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SUPERVISORY STRESS TESTING AS A NEW TOOL FOR CONTROLLING FINANCIAL RISKS OF RA COMMERCIAL BANKS

Nowadays, stress testing has emerged as a common tool for financial supervision and regulation with many countries undertaking related reforms. The International Financial Reporting Standard (IFRS) 9 has prescribed stress testing for banks and financial institutions as an exercise to determine the volatility in the expected credit loss in baseline and adverse scenarios such as significant deceleration in GDP growth or sharp increase in unemployment rates[1]. The Basel Committee on Banking Supervision (BCBS) is finalising a new set of guidelines to replace the stress testing principles set in 2009[2]. Using a concurrent stress testing approach will go a long way in strengthening the financial systems. Supervisory (concurrent) stress testing exercises today have many different goals, with some exercises having multiple objectives. The paper describes the

[1] International Financial Reporting Standard 9, http://eifrs.ifrs.org/eifrs/bnstandards/hy/2018/ifrs09.pdf
[2] Basel Committee on Banking Supervision, "Principles for Sound Stress Testing Practices and Supervision" Basel, May 2009, p. 9.

features of supervisory stress testing, the study of macro and banking factors, their impact on the NPL ratio. The analysis will make it possible to introduce supervisory stress testing in Armenian banks and use it as an important tool for managing financial risks.

Keywords: *concurrent stress testing, nonperforming loans, economic activity index, operating efficiency, consumer price index, autocorrelation*

JEL: G21, G32

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Introduction. Nowadays it is essential for all kind of financial institutions, including banks to calculate the possible risks they can face. One of the most common methods of doing this is stress testing. Stress testing is considered to be a common tool for financial supervision and regulation with many countries undertaking related reforms. Though it is widely used all around the world, in The Republic of Armenia the Central Bank does not use supervisory stress testing for setting its standards and capital buffers, although CBA prescribes mandatory stress testing for local commercial banks, where it highlights minimum requirements for stress tests performed by banks[3]. For setting concurrent stress testing on Armenian commercial banks the CBA should have a special methodology for performing stress testing and for developing scenarios it should find out all macro and micro indicators affecting the Armenian financial market.

This paper refers to stress testing of one of the most important financial indicators which is Non-Performing Loans Ratio (NPL). There is a growing recognition that the quantity or percentage of non-performing loans is related to bank failures and the financial status of a country. So the aim of this study is finding out all macroeconomic and bank specific factors, that affect the NPL ratio in Armenian banks.

Literature review. There are many articles that have studied the links between the financial system and the economy. The most important examples are Bernanke and Gertler[4] and Bernanke, Gertler and Gilchrist[5] who developed the concept of the financial accelerator, arguing that credit markets are cyclical and that information asymmetry between creditors and debtors has an effect on amplifying and spreading shocks on the credit market. The Kiyotaki and Moore[6] model showed that if credit markets are imperfect, then relatively small shocks might be suffcient to explain business cycle fluctuations.

Competition has increased in the domestic and European banking markets, being strengthened by the deregulation process[7]. Banks have created permissive lending conditions to attract customers. Low interest rates, rising house prices

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[3] Regulation 4, Minimum requirements for implementation of internal control of bank, CBA, 2013.

[4] **Bernanke, B., Gertler, M.,** Agency Costs, NetWorth, and **Business** Fluctuations. Am. Econ. Rev. 1989, 79, 14–31.

[5] **Bernanke, B., Gertler, M., Gilchrist, S.,** The Financial Accelerator in a Quantitative Business Cycle Framework; Working Paper No. 6455; NBER: Cambridge, MA, USA, 1998.

[6] **Kiyotaki, N., Moore, J.,** Credit chains. J. Political Econ. 1997, 105, 211–248.

[7] **Salas, V., Saurina, J.,** Credit risk in two institutional regimes: Spanish commercial and savings banks. J. Financ. Serv. Res. 2002, 22, 203–224. Available online: https://link.springer.com/article/10.1023/A:1019781109676 (accessed on 27 Feb 2022).

and a stable economic environment characterised the precrisis period. This situation has led to the expansion of credit from both supply and demand. In our paper, we focus on the postcrisis period, characterised by high interest rates, falling house prices, and an unstable economic environment (rising unemployment, rising inflation, declining wages). Several studies have examined the causes of NPLs and problem loans (e.g., Fernandez de Lis, Pagés and Saurina[8]; Boudriga, Taktak and Jellouli[9]; Espinoza and Prasad[10]). Many studies have analysed various factors that can influence NPLs. In the next subsections, we present these factors grouped into the major factors of influence.

