



## ANALYSIS OF MACROECONOMIC SHOCKS RESISTANCE OF MOLDOVAN BANKING SECTOR

Rodica PERCIUN<sup>1</sup>, Tatiana COLESNICOVA<sup>2</sup>, Olga TIMOFEI<sup>3</sup>

<sup>1</sup>PhD, associate professor, NIER, Republic of Moldova

<sup>2</sup>PhD, associate professor, NIER, Republic of Moldova

<sup>3</sup>PhD, NIER, Republic of Moldova

**Abstract** Banks and the banking system are the most important financial institutions of any state. Interacting directly with all sectors of national economy, they help to address the main issues of redistribution of funds between individuals and companies, between various branches of national industry and attract investments, etc. In this way the country's economy and the banking sector are closely intertwined. On the one hand, the stability of the banking sector has a key role in ensuring an efficient allocation of financial resources and economic growth, and on the other hand, the evolution of the macroeconomic environment imprints on the state and stability of banking sector. This scientific work aims to determine the impact of macroeconomic indicators of the Republic of Moldova on the national banking sector, and based on the interdependence of macroeconomic and banking indicators to analyze how certain variables respond to different sources of shock in the economy.

### Key words:

Financial system,  
Moldovan banking  
sector,  
Macroeconomic  
indicators, Banking  
indicators,  
Econometric model,  
Economic growth of  
the country

### JEL Codes:

O11  
C21  
P34

### 1. INTRODUCTION

The relevance of this research topic arises from the reality, the financial system is facing with. Recently, the issue of providing financial stability to the country increases significantly. One of the most important aspects of the economic security of a country is the financial sector, its ability, to ensure all participants in the economic life with financial resources in necessary amounts and acceptable conditions. The financial stability is an integrant element of the economic and national security of a country. In particular, the analysis and development of the toolpack for financial stability measurement of

the country is a novelty for the Republic of Moldova.

The methods which are used include theoretical and comparative approaches such as descriptive statistics. We know, from the specialty literature, that the role of the banking sector in providing financial stability to the country is determined on the one hand by the possibility of focusing on its threats and risks, on the other hand by its deep infiltration in ensuring financial interests of the whole economy of individual enterprises and organizations. As a consequence, the banking sector is a critical element binding and creating interaction opportunities of different sectors of the

economy; national and foreign enterprises, interests of various economic actors, as well as interests of the country with global community.

Therefore, this problem is not only actual, but also extremely critical. Firstly, due to the rudimentary development of the market economy institutions which age is up to 20 years. Secondly, the lack of a systematic and sequential promotion of economic reforms, mainly due to the persistent political crisis. Thirdly, the most important for a development of investment economy, the insignificant contribution of the banking sector in the sustainable economic growth of the country is obvious. The level of investment in the Republic of Moldova is several times lower compared to the other countries with a similar economy. In these conditions, the banking system should provide long-term cheap investing resources for the real economy, without them the issue of a sustainable economic development, GDP increase, entrepreneurship development etc. can not be approached.

Since 1991, the Moldovan banking system is permanently transforming and completing. Within about 25 years, there were registered various events, from significant progresses to serious violations. However, the ability of the national banking system has increased. The volume of active and passive operations has significantly risen since 1991. At the same time, there is a diversification of the banking operations and services directed to fulfill all customs requirements, main directives being focused not only on the presentation of a wide range of banking products,

but also on providing efficiency, accessibility in time and space.

However, the development of the banking system generates also the banking risk diversification which have become difficult to control, and especially to prevent.

## 1. WORLD EXPERIENCE ON BANK STRESS TEST

After the trigger of global financial crisis, the relevance of stress test is firstly explained by the fact, that in recent years it began to turn into new standards of the banking business culture. The stress test helps banks to determine in advance the potential instability sources, eventual capitalization issues, liquidity and others. Consequently, year by year, more banks use this instrument to determine the level of financial stability. In turn, the stress test of the banking system helps the central banks to determine whether the entire banking sector of the economy survives or not under crisis conditions.

By means of stress tests, it is possible to assess the impact of economic shocks on various indicators of the banking activity, for example: incomes, assets, liquidity, loan portfolio structure and others. Moreover, this is an instrument chosen by quantitative measurement of the possible changes in the bank balance, its costs structure, eventual losses on loans and deposits. All these allow the regulator to assess the eventual loss volume of the entire banking sector and to determine the level of reserves which the banks have to create in order to overcome without

complications even the worst shocks in the economy.

In October, 2014 the **European Central Bank** updated the stress test methodology, adding to the applied methods, the general audit of the property value which exists at each bank balance and assessment of bank asset quality. The bank loan portfolio is assessed as the largest asset package, i.e. money borrowed from customs, which theoretically have to be reimbursed. At the same time, the value of these assets was determined, taking into account that the bank shall actually reimburse this debt – the stretch loan of a company on the brink of collapse has been assessed lower than a loan of a healthy company. In addition there was also taken into account the amount of the pledge received by Bank, such as a house in the case of a mortgage loan (UaDaily, 2014).

The stress tests of the European banks carried out in 2016 by the European Central Bank, European Banking Authority and *European*

*Systemic Risk Board*, included two test scenarios – basic and unfavourable, which were assessing whether the banks go through recession, low interest rates and depreciation of currencies, as well as the drop of prices on real estate. In comparison with the tests from 2014, this year there was not the „admitted/rejected criterion. The European Central Bank and European Banking Authority have checked how much capital will be kept at 51 banks in both scenarios, however the investors have to make the conclusions. Overall, the investors would like banks to maintain the capital adequacy at the level of 5,5% even in the worst situation. Monte Paschi has the worst result: in the case of unfavourable scenario, the bank would remain in a negative capital position (minus 2,44%, see Table 1). Among the large banks, Italian UniCredit, British Barclays, French Societe Generale, Commerzbank and Deutsche Bank from Germany (Table 1) have low results (Bruno, L., 2016).

**Table 1. Lowest EU banks**

<b>Bank</b>	<b>Country</b>	<b>Capital adequacy on unfavourable scenario</b>
Monte Paschi	Italy	-2,44
Allied Irish Banks	Ireland	4,31
Raiffeisen-Landesbanken	Australia	6,12
Bank of Ireland	Ireland	6,15
Banco Popular Espanol	Spain	6,62
Unicredit	Italy	7,1
Barclays	Great Britain	7,3
Commerzbank	Germany	7,42
Societe Generale	France	7,5
Deutsche Bank	Germany	7,8

Source: European Banking Authority (EBA) [https://www.eba.europa.eu/languages/home\\_ro](https://www.eba.europa.eu/languages/home_ro)

By the end of 2013, the European banks attracted 180 billion Euro. Several banks, after

declaring the stress tests results, have said that these were more difficult compared to 2014. The

tests have been criticized due to the fact that the Brexit, possibility of negative rates and consequences of new supervision requirements (the so-called „Basel IV”) were not considered. Supervision innovations may lead to the fact that one hundred of the world largest banks have to hold an additional capital of 350 billion Euro, according to the KPMG forecast.

Greek and Portuguese banks, which have many problems too, will be tested separately: in 2016, the regulators checked 51 banks (with assets amounting to 30 billion Euro) against 130 banks in 2014. Their results will not be published.

A few hours before announcing the stress test results, Monte Paschi (the third by assets in Italy and the oldest bank in the world) has declared that intends to attract 5 billion Euro if it is able to sell the problem loans to the tune of 9,2 billion Euro. Overnight, it became known that Monte Paschi received an offer from the Italian banker and former Minister, Corrado Passera and UBS. It was about 3 billion Euro in capital injection and partial conversion of subordinated bonds, according to Italian mass-media. Monte Paschi rejected this offer.

Several European researchers study the financial stability measurement using different methods. Thus, Van den End J. W., Tappa M. (2005) writes in more detail about different methods of performing stress tests. Albulescu C. T. (2010) relates thoroughly about the application of Stochastic Simulation Model for the research of Romania’s financial stability. International experience regarding this issue is described in

detail in the financial report of Czech National Bank (Gersl,A. and Hermanek, J., 2007).

In the **United States of America**, the stress test is a very popular tool of risk management. Therefore, at the beginning of 2009 SCAP - Supervisory Capital Assessment Program has been launched, which assessed the sustainability of the largest 19 American banking holdings. The governing bodies of the program have drawn up common benchmarks of the loss rates foreseen for each loan category for all tested organizations. At the same time, the American holdings participating in SCAP, were allowed to use their estimates, other than the recommended ones, provided to be well-grounded (bottom-up approach). The validity of these calculations has been controlled by a team formed of over 150 analysts, economists, representatives of supervisory bodies. However, according to recent data (Yellen, J.L., 2016), the Committee on Capital Markets Regulation (CCMR), which connects the US large banks (JPMorgan Chase, Citigroup, Goldman Sachs, Wells Fargo, State Street and others), considers that the key-directives of stress tests are against law. The Committee on Capital Markets Regulation has prepared a report that says, the bankers do not like the conditions, that the Federal Reserve System of the United States of America, which performs stress tests, includes in the unfavourable testing scenario mathematical models. The US Administrative Procedure Act requires the regulators to public such documents for public discussions, but the Federal Reserve System does not publish scenarios and models. The stakes are high for banks: from the

results of stress tests depends on whether they will need to increase their capital, and whether they will be able to pay dividends and redeem their shares on the market. The Federal Reserve System began to perform stress tests in the largest US banks due to the crisis of 2008, when the Lehman Brothers investment bank went bankrupt, several US big financial companies have failed and the government had to provide financial assistance to several banks. The first stress tests have been performed in 2009 and since then these are organized annually. The number of participants is increasing every year: until 2014 – fewer than 20, this year – 33 banks with assets from 50 billion dollars. The regulators consider the stress tests as an efficient tool: the banks have consolidated the risk management, started to control better the businesses around the world and increased the share capital. With every passing year the testings are going to be tougher.

The results of the last stress tests showed that the banks, which in the previous year passed unsatisfactorily the test – Bank of America (BofA) and Citi – this time passed the tests. Morgan Stanley was the only bank which conditionally passed the test. The „daughters” of European banks – German Deutsche Bank and Spanish Santander failed to test. For Deutsche Bank, this is the second year running and for Santander – the third one. The failure of stress tests means they will not be able to increase their profits which are transferred to parent companies. Promptly, after the publication of the stress test results, BofA, Citi and JPMorgan reported the increase in dividend payments.

**Central Bank of Russian Federation** has

published the stress test data of banks based on the results of 2016 in „Banking Supervision Report 2016” (BR, 2017). The Bank of Russia performs the stress test by using the scenario analysis under a macroeconomic model, which is a system of regression equations describing the impact of the macroeconomic environment (macro parameters), including GDP, exchange rate of ruble in relation to foreign currencies, inflation, real household disposable revenues, investment in fixed capital on the banking sector indicator (volume of funds in the accounts of organizations, contributions of individuals and deposits of legal entities, cost (revaluation) of securities, loans issued to individuals and legal entities, amendment of „bad” loan rate in these loans). At the same time, in 2016 the Bank of Russia has improved the approaches of assessing the credit risk: share of portfolio risks became more granulated.

Taking into account the influence of macro factors on main banking indicators for each credit institution during the forecast period (quarterly), the calculations are based on an imitative balance sheet model reflecting the possible bank behaviour under stress conditions and forming a forecast of financial result.

The revenues, generated during the forecast period, offset partially the volume of eventual losses. The shaping result is a forecast of total losses of credit organization from all risk types under stress, as well as the potential capital and liquidity deficit. The capital deficit means the necessary resources for credit institutions to comply with the three capital adequacy standards; under

the liquidity deficit – the value of uncovered outflows and client means.

