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Original Scientific Article

INTERNAL AND EXTERNAL FACTORS OF NON-PERFORMING LOANS: THE EXAMPLE OF THE BANKING SECTOR IN BOSNIA AND HERZEGOVINA

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Abstract: *Non-performing loans are loans that do not generate income for banks and represent one of the most sensitive categories of a bank's balance sheet. Their increase can affect both the liquidity and the solvency of banks. This paper investigates internal (specific) and external (macroeconomic) determinants of non-performing loans of the banking sector in Bosnia and Herzegovina for the period 2008: Q1 - 2020: Q4 including correlation and regression analysis. The results of the research showed that the following independent variables have the strongest impact on non-performing loans as a dependent variable: unemployment rate, provisions to non-performing loans, and real GDP growth rate. On the other hand, the independent variable return on equity had the weakest impact on non-performing loans.*

Keywords: *Non-performing loans, Unemployment rate, Provisions to non-performing loans, Fixed effect model, Random effect model, Return on equity.*

JEL classification B22 · G20 · G21

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1. INTRODUCTION

Despite the strong expansion of innovation in the financial services sector at the end of the past and the beginning of this century, credit risk is still the main reason for bank insolvency. In modern business conditions, over 80% of the bank's balance sheet relates to this aspect of banking risk management. Unlike traditional commercial banking, the strong expansion of investment banking in modern conditions has affected the expansion of the range of risks to which banks are exposed in their operations. Credit risk is defined as the risk of default based on debt incurred, i.e., non-payment of principal and interest by the debtor.

Among the types of risks faced by banks, credit risk is the most important if the focus is on the source of potential losses. Non-fulfillment of obligations by the banks' clients as the other party in the credit business results in the loss of the entire receivable. If several key clients of the bank are not able to service their obligations properly, this can cause large losses to the bank, which can cause insolvency of the bank (Đukić, 2011). The non-performing asset is an asset that does not bring income and those items are principal and interest due. If not collected for more than 90 days from the date of their maturity they are classified as categories C, D and E (Plakalović & Alihodžić, 2015).

This study examines the trend of non-performing loans in the banks of Bosnia and Herzegovina during the period 2008-2020. The analysis shows that non-performing loans are primarily the result of the influence of external and internal determinants. The decline in economic activity in the country affects the decline of bank assets and consequently leads to an increase in non-performing loans. On the other hand, in a period of stable and positive economic trends, bank customers are financially able to settle their debts, which affects the quality of non-performing loans to be stable and even declining. Therefore, the main goal of this research is to investigate the impact of internal and external variables on the growth/decline rate of non-performing loans in the banking sector in Bosnia and Herzegovina for the period 2008-2020.

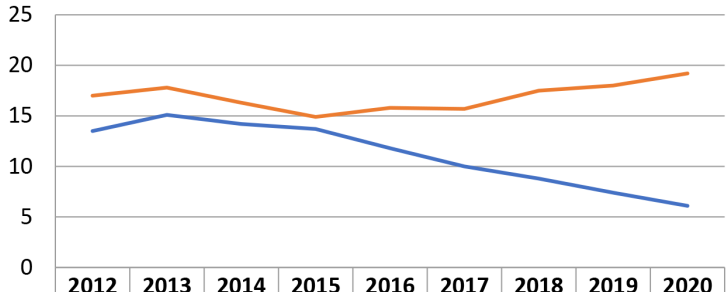
This research is structured in six parts. The first part deals with introductory considerations. Part two refers to the analysis of selected indicators of the financial health of banks in Bosnia and Herzegovina. Part three consists of a review of the literature and research hypotheses, as well as the dimensions of various studies conducted on the topic of non-performing loans. Part four of the methodological approach discusses the sample, data collection, and research model. The empirical findings of this study are presented in part five. Part six consists of conclusions and recommendations.

2. ANALYSIS OF CERTAIN HEALTH INDICATORS OF THE BANKING SECTOR IN BOSNIA AND HERZEGOVINA

The financial model in Bosnia and Herzegovina is bank-centric and characterized by a high level of competition. Observed on the other hand, in addition to competition in the banking system of Bosnia and Herzegovina, there is a moderate concentration. Figure 1 shows the linear trend of non-performing loans and capital adequacy ratio for the period: 2012 - 2020.