Research methodology. As already mentioned, the main aim of this research is finding out the micro and macro factors that affect banks' NPL ratio in Armenia. For this purpose, first of all we have separated all possible bank specific and macroeconomic factors that could have an influence on NPL ratio. Then we run a model to find a significant and long term relations between NPL ratio and chosen factors by using time series dataset covering the monthly period between January 2013 and December 2020 (96 observations). The model chosen for studying the influence of the selected factors on the NPL ratio is the multiple regression model, presented in the form of a linear relation:

$$\boldsymbol{Y_i = \beta_1 x_{1i} + \beta_2 x_{2i} + \cdots + \beta_p x_{pi} + u_i,} \qquad \textbf{(1)}$$

where $i = 1, \ldots n$, y_i represents the values of the explained variable Y, and x_{1i}, x_{2i}, … x_{pi} are the values of the independent variables X_1, … X_p. The coefficients β_1, β_2, … β_p are the parameters of the regression model, and ui are the values of the residual variable. The regression model also includes the constant variable C, corresponding to the impact of other exogenous variables influencing NPLs, which are not considered in the present analysis.

For our regression model we used a significance level of 1%, and all independent variables that were not significant in chosen level were removed from the model. For verifying the reliability of the regression parameters we used the correlation matrix and the confidence intervals. Using the Durbin-Watson statistics and Breusch-Godfrey serial correlation test we confirmed the absence of the autocorrelation in the model. The presence of homoscedasticity we approved using White and Glejser tests of heteroscedasticity.

Also we have used Jarque-Bera test, the results of which enables us accept the hypothesis of the skewness being zero and the kurtosis matching normal distribution.

The high quality of our regression model is confirmed by the very little difference between actual and fitted values of dependent variable.

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[8] **Fernandez de Lis, S., Martinez Pagés, J., Saurina, J.,** Credit Growth, Problem Loans and Credit Risk Provisioning in Spain; Banco de Espana Working Paper 18; Bank of Spain: Madrid, Spain, 2000.

[9] **Boudriga, A., Taktak, N., Jellouli, J.,** Bank Specific, Business and Institutional Environment Determinants of Nonperforming Loans: Evidence from MENA Countries. In Proceedings of the Economic Research Forum 16th Annual Conference, Cairo, Egypt, 9 January 2009.

[10] **Espinoza, R.A., Prasad, A.,** Nonperforming Loans in the GCC Banking System and Their Macroeconomic Effects Working Paper WP/10/224; International Monetary Fund: Washington, DC, USA, 2010.

For introducing the necessity of setting concurrent stress testing on Armenian commercial banks by the Central Bank of Armenia we compared the NPL ratio and its dynamics in Armenia and in other countries.

Analysis. According to World Bank data[11], Armenia is lagging behind major economies, with a high number of non-performing loans (NPLs). Between 2018 and 2020, non-performing loans increased by about two percent in Armenian banks whereas in other countries, they either declined substantially or increased marginally (Table 1).

Table 1

Banks non-performing loans to total gross loans in %

COUNTRY	2018	2020	DIFFERENCE
UNITED STATES	0.913	1.065	**0.152**
UNITED KINGDOM	1.073	1.261	**0.188**
CHINA	1.833	2.84	**1.007**
FRANCE	2.748	2.705	**-0.043**
INDIA	9.461	7.939	**-1.522**
ARMENIA	4.754	6.555	**1.801**
GEORGIA	2.679	2.267	**-0.412**
TURKEY	3.687	3.89	**0.203**
HONGKONG	0.547	0.902	**0.355**

According to CEIC data[12], Armenian Non Performing Loans Ratio stood at 7.5% in Feb 2021, compared with the ratio of 7.3% in the previous month. The data reached an all-time high of 10.8% in April 2009 and a record low of 2.0% in December 2005. The Central Bank of Armenia defines Non Performing Loans as loans for which interest and principal payments are overdue for more than 90 day[13]. Armenia Non-Performing Loans was reported at 582.595 USD mn in February 2021. This records a increase from the previous number of 520.620 USD mn for January 2021.

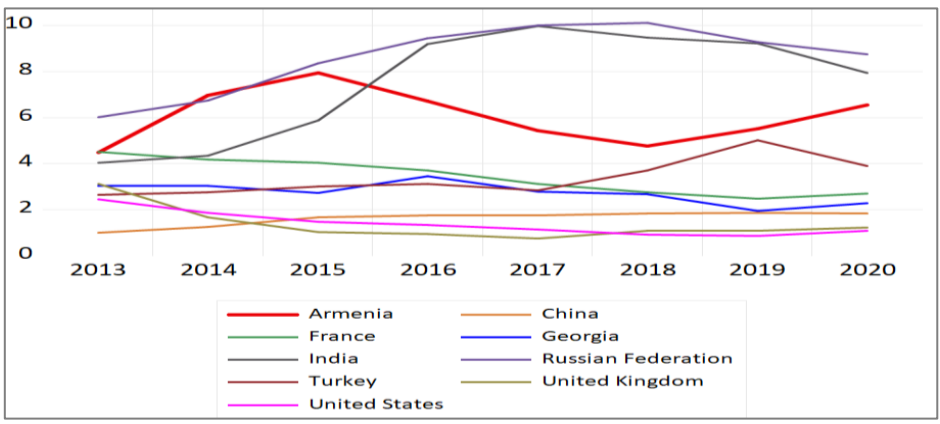


Figure 1. ***Banks non-performing loans to total gross loans in 2013-2020,%[14]***

[11] https://data.worldbank.org/indicator/FB.AST.NPER.ZS.