In the „Banking Supervision Report 2016” the stress test parameters and results of the Russian banks conducted by megaregulator last year are thoroughly analyzed. As it can be seen in the study, by means of stress tests there has been assessed the damage degree for the Russian banking sector if any shocks arise, taking into account that the impact on the Russian economy has worsened the external economic conditions. Additionally, the Bank of Russia has performed sensitivity tests of Russian banks in liquidity and concentration risks of lending in particular sectors of economy. The stress test results were actively used in supervision activities.

The macroeconomic scenario of stress test, as of January 1, 2017 implied a drop in fuel prices up to 25 US dollars per barrel and a GDP decrease of 1,4%; these events are accompanied by an increase of interest rates in Russian financial market and a decline of share indices. The forecast of credit organizations' losses has been performed in terms of four main risk types: credit risk (including worsening risk of stretch loan quality), market risk, risk of loss of liquidity, as well as interest rate risk by banking card.

The stress test set shows a pretty low concentration on lending the specified industries and indicates the absence of systemic risks for the banking sector. Taking into account the quite conservatory parameters of the stress scenario, the real impact of the similar events on the capital adequacy in the banking sector will be less

significant, according to the Central Bank.

At the same time, it is also worth mentioning several researches in this area, which describes in detail the ways and methods to perform stress tests in the banking sector. Thus, A.V. Vinogradov, K. B. Kuznetsov, K. V. Shimanovsky wrote in their article „Complex of stress test models of Russian banking sector” that, according to the Basel Committee on Banking Supervision announcement, the last crisis has revealed that in anti-crisis period, the stress test was attributed with only several „mechanical exercises”, with a low level of confidence. For all that, after the last crisis, the role of this methodology of assessing the stability of credit institutions has significantly increased: the Basel Committee issued „Principles of effective stress testing practices and supervision” (Simanovsky, A.I. ,2007), that there is referred to the need to create qualitative stress tests methodologies by banks. Additionally, the Basel Committee on banking supervision recommends the supervision authorities to apply the own stress tests methodologies.

According to the article of O. Solntsev A. Pestova și M. Mamonov „Stress test: will the Russian banks require a new state support?”, the macroeconomic stress tests of different types are a key element of the assessment program of the financial systems launched by the IMF and World Bank by the end of 1990. At the moment, more and more central banks, more specifically 40, perform macroeconomic stress tests and publish the results in their reports on financial stability of the system (Solntsev, O.G. et al., 2010).

### 3. PROBLEM STATEMENT

Given the importance of stress test of credit organizations in the country, the purpose of this paper is to perform the own stress test of the 11 Moldovan active banks, including identifying the key-factors of the external environment, which have a significant impact on the sustainable operation of these banks. The creation of an econometric model describing the dependence of banking indicators in a specific set of macroeconomic parameters has a scientific and practical significance regarding the current economic conditions.

To achieve this goal there are set the following tasks:

- identifying macroeconomic factors which affect the banking indicators; using the econometric tool (STATA - Data Analysis and Statistical Software for Professionals) to build a dependence model of stability and profitability of 14 (11 since 2015) Moldovan banks with a set of macroeconomic parameters, to assess the importance of the proposed factors;

- based on interdependence between macroeconomic and banking indicators to analyse how several variables respond to different shock sources in economy;

The general effect of recent financial crises on the Moldovan banking system has been especially experienced in bank assets. The sharp increase of credit risk during this period had determined the banks to reduce the loans and to grow significantly the compensations for loan losses. The crisis effects were indirectly refelt by banks, especially by remittances and foreign trade.

These macroeconomic indicators have substantially diminished following the economic decline in Europe, especially in 2009. The decrease of private consumption in euro area as a result of crisis contributed to the sharp decrease of Moldovan export in EU and volume of remittances from 2009 and 2012. The crisis events have negatively influenced the solvency of Moldovan debtors and quality of loan portfolio of local banks, respectively.

After analyzing the world experience on stress test, several key macroeconomic variables were chosen as explanatory variables which affects most the banking activity in our country. For the construction of the econometric models, since 2004, have been selected quarterly data of all Moldovan banks and 52 observations were eventually achieved.

The economy and banking system are closely interconnected. The lending by the banking system to economic entities of the economy (population, corporate customs) is directly related by more macroeconomic processes. Getting loans means that the subjects of economy have free funds to reimburse them. Therefore, the banking system in modern economy serve as a welfare indicator of the country and its sustainable development. Within this interdependence, it is rational to mention that, without a sustainable development of banks and banking system, it is impossible for the economy of our country, as a whole to operate and develop in a sustainable manner.

Starting from the specific situation of the Moldovan banking system, we chose 6 interdependent variables, which we suppose that

influence the volume and dynamics of the Moldovan banking sector: GDP, dual-currency basket value, average natural gas price, average monthly salary, value of industrial production at current prices, total net remittances in relation to GDP.

The aforementioned indicators allow us to identify the strengths and weaknesses of the banking system development of the country and the existing or eventual risks of its operation. In dynamics, these indicators may indicate an increase of the negative phenomena in the banking system and reduction of its sustainable development.

There is an interdependence of the macroeconomic factors, which strengthen their individual influence on the bank risk, however they can also make the empiric assessment of their relative importance for the banking risk difficult.

#### 4. METHODOLOGY AND DATA SOURCES

In our case with the sample of 14 banks (11 from 2015) we will use a *random effects model* also called a *variance components model*. This type of model can be considered as a compromise between the sequential regression, which implies a fairly strong homogeneity constraint for all coefficients of the regression equation  $i$  and  $t$ , and also the fixed effect model, which makes it is possible to introduce a constant for each object of the sample and thus to take into account the existing heterogeneity in reality but which, however, is not observed.

In the model with random effects, individual heterogeneity is not considered in the equation, but in the covariance matrix, which has a block-diagonal

shape, because within each group the random effects correlate with each other. To evaluate such a regression, it is better to use the least generalized square (GLS) method. The overall view of the model is as follows (Formula 1):

$$y_{it} = a + X'_{it}B + u_i + e_{it}, \text{ where} \quad (1)$$

$i$  - bank number,  $t$  - period (quarterly),  $a$  - free term,  $B$  - vector of dimensional coefficients,  $X'_{it}$  - row vector of explanatory variable matrix,  $u_i$  - unobservable individual effects,  $e_{it}$  - residual perturbation.

The random effects model can be considered as a linear pattern in which the error has a special structure.

Linear regression is an approach for modeling the relationship between a scalar dependent variable  $y$  and one or more explanatory variables denoted  $X$ . The case of one explanatory variable is called simple linear regression. For more than one explanatory variable, the process is called multiple linear regression. This term should be distinguished from multivariate linear regression, where multiple correlated dependent variables are predicted. In our case, for the regression analysis, we used a multivariate linear regression. The formula for a multivariate regression line is (Formula 2):

$$y_i = a_0 + \sum_{i=1}^n a_i x_i + \varepsilon, \quad (2)$$

where,  $y_i$  is the endogenous variable;  $a_i$  are parameters of regression, which show the average influence of individual fluctuation by exogenous variable  $x_i$  on the  $y$ ,  $i=1, \dots, n$ ;  $x_i$  are the exogenous variables influencing fluctuation of  $y$ ,  $i=1, \dots, n$ ;  $\varepsilon$  is

casual or stochastic component.

The dataset consists of a quarterly macroeconomic and banking data covering the period between the fourth quarter of 2013 and the fourth quarter of 2016, which allowed the problem to be solved over short time frames. In addition, the benefit of the quarterly vs. yearly model is its increased informative content, as it allows for a more in-depth analysis of the interrelations between indicators, taking into account their annual changes and seasonal fluctuations.

The macroeconomic data used for the empirical analysis of the theoretical hypotheses are derived from the statistical database of the Republic of Moldova. Also, sources of statistical information on GDP, average price on natural gas, monthly average earnings, net transfers, imports-exports, etc. such publications as Quarterly Statistical Bulletin, Social-Economic Situation of the Republic of Moldova, Statistical Yearbook of the Republic of Moldova - edited by the National Bureau of Statistics of Republic of Moldova; Moldovan Economic Trends - edited by the National Institute of Economic Research; ANOFM reports; information from the NBM and others.

All the banking important variables (for example, Long-term liquidity) are modeled at the macroeconomic level from the consolidated balance sheet of Moldova's banking sector. Banking data are taken from the database of the National Bank of Moldova and includes data on 14 Moldovan banks (11 banks from 2015).

Dependent variables include 6 bank indicators: Risk-weighted capital adequacy, Non-

performing loans, Return on assets (ROA), Return on equity (ROE), Long-term liquidity, Current liquidity.

Independent variables include 7 key macroeconomic indicators: - Moldova's GDP, in current prices, the average price for natural gas, dol. USA / 1000 m<sup>3</sup>, average monthly earnings, lei, turnover in the main retail businesses (excluding motor vehicles and motorcycles) in lei, volume of foreign transfers in USD, volume of export and import in USD.

Taking into account mentioned in the previous section macroeconomic variables, the resulting equation is as follows (Formula 3):

$$y_i = a_0 + a_1 \times gdp + a_2 \times price\_gaz + a_3 \times monthly\_average\_earning + a_4 \times turnover\_retail\_trade + a_5 \times transfert + a_6 \times export + a_7 \times import \quad (3)$$

where, the dependent variables are the set of the banking indicators and independent variables are the set of the factors influencing the *i-th* variable includes some macroeconomic indicators of the country.

$y_i$  are Banking Indicators: Risk-Weighted Capital Satisfaction, Bad Credit Balance (Basic Amount) / Debt Balance (Basic Amount)), Return on Assets (ROA), Return on Equity (ROE) Liquid\_long), Current Liquid (Liquid\_curent).

$x_i$  are the macroeconomic indicators of the country: GDP (gdp); average price on natural gas (price\_gaz), average monthly earnings (monthly\_average\_earning), turnover in enterprises with main activity of turnover (turnover\_retail\_trade), total transfers (transfer), export and import.

Equation (3) is a basic one for estimating the dynamics of dependent variables and presented in a linear form, allows us to interpret regression coefficients to explanatory variables as corresponding elasticity coefficients.

Standard statistics were used to assess the quality of the models: the determination coefficient  $R^2$  and the coefficient of adjustment of the factor  $R^2_{adj}$ , F - Fisher's statistics, Root MSE - the mean square error root, t-statistic and its p value.

The determination coefficient ( $R^2$ ) is the dependency dependent dispersion fraction, explained by the dependency model examined, ie the explanatory variables. More precisely, the unit minus the fraction of the unexplained dispersion (dispersion of the random error of its model dependent upon the dispersion of the dependent variable) in the dispersion of the dependent variable. This is considered as a universal measure of the dependency of a random variable from many others. In the particular case, the linear dependence  $R^2$  is a square, the so-called multiple correlation coefficient between the dependent variable and the explanatory variables. In particular, for the linear regression model, the coefficient of determination is equal to the square of the correlation coefficient common between y and x.

The coefficient of determination for the constant model is from 0 to 1. The closer to 1 is the value of the coefficient, the greater the dependency. When evaluating regression models, it is interpreted as the correspondence of the data model. For acceptable models, the assay coefficient should be assumed to be at least 50% (in this case, the

multiple correlation coefficient exceeds the 70% mode). Models with a factor of more than 80% can be considered good enough (correlation coefficient exceeds 90%). The value of the determination coefficient 1 means the functional dependence between the variables.