Figure 1 illustrates the linear trend of non-performing loans and capital adequacy ratio of banks in B&H for the period 2012 - 2020. Both NPLs and CAR had the same pattern from 2013 to 2015. From 2014 NPLs begin to decrease and from 2015 CAR starts to grow again, much more than the legal minimum of 12%. For the observed period, the highest value of non-performing loans was recorded in 2013 (15.1%), the lowest in 2020 (6.1%), and the average value of 11.18%. The decrease

in the value of non-performing loans was influenced by the following essential factors: write-offs of non-performing loans, monitoring measures, growth in lending activity, and decline in interest rates. Unlike non-performing loans, the capital adequacy ratio recorded the highest value in 2020 (19.2%), the lowest value in 2015 (14.9%), and an average value of 16.91%.



	2012	2013	2014	2015	2016	2017	2018	2019	2020
Non-performing loans - NPLs	13.5	15.1	14.2	13.7	11.8	10.0	8.8	7.4	6.1
Capital adequacy ratio - CAR	17.0	17.8	16.3	14.9	15.8	15.7	17.5	18.0	19.2

Figure 1. The linear trend of non-performing loans and capital adequacy ratio in B&H for the period: 2012 - 2020

Source: Calculation by the author based on data from the Banking Agency of the Federation of Bosnia and Herzegovina and the Banking Agency of the Republika Srpska

Profitability indicators are practically surrogates for the value of the bank's shares. The behavior of stock prices is the best indicator of the banks' operations because it reflects the assessment of the banks' operations by the market. However, this indicator is often not reliable in banking. The reason is that bank shares are often not traded on official stock exchanges because the banks are small in size (Plakalović & Alihodžić, 2015). The table below illustrates the linear trend of profitability indicators of banks in Bosnia and Herzegovina for the period: 2012 - 2020.

Table 1. The tendency of profitability indicators of banks in Bosnia and Herzegovina for the period: 2012 - 2020

Indicators	2012	2013	2014	2015	2016	2017	2018	2019	2020	Average
ROA	0.7	-0.1	0.8	0.3	1.1	1.5	1.3	1.4	0.8	**0.9**
ROE	5.1	-0.5	5.4	2.0	7.3	10.2	9.6	10.4	6.0	**6.2**

Source: https://data.imf.org (adjusted by the author)

As can be seen from table 1 both indicators of bank profitability had a very volatile and fluctuating trend. The first ROA profitability indicator recorded the highest value in 2017 (1.5%), the lowest value in 2013 (-0.1%), and an average value of 0.9. Unlike ROA, the second ROE profitability indicator had the highest value in 2019 (10.4%), the lowest value in 2013 (-0.5%), and an average value of 6.2%. The decline in the value of both indicators of bank profitability from 2019 to 2020 is primarily the result of a significant reduction in profits that banks reported at the end of 2020 as well as the impact of the global pandemic COVID-19.

3. REVIEW OF RELEVANT LITERATURE AND RESEARCH HYPOTHESES

Babouček and Jančar (2005) analyzed the links between credit quality and macroeconomic shocks in the Czech banking sector in the period 1993-2006. The results of the research showed that there is a significant positive link between non-performing loans, unemployment rates, and consumer

price inflation. Therefore, economic growth affects the stability of the banking sector. Godlewski (2005) investigated the relationship between NPLs and return on assets (ROA) and concluded that the lower the ROA rate the higher the NPLs will be and vice versa.

Quagliariello (2007) investigated the performance of banks and the riskiness of bank loans in Italy using a large sample of banks observed between 1985 and 2002. The results show that non-performing loans and loan loss provisions are generally low in growth periods and increase in periods of downturn.

Glogowski (2008) investigated the factors of credit losses for 108 Polish banks in the period from 1996 to 2006. He concluded the importance of a set of macroeconomic variables that make up real GDP growth, real interest rates, and unemployment. Marcucci and Quagliariello (2008) investigated the effects of the economic cycle on the rate of default on loans at the national level in the period 1990-2004. The results of the research showed that standard rates follow a cyclical pattern, especially decreasing during periods of economic expansion and increasing during periods of decline.