[12] https://www.ceicdata.com/en/indicator/armenia/non-performing-loans-ratio

[13] Resolution on Approval of Procedure on Classification of Loans and Receivables and Creation of Possible Loss Reserves for Banks Operating in the Territory of the Republic of Armenia, chapter 2, point 10.

[14] The figure is compiled by the author based on the dataset of worldbank.org

Figure 1 shows the percentage increase in nonperforming loans of banks in different countries in 2013-2020.

As can be seen in Figure 1, a declining trend in nonperforming loans can be seen in these countries in recent years, with the exception of Armenia and Turkey, although the latter has been declining since 2019. From the NPL index of Armenian banks on a monthly basis (Figure 2), we can see that the index of non-performing loans reached its peak in the first quarter of 2016 (10.5%), then there is a downward trend, reaching 4.8% in the fourth quarter of 2018. From 2018, growth is observed, which becomes more noticeable from the second quarter of 2020, amounting to 6.55% in the fourth quarter of 2020.

Figure 2 ***NPL ratio for Armenian banks (monthly)***[15]

Although the Central Bank of Armenia sets standards and regularly reviews several capital buffers, it does not use supervisory stress testing for setting them[16]. So that the CBA could run concurrent stress testing on Armenian commercial banks, it must develop a special methodology for performing stress testing, through which two stress testing scenarios must be developed: basic and adverse. In order to compile scenarios, it is necessary to have the majority of macro-micro indicators affecting the financial market of the Republic of Armenia. Only in this way the results of stress testing can predict the financial indicators of commercial banks in the near future and it will be possible to take measures to prevent probable deteriorations.

There is a growing recognition that the quantity or percentage of non-performing loans (NPLs) is related to bank failures and the financial status of a country. Especially after 2007-2009 global financial crisis, which started in the US and spread to whole world especially Europe, the issue of non-performing loans (NPLs) has gained increasing attentions because of the rapid increased default of sub-prime mortgage loans.

From this point and the necessity, the aim of this study is to determine the long term effects of macroeconomic and bank specific factors on non-performing

[15] The figure is compiled by the author based on the dataset of armstat.am

[16] Regulation of definition and calculation of high thresholds through limits of capital interest rate of banks, CBA, 2019.

loan ratio in Armenia. In particular, we run linear regression models and cointegration analysis to find a significant and long term relations between NPL ratio and several specific factors by using time series dataset covering the monthly period between January 2013 and December 2020 (96 observations). In this study, we take into consideration, 11 bank specific factors and 11 macroeconomic factors (Table 2 and Table 3).

Table 2

Bank Specific Factors[17]

BANK LEVEL FACTORS	*DEFINITIONS*
LONG-TERM LOAN RATES	*AVERAGE LONG-TERM LOAN RATES (MONTHLY)*
SHORT-TERM LOAN RATES	*AVERAGE SHORT-TERM LOAN RATES (MONTHLY)*
NON RESIDENTS LOANS RATIO	*NONRESIDENTS LOANS TO ALL LOANS, %*
RETURN ON ASSETS	*NET INCOME / AVERAGE TOTAL ASSETS*
RETURN ON EQUITY	*NET INCOME / SHAREHOLDERS' EQUITY*
NET INTEREST MARGIN	*NET INTEREST INCOME / EARNING ASSETS*
OPERATING EFFICIENCY	*NON INTEREST EXPENSES / NET INCOME*
CAPITAL ADEQUACY RATIO	*CAPITAL / RISK WEIGHTED ASSETS*
LIQUIDITY RATIO	*LIQUID ASSETS / TOTAL ASSETS*
INCOME DIVERSIFICATION	*NONINTEREST INCOME / TOTAL INCOME*
CREDIT GROWTH	*(GROSS LOANS(T)-GROSS LOANS (T-1)) / GROSS LOANS (T-1)*

Table 3

Macroeconomic Factors[18]

