTH OF BUDGETARY REVENUES ON THE QUALITY OF BANKING PORTFOLIOS



Source: EG calculations based on Ministry of Finance data and NBS

CHART 18. THE IMPACT OF 1 P.P. ACCELERATION IN REAL ANNUAL GROWTH OF BUDGETARY EXPENDITURES ON THE QUALITY OF BANKING PORTFOLIOS

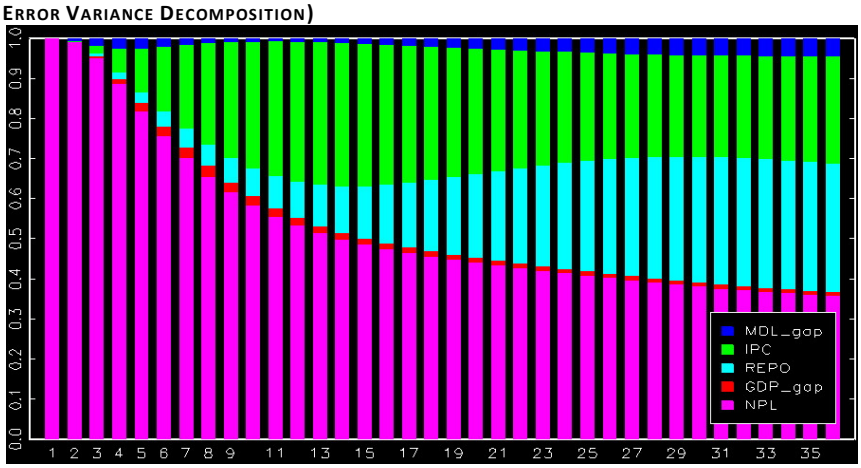


Source: EG calculations based on Ministry of Finance data and NBS

Structural Stress-test Analysis

Besides their impulse-response functions, vector autoregressive models allow us to analyze the structure of particular shocks on the quality of banking loan portfolios. It is performed through the forecasted error variance decomposition. Thus, we can compare estimated evolution of shares of different shocks on the banking system. For example, the Chart 19 reveals the fact that, on the short run, inflation (green) has the biggest impact on the bank's portfolios quality, while on the long-run – monetary policy. The letter one registers significant results after about 18-20 months due to its slow transmission process (light blue). At the same time, we can notice that the shocks in GDP gap and exchange rate are relatively negligible.

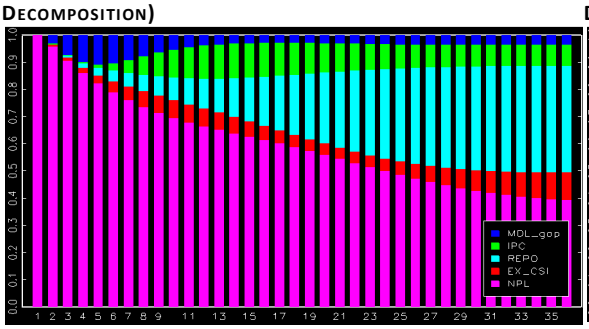
CHART 19. THE SHARE OF A SERIES OF SHOCKS ON BANKING PORTFOLIO QUALITY (FORECASTED ERROR VARIANCE DECOMPOSITION)



Source: EG calculations based on NBM and NBS data

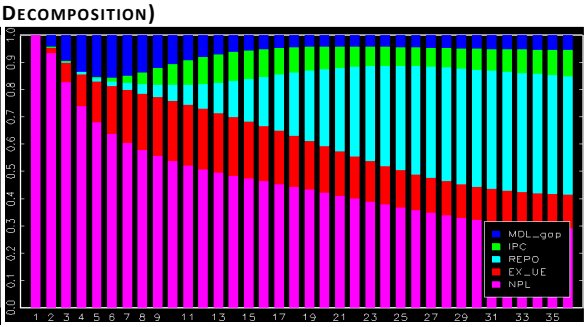
The Chart 20 and Chart 21 denote that the shocks in demand from CIS countries are much lower in comparison with the EU countries (red). Therefore, the banking system is likely to benefit of a DCFTA with EU since it will enhance the quality of their loan portfolios and their overall financial situation.