$R^2$  ( $R^2_{adj}$ ) - is used to compare models with a different number of factors so that the number of regressions (factors) does not affect the  $R^2$  statistics normally used is the adjusted determination coefficient in which they are used impartial estimates of dispersions. This indicator is always lower than 1, but theoretically could even be less than 0 (only at a very low value of the determination coefficient and a large number of factors). Therefore, the interpretation of the indicator is lost as a "quota". However, the use of the indicator in comparison is justified. For models with the same dependent variable and sample size, the comparison of models using the adjusted determination coefficient is equivalent to their comparison with residual dispersion or standard model error. The only difference is that the last criterion, the smaller it is, the better.

Fisher's F or Fisher's test (criteria F, criteria  $\varphi^*$ ) is a statistical criterion, the test statistic for Fisher distribution (F distribution) when performing the null hypothesis. Test statistic in one way or another is reduced to the selective dispersion ratio (square sums, divided by "degree of freedom"). For statistics to have a Fisher distribution, it is necessary that the numerator and the denominator are random random variables, and the corresponding square sums have the Xu-square

distribution. This requires the data to have a normal distribution. In addition, the dispersion of random variables whose squares are summed is assumed to be the same. The test is performed by comparing the value of the statistics with the critical value of the corresponding Fisher distribution at a certain level of significance.

Root Mean Squared Error (RMSE) - root mean square error - the main statistical criterion for determining the quality of the model. For the calculation of the mean square error (MSE), all the residual regression residues rise to square, the sum is divided by the total number of errors (Formula 4):

$$MSE = \frac{\sum_{i=1}^n (y_i - \hat{y}_i)^2}{n} \quad (4)$$

The square root of this value is called RMSE (Root Mean Squared Error) (Formula 5):

$$RMSE = \sqrt{\frac{\sum_{i=1}^n (y_i - \hat{y}_i)^2}{n}} \quad (5)$$

t-statistic and its value p (or t-criterion Student) - common name for a class of methods of statistical hypothesis testing (statistical criteria) based on the Student distribution. The most common uses of the t-criterion are associated with testing the equivalence of the mean values in two samples. t-statistics are usually constructed according to the following general principle: in the random variable numerator with zero mathematical expectations (in the zero hypothesis), and the

denominator - the selective standard deviation of this random value obtained as the square root of the unmixed dispersion estimate.

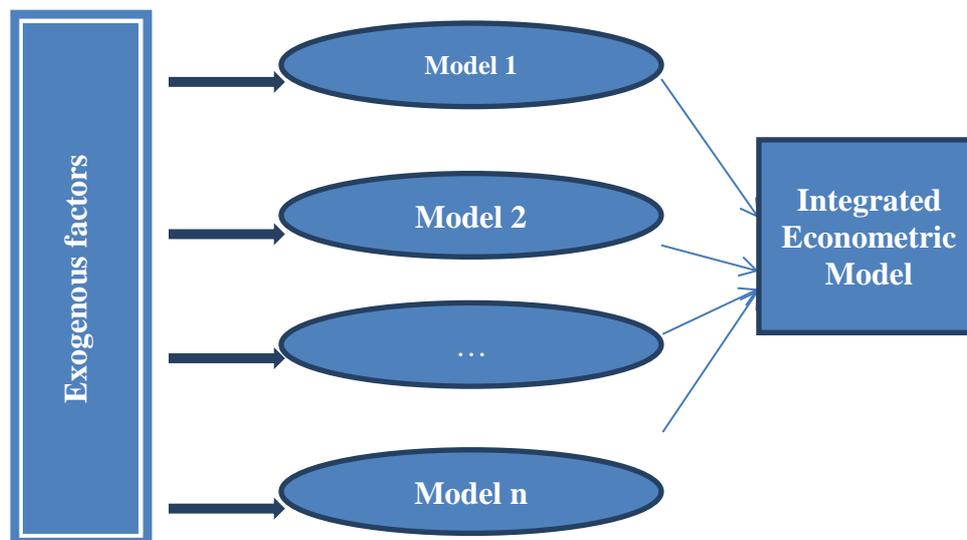
This criterion was developed by William Gosset to assess the quality of beer at Guinness. In connection with the obligations to non-disclosure of business secrets - Guinness's management considers such use of the statistical apparatus in its work, Gosset's article was published in 1908 in the journal "Biometrika" under the pseudonym "Student".

## 5. ECONOMETRIC MODEL AND ANALYSIS OF EMPIRICAL RESULTS

### Dataset

The resulting equation was calculated using the program Stata/SE 9.2 with the aforesaid factors. The results of the multivariate linear regression include coefficients of the model with their standard errors. Coefficients were calculated using the least squares approach. Statistical significance of the calculated coefficients is on the level of 5%. The conceptual scheme of the model consists of assessing the impact of exogenous factors on several independent variables, and then unifying them into an integrated econometric model (Figure 1).

**Figure 1. Conceptual scheme for the econometric model for the Republic of Moldova**



Sources: elaborated by the authors

**Model 1 (Dependent Variable: Risk-Weighted Capital Adequacy)**

*Risk-Weighted Capital Adequacy* is a bank capital adequacy indicator, which implies the conventional stability of the minimum capital level, based on certain parameters reflecting the dimensions of the activities of bank and the associated risks, to ensure a correlation between the achieved benefits and eventual losses due to the assumption of a certain degree of risk (Cociug, V. and Cinic, L., 2008).

$$CAR = \frac{TRC}{RWA} * 100\% \quad (6)$$

where:

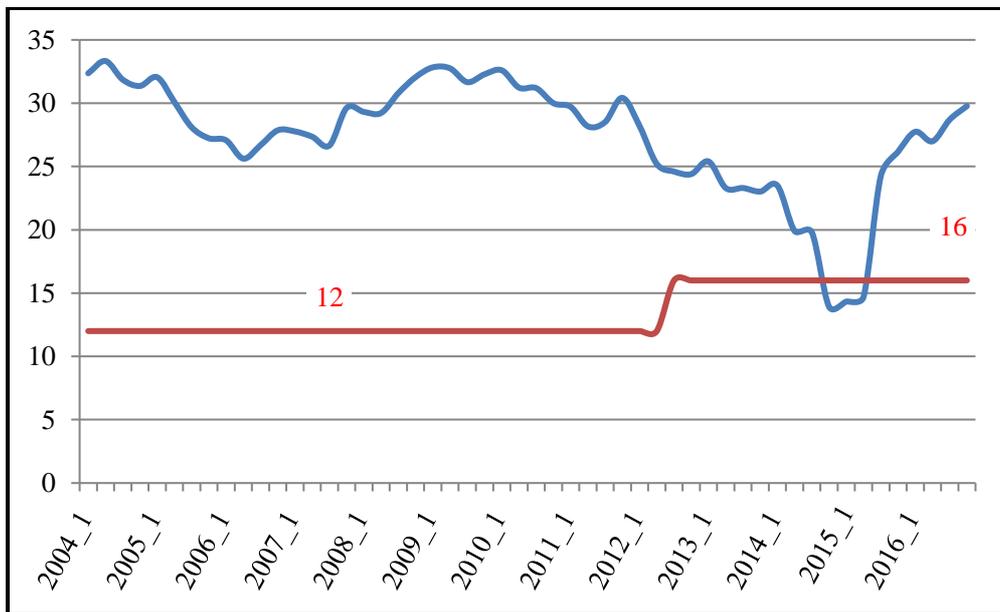
*CAR* – Capital Adequacy Ratio;

*TRC* – Total Regulatory Capital or Capital Requirement;

*RWA* – Risk-Weighted Assets.

The capital adequacy indicator determines the ability to cover the losses caused by the bank risk assets from the total regulatory capital account. In the Republic of Moldova, according to the legislation in force,  $CAR \geq 16\%$ , this margin being imposed since June 2012 (NBM, 2011). In the previous period, the margin set by the NBM was situated at the level of 12%. The increase was due to the tightening of requirements imposed by the Basel Committee on capital adequacy pursuant to the existing increased risk in the international banking system.

**Figure 2. Dynamic of risk-weighted capital adequacy ratio in Moldovan banking system during 2004-2016, %**



Source: elaborated by the authors according to data of the NBM, [www.bnm.md](http://www.bnm.md)

weighted assets in the sector) still remained at a

In dynamics of the banking system, excepting the period between the end of 2014 and the beginning of 2015 (affected by the devaluation of the three banks in the banking system) the risk-weighted capital adequacy ratio is much higher compared to the margin set by the National Bank of Moldova in the regulation on risk-weighted capital adequacy. During the analyzed period, the risk-weighted capital adequacy ratio is about two to three times higher compared to the established ratio. This says that the banks in the domestic banking system hold a too high capital compared to its capital adequacy ratio, marking a prudent approach of the operating activity of the domestic banks, which are aimed at maintaining a high volume of regulatory capital in relation to the level of the assumed risk. On December 31, 2016 the average of the risk-weighted capital adequacy in the sector, (ratio of total regulatory capital value to risk-

high level – 29,8% (minimum level regulated in Moldova being at least 16,0%) showing a high level of bank security determined by a potential carrying out risky operations without affecting the capital.

Reducing it up to the required level would allow the banks to capitalize their potential performing credit operations without risking the financial security.

The evaluation of the regression model where Risk-weighted capital adequacy is the dependent variable, has identified that the majority of the coefficients explaining the impact of the factors are statistically significant. Estimation of model parameters and results of statistical significance are presented in Table 2.

**Table 2. The estimation of the impact of Moldovan macroeconomic determinants on finance indicator - *Risk-Weighted Capital Adequacy***  
 (dependent variable - *Suf\_cap*)

Variable name	Variable interpretation	Coef.	Std. error
<i>gdp</i>	GDP RM	0.0005541	0.0002728
<i>price_gaz</i>	Average price for natural gas	<b>-0.405485</b>	0.0131124
<i>monthly_average_earning</i>	Monthly average earning	-0.0096862	0.002553
<i>turnover_retail_trade</i>	Turnover of enterprises with main retail trade activity	0.0000433	0.0006915
<i>transfert</i>	Total transfers from abroad	<b>-0.0337801</b>	0.0137797
<i>export</i>	Export volume	0.0046531	0.0112091
<i>import</i>	Import volume	0.0070703	0.0041454
<i>_cons</i>	Constant	61.73588	6.721651
<b>F statistic</b>		7.71	
<b>Prob&gt;F</b>		0.0001	
<b>R-squared</b>		0.6584	
<b>Root MSE</b>		3.3886	

- assessment of all coefficients is at 5% significance level

Sources: authors' calculations according to the data base of National Bureau of Statistics of Republic of Moldova and National Bank of Moldova

As a result of the estimates, there was a more pronounced impact on *Risk-Weighted Capital Adequacy* (GSC) on the part of two macroeconomic indicators: the natural gas price and the transfers. Both indicators have a negative impact on the GSC. Thus, if the average natural gas price will increase by 1 p.p. provided that the remainder of the independent variables remain constant, then the GsC will decrease by 0.4 p.p. Increase of indicator transfers by 1 p.p. Under the same conditions, the GC decreases by 0.03 p.p.