MACROECONOMIC FACTORS	*DEFINITIONS*
CONSUMER PRICE INDEX	*THE PRICE OF AN AVERAGE MARKET BASKET OF CONSUMER GOODS AND SERVICES*
USD	*USD / AMD RATE*
RUB	*RUB / AMD RATE*
ECONOMIC ACTIVITY INDEX	*GDP INDEX OF A GIVEN MONTH*
FUEL PRICE	*THE AVERAGE PRICE OF GASOLINE, OIL AND ELECTRICITY*
REAL ESTATE PRICE	*THE AVERAGE PRICE OF RESIDENTIAL ESTATES*
INTEREST RATE	*THE INTEREST RATE AT WHICH BANKS TAKE LOANS FROM THE CENTRAL BANK OF ARMENIA*
UNEMPLOYMENT RATE	*THE NUMBER OF UNEMPLOYMENT PEOPLE*
HOUSEHOLD DEBT	*THE COMBINED DEBT OF ALL PEOPLE IN A HOUSEHOLD*
LONG-TERM YIELD CURVES	*THE AVERAGE RATE OF LONG-TERM YIELD CURVES*
MONETARY MULTIPLIER	*MONEY SUPPLY / MONEY BASE*

The model chosen for studying the influence of the independent variables selected on the NPL rate is the multiple linear regression model.

We obtain the elements of the multiple regression model, as well as the values of certain factors and tests for the appreciation of the validity and quality

[17] The table is compiled by the author based on the dataset of armstat.am, cba.am, tradingeconomics.com and data.imf.org

[18] The table is compiled by the author based on the dataset of armstat.am, cba.am, tradingeconomics.com and data.imf.org

of the equation attached to the model. Therefore, after creating the group formed from the variables presented above, we defined the equation corresponding to the multiple regression model, with the rate of the nonperforming loans (NPLs) as the dependent variable and the factors of Tables 2 and 3 mentioned above as independent variables. However, many variables from Table 2 and Table 3 then have been removed from the regression as they were not significant in the chosen significance level. The estimation of the parameters in the equation of the regression model was made using the method of least squares[19]. The obtained values, which also represent the coefficients of the variables in the regression model and the results from the tests, are presented in Table 4.

Table 4

Estimations results[20]

Dependent Variable: NPL
Method: Least Squares
Sample: 2013M01 2020M12
Included observations: 96

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NON RESIDENTIAL LOANS RATIO	-0.323865	0.036307	-8.920196	0.0000
ECONOMIC ACTIVITY INDEX	-0.133997	0.022034	-6.081492	0.0000
CONSUMER PRICE INDEX	-0.246272	0.048319	-5.096764	0.0000
UNEMPLOYMENT RATE	1.481732	0.080204	18.47464	0.0000
USD AMD EXCHANGE RATE	0.483615	0.093021	5.198993	0.0000
OPERATING EFFICIENCY	0.080082	0.017043	4.698916	0.0000
FUEL PRICE	0.494614	0.120806	4.094287	0.0001
C	9.466803	0.188656	50.18013	0.0000

R-squared	0.899940	Mean dependent var	6.822307
Adjusted R-squared	0.891981	S.D. dependent var	1.482754
S.E. of regression	0.487326	Akaike info criterion	1.479890
Sum squared resid	20.89886	Schwarz criterion	1.693586
Log likelihood	-63.03472	Hannan-Quinn criter.	1.566269
F-statistic	113.0674	Durbin-Watson stat	1.649894
Prob(F-statistic)	0.000000		

From Table 4, we find a linear relationship between NPLs and their explanatory factors, statistically significant at a significance level of 1% (Prob (F-statistic) = 0.000). According to Fisher's criterion, this model is adequate, since the significance level of the model is less than 0.00001. The four coefficients are positive, and three coefficients are negative. If each of the components with positive coefficients increases, non-performing loans will also increase, and vice versa. In this regression we got the Adjusted R-squared with the value of 89.2%, which means that the NPL ratio is explained by the selected variables in 89.2%. In Table 4, we represent a linear relationship between NPL and its explanatory factors, statistically significant at a significance level of 1% (Prob(F-statistic) = 0.000). In the Coefficient column from the results presented in Table 4, we have

[19] **Aldrich, J.,** Doing Least Squares: Perspectives from Gauss and Yule. International Statistical Review. 1998, 66 (1), pp. 61–81.