Nkusu (2011) investigated the relationship between non-performing loans (NPLs) and macroeconomic performance between 1998 and 2009. The results emphasize that in advanced economies, unfavorable macroeconomic developments affect credit quality and that this in turn leads to higher problem loans and declining GDP growth.

Vaskov et al. (2012) presented the first empirical analysis of macroeconomic determinants of non-performing loans in the Macedonian banking system, based on a panel assessment, i.e., on a sample of 16 banks. The results showed that the variables with the greatest strength of explanation are the inflation rate and the REER, both of which have positive signs in the equations that explain the movement of non-performing loans. They found weak power to explain the GDP ratio and the interest rate ratio.

Dash and Kabra (2010) investigated non-performing loans in the Indian banking sector from 1998-99 to 2008-09. They used data both at the bank level and at the macroeconomic level, where they found evidence of the importance of credit growth, credit-to-asset ratios, economic growth, and the rate of loan losses.

Louzis et al. (2010) used the dynamic data panel method to examine which determinants affect NPLs for the Greek banking sector and for each credit category. They studied a set of basic macroeconomic indicators, namely the real GDP growth rate, the unemployment rate, and the real interest rate for each type of loan. They used a set of data from the new major Greek banks for the period: 2003-2009. The results showed that non-performing loans are related to the following variables: GDP, unemployment rate, interest rate, and quality of management.

Rachman et al. (2018) examined various banking factors that have affected problem loans in Indonesia and concluded that the high profitability of banks has lower NPLs due to their better performance and efficiency of the credit supervision system. Kumar and Kishore (2019) concluded that in terms of banking factors, NPLs and CARs have a negative correlation in the banking sector.

Based on the goal set in the introductory part of the paper, the following hypotheses will be tested with the help of random and fixed effect models.

Null Hypothesis

H_0I: There is no significant statistical impact of the following variables (capital adequacy ratios - CAR, provisions for non-performing loans - PNPL, return on assets - ROA, return on equity - ROE, real GDP growth rates and unemployment rates - UN) on the growth rate of non-performing loans - NPLs at significance level $p \leq 0.05$. The first null hypothesis consists of the following sub-hypotheses:

H_0I-1 There is no significant statistical impact of the capital adequacy ratio on the growth rate of non-performing loans at the significance level $p \leq 0.05$.

H_0I-2 There is no significant statistical impact of provisions for non-performing loans on the growth rate of non-performing loans at the significance level $p \leq 0.05$.

H_0I-3 There is no significant statistical impact of return on assets on the growth rate of non-performing loans at the significance level $p \leq 0.05$.

H_0I-4 There is no significant statistical effect of return on equity on the growth rate of non-performing loans at the significance level $p \leq 0.05$.

H_0I-5 There is no significant statistical effect of the real GDP growth rate on the growth rate of non-performing loans at the significance level $p \leq 0.05$.

H_0I-6 There is no significant statistical effect of the unemployment growth rate on the growth rate of non-performing loans at the significance level $p \leq 0.05$.

An Alternative Hypothesis

H_0I: There is a significant statistical impact of the following variables (capital adequacy ratios - CAR, provisions for non-performing loans - PNPL, return on assets - ROA, return on equity - ROE, real GDP growth rates and unemployment rate - UN) on the growth rate of non-performing loans - NPLs at the significance level $p \leq 0.05$. The first alternative hypothesis consists of the following sub-hypotheses:

H_0I-1 There is a significant statistical impact of the capital adequacy ratio on the growth rate of non-performing loans at the significance level $p \leq 0.05$.

H_0I-2 There is a significant statistical effect of provisions for non-performing loans on the growth rate of non-performing loans at the significance level $p \leq 0.05$.

H_0I-3 There is a significant statistical impact of return on assets on the growth rate of non-performing loans at the significance level $p \leq 0.05$.

H_0I-4 There is a significant statistical effect of return on equity on the growth rate of non-performing loans at the significance level $p \leq 0.05$.

H_0I-5 There is a significant statistical effect of the real GDP growth rate on the growth rate of non-performing loans at the significance level $p \leq 0.05$.