CHART 20. THE SHARE OF A SERIES OF SHOCKS ON BANKING PORTFOLIO QUALITY (FORECASTED ERROR VARIANCE DECOMPOSITION)



Source: EG calculations based on NBM and NBS data

CHART 21. THE SHARE OF A SERIES OF SHOCKS ON BANKING PORTFOLIO QUALITY (FORECASTED ERROR VARIANCE DECOMPOSITION)



Source: EG calculations based on NBM and NBS data

5. Conclusions and Recommendations

According to the estimation results, the Moldovan banking system is likely to be a net beneficiary of a Deep and Comprehensive Free Trade Agreement with the European Union. Still, the positive effects will be partly mitigated by a series of fundamental systemic deficiencies related to commercial banks' activity, as well as to the entire national economy. Thus, the limited reciprocal confidence between banks and population/firms significantly hampers the financial intermediation function of the banking system. As a result, despite the dynamic economic growth during the years before the recent financial turmoil, the commercial banks didn't integrate deeply into the economic system, Moldova getting one of the lowest shares of banking credit in GDP from the region. At the same time, the problem of high credit costs persist, which is determined by 3 main factors: high costs of collected resources from the population/firms, high risk premiums and wide profit margins paralleled with poor competition. Still, such a modest integration of the banking system has its own advantages. Thus, it made the commercial banks more immune to potential macroeconomic shocks though the liquidity abundance which ensures a relative stability of the banking system. Thus, it can act as a barrier to the economic growth, as well as an airbag for economic turmoil.

A DCFTA could have positive impacts on banking efficiency as well. Most of studies on banking efficiency and technology convergence performed for various European banking systems confirm their gradual homogenization. Moldova shouldn't be an exception if the local regulatory framework will continue to adjust to the European one and if the commercial banks will keep the current pace of technologisation of banking activity. This convergence process could be spurred by the fact that there are many Moldovan banks owned by bigger European banks which could facilitate the import of know-how and technologies into the local banking sector.

To make the banking liberalization beneficial for the entire economy, it should be paralleled with efficient actions aimed at financially strengthening the system and making it immune to exogenous or endogenous economic cycles effects. At the same time, we have to keep in mind that the liberalization reforms also imply some costs and additional requirements for each party involved in the process. In order to ensure a higher efficiency of commercial banks it is necessary to switch to new risk management models, to replace the purely quantitative approaches to more qualitative ones. In other words, the implementation of Basel II and Basel III principles is of imperative importance.

The stress-test analysis confirms the fact that the Moldovan banking system is quite sensible to various macroeconomic shocks, due to its interdependence with various branches of the national economy. Some exceptions are the agricultural sector, exchange rate and budgetary expenditures, which have a milder influence on the banking activity. The interesting fact is that these variables are estimated to have a negative impact on the quality of banking loan portfolios as a result of signing a DCFTA with EU. Still, the empirical simulations showed that the positive effects will prevail over the negative ones. Thus, the surge in light industry, exports to EU market, decrease in price level (on a long-run) and acceleration of economic growth will significantly improve the financial situation of most of commercial banks. At the same time, the adverse effects caused by the contraction in budgetary revenues, strengthening of the national currency and fall in large scale agricultural production are likely to be less significant. Hence, they don't represent an imminent warning for the Moldovan banking system. Therefore, the stress-test analysis reveals that the commercial banks are well prepared for a DCFTA with EU, as the potential macroeconomic shocks are likely to bring net benefits to the entire banking sector.

In order to eliminate the systemic deficiencies and to ensure a more dynamic development of the analyzed sector, **we recommend to relevant public authorities to implement the following actions, depending on the particular objectives:**

Objective no. 1: To increase the intermediation level of commercial banks

- The Fund for Deposit Guaranties should be expanded with a component guaranteed by the Government and by motivating the commercial banks to contribute with a small share of their assets into this fund. It will consolidate the confidence in the banking system which, in the medium and long term, will ensure an increase in deposits and banks' lending capacity.
- The Fund for Credit Guaranties for SMEs should be expanded. As we have already mentioned in this study, the issue of low access to credit is mostly specific to SMEs, due to higher uncertainties and risks, as well as insufficiency of lacking of collateral. Therefore, it is necessary to increase the capitalization of the Fund for Credit Guaranties with the financial assistance of international development partners and some contribution from the state budget.