[20] The table is compiled by the author using the EViews 12 program.

the coefficients of the equation of the regression model. The Variable column shows the names of the variables to which the coefficient corresponds. Each parameter estimated in this manner measures the contribution of the independent variable to the dependent variable. By using EViews 12 statistical package, we run regression analysis on Equation 1. According to the estimated ordinary least square results, p-values of nonresidents loans ratio, USD, Economic activity index, Operating efficiency, Consumer price index, Unemployment rate, Fuel price are respectively all within acceptable range and they are significant at 1% significance level. On the other hand, the rest of variables are not significant at 1% significance level. So we ignore those insignificance variables in those modes. By ignoring them, we obtain the following estimated ordinary least square results for Equation 1. Hence, the regression equation is

$$\begin{aligned} \boldsymbol{NPL} = &-\mathbf{0,32} * \textbf{Non residents loans ratio} - \mathbf{0,13} \\ &* \textbf{Economic activity index} - \mathbf{0,24} \\ &* \textbf{Consumer price index} + \mathbf{1,48} * \textbf{Uneployment rate} \\ &+ \mathbf{0,48} * \textbf{USD}_{\textbf{AMD}} + \mathbf{0,08} * \textbf{Operating Efficiency} \\ &+ \mathbf{0,49} * \textbf{Fuel Price} + \mathbf{9,46} \end{aligned} \qquad (2)$$

Let us examine the degree of correlation between the variables. For this, we will build a correlation matrix. The correlation matrix is shown in Table 5.

Table 5

The correlation matrix[21]

	NPL	NON...	FUEL...	ECO...	CON...	OPE...	UNE...	USD ...
NPL	1.000...	0.023...	-0.329...	-0.125...	-0.555...	0.053...	0.743...	0.275...
NON RESIDENTIAL LOAN...	0.023...	1.000...	-0.512...	0.160...	0.135...	0.229...	0.562...	0.650...
FUEL PRICE	-0.329...	-0.512...	1.000...	0.552...	0.191...	-0.163...	-0.444...	-0.661...
ECONOMIC ACTIVITY INDEX	-0.125...	0.160...	0.552...	1.000...	0.051...	-0.055...	0.193...	-0.112...
CONSUMER PRICE INDEX	-0.555...	0.135...	0.191...	0.051...	1.000...	-0.041...	-0.340...	0.187...
OPERATING EFFICIENCY	0.053...	0.229...	-0.163...	-0.055...	-0.041...	1.000...	0.034...	-0.020...
UNEMPLOYMENT RATE	0.743...	0.562...	-0.444...	0.193...	-0.340...	0.034...	1.000...	0.522...
USD_AMD_EXCHANGE_RATE	0.275...	0.650...	-0.661...	-0.112...	0.187...	-0.020...	0.522...	1.000...

It follows from the correlation matrix that only variable Unemployment rate has a significant effect on the NPL, i.e. the number of unemployment people is correlated with the NPL. The high impact of Unemployment rate on NPL we can see also from our equation 2 where the coefficient of above mentioned variable is 1.48.

We can also note the absence of a correlation between the exogenous variables.

Another method to verify the reliability of the regression parameters is represented by the method of confidence intervals. The confidence intervals are presented in Table 6. We have intervals with a confidence coefficient of 90%, 95% and 99%. Therefore, we can affirm with a confidence level of 99% that the growth of one percent in the unemployment rate leads to the growth of NPLs between 0.85% and 1.55%.

[21] The table is compiled by the authors using the EViews 12 program.

Table 6

The confidence intervals[22]

Coefficient Confidence Intervals
Sample: 2013M01 2020M12
Included observations: 96

Variable	Coefficient	90% CI Low	90% CI High	95% CI Low	95% CI High	99% CI Low	99% CI High
NON RESIDENTIA...	-0.277429	-0.343375	-0.211484	-0.356268	-0.198590	-0.381889	-0.172970
FUEL PRICE	0.404366	0.200788	0.607943	0.160986	0.647745	0.081894	0.726837
ECONOMIC ACTIV...	-0.116348	-0.153710	-0.078986	-0.161015	-0.071681	-0.175531	-0.057166
CONSUMER PRIC...	-0.196276	-0.280776	-0.111777	-0.297296	-0.095256	-0.330125	-0.062427
OPERATING EFFIC...	0.083848	0.056247	0.111448	0.050851	0.116844	0.040128	0.127567
SHORT TERM LO...	0.302624	0.105056	0.500192	0.066429	0.538819	-0.010328	0.615576
UNEMPLOYMENT ...	1.204324	0.981756	1.426892	0.938242	1.470407	0.851772	1.556877
USD AMD EXCHA...	0.602251	0.433393	0.771108	0.400380	0.804121	0.334777	0.869724
C	9.069237	8.669271	9.469202	8.591073	9.547400	8.435683	9.702790

It should be noted that the macro-banking factors selected by the author make seasonality adjustments to avoid possible erroneous results that may occur due to the seasonality factor.

Let us check the residuals for autocorrelation. For this, we write out from Table 4 the value of the Durbin-Watson statistics.

$$DW = 1,649894 \qquad (3)$$

According to the table Durbin-Watson[23], we determine the significant points d_L and d_U for 1% significance level. For $k = 7$ and $n = 96$, d_L is equal to 1,381 and d_U is equal to 1,690. As $d_L < DW < d_U$, we can neither accept nor deny the null hypothesis of the absence of autocorrelation.