H_0I-6 There is a significant statistical impact of the unemployment growth rate on the growth rate of non-performing loans at the significance level $p \leq 0.05$.

4. DATA AND METHODOLOGY

4.1. Data

The sample of this research is the total banking sector of Bosnia and Herzegovina (22 banks in total). Data on banking performance indicators were collected from the websites of the Banking Agency of the Federation of B&H, the Banking Agency of the Republika Srpska, the Central Bank of Bosnia and Herzegovina, and the International Monetary Fund. Indicators on macroeconomic indicators were collected from the websites of the Agency for Statistics of Bosnia and Her-

zegovina and the Labor and Employment Agency of Bosnia and Herzegovina. The growth rate of non-performing loans was used as a dependent variable in this study. As independent variables in the model were used the following: capital adequacy ratio, provisions for non-performing loans, return on asset, return on equity, real GDP growth rate, and unemployment rate. Table 2 shows the variables and the expected effects of the dependent and independent variables.

Table 2. A Brief Description of the Dependent and Independent Variables in the Model

Variable	Short definition	Expected sign
NPLs	Non-performing loans as % of total loans	-
CAR	It represents the ratio between the net amount of capital and the assets that are exposed to risk.	+
PNPLs	Provisions to non-performing loans	+
ROA	Profit to total assets	+
ROE	This ratio is obtained by dividing the net profit of the bank by the capital	-
RGDP	Gross domestic product per inhabitants % change over the previous period (real)	**+ or -**
UN	The unemployment rate in % of the labor force	+

Source: Calculation by the author

Non-performing loans (NPLs) - NPLs are loans that remain unpaid. The IMF stated that a loan is considered uncollectible if it does not generate interest and the amount of principal for at least 90 days. Loans become NPLs if full payment of principal and interest is not made on time, and is no longer expected in future dates (Alton & Hazen, 2001). In this study, NPLs were measured as the ratio of non-performing loans to total loans

Capital adequacy ratio (CAR) - is determined by comparing the net amount of capital with the asset that is exposed to risk. This applies not only to the banks' balance sheet assets but also to the banks' off-balance sheet items. Therefore, the capital adequacy ratio is calculated based on the net capital ratio (adjusted capital) whose amount is determined as the difference between the amount of capital and deductible items (Plakalović & Alihodžić, 2015).

Provisions to non-performing loans (PNPLs) – each bank must prepare for a loss on its loans. To compensate for this credit risk, the bank estimates the expected future loss on the loan and records the appropriate reserve. Posting provisions means that the bank recognizes the loss on the loan in advance. Banks use their capital to absorb these losses by posting provisions, the bank takes over the loss and therefore reduces its capital by the amount of money it will not be able to collect from the client (www.bankingsupervision.europa.eu). In this study, provisions for non-performing loans will be used as an independent variable.

Return on assets (ROA) - is considered the most appropriate measure to assess the performance of the bank. ROA is obtained by sharing the banks' income before interest with its assets. Therefore, ROA measures the efficiency of management in using the banks' resources to make a profit. It also assesses the banks' efficiency in using actual investments for interest and other fees. This measure of bank profitability is especially important when comparing the operational efficiency of banks (Sinkey, 1989).

Return on Equity (ROE) – expresses how much a bank earns based on the book value of its investments. This ratio is obtained by dividing the banks' net profit by capital, which reflects reve-

nue generation, operational efficiency, leverage, and tax planning. For some banks, the ROE may be high because the banks do not have an adequate capital ratio. Banks with low returns can increase their return on investment, by using additional leverage, i.e., by increasing the ratio of assets and capital (Koch & MacDonald, 2009).

Real GDP growth rate (RGDP) - measures economic growth expressed in the gross domestic product (GDP) from one period to another adjusted for inflation or deflation. In other words, it reveals changes in the value of all goods and services produced by the economy - the economic product of a country, taking into account price fluctuations (www.investopedia.com).

Unemployment rate (UN) - the unemployment rate is the number of unemployed workers divided by the total working-age population (https://hr.wikipedia.org). In this research, it will be used as an independent variable and we will assume that there is a positive relationship between the unemployment rate and the growth rate of non-performing loans.