Objective no. 2: To mitigate the banks' reluctance related to their lending activity

- It is necessary to develop extrajudicial mechanisms for collateral execution. It will allow banks to have an easier access to the debtors' collateral in case of their bankruptcy (e.g. Romania, Georgia, UK, etc). It will decrease the moral hazard of banks' clients and will make the banks to decrease the risk premiums and, consequently, the costs of credit.
- The solvency legislation should be improved. Particularly, it should contain a maximum period in which the debtor who initiated the bankruptcy procedure must pass the collateral to the bank.
- It is necessary to ensure a normal functioning of credit history bureaus. It will stimulate the competition in the banking sector and will decrease the banking risks due to higher transparency regarding the credit histories of the population/firms. At the same time, the relevant public authorities should be vigilant in monitoring how the banks are cooperating in sharing the information about their clients. Otherwise, the efficiency and usefulness of these credit bureaus is likely to be limited.

Objective no. 3: To foster the competition on the market of banking services

- The Government should privatize its assets from the banking sector. Thus, the entrance of some strategic investors in this sector will foster the competition among the players which will result in lower lending interest rates and higher banking efficiency.
- The entrance on the market should be liberalized. It will stimulate the R&D and innovation, support of scientific projects in this area and development of new products and services. All in all, it could have positive impact on the quality of banking services and the development of the capital market.

Objective no. 4: To improve the regulatory framework of the banking activity

- It is necessary to address the pro-cyclical behavior banks' lending activity. It will ensure a better stability of the banking system and its adjustment to the new EU requirements.
- NBM should develop an internal unit for macroeconomic supervision through modern forecasting techniques and stress-tests. It will increase the efficiency of regulatory and monitoring activities and will allow a faster decision making process.
- The communication between banks and NBM regarding the implementation of Basel III requirements should be improved.

- NBM should undertake the responsibilities and obligations of the National Commission for Financial Markets (NCFM). In this way there will be a single entity responsible for monitoring and regulation the whole financial sector, according to the best European practices. It will, also, improve the monetary policy transmission process and the market regulation, as many banks, which are under the supervision of NBM, have their own leasing and insurance companies which are, currently, regulated by NCFM.

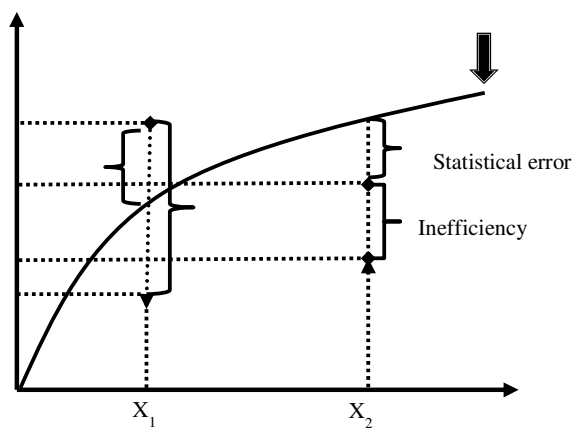
6. Annex A: SFA Methodology

In the mid of the last century, the economist J. Farell was the first to propose an econometric method for measuring the efficiency of production units. In (Farrell, 1957)for the first time the cost of production of a company was expressed as a function of the quantity of produced outputs and a model is defined for the estimation of deviations from the best practice within an industry.

We will use advanced econometric techniques that have derived in (Aigner, Lovell, & Schmidt, 1977)and(Meeusen & van Den Broeck, 1977). The main idea at the core of this model relates to the statistical properties of the residuals of the production or cost function that is to be estimated.Thus, we specify the production function as:

$$yi = f\left(\underbrace{xi}\,;\underbrace{\beta}\right) + \varepsilon i,$$

where the vector of production yiis a function of the vector of inputs xi and some firm specific variables. The εiterm is formed of two distinct components: $vi \sim N(0;\sigma_v^2)$which represents the statistical error and$ui \sim N(0;\sigma_u^2)$which represents the inefficiency term. Graphically the problem can be depicted as in the figure below.



Source: (Coelli, et al. 2005),

In this paper we specified a trans-logarithmic cost and profit functions for the banks.The underlying formula is:

$$\boldsymbol{lnt}c_i = \beta_0 + \sum_m^M \beta_m \ln w_{ij,m} + \sum_n^N \gamma_n \ln z_{ij,n} + 0.5\sum_m^M \sum_M^N \theta_{mn} \ln w_{ij,m} \ln y_{ij,M} + 0.5\sum_n^N \sum_N^n \varphi_{mn} \ln y_{ij,n} \ln y_{ij,N} + \sum_m^M \sum_n^N \omega_{mn} \ln w_{ij,m} \ln w_{ij,n} + v_{ij} + u_{ij}$$

For the profit function the only variable that has to be changed is ***lntc**$_i$ which is replaced by **lnpro**$_i$.*