Check for similar autocorrelations, use the Breusch-Godfrey serial correlation test (Table 7).

Table 7

the Breusch-Godfrey serial correlation test results[24]

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

F-statistic	1.534753	Prob. F(2,86)	0.2214
Obs*R-squared	3.308344	Prob. Chi-Square(2)	0.1913

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NON RESIDENTIAL LOANS RATIO	-0.007028	0.036593	-0.192070	0.8481
FUEL PRICE	-0.054324	0.126354	-0.429935	0.6683
ECONOMIC ACTIVITY INDEX	0.007601	0.022708	0.334718	0.7387
CONSUMER PRICE INDEX	0.026885	0.052437	0.512703	0.6095
OPERATING EFFICIENCY	-0.005049	0.017464	-0.289115	0.7732
UNEMPLOYMENT RATE	0.012745	0.080356	0.158610	0.8743
USD AMD EXCHANGE RATE	-0.037514	0.096059	-0.390528	0.6971
C	-0.006271	0.187560	-0.033437	0.9734
RESID(-1)	0.201075	0.114775	1.751909	0.0834
RESID(-2)	-0.008039	0.114249	-0.070361	0.9441

[22] The table is compiled by the authors using the EViews 12 program.
[23] https://www.real-statistics.com/statistics-tables/durbin-watson-table/
[24] The table is compiled by the authors using the EViews 12 program.

We can focus on the values of P-probabilities for the residual lag coefficients in the auxiliary model, which also indicate their significance, therefore, the presence of a serial correlation in the model that needs to be adjusted. In our case, the coefficients at RESID (-1) and RESID (-2) are not significant in 1% significance level. This confirms the absence of the autocorrelation of the 1st and 2nd order correlation.

With the Glejser test of heteroscedasticity we accept the null hypothesis of the presence of homoscedasticity with the P value of 0.5284. (Table 8).

Table 7

the results of Glejser test of heteroskedasticity[25]

Heteroskedasticity Test: Glejser
Null hypothesis: Homoskedasticity

F-statistic	0.852694	Prob. F(7,88)	0.5471
Obs*R-squared	6.097878	Prob. Chi-Square(7)	0.5284
Scaled explained SS	6.241380	Prob. Chi-Square(7)	0.5119

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.275863	0.116291	2.372173	0.0199
NON RESIDENTIAL LOANS RATIO	0.034124	0.022380	1.524743	0.1309
FUEL PRICE	0.157886	0.074467	2.120216	0.0368
ECONOMIC ACTIVITY INDEX	-0.022154	0.013582	-1.631106	0.1064
CONSUMER PRICE INDEX	-0.025178	0.029785	-0.845337	0.4002
OPERATING EFFICIENCY	-0.004883	0.010505	-0.464788	0.6432
UNEMPLOYMENT RATE	0.010082	0.049439	0.203938	0.8389
USD AMD EXCHANGE RATE	0.067181	0.057340	1.171635	0.2445

The presence of homoscedasticity we can also approve with the White test of heteroscedasticity (Table 8).

Table 8

the results of White test of heteroskedasticity[26]

Heteroskedasticity Test: White

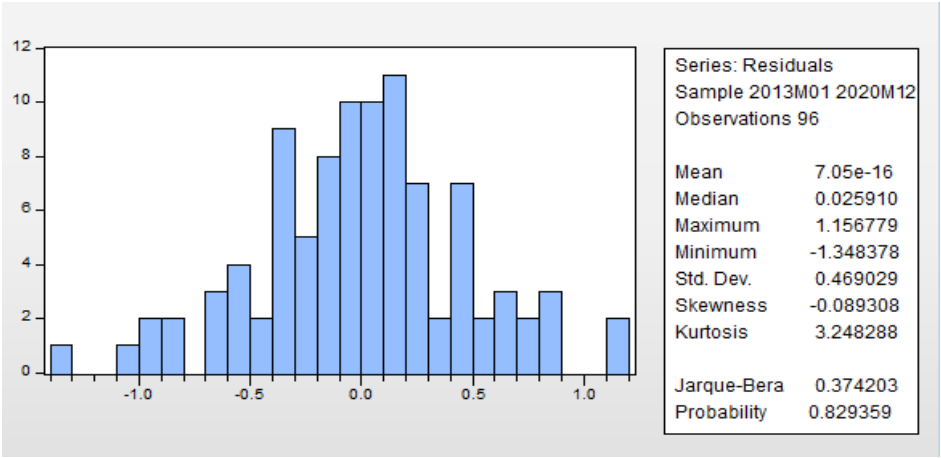
F-statistic	1.228098	Prob. F(35,60)	0.2384
Obs*R-squared	40.06868	Prob. Chi-Square(35)	0.2554
Scaled explained SS	37.84860	Prob. Chi-Square(35)	0.3406

To check whether the sample data have the skewness and kurtosis matching a normal distribution we have used Jarque-Bera test, the results of which are represented in Table 9. With the Mean value of 7.05e-16 which approximately equals 0 and Probability value of 0.829359 we can accept the hypothesis of the skewness being zero and the kurtosis matching normal distribution.