4.2. Methodology

The following general regression model was used to assess the impact of internal and external variables on the movement of non-performing loans in the banking sector in Bosnia and Herzegovina:

$$Y_{i,t} = \alpha + \beta' X_{i,t} + \mu_{i,t} \quad (1)$$

Where in:

$Y_{i,t}$ dependent variable;
α represents a constant, ie the mean value of Y;
β' is the kx_1 parameter vector estimated on the explanatory variables;
$\mu_{i,t}$ is a random error.

By including all independent and dependent variables in equation (1), equation 2 is formulated as follows:

$$NPL_{i,t} = \alpha + \beta_{i,t} (CAR_{i,t} + PNPL_{i,t} + ROA_{i,t} + ROE_{i,t} + RGDP_{i,t} + UN_{i,t}) \quad (2)$$

If the p – value is statistically significant, the fixed effect model should be used. On the other hand, if the p – value is not statistically significant, a random effect model should be used. The significance test was performed for all variables using the t-test at the significance level of 95% (Chmelarova, 2007). The null and the first alternative hypothesis will be tested using the Hausman test.

5. FINDINGS AND DISCUSSION

Before hypotheses testing, the results of correlation and regression are shown in tables 3-7. The total number of observations is 52, which is a relatively representative sample both in terms of the banking sector and in terms of the time frame.

A strong positive correlation between the dependent variable in the model (NPLs) was observed with the following independent variables: unemployment rate (0.551) and provisions for non-performing loans (0.427) at significance ($p<0.05$). With the increase in the unemployment rate, there

may be a problem of debt repayment, i.e., an increase in the default rate, given that more and more people are losing their jobs, and consequently credit risk increases in both households and companies that reduce production. Therefore, the relationship between the unemployment rate and non-performing loans is directly proportional: with an increase in the unemployment rate, there is a consequent increase in non-performing loans (Diaconaşu et al., 2014).

Table 3. Correlation matrix (Pearson coefficient of correlation) between dependent and independent variables of the banking sector of B&H for the period: 2008: Q1 - 2020: Q4

		NPLs	CAR	PNPLs	ROA	ROE	RGDP	UN
NPLs	Pearson Correlation	1.000	-0.048	0.427	0.326	0.262	0.290	0.551
	Sig. (2-tailed)	-	0.735	0.002	0.018	0.060	0.037	0.000
	N	52	52	52	52	52	52	52
CAR	Pearson Correlation	-0.048	1.000	0.394	0.045	0.065	-0.290*	-.0379
	Sig. (2-tailed)	0.735	-	0.004	0.750	0.648	0.037	0.006
	N	52	52	52	52	52	52	52
PNPLs	Pearson Correlation	0.427	0.394	1.000	0.772	0.751	0.368	-0.434
	Sig. (2-tailed)	0.002	0.004	-	0.000	0.000	0.007	0.001
	N	52	52	52	52	52	52	52
ROA	Pearson Correlation	0.326	0.045	0.772	1.000	0.993	0.503	-0.308
	Sig. (2-tailed)	0.018	0.750	0.000	-	0.000	0.000	0.026
	N	52	52	52	52	52	52	52
ROE	Pearson Correlation	0.262	0.065	0.751	0.993	1.000	0.494**	-0.348
	Sig. (2-tailed)	0.060	0.648	0.000	0.000	-	0.000	0.011
	N	52	52	52	52	52	52	52
RGDP	Pearson Correlation	0.290	-0.290	0.368	0.503	0.494	1.000	-0.138
	Sig. (2-tailed)	0.037	0.037	0.007	0.000	0.000	-	0.328
	N	52	52	52	52	52	52	52
UN	Pearson Correlation	0.551	-0.379	-0.434**	-0.308	-0.348	-0.138	1.000
	Sig. (2-tailed)	0.000	0.006	0.001	0.026	0.011	0.328	-
	N	52	52	52	52	52	52	52

Source: Calculation by the author

According to Cohen (1988), the obtained values of coefficients of correlation can be interpreted as follows:

- When r = 0.10 to 0.29 then the correlation is small.
- When r = 0.30 to 0.49 then the correlation is medium.
- When r = 0.50 to 1.0 then the correlation is large

Table 4. Summary Correlation Statistics Between Dependent and Independent Variables of Banks in the Western Balkans for the Period: 2008:Q1 – 2020:Q4

Dependent variable	R	R Square	Adjusted R Square	Std Error of the Estimate	Durbin-Watson
NPLs	0.940	0.883	0.867	1.377	0.851

Source: Calculation by the author

The obtained results from the Table 4 indicate that there is a strong and large correlation between dependent and independent variables. This research is focused on the analysis of internal and external variables that affect the increase/decrease in non-performing loans in the banking sector in Bosnia and Herzegovina. The results of the regression are presented in tables 5-7.