A few important steps in the estimation process have to be followed. Fisrt we maximize the log-likelihood function, derived in(Aigner, Lovell, & Schmidt, 1977)and represented by the following formula:

$$\ln L(y|\,\beta,\lambda,\sigma^2\,) = N * \ln\frac{\sqrt{2}}{\sqrt{\pi}} + N * \ln\sigma^{-1} + \sum_{i=1}^{N} \ln[1 - \Phi * (\varepsilon_i \lambda \sigma^{-1})] - \frac{1}{2\sigma^2}\sum_{i=1}^{N} \varepsilon_i^2$$

Note: Vector of outputs „y" is maximized as a function of vectorβ, $\lambda = \sqrt{\frac{\sigma_u^2}{\sigma_v^2}}and\sigma = \sqrt{\sigma_v^2 + \sigma_u^2}$. Symbol„Φ" in the formula refers to the cummulative distribution function of a standard normal variable estimated at $(y_i - \beta^T x_i) * \lambda\sigma^{-1}$.

Once we get the maximization results we estimate the individual efficiency scores using the following formula:

$$TE_i = \frac{y_i}{\exp(x_i^T\beta + v_i)} = \frac{\exp(x_i^T\beta + v_i - u_i)}{\exp(x_i^T\beta + v_i)} = \exp(-u_i).$$

Final inefficiency prediction formula for each individual bank, derived in (Jondrow, et al. 1982), is the following:

$$u_i \equiv E\{u_i|y_i\} = u_i^* + \sigma_* \left[\frac{\phi\left(\frac{u_i^*}{\sigma_*}\right)}{\Phi\left(\frac{u_i^*}{\sigma_*}\right)}\right]$$

where we denote$u_i^* = -\ln(q_i - x_i^T\beta)$, $\sigma_* = \frac{\sigma_v^2\sigma_u^2}{\sigma^2}$, φ(x) – normal standard density evaluated at xi and Φ(x) – cumulative standard normal function evaluated at xi, as in(Coelli, et al. 2005).

This last expression represents the formula used by the authors to make the predictions regarding the efficiency of banks analysed in the paper. The authors assume that the inefficiency term has a half-normal distribution, which allows them to distinguish it from statistical noise. For a comprehensive discussion of the methodology the papers referred in this paper could be consulted.

7. Annex B: SFA Estimation Output

Stochastic Production Frontier, e = v-u

PRO	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
|Primary Index Equation for Model						
Y1	-.45603	.30517	-1.49	.1351	-1.05415	.14208
Y2	.06902	.17475	.39	.6929	-.27348	.41152
Y3	-.03882	.39350	-.10	.9214	-.81007	.73243
W1	-.22706	.21819	-1.04	.2980	-.65469	.20058
W2	.19997	.21318	.94	.3482	-.21787	.61780
SY1	-.04666	.11057	-.42	.6731	-.26338	.17006
SY2	.02132	.02421	.88	.3785	-.02613	.06878
SY3	.19843*	.11620	1.71	.0877	-.02931	.42617
SW1	-.07631	.09797	-.78	.4360	-.26833	.11571
SW2	.10516	.06812	1.54	.1227	-.02837	.23868
Y1Y2	.22517**	.11428	1.97	.0488	.00119	.44914
Y1Y3	-.39365**	.18380	-2.14	.0322	-.75389	-.03342
Y2Y3	.00888	.04804	.18	.8534	-.08527	.10303
Y1W1	.01396	.11621	.12	.9044	-.21382	.24173
Y1W2	.16943	.11472	1.48	.1397	-.05540	.39427
Y2W1	-.02092	.04484	-.47	.6408	-.10882	.06697
Y2W2	-.04862*	.02876	-1.69	.0910	-.10499	.00776
Y3W1	-.13539	.10985	-1.23	.2178	-.35069	.07991
Y3W2	-.05749	.06740	-.85	.3937	-.18960	.07461
W1W2	.06309	.07391	.85	.3933	-.08177	.20795
GOV	-.00108	.00118	-.91	.3612	-.00340	.00124
EQAS	.06938***	.00695	9.98	.0000	.05575	.08300
D_ASSETS	.00032	.00077	.41	.6810	-.00119	.00183
D_LOANS	.00060	.00066	.92	.3586	-.00068	.00189
IEBRD	-.31054**	.15214	-2.04	.0412	-.60873	-.01234
LIR	.01344	.01687	.80	.4255	-.01962	.04650
D_C_P	.00314	.00333	.94	.3451	-.00338	.00966
L_D	-.00139	.00183	-.76	.4490	-.00498	.00220
BRANCHES	.00203	.00409	.50	.6198	-.00598	.01004
GDP	-.41967D-04***	.1398D-04	-3.00	.0027	-.69372D-04	-.14562D-04
|Variance parameters for compound error						
Lambda	2.60203***	.31434	8.28	.0000	1.98594	3.21813
Sigma	1.89593***	.00296	640.97	.0000	1.89013	1.90173

Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

Stochastic Cost Frontier Model, e = v+u

TC	Coefficient	Standard Error	z	Prob. |z|>Z*	95% Confidence Interval	
|Primary Index Equation for Model						
Y1	.23899**	.10261	2.33	.0198	.03789	.44009
Y2	.22101***	.05291	4.18	.0000	.11731	.32471

```
      Y3|     .76716***      .12145     6.32  .0000      .52912  1.00521
      W1|     .39465***      .06211     6.35  .0000      .27291  .51639
      W2|    -.04416         .06407     -.69  .4907     -.16974  .08142
     SY1|    -.02641         .03257     -.81  .4174     -.09026  .03743
     SY2|     .00317         .00750      .42  .6725     -.01153  .01786
     SY3|     .02164         .03079      .70  .4822     -.03870  .08198
     SW1|    -.09226***      .03057    -3.02  .0025     -.15217  -.03236
     SW2|     .01415         .01792      .79  .4298     -.02097  .04927
    Y1Y2|    -.02486         .03306     -.75  .4520     -.08967  .03994
    Y1Y3|     .08234         .05190     1.59  .1127     -.01939  .18407
    Y2Y3|     .03008**       .01358     2.22  .0268      .00346  .05671
    Y1W1|     .08316**       .03633     2.29  .0221      .01195  .15437
    Y1W2|     .08541**       .03922     2.18  .0294      .00854  .16229
    Y2W1|     .05888***      .01489     3.96  .0001      .02970  .08805
    Y2W2|     .01345         .00908     1.48  .1388     -.00436  .03125
    Y3W1|     .14312***      .03375     4.24  .0000      .07697  .20927
    Y3W2|    -.02216         .01814    -1.22  .2218     -.05772  .01339
    W1W2|    -.05985***      .02308    -2.59  .0095     -.10508  -.01462
     GOV|     .00097***      .00036     2.71  .0067      .00027  .00166
    EQAS|     .00314         .00196     1.60  .1088     -.00070  .00697
D_ASSETS|    -.00028         .00023    -1.20  .2283     -.00073  .00017
 D_LOANS|     .00022         .00021     1.05  .2949     -.00019  .00062
   IEBRD|    -.28027***      .04369    -6.42  .0000     -.36589  -.19465
     LIR|     .00806         .00503     1.60  .1091     -.00180  .01792
   D_C_P|     .00029         .00103      .28  .7804     -.00173  .00230
     L_D|     .00052         .00050     1.04  .3005     -.00046  .00150
BRANCHES|    -.00112         .00114     -.98  .3252     -.00334  .00111
     GDP|-.66391D-05      .4184D-05    -1.59  .1125 -.14839D-04  .15611D-05
        |Variance parameters for compound error
  Lambda|    1.63542***      .18308     8.93  .0000     1.27659  1.99425
   Sigma|     .48864***      .00100   490.79  .0000      .48669  .49059
--------+-------------------------------------------------------------------
--
Note: nnnnn.D-xx or D+xx => multiply by 10 to -xx or +xx.
Note: ***, **, * ==>  Significance at 1%, 5%, 10% level.
                  -------------------------------------------------------
                  --------------------
```

8. Annex C: Description of the Vector Autoregressive Model (VAR)

The VAR models are widely used for estimation of the impacts of macroeconomic shocks and analyzing how they are spread over time. Most often, this methodology is used for quantitative assessment of monetary policy transmission mechanisms (e.g. what is the impact of 1 p.p. rise in base rate on the inflation level, GDP and exchange rate?). The reduced form VAR models are composed of a system of equations, where each variable represents a linear function of its lagged values, lagged values of other variables and error term which is not auto-correlated. Each equation is estimated based on the OLS method. The error represents the surprise variations of each variable which has an impact over the entire system of equations.