[25] The table is compiled by the authors using the EViews 12 program.
[26] The table is compiled by the authors using the EViews 12 program.

Table 9

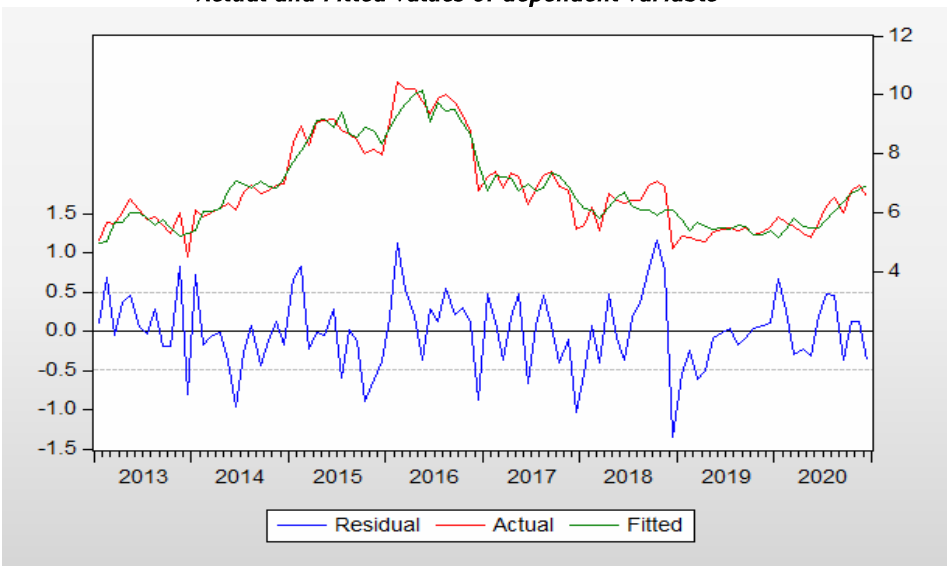
The results of Jarque-Bera test[27]



Thus, the constructed regression Equation 1 has a high coefficient of determination and significant F-statistics, all regression coefficients are statistically significant. It can be used for practical purposes, since it does not have the following drawbacks: there is no autocorrelation of residuals of random deviations, we accept the null hypothesis of the presence of homoscedasticity, all factors are seasonally adjusted and kurtosis has a normal distribution. Also the high quality of our regression model is confirmed by the very little difference between actual and fitted values of dependent variable (Table 10). The residual between actual and fitted values of NPL differs from -0.5 to 0.5.

Table 10

Actual and Fitted values of dependent variable[28]



[27] The table is compiled by the authors using the EViews 12 program.
[28] The table is compiled by the authors using the EViews 12 program.

In conclusion, let us look at the factors that affect Equation 1.

The first factor refers to loans to non-residents. A decrease of one point leads to a 0.32% increase in the NPL. This is explained by the fact that non-resident entities and individuals are creditworthy, their creditworthiness is not affected by the factors affecting the Armenian economy.

The second factor is the Economic Activity Index. A decrease of one point leads to an increase of 0.13% NPL, which is quite logical.

The consumer price index has a negative effect on the NPL: the one point decrease of CPI leads to a 0.24% increase in the NPL. This is explained by two factors. The first is the devaluation of foreign currency, through which loans are repaid. Secondly, we expect a negative impact of inflation on NPLs as a rapid rise in prices exacerbates market frictions, forcing banks to exercise caution in lending.

The variable unemployment rate influences the outstanding loans of the individuals because the credited persons have fewer possibilities to repay the loan taken due to a lack of income, the unemployment benefits being small in Armenia.

The USD-AMD exchange rate and fuel price significantly reduced the population's income and influenced a decrease in the credit repayment capacity by the fact that during the analyzed period the increase in the exchange rate of these currencies generated an increase of monthly credit rate, and this situation made it impossible for individuals to pay their debts to banks.

Operating efficiency is directly proportional to NPL, as the increase in operating costs and the decrease in net profit mainly depends on the improper repayment of loans.

Conclusion: By comparing the NPL ratio and its dynamics in Armenia and in other countries, we found out the necessity for using stress tests by the Central Bank of Armenia. Concurrent stress tests will contribute to the CBA's statutory objectives to protect and enhance the stability of the RA financial system and, subject to that, support the economic policy of the Government. Equally, they will contribute to the CBA's general objectives to promote safety and soundness of banks and to facilitate effective competition through a proportionate approach. Results inform policy actions by CBA, alongside other inputs, to set macro and micro prudential capital buffers. Additionally, concurrent stress tests continue to be complemented by individual banks' own stress tests, as part of their policy. It explores a range of scenarios, and together with the results from concurrent stress tests, provide committees with a rich information set.