The total number of observations is 52, which makes the model relatively representative. The empirical value of the F - test for 10 degrees of freedom in numbering and 42 in the denomination was 58.78. Also, the probability based on the regression of fixed effects is 0.000, which explains that the model is very significant.

Table 5. Regression of Fixed Effects Model Between Dependent (NPLs) and Independent variables of the banking sector of B&H for the period: 2008: Q1 - 2020: Q4

				Number of obs = 52		
				Number of groups = 4		
				Obs per group	min = 13	
R – sq	within = 0.8936				avg =13.0	
	between = 0.0174				max = 13	
	overall = 0.8816			F (10,42)= 58.78		
				Prob>F = 0.000		
	Coef.	**Std. Err.**	**t**	**P>|t|**	**|95% Conf.Interval|**	
CAR	0.190915	0.27864	0.69	0.493	-0.35522	0.73705
PNPLs	0.176320	0.025664	6.87	0.000	0.12601	0.22662
ROA	5.48182	3.238171	1.69	0.090	-0.86487	11.8285
ROE	-0.86259	0.43177	-2.00	0.046	-1.70885	-0.01633
RGDP	0.20343	0.07285	2.79	0.005	0.06064	0.34622
UN	0.82068	0.06237	13.16	0.000	0.69842	0.94293
_cons	-36.6473	5.24435	-6.99	0.000	-46.9261	-26.3686
sigma_u	0					
sigma_e	1.3573689					
rho	0					

Source: Calculation by the author

By testing the first six sub-hypotheses, it can be concluded that the strongest causality, i.e., correlation with the growth rate of non-performing loans was recorded by the following variables: provisions for non-performing loans (0.000), unemployment rate (0.000), return on equity (0.04) and real GDP growth rate (0.005). The obtained results lead to the conclusion that the null hypothesis was rejected and the alternative hypothesis was accepted. Independent variables: capital adequacy ratio and return on asset do not have a significant impact on the growth rate of non-performing loans of the banking sector in Bosnia and Herzegovina. Therefore, in the first and third sub-hypotheses, the null hypothesis was accepted and the alternative hypothesis was rejected. The previous table also shows a positive correlation between the real growth rate of GDP and NPLs. This is typical for countries that have a changing and volatile trend of economic activity such as Bosnia and Herzegovina. In many studies, the relationship between GDP and NPLs is inversely related. The primary cause of high levels of non-performing loans is slow economic activity, as evidenced by statistically significant and economically high GDP ratios, unemployment, and inflation rates (Škarica, 2014).

The results from Table 6 showed that generalized least squares regression (GLS) better describes the impact of independent variables on the growth rate of non-performing loans. The strongest positive impact on the dependent variable (NPLs) was achieved by the following independent variables: pro-

visions for non-performing loans (0.186) at a significance of 0.000, then unemployment rate (0.829) at a significance of 0.000 and real GDP growth rate (0.224) at a significance of 0.004. On the other hand, the variable return on equity (-0.848) had the weakest impact on NPLs. In terms of testing the first six sub-hypotheses, the obtained results are the same as in the fixed effects model with the only difference being the better prediction of the real GDP growth rate variable. Banks use provisions for loan losses in order to cover various types of credit losses such as non-performing loans. A minimal part of them is spent on problem loans since banks have a significant part of NPLs every year. Higher provisions for loan losses are an indicator of management inefficiency and are often positively associated with actual losses. Banks with poor credit quality face higher risk in their loan portfolios which affects the higher growth of NPLs (Beck et al., 2015). In the banking sector of Bosnia and Herzegovina, the highest provisions for non-performing loans were recorded in the second quarter of 2020 (80.4%), while the lowest provisions were achieved in the first quarter of 2010 (32.7%).