Negative influence, but less pronounced, has proved to have a medium salary gain on the GSC, its increase by 1 p.p. provided that the remainder of the independent variables remain constant, causes

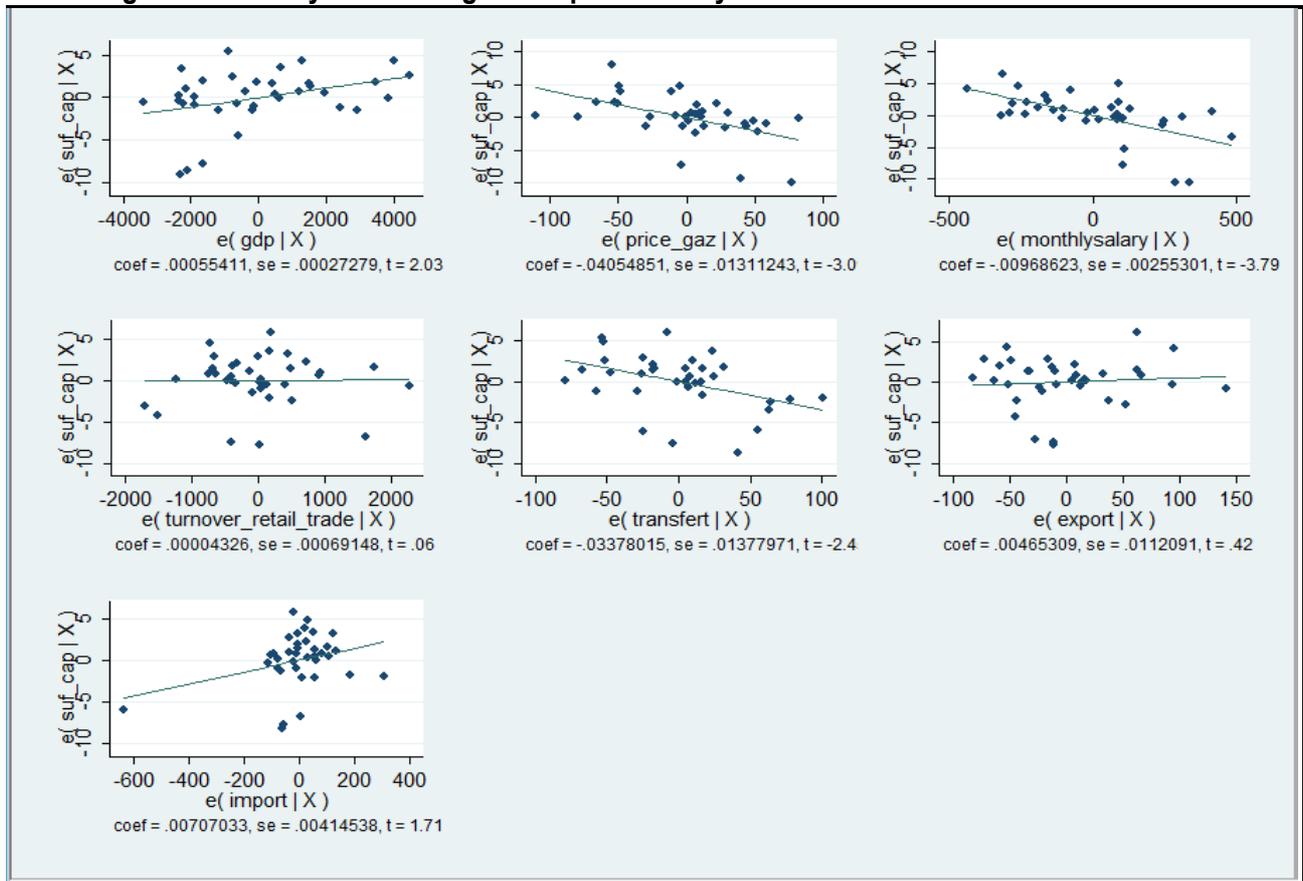
the GSC to decrease by 0.009 p.p.

A positive but less pronounced relationship

was established between GSC and export volume, import volume, GDP and turnover. In this way, increasing these indicators by 1 p.p. provided that the remainder of the independent variables remain constant, then the GC will increase by 0.004 p.p.; 0.007 p.p.; 0.0005 p.p. and 0.00004 p.p. suitable.

The model indicates that all dependent variables have a statistically significant influence on the evolution of GSC. Figure 3 illustrates the graphical correlation between the key macroeconomic variables and the *Risk-Weighted Capital Adequacy* in the Moldovan banking sector.

**Fig. 3. Sufficiency of risk-weighted capital and key macroeconomic variables correlation**



Sources: authors' calculations according to the data base of National Bureau of Statistics of Republic of Moldova and National Bank of Moldova

**Model 2 (Dependent Variable: Non-performing Loan Rate)**

*Non-performing loan rate* is an indicator showing the trends in bank lending of economy. The non-performing loans are granted by bank as loans without being reimbursed and a future reimbursement is doubtful. In order to ensure and avoid some negative effects on lending activities, the banks create certain risk funds for types of high-risk loans influencing ultimately the efficiency of their activity.

The increase of this indicator reflects a low

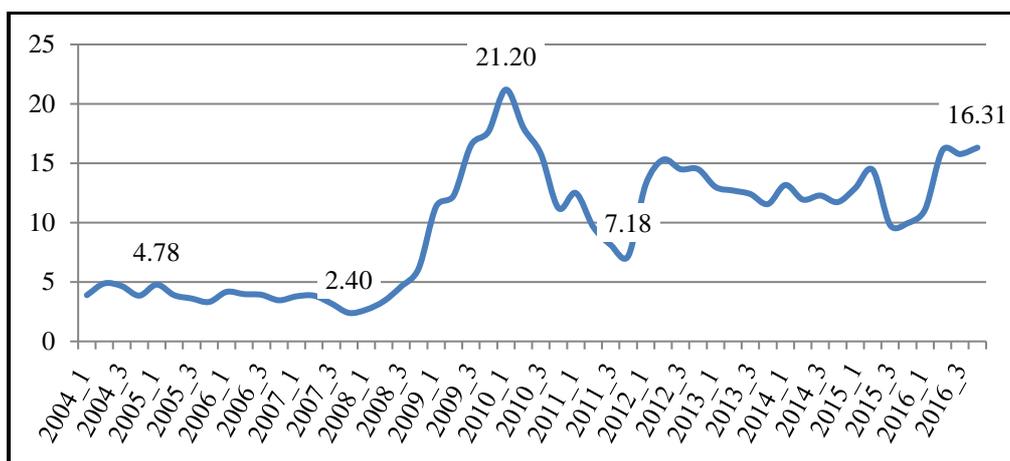
quality of loan portfolio and a high-risk degree. The decrease of this indicator in dynamics is positively appreciated.

In dynamics of the banking system, *the weight of non-performing loans in total loans* in the Republic of Moldova is characterized by an uneven fluctuating development and an increasing trend. There is noticed that since 2008, the fluctuations of this indicator were not clearly defined and its values had already a decreasing trend. Since 2009, the situations has suddenly worsened, as a result of the impact of the world financial crisis experienced by

the national economic agents, as well as the population, whose payment ability has unexpectedly declined. And even if, in 2011 there was observed a revival of this situation, the indicator values remains sufficiently high, triple, compared to

the previous years of the international financial crisis (figure 4).

**Figure 4. Dynamic of non-performing loan weight in total loans in Moldovan banking system, %**



Source: elaborated by the authors according to the data of the NBM

During 2016, the increase of non-performing loan rate shows the quality of loan portfolio which is worsening. During 2016, the weight of non-performing loans in total loans posted an increase of 16,31%. This increment was mainly due to the fact that the growth rate of non-performing loan value was higher compared to the general loan portfolio and regulatory capital. We state, that lending activity of the domestic banking sector is strongly influenced by the low solvency of the economic agents dependent on the instable macroeconomic situation and problems in corporate governance of the banks.

The low quality of loans and wrong assessment of credit risk is one of the main causes in bankruptcy of banks. If the loan quality deterioration is not discovered in good time, the

problem may be aggravated and extended. By means of this econometric study, we intended to determine the extent to which the non-performing loan rate is influenced by the development of macroeconomic indicators.

The evaluation of the econometric model where *Non-performing loan rate* is the dependent variable has identified that the majority of the coefficients explaining the impact of the factors are statistically significant. Estimations of the coefficients from the econometric model and their statistical significance are presented in the Table 3.

**Table 3. The estimation of the impact of Moldovan macroeconomic determinants on finance indicator – Non-performing loan rate (dependent variable - NPL)**

Variable name	Variable interpretation	Coef.	Std. error
<i>gdp</i>	GDP RM	-0.0000633	0.0003103
<i>price_gaz</i>	Average price for natural gas	<b>0.0203214</b>	0.0149149
<i>monthly_average_earning</i>	Monthly average earning	0.0017987	0.002904
<i>turnover_retail_trade</i>	Turnover of enterprises with main retail trade activity	0.0007318	0.0007865
<i>transfert</i>	Total transfers from abroad	<b>-0.0233048</b>	0.0156739
<i>export</i>	Export volume	<b>-0.0198548</b>	0.0127499
<i>import</i>	Import volume	0.0034013	0.0047152
<i>_cons</i>	Constant	8.387033	7.645636
<b>F statistic</b>		1.53	
<b>Prob&gt;F</b>		0.1991	
<b>R-squared</b>		0.2762	
<b>Root MSE</b>		3.8544	

- assessment of all coefficients is at 5% significance level

Sources: authors' calculations according to the database of National Bureau of Statistics of Republic of Moldova and National Bank of Moldova

As a result of the estimates made, the existence of a positive well-pronounced correlation between the *average price for natural gas* and the *non-performing loan rate* was determined. In this context, if the average natural gas price increases unitarily and the rest of the variables remain constant, the *non-performing loan rate* will increase by 0.02 p.p.

However, positive, but less-pronounced influences have been proven by *monthly average earning*, *import volume* and *turnover*. Increasing these variables with one unit, provided the rest of the independent variables remain constant, will determine the increase of NPL rate by 0.001 p.p.; 0.003 p.p.; and 0.0007 p.p., correspondingly.

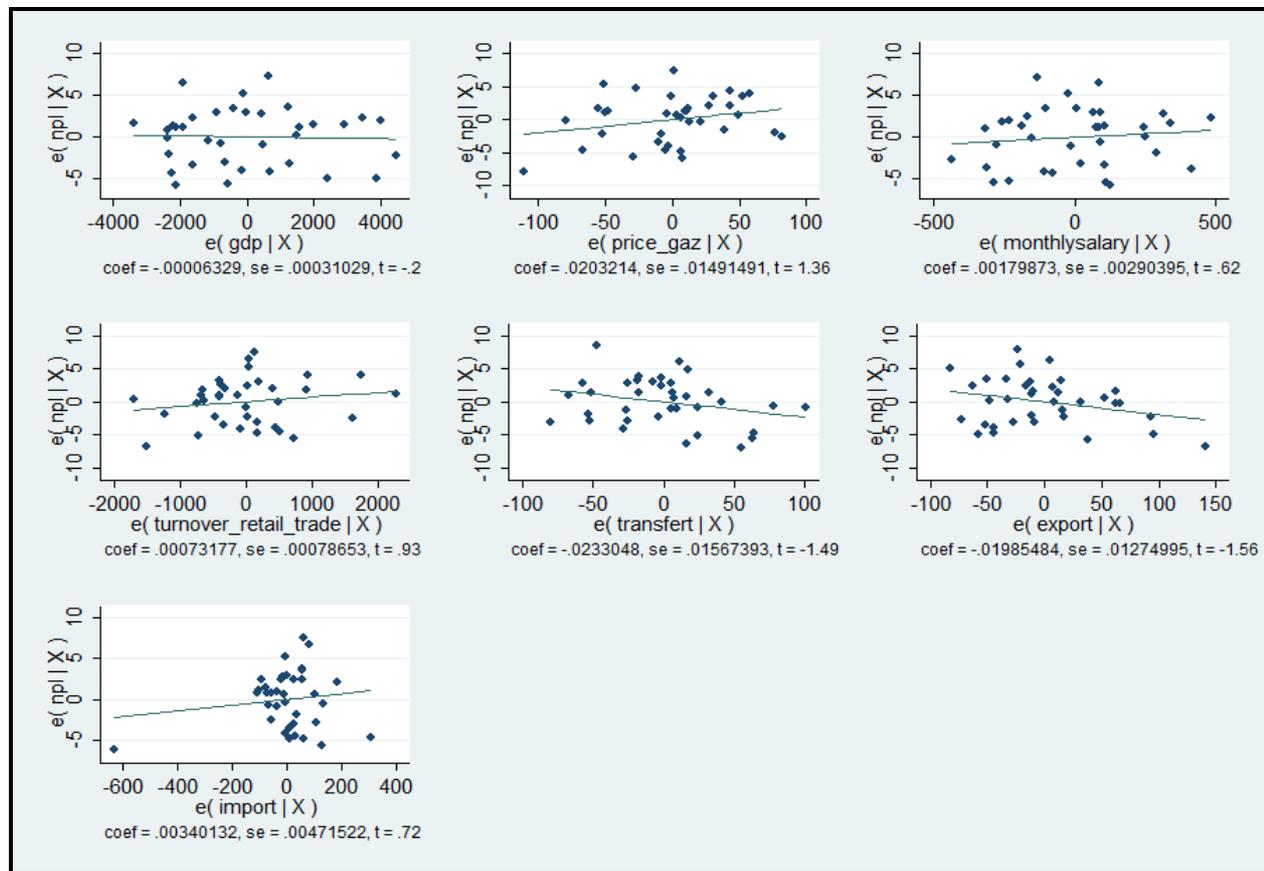
A pronounced negative impact on the level of *non-performing loan rate* was determined by the