As a result of our analysis, we can conclude that for setting scenarios for stress testing of banks' NPL ratio the CBA should pay attention to the following factors: loans to non-residents, the economic activity Index, the consumer price index, the unemployment rate, the USD-AMD exchange rate, fuel prices, operating efficiency. Moreover, the first three factor have a negative influence on NPL ratio, and the others have positive influence.

According to the Basel Range of Practices paper[29], microprudential concurrent stress test results are primarily used by supervisory authorities for reviewing and validating the Internal Capital Adequacy Assessment Process of banks and their liquidity adequacy assessments. CBA can use the results to set capital requirements in a wide variety of ways – e.g. by setting capital add-ons or assessing the quality of a bank's capital planning processes. For example, in the US, several dividend pay-outs and share repurchases were rejected because they failed the stress tests and their capital levels were found to be inadequate under stressful scenarios[30].

Macroprudential stress tests focus on the resilience of banking systems. When assessing the interaction between firms, supervisors will tend to use 'top-down' modelling approaches to capture any feedback loops, amplification mechanisms and spillovers.

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ԱՐՄԱՆ ՀԱՄԲԱՐՁՈՒՄՅԱՆ
ՀՊՏՀ կառավարչական հաշվառման և աուդիտի ամբիոնի ասպիրանտ

ՄԵՍՐՈՊ ՄԵՍՐՈՊՅԱՆ
ԵՊՀ մաթեմատիկայի և մեխանիկայի ֆակուլտետի ակտուարական և ֆինանսական մաթեմատիկայի բաժնի ուսանող

Վերահսկողական սթրես թեստավորումը որպես ՀՀ առևտրային բանկերի ֆինանսական ռիսկերը կառավարելու նոր գործիք.– Այսօր սթրես թեստավորումը ֆինանսական վերահսկողության և կարգավորման կարևորագույն գործիք է համարվում այն երկրներում, որոնք իրականացնում են համապատասխան բարեփոխումներ: Ֆինանսական հաշվետվությունների միջազգային ստանդարտ (ՖՀՄՍ) 9-ը բանկերի և ֆինանսական հաստատությունների համար սթրես թեստավորումը սահմանում է որպես ակնկալվող վարկային կորուստների չափման գործիք խիստ և անբարենպաստ սցենարներում, ինչպիսիք են, օրինակ՝ ՀՆԱ աճի զգալի նվազումը կամ գործազրկության մակարդակի կտրուկ աճը: Բանկային վերահսկողության Բազելի կոմիտեն (BCBS) կազմում է ուղեցույցների նոր փաթեթ, որը կփոխարինի 2009 թվականին սահմանված սթրես թեստավորման սկզբունքներին: Հոդվածում նկարագրված են վերահսկիչ սթրես թեստավորման առանձնահատկությունները, կատարվել են մակրո և բանկային մակարդակի գործոնների ու չաշխատող վարկերի նկատմամբ վերջիններիս ազդեցության ուսումնասիրություններ: Վերոնշյալ վերլուծությունները հնարավորություն կտան ՀՀ բանկերում ներդնելու վերահսկիչ սթրես թեստավորումը և օգտագործելու դա որպես ֆինանսական ռիսկերի կառավարման կարևոր գործիք:

Հիմնաբառեր. *վերահսկիչ սթրես թեստավորում, չաշխատող վարկեր, փնտրեսական ակտիվության ցուցանիշ, գործառնական արդյունավետություն, սպառողական գների ինդեքս, ավտոկոռելյացիա*
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Контрольное стресс тестирование как новый инструмент контроля финансовых рисков коммерческих банков РА.– В настоящее время стресс-тестирование стало важным инструментом финансового надзора и регулирования в странах, проводящих соответствующие реформы. Международный стандарт финансовой отчетности (МСФО) 9 определяет стресс-тестирование для банков и финансовых учреждений в качестве инструмента для определения ожидаемых кредитных убытков в неблагоприятных ситуациях, таких как значительное замедление роста ВВП или резкое увеличение уровня безработицы. В статье описаны особенности контрольного стресс-тестирования, проведены исследования факторов макро- и банковского уровня, а также анализ влияния последних на коэффициент недействующих кредитов. Вышеуказанные анализы позволят внедрить контрольное стресс-тестирование в банках Армении, использовать его как важный инструмент управления финансовыми рисками.

Ключевые слова: *контрольное стресс-тестирование, проблемные кредиты, индекс экономической активности, операционная эффективность, индекс потребительских цен, автокорреляция*
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