Table 6. Random Effect Regression (GLS) Between Dependent and Independent Variables of the banking sector of B&H for the period: 2008: Q1 - 2020: Q4

				Number of obs = 52		
				Number of groups = 4		
				Obs per group	min = 13	
R – sq	within =0.8927				avg =13.0	
	between=0.0047				max = 13	
	overall= 0.8827			Wald chi2(6) = 338.59		
				Prob>chi2= 0.0000		
	Coef.	**Std. Err.**	**t**	**P>|t|**	**|95% Conf.Interval|**	
CAR	0.21695	0.2755	0.79	0.435	-0.33906	0.77298
PNPLs	0.18652	0.02679	6.96	0.000	0.13245	0.24059
ROA	5.06258	3.29965	1.53	0.132	-1.59638	11.7215
ROE	-0.84862	0.43444	-1.95	0.057	-1.72536	0.02811
RGDP	0.22460	0.07305	3.07	0.004	0.07716	0.37203
UN	0.82993	0.06188	13.41	0.000	0.705042	0.95483
_cons	-37.8172	5.20547	-7.26	0.000	-48.322	-27.3122
sigma_u	0.47836					
sigma_e	1.35736					
rho	0.11047					

Source: Calculation by the author

Table 7. Results obtained using the Hausman test

	(b) fixed	**B(random)**	**(b-B) Difference**	**Sqrt(diag(V_b-V_B)) S.E.**
CAR	0.1909154	0.2169578	–0.0260425	0.0416436
PNPLs	0.1763201	0.186521	–0.0102009	–
ROA	5.481828	5.062588	0.4192401	–
ROE	–0.8625951	–0.8486258	–0.0139693	–
RGDP	0.2034354	0.2246002	–0.0211648	–
UN	0.8206826	0.8299389	–0.0092564	0.0077876

Source: Calculation by the author

$$\chi^2(6) = (b–B)'[(V_b-V_B)^{-1}(b-B) = 3.34; \text{Prob} > \chi^2 = 0.7651$$

The results of the Hausman test showed that the value of Pro > χ^2 = 0.7651 is greater than 5%, i.e., that the random effect model (GLS) gives greater significance than the regression of the fixed effect.

6. CONCLUSION

There are a large number of empirical studies that emphasize the issue of non-performing loans since the increase in non-performing loans has been particularly monitored in terms of weakened economic activity and financial crises. Determining the percentage increase in non-performing loans in banking systems is of capital importance in order to maintain the financial and creditworthiness of banks. Weakened economic activity and the global financial crisis have re-emphasized the importance of the banking system in most advanced economies as well as emerging market economies. In recent years, banking systems have had certain structural weaknesses that manifest in the form of non-performing loans, moral hazards, poor governance, etc. These problems can weaken the banking system and overall financial stability. In this regard, the solution to these problems is necessary for sustainable economic development, good economic performance, job creation, and overall financial stability. If certain measures and activities are not taken to reduce the given structural problems, potential risks in the banking system can cause a decline in economic growth, rising unemployment, and possibly a banking crisis.

This paper tests the impact of internal (specific) and external (macroeconomic) variables on the growth rate of non-performing loans of banks in Bosnia and Herzegovina in the sample of the total banking sector, which makes 52 observations during the period: 2008 - 2020. The study used the effects of independent variables on the dependent variable using the unified OLS regression model (FE), and the GLS random effects regression model using the Hausman test. The following variables had the most significant impact through the OLS and GLS regression models: unemployment rate, provisions to non-performing loans, and real GDP growth rate. Therefore, the findings of this study indicate that the following sub-hypotheses were confirmed within the null hypothesis: the first, third, and fourth sub-hypotheses, and the second, fifth, and sixth sub-hypotheses were rejected. In contrast to the null hypothesis, the following sub-hypotheses were confirmed in the alternative hypothesis: the second, fifth and sixth. The following variables had the strongest impact on the NPLs variable: unemployment rate, provisions to non-performing loans, and real GDP growth rate.