*remittances* and *export volumes*. Increasing them by one unit, provided the other variables remain at a constant level, will reduce the *non-performing loan rate* by 0.02 p.p. and 0.01 p.p., correspondingly.

Also, a negative impact, but less pronounced on the *rate of non-performing loans* has the GDP growth. Increasing it by 1 p.p. will condition the lowering of *non-performing loan rate* by 0.00006 p.p. in the same conditions.

The model indicates that all the dependent variables have a statistically significant influence on the evolution of the *non-performing loan rate*. Figure 5 illustrates the graphical correlation between the key macroeconomic variables and the *share of non-performing loans in total loans* in the banking sector of the Republic of Moldova.

**Figure 5. Correlation between the share of non-performing loans in total loans and key macroeconomic variables**



Sources: authors' calculations according to the database of National Bureau of Statistics of Republic of Moldova and National Bank of Moldova

**Model 3 (Dependent Variable: Return On Assets)**

Return on assets (ROA Return On Assets) is another relevant indicator for banking activity and is expressed by:

$$ROA = \frac{\text{Venit net}}{\text{Active totale}} \times 100 \quad (7)$$

This indicator measures the net income generated by each monetary asset unit. The Return on assets (ROA) provides an overview on bank profitability. The classic indicator is situated between 0,5-1,6%. A decreasing trend of this indicator shows that the bank has income problems.

An increasing trend is generally a positive sign but may also indicate an excessive risk-taking.

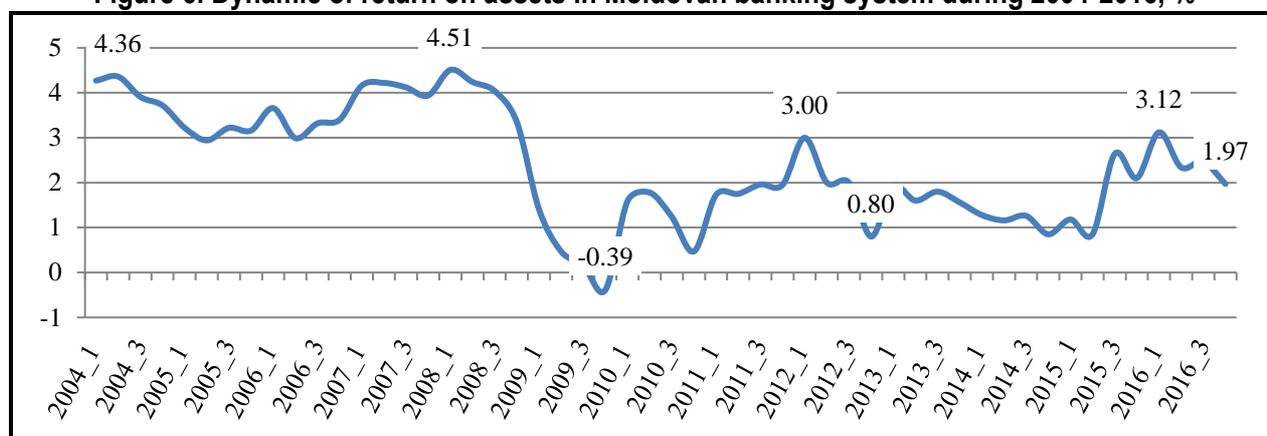
The profitability analysis is a key component of the bank asset management at all levels of bank management, as they are the most profitable banking operations but also the most risky ones.

Analyzing the development of profitability in the banking system during 2004 – 2016, there is seen a significant decline of the ROA performance indicators during 2009-2016 compared to the previous period. This is vastly due to the 2009 crisis, which affected negatively the entire economy of the country, including the banking system. As a result of

the NBM measures to improve and encourage the banks during 2009-2010, the return on assets

remained positive during the period of 2011-2016.

**Figure 6. Dynamic of return on assets in Moldovan banking system during 2004-2016, %**



Source: elaborated by the authors according to the data of the NBM

It is known that the return on assets is the best measure of the banking efficiency, as expresses directly the result obtained through the specific management of the banking intermediation and improvement of its active operations, in terms of an amount of resources, through this econometric study, we set out to determine that the measure of this indicator is influenced by the development of macroeconomic indicators in the Republic of

Moldova.

The evaluation of the econometric model where *return on assets* is the dependent variable has identified that the majority of the coefficients explaining the impact of the factors are statistically significant. Estimations of the coefficients from the econometric model and their statistical significance are presented in the Table 4.

**Table 4. The estimation of the impact of Moldovan macroeconomic determinants on finance indicator – (dependent variable - ROA)**

Variable name	Variable interpretation	Coef.	Std. error
<i>gdp</i>	GDP RM	0.0000822	0.0000864
<i>price_gaz</i>	Average price for natural gas	<b>-0.0083396</b>	0.0041535
<i>monthly_average_earning</i>	Monthly average earning	-0.0003449	0.0008087
<i>turnover_retail_trade</i>	Turnover of enterprises with main retail trade activity	-0.0004175	0.000219
<i>transfert</i>	Total transfers from abroad	<b>0.0052611</b>	0.0043649
<i>export</i>	Export volume	<b>0.0016827</b>	0.0035506
<i>import</i>	Import volume	-0.000195	0.0013131
<i>_cons</i>	Constant	5.03892	2.129161
<b>F statistic</b>		1.13	
<b>Prob&gt;F</b>		0.3743	
<b>R-squared</b>		0.2199	
<b>Root MSE</b>		1.0734	

- assessment of all coefficients is at 5% significance level

Sources: authors' calculations according to the data base of National Bureau of Statistics of Republic of Moldova and National Bank of Moldova

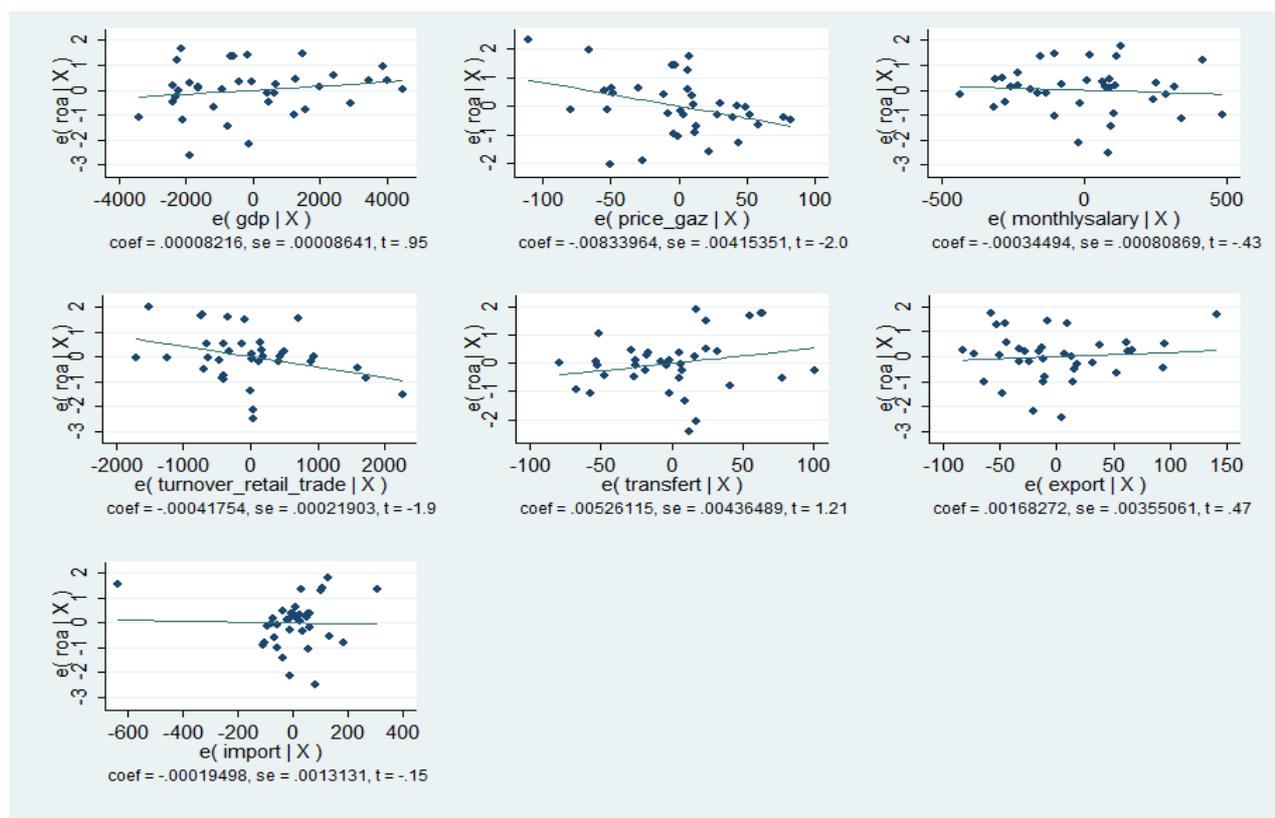
As a result of the estimates, there is a weak correlation between the majority of macroeconomic indicators and the return on assets of the banking system in the Republic of Moldova. Positive influences on bank profitability proved to be: transfers, imports and GDP, the increase of which by one unit will increase ROA by 0.005 p.p., 0.001 p.p. and 0.00008 p.p. accordingly.

Negative impact, albeit poorly pronounced, but will have the average price on natural gas, average earnings and export volume. Increasing

these indicators by 1 p.p. will result in decreasing ROA by 0.008 p.p., 0.0004 p.p. and 0.0001p.p. accordingly.

The model indicates that all dependent variables have a statistically significant influence on ROA evolution. Figure 7 illustrates the graphical correlation between the key macroeconomic variables and the Return on Assets in the banking sector in Moldova.

**Figure 7. The correlation between Return on Bank assets and key macroeconomic variables**



Sources: authors' calculations according to the database of National Bureau of Statistics of Republic of Moldova and National Bank of Moldova

**Model 4 (Dependent Variable: Return on Capital – ROE)**

Financial profitability or return on equity has a special significance for a bank's shareholders

because it indicates the effect of the involvement (by buying shares) in the activity of the bank.