In this study we used a recursive VAR model in order to avoid the correlation of error term among the equations. Thus, besides the simple VAR model we employ the contemporaneous values of each variable. It is necessary to mention that this model does not have exogenous variables and other restrictions. The only intervention in the estimation process which can affect the estimation efficiency is the ordering of equations. Therefore, in the first equation the dependent variable is a function of its lagged value and the lagged values of other variables. In the second equation, the dependent variable is a function of the contemporaneous value of the dependent variable from the previous equation and the lagged values of all other variables. The variables are ordered depending on their speed of reaction to various shocks. As a result, the financial variables (refinancing rate, required reserves rate, inflation, exchange rate) are placed at the end because they are supposed to react more promptly to shock caused by real variables (GDP, the share of non-performing loans in total credits, public revenues and expenditures and exports). Thus, the later ones are placed at the very beginning taking into account the lagged reaction to shocks in financial variables. For example, GDP gap is ordered after the share of non-performing loans because the economic cycles affect the quality of banking assets with some lags.

The system of equations used in this study is presented as follows:

(1) $NPL_t = \alpha_0 + \sum_{i=1}^{k} \alpha_{1i} NPL_{t-i} + \sum_{i=1}^{k} \alpha_{2i} GDP_gap_{t-i} + \sum_{i=1}^{k} \alpha_{3i} REPO_{t-i} + \sum_{i=1}^{k} \alpha_{4i} IPC_{t-i} + \sum_{i=1}^{k} \alpha_{5i} MDL_gap_{t-i} + \varepsilon_{1t}$

(2) $GDP_gap_t = \beta_0 + \sum_{i=1}^{k} \beta_{1i} NPL_{t-i} + \sum_{i=1}^{k} \beta_{2i} GDP_gap_{t-i} + \sum_{i=1}^{k} \beta_{3i} REPO_{t-i} + \sum_{i=1}^{k} \beta_{4i} IPC_{t-i} + \sum_{i=1}^{k} \beta_{5i} MDL_gap_{t-i} + \beta_6 NPL_t + \varepsilon_{2t}$

Notă: În toate simulările în locul *GDP_gap* am utilizat *Servicii, IPI, Agr, Comert, Ex_CSI, Ex_UE, Ven_r, Chel_r.*

(3) $REPO_t = \lambda_0 + \sum_{i=1}^{k} \lambda_{1i} NPL_{t-i} + \sum_{i=1}^{k} \lambda_{2i} GDP_gap_{t-i} + \sum_{i=1}^{k} \lambda_{3i} REPO_{t-i} + \sum_{i=1}^{k} \lambda_{4i} IPC_{t-i} + \sum_{i=1}^{k} \lambda_{5i} MDL_gap_{t-i} + \lambda_6 NPL_t + \lambda_7 GDP_gap_t + \varepsilon_{3t}$

Note: Instead of REPO we used REZ in order to analyze the differences in monetary policy transmission process depending on the type of monetary policy instrument employed by the central bank.

(4) $IPC_t = \delta_0 + \sum_{i=1}^{k} \delta_{1i} NPL_{t-i} + \sum_{i=1}^{k} \delta_{2i} GDP_gap_{t-i} + \sum_{i=1}^{k} \delta_{3i} REPO_{t-i} + \sum_{i=1}^{k} \delta_{4i} IPC_{t-i} + \sum_{i=1}^{k} \delta_{5i} MDL_gap_{t-i} + \delta_6 NPL_t + \delta_7 GDP_gap_t + \delta_8 REPO_t + \varepsilon_{4t}$

(5) $MDL_gap_t = \rho_0 + \sum_{i=1}^{k} \rho_{1i} NPL_{t-i} + \sum_{i=1}^{k} \rho_{2i} GDP_gap_{t-i} + \sum_{i=1}^{k} \rho_{3i} REPO_{t-i} + \sum_{i=1}^{k} \rho_{4i} IPC_{t-i} + \sum_{i=1}^{k} \rho_{5i} MDL_gap_{t-i} + \rho_6 NPL_t + \rho_7 GDP_gap_t + \rho_8 REPO_t + \rho_9 IPC_t + \varepsilon_{5t}$

One of the most popular methods of analysis of VAR estimation results is the impulse-response function. It illustrates how the shocks are spread among the equation system. Thus, we can estimate the impact of 1 unit increase in some variables on the banking portfolio quality. For example, an increase in ε_{1t} will affect the contemporaneous value of NPL variable, as well as future values of other variables included in VAR (*GDP_gap, REPO, IPC, MDL_gap*) because the lagged *NPL* variable is present in each equation from the system.