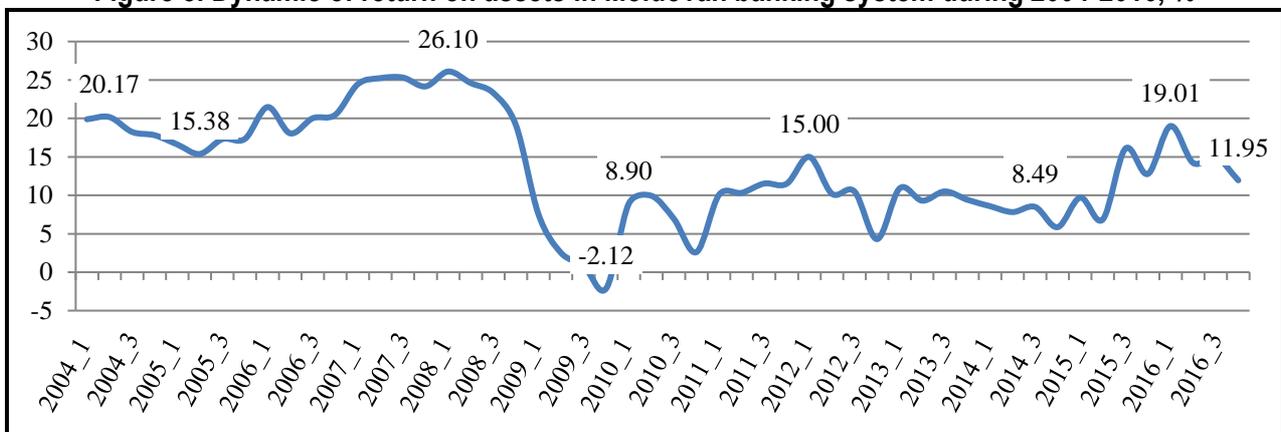
$$ROE = \frac{\text{Venit net}}{\text{Capital propriu}} \times 100$$

(8)

Therefore, the main goal of a bank management is to maximize the value of its shareholders' investment and return on equity indicator (ROE) by achieving several performing capital investment and using efficiently the (own and attracted) bank resources.

This indicator measures the degree of investment recovery of bank's owners, providing information on efficiency of using the invested capital. The classic value of this rate in developed countries is about 10-12%. A higher financial rate of return can be the effect of a low capital or the expression of the increased ability to achieve additional resources by the way of loan.

**Figure 8. Dynamic of return on assets in Moldovan banking system during 2004-2016, %**



Source: elaborated by the authors according to the data of the NBM, [www.bnm.md](http://www.bnm.md)

In dynamics, the financial results of the banks in the domestic banking system were quite high during 2004 and 2008, (up to 26,1% of ROE value), then in 2009 they have registered negative values and in 2010 a modest increase. The economic and financial profitability have registered a decreasing trend due to the low dynamics of net profit compared to the increase of asset and equity capital. The negative results are a consequence of the global financial crisis, which by the end of 2009 registered a reduction in the net income resulted from the financial activity and substantial increase of breakdowns for the declines of loan losses. During 2010, there is seen an improvement of these

indicators as a result of implementing several measures of exclusion of the crisis effects, using more efficiently the capital and reviewing the lending policies. During 2011 – 2016, the return on equity has maintained positive, even in the years affected by the devaluation of some banks in the national banking system.

The evaluation of the regression model where the *Return on Capital* represents the dependent variable has identified that the majority of the coefficients explaining the impact of the factors are statistically significant. Estimate of model parameters and results of statistical significance are presented in Table 5.

**Table 5. The estimation of the impact of Moldovan macroeconomic determinants on finance indicator – *Rentabilitatea capitalului* (dependent variable - ROE)**

Variable name	Variable interpretation	Coef.	Std. error
<i>gdp</i>	GDP RM	0.0003448	0.0004874
<i>price_gaz</i>	Average price for natural gas	<b>-0.0495956</b>	0.0234293
<i>monthly_average_earning</i>	Monthly average earning	-0.0002013	0.0045617
<i>turnover_retail_trade</i>	Turnover of enterprises with main retail trade activity	-0.0024631	0.0012355
<i>transfert</i>	Total transfers	<b>0.0366107</b>	0.0246216
<i>export</i>	Export volume	<b>0.0101664</b>	0.0200284
<i>import</i>	Import volume	-0.0021005	0.007407
<i>_cons</i>	Constant	25.53316	12.01026
<b>F statistic</b>		1.21	
<b>Prob&gt;F</b>		0.3279	
<b>R-squared</b>		0.2328	
<b>Root MSE</b>		6.0547	

- assessment of all coefficients is at 5% significance level

Sources: authors' calculations according to the database of National Bureau of Statistics of Republic of Moldova and National Bank of Moldova

The empirical results have determined that the return on equity (ROE) is more closely related and that depends more on the next macro factors: the average price of natural gas, transfers, export. Thus, the macroeconomic indicator "Average price on natural gas" negatively influences the ROE indicator, and if this macroeconomic indicator, provided the remainder of the independent variables remain constant, increases by 1 p.p., ROE will decrease by 0.05 p.p.

Transfers are directly correlated with ROE, therefore, if they increase by 1 p.p, provided that the remainder of the independent variables remain constant, ROE will increase by 0.04 p.p.

A similar situation has the macroeconomic indicator Exports of Goods and Services, ROE is in direct relation, respectively, if exports will increase

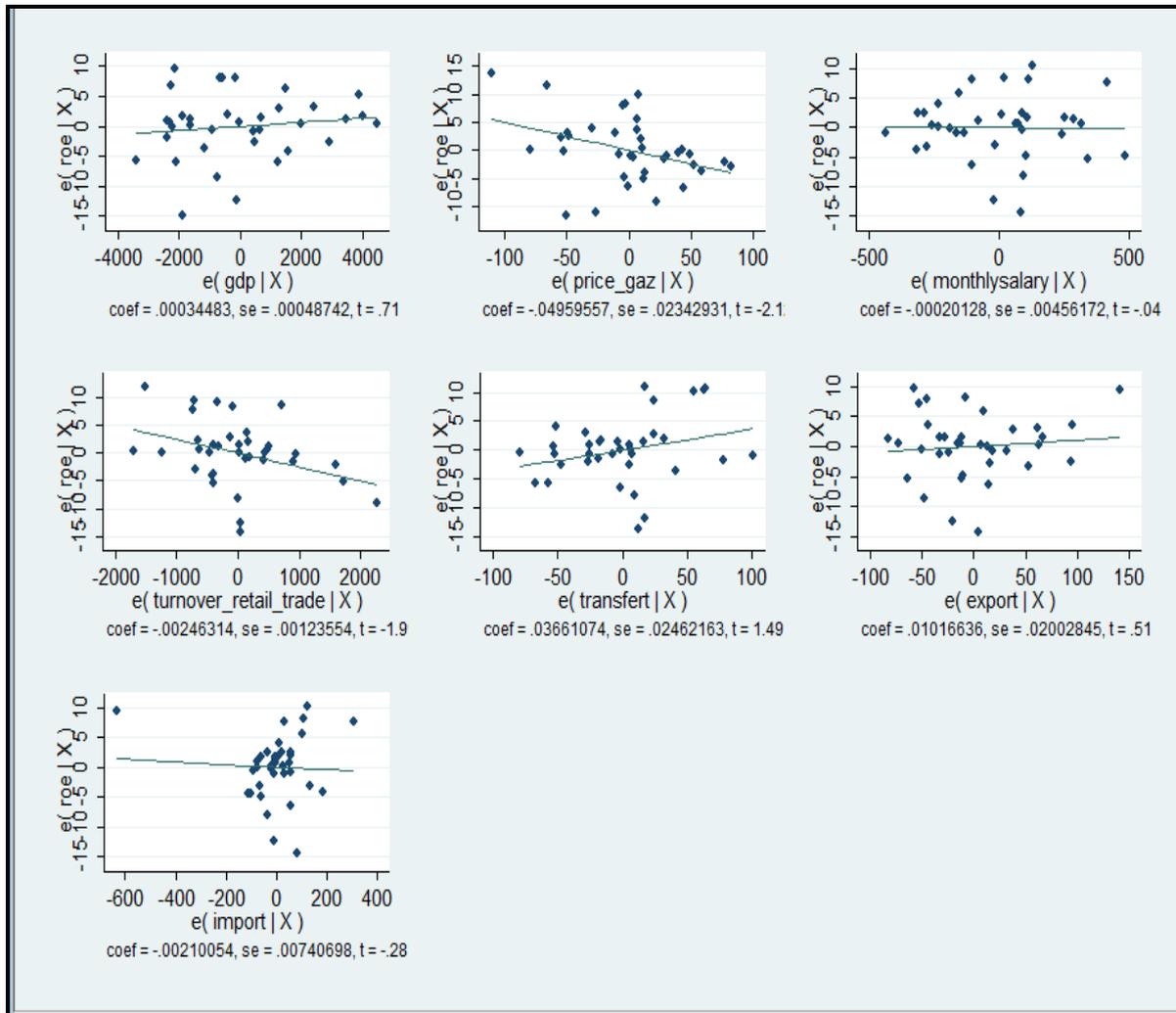
by 1 p.p, provided that the remaining independent variables remain constant, ROE will increase by 0.01 p.p.

The empirical results provide evidence that there is a positive but weak relationship between the GDP growth rate and ROE, so if GDP increases by 1 p.p, ROE will increase by 0.0003 p.p. Also, Regression Coefficients indicate a negative but also very weak relationship between Import independent variables, monthly average earning, turnover in primary retail businesses, and ROE dependent variable. Therefore, if Import, the average monthly earnings, the turnover will increase each with 1 p.p., provided that the remainder of the independent variables remain constant, ROE will decrease respectively by: 0,002; 0.0002; 0.002.

The model indicates that all the dependent variables have a statistically significant influence on the evolution of the return on capital Figure 9

illustrates the graphical correlation between the key macroeconomic variables and the ROE in the Moldovan banking sector.

**Figure 9. Correlation between Return on Capital and Macroeconomic variables**



Sources: authors' calculations according to the database of National Bureau of Statistics of Republic of Moldova and National Bank of Moldova

**Model 5 (Dependent Variable: Long-Term Liquidity)**

By long-term bank liquidity has been meant the banks' compliance with the provisions of Liquidity principle I imposed by the NBM, according to which the amount of bank assets with a repayment term of more than 2 years should not exceed the amount of its financial resources. On the

banks assets, there are also included the investment securities which are taken into account in the calculation of this normative. Therefore, indirectly the purchase of these securities by banks dependent on the amount of bank capital, other disposable resources is hereby limited.

Liquidity principle I identifies the absolute liquidity and can lay at the basis of transformation

risk assessment.

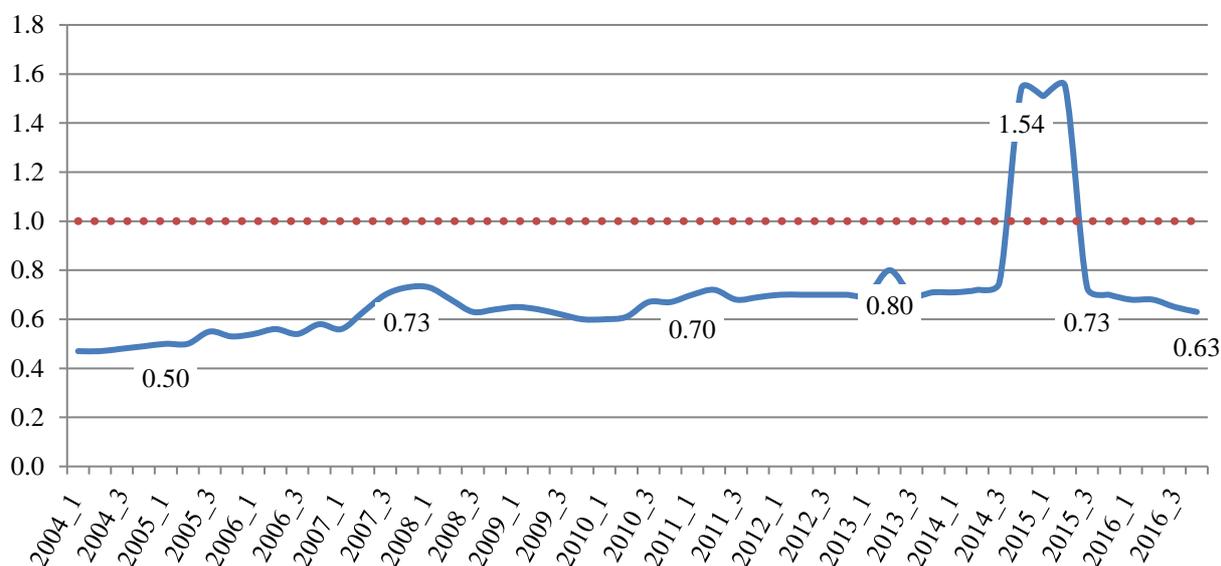
$$K_1 = \frac{\sum \text{activelor}_{pe\_termen\_lung}}{\sum \text{pasivelor}_{pe\_termen\_lung}} \leq 1$$

(9)

Analyzing the development of long-term liquidity indicator in the domestic banking system

allows us to pursue a pretty stable situation in this respect if we omit the atypical disturbances caused by the devaluation of some banks during 2014-2015. Thus, we notice, that over the years the long-term liquidity level of the banks remained sufficient and complied with the requirements of monetary authorities regardless the recession of 2009.

**Figure 10. Dynamic of long-term liquidity in Moldovan banking system during 2004-2016, %**



Source: elaborated by the authors according to the data of the NBM

The prudence of bank management in operating liquidities is beneficial for the health of the banking system, however a particular interest is the extent to which this indicator can be still influenced by the development of macroeconomic indicators, what we have planned through our econometric study.

The evaluation of the econometric model where *Long-term bank liquidity* is the dependent variable has identified that the majority of the coefficients explaining the impact of the factors are statistically significant. Estimations of the coefficients from the econometric model and their statistical significance are presented in the Table 6.

**Table 6. The estimation of the impact of Moldovan macroeconomic determinants on finance indicator – Long-term bank liquidity**

Variable name	Variable interpretation	Coef.	Std. error
<i>gdp</i>	GDP RM	-0.0000322	0.0000184
<i>price_gaz</i>	Average price for natural gas	0.0016282	0.0008857

<i>monthly_average_earning</i>	Monthly average earning	0.0003703	0.0001724
<i>turnover_retail_trade</i>	Turnover of enterprises with main retail trade activity	0.0000337	0.0000467
<i>transfert</i>	Total transfers from abroad	0.0003925	0.0009308
<i>export</i>	Export volume	-0.0003087	0.0007571
<i>Import</i>	Import volume	-0.0002284	0.00028
<i>_cons</i>	Constant	-0.3496858	0.4540296
<b>F statistic</b>		1.62	
<b>Prob&gt;F</b>		0.1714	
<b>R-squared</b>		0.2880	
<b>Root MSE</b>		0.22889	

- assessment of all coefficients is at 5% significance level

Sources: authors' calculations according to the database of National Bureau of Statistics of Republic of Moldova and National Bank of Moldova

Empirical results have shown once again that there is no close link between long-term liquidity and macroeconomic variables. Therefore, irrespective of the macroeconomic situation or possible shocks that may come to the national economy, banks, according to the econometric model, will have liquidity and will be able to resist any crises.

However, even if these correlations are small, we can state according to the model that a direct impact on long-term liquidity has the following macroeconomic variables: gas price, earnings, turnover of enterprises, transfers. And such macroeconomic factors as export, import and GDP growth have a reverse effect on long-term liquidity.

According to empirical data, we have the following situation:

If the "average price for natural gas" will increase by 1 p.p., provided that the remaining independent

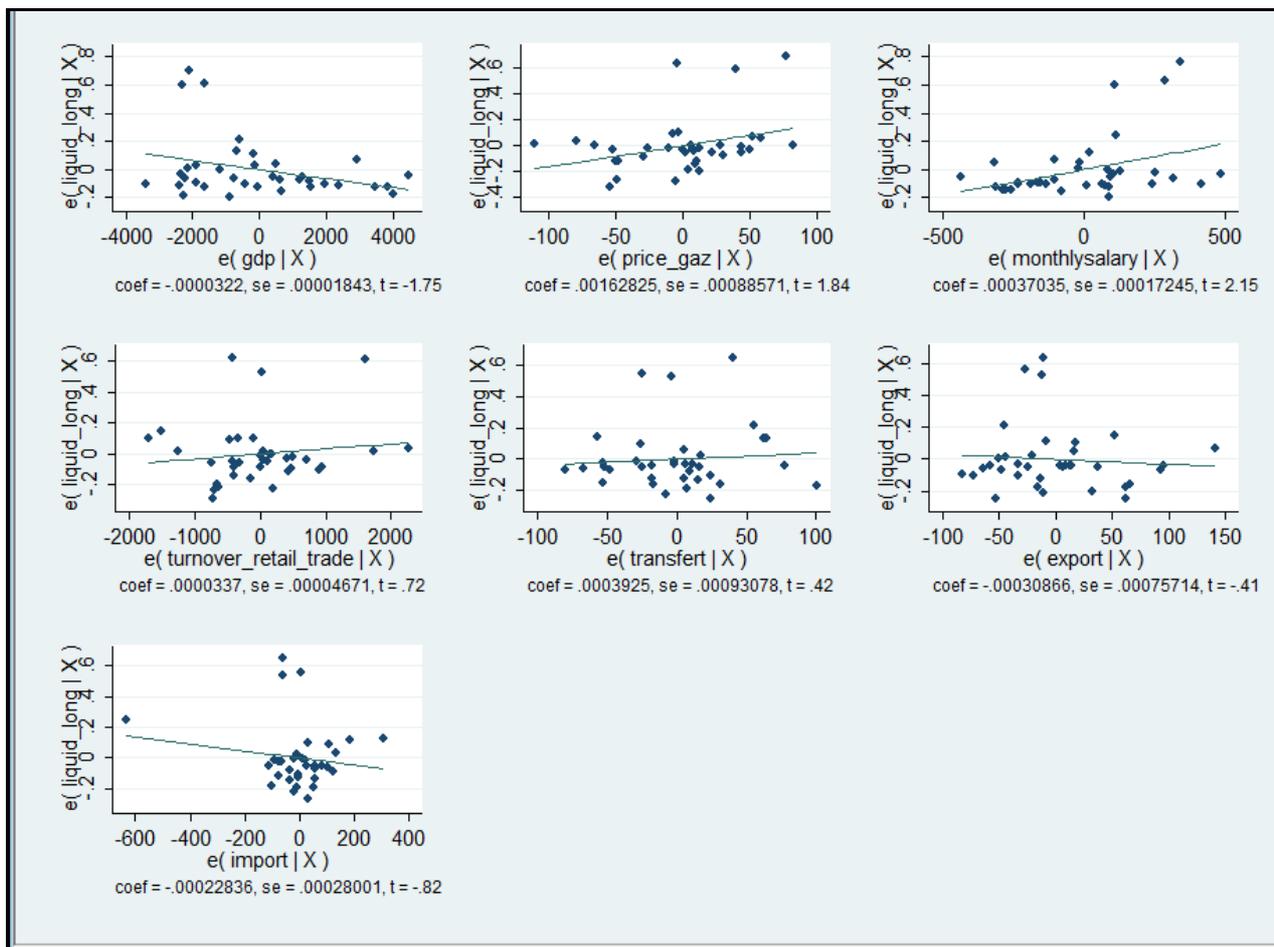
variables remain constant, then Long-term liquidity will increase by 0.002 p.p.

If the Transfers will increase by 1 p.p., provided the remainder of the independent variables remain constant, then Long-term Loss will increase by 0.0004 p.p. If Exports of Goods and Services will increase by 1 pp, provided that the remainder of the independent variables remain constant, Long-term Liquidity will drop by 0.0003 p.p.

If import and GDP will increase by 1 p.p. each, provided that the remainder of the independent variables remain constant, the long-term liquidity will respectively expire: by 0.0002 and 0.00003 p.p.

The figure 11 illustrates the graphical correlation between macroeconomic variables and long-term liquidity of the national banking sector.

Figure 11. Correlation between Long-term bank liquidity and Macroeconomic variables



Sources: authors' calculations according to the data base of National Bureau of Statistics of Republic of Moldova and National Bank of Moldova

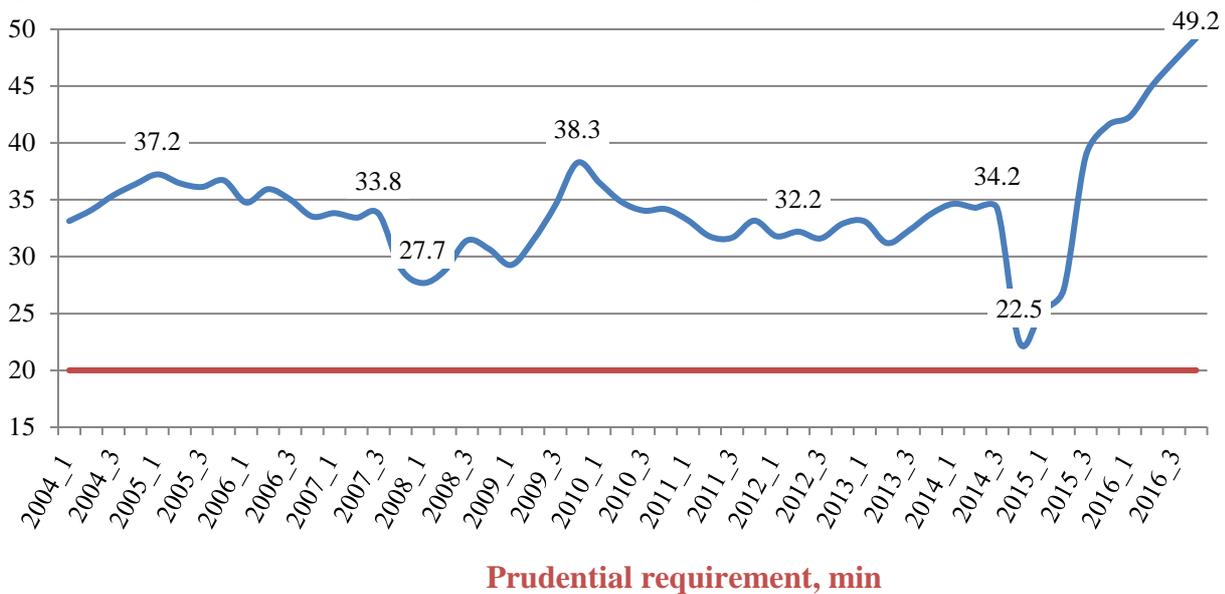
### Model 6 (Dependent Variable: Current Liquidity)

Current liquidity of banks is one of the banking performance indicators, which is expressed as a liquid asset ratio in total assets, a ratio that shall not be lower than the percentage rate set by the NBM, which at present accounts for 20% (NBM,1997).

$$K_2 = \frac{\text{Active\_lichide}}{\text{Total\_active}} * 100 \geq 20 \quad (10)$$

During the reviewed period, in dynamics, the current liquidity of the national banking system fell within the prudential margins set by the NBM. However, there is seen its pronounced fluctuation. The weight of liquid assets in total assets (liquidity principle II) registers sharp increases in the previous periods of economic recession or banking crisis. Even in 2016, we state an excessive growth of bank liquidities, which is explained by the migration of a share of loan assets to low-risk liquid assets and acceptable return, such as state securities.

**Figure 12. Dynamic of current liquidities in Moldovan banking system during 2004-2016**



Source: elaborated by the authors according to the data of the NBM

Maintaining an excess liquidity is peculiar to the domestic banking system, the current liquidity indicator is permanently increasing. Unfortunately, this situation is favoured by the NBM, which maintains the interest rate on securities, issued by it and deposits attracted by banks at a pretty high level.

The continuous growth of liquidities in the banking system is the result of tightening the monetary policy promoted by the NBM which aims to sterilize the excess of money supply in order to maintain the inflation target however it affects the ability of banks to lend. As long as the NBM will continue to manage the surplus liquidity in order to support a proper functioning of interbank money market through open-market operations the banks will be discouraged from placing in loans which at

a similar return could produce a higher risk than state securities and the increase of required reserve ratio will only act to the increase of the liquidity requirements maintained on the banks' accounts at the NBM. In this case it is important to express a decision which could clearly establish the monetary policy option of the NBM – maintaining the inflation target or increasing the banking system's ability to lend and implicitly, the economic growth of the country.

Regression model evaluation where Current liquidity is the dependent variable has identified that most coefficients explaining the impact of factors are statistically significant. Estimate of model parameters and results of statistical significance are presented in Table 7.

**Table 7. The estimation of the impact of the evolution of macroeconomic variables on the financial indicator - Current liquidity**

Variable name	Variable interpretation	Coef.	Std. error
<i>gdp</i>	GDP RM	-0.0000322	0.0000184
<i>price_gaz</i>	Average price for natural gas	0.0016282	0.0008857
<i>monthly_average_earning</i>	Monthly average earning	0.0003703	0.0001724
<i>turnover_retail_trade</i>	Turnover of enterprises with main retail trade activity	0.0000337	0.0000467
<i>transfert</i>	Total transfers from abroad	0.0003925	0.0009308
<i>export</i>	Export volume	-0.0003087	0.0007571
<i>import</i>	Import volume	-0.0002284	0.00028
<i>_cons</i>	Constant	-0.3496858	0.4540296
<b>F statistic</b>		1.62	
<b>Prob&gt;F</b>		0.1714	
<b>R-squared</b>		0.2880	
<b>Root MSE</b>		0.22889	

- assessment of all coefficients is at 5% significance level

Sources: authors' calculations according to the data base of National Bureau of Statistics of Republic of Moldova and National Bank of Moldova

Empirical results have determined that there is no close link between current liquidity and macroeconomic variables. Therefore, irrespective of the macroeconomic situation or the possible shocks that may come to the national economy, banks, according to the econometric model, will have current liquidity and will be able to resist possible crises.

However, even if these correlations are small, we can state according to the model that a direct impact on Current Liquidity has the following macroeconomic variables: gas price, earnings, turnover, transfers. And such macroeconomic factors as export, import and GDP growth have a reverse effect on current liquidity.

According to empirical data, we have the following situation:

If the average price for natural gas increases by 1 p.p, provided that the remainder of the

independent variables remain constant, then the current liquidity will increase by 0.002 p.p.

If the Transfers will increase by 1 p.p, provided that the remainder of the independent variables remain constant, then the Current Fluidity will increase by 0.0004 p.p.

If the salary increases by 1 p.p, provided that the rest of the independent variables remain constant, then the current liquidity of the national banking sector will increase by 0.0004 p.p.

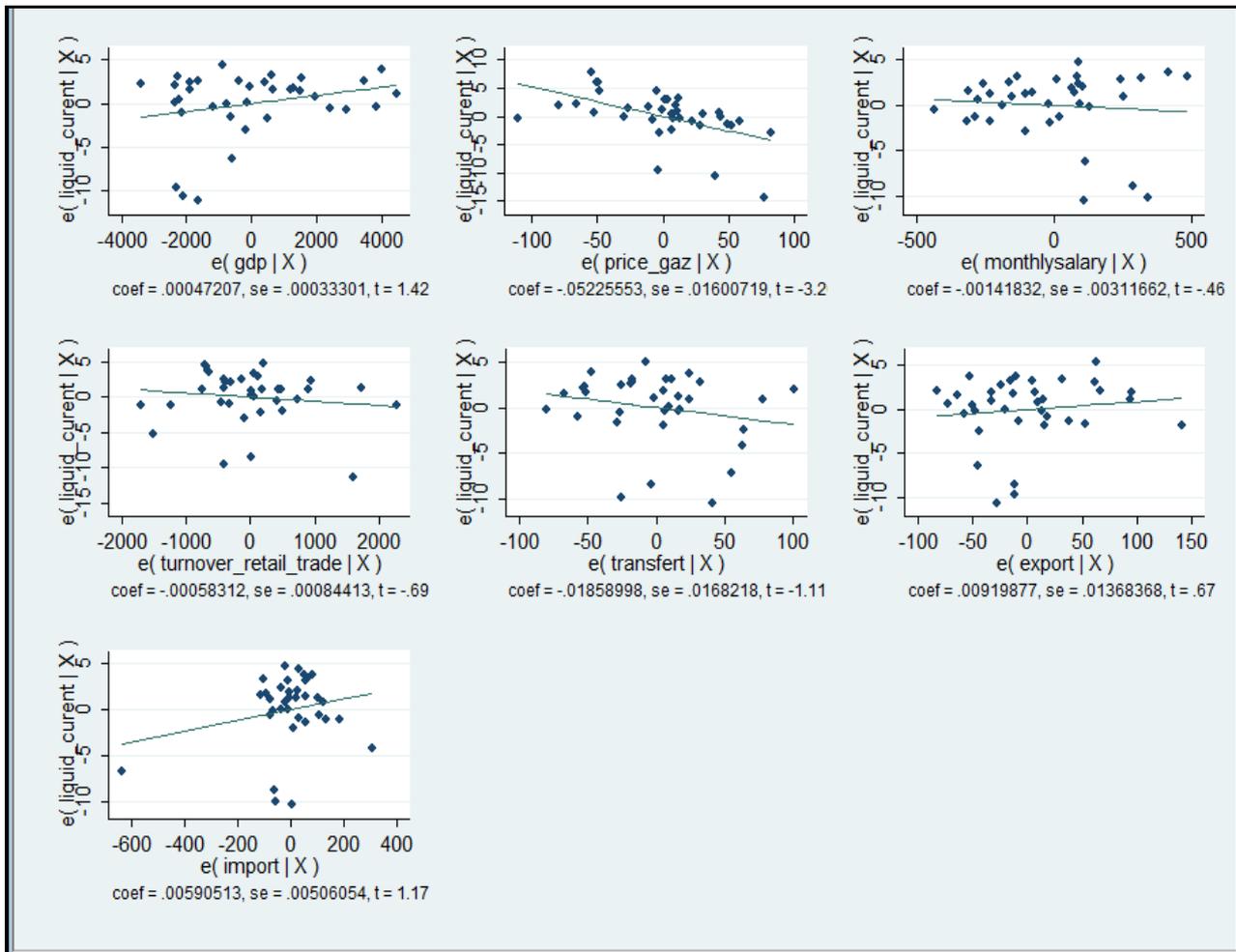
If Exports of Goods and Services will increase by 1 p.p, provided the remainder of the independent variables remain constant, the Current Liquidity will decrease by 0.0003 p.p.

If import and GDP will increase by 1 p.p each, and provided that the remainder of the independent variables remain constant, the Current Liquidity will decrease respectively by: 0.0002 and 0.00003 p.p.

The model indicates that all dependent variables have a statistically significant influence on the evolution of Current Liquidity. Figure 13 illustrates the graphical correlation between the key

macroeconomic variables and current liquidity in the Moldovan banking sector.

**Fig. 13. The correlation between current liquidity and macroeconomic variables**



Sources: authors' calculations according to the data base of National Bureau of Statistics of Republic of Moldova and National Bank of Moldova

## 6. CONCLUSIONS

The banks come in a very organic way in the mechanism of business and regulation of the economic life, interact with the budgetary process, tax system, price and income policy, conditions of foreign trade. Therefore, a survey on assessment of macroeconomic indicators impact on the main indicators of the national banking sector has been

conducted. Following the empirical analysis of the macroeconomic situation of the Republic of Moldova there were chosen a set of relevant macroeconomic indicators which have a great impact on the national economy, such as: Moldovan GDP at current prices, average natural gas prices, USD /1000 m<sup>3</sup>, average monthly salary, lei, turnover of retail trade enterprises (excepting vehicles and

motorcycles) in lei, volume of remittances from abroad in USD, volume of export and import in USD. Also, we chose the following financial stability indicators of the banking sector: risk-weighted capital adequacy, non-performing loan rate, return on assets (ROA), return on equity (ROE), long-term liquidity, current liquidity.

As a result of the stress-test exercise, it turned out that the macroeconomic indicators have an insignificant influence on the banking sector stability, indicating that:

- national banking sector is well capitalized, holds liquidities, is efficient and profitable and at the same time complies with the prudential criteria and for that reason can be considered resistant to eventual macroeconomic shocks;

- banking sector contribution is insignificant in the economic growth of the country. The level of investment and financial intermediation in the Republic of Moldova is several times lower compared to other countries with a similar economy, but with a higher development dynamics. Thus, the banking system cannot provide long-term cheap investment resources in real economy branches, in the absence of which the problem of sustainable economic development, GDP growth, entrepreneurship development etc. cannot even be approached;

- the banking sector in the Republic of Moldova acts relatively independent for a lengthy period, for its own benefit, without creating additional connections with the interests of other economic actors, national economy and even in spite of them;

- at the same time, the authors also take into account the data deficiency as a factual material. The nature of statistical data is a barrier in the process of explaining the phenomenon. They have a relatively short temporal coverage and are doubtful to relatively high comparison failures. The causes of statistical deficiencies are essentially the under-developed institutional abilities and high ratios of unseen economy. However, the data deficit as a factual material does not question the validity of theoretical reasonings and does not make their empiric probing difficult.

In conclusion, the Moldovan sovereignty, independence, stability and sustainable economic growth depend to a great extent on the level of development of the national economy and financial system stability. The financial stability is an essential component in the activity of monetary authorities to maintain and develop continually the banking sector, which is chiefly responsible for the process of efficient allocation of resources in economy.

The efficient and necessary supervision of the banking activity is possible only under circumstances of synthesis, analysis and forecast for a proper interpretation of the negative effects of some micro and macroeconomic factors which could cause unfavourable fluctuations in the main economic indicators, increase of inflation and banking system vulnerability.

The increase of banking sector efficiency and performance requires the implementation of certain necessary regulations possible to achieve only under the existence of certain methods of

monitoring and detecting in good time the negative effects, which may arise from the development of micro and/or macroeconomic factors.

These methods should allow the early risk detection and prevention of economic shocks development in order to manage efficiently the cash flows in the banking system, investment, inflation, exchange rate of national currency, promotion of a restrictive monetary policy, strengthening of foreign exchange rate, protection of depositors' interests and direction of money flow in real economy.

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