Several determinants of non-performing loans can be used for future research. Many other macroeconomic and banking indicators can influence the development of non-performing loans. The strength of the financial system, proper regulation, and monetary policy should also be considered as one of the variables of non-performing loans. Therefore, a larger set of data on bank operations as well as a larger number of determinants that would be included in the model would give a better understanding of the impact of internal and external factors on non-performing loans. The author's new research on this issue can certainly be expanded depending on the choice and inclusion of a large number of independent variables.

References

Alton, R. G., & Hazen, J. H. (2001). As economy flounders, do we see a rise in problem loans, *Federal Reserve Bank of St. Louis*, *11*(4), 45-65.

Babouček, I., & Jančar, M. (2005). Effect of macroeconomic shocks to the quality of the aggregate loan portfolio. Czech National Bank. *Working Paper Series 1*, 1-62.

Beck, R., Jakubik, P., & Piloiu, A. (2015). Key Determinants of Non-performing Loans: New Evidence from a Global Sample. *Open Economies Review, 26*(3), 525-550. https://doi.org/10.1007/s11079-015-9358-8

Chmelarova, V. (2007). The Hausman test and some alternatives, with heteroskedastic data. M.S. Louisiana State University, USA. https://doi.org/10.31390/gradschool_dissertations.936

Cohen, J. W. (1988). Statistical power analysis for the behavioral sciences (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.

Dash, M. K., & Kabra, G. (2010). The Determinants of Non-Performing Assets in Indian Commercial Bank: An Econometric Study, *Middle Eastern Finance and Economics, 7*, 94-106.

Diaconaşu, D. E., Popescu, M., & Socoliuc, O. R. (2014). Macroeconomic determinants of non-performing loans in emerging markets', in Roman, A. and Anton, S.G. (Eds.): *Monetary, Banking and Financial Issues in Central and Eastern EU Member Countries: How Can Central and Eastern EU Members Overcome the Current Economic Crisis*?, Alexandru Ioan Cuza University of Iaşi, Iasi, 67–73.

Đukić, Đ. (2011). *Upravljanje rizicima i kapitalom u bankama*. Centar za izdavačku delatnost Ekonomskog fakulteta u Beogradu: Beograd.

Glogowski, A. (2008). Macroeconomic determinants of Polish banks' loan losses – results of a panel data study, National Bank of Poland Working Paper, No. 53.

Godlewski, C. J. (2005). Bank capital and credit risk taking in emerging market economies. *Journal of Banking Regulation, 6*(2), 128-145. https://doi.org/10.1057/palgrave.jbr.2340187

Koch, T. W., & MacDonald, S. S. (2009). Bank Management. Cengage Learning. Boston. USA.

Kumar, V., & Kishore, M. P. (2019). Macroeconomic and bank specific determinants of nonperforming loans in UAE conventional bank, *Journal of Banking and Finance Management*, *2*(1), 1-12.

Louzis, D. P., Vouldis, A. T., & Metaxas, V. L. (2010). *Macroeconomic and bank-specific determinants of non-performing loans in Greece: a comparative study of mortgage, business and consumer loan portfolios*. Bank of Greece, Working Paper, No. 118.

Marcucci, J., & Quagliariello, M. (2008). Is Bank Portfolio Risk Procyclical? Evidence from Italy Using a Vector Autoregression. *Journal of International Financial Markets, Institutions and Money*, *18*(1), 46- 63.

Nkusu, M. (2011). Nonperforming Loans and Macrofinancial Vulnerabilities in Advanced Economies. *IMF Working paper, 11*(61), 1-27. https://doi.org/10.5089/9781455297740.001

Plakalović, N., & Alihodžić, A. (2015). *Novac, banke i finansijska tržišta*. Ekonomski fakultet Banja luka: Banja luka.

Quagliariello, M. (2007). Banks' Riskiness Over the Business Cycle: A Panel Analysis on Italian Intermediaries. *Applied Financial Economics*, *17*(2), 119-138. https://doi.org/10.1080/09603100500486501

Rachman, R. A., Kadarusman, Y. B., Anggriono, K., & Setiadi, R. (2018). Bank-specific factors affecting non-performing loans in developing countries: case study of Indonesia, *The Journal of Asian Finance, Economics and Business (JAFEB), 5*(2), 35-42. https://doi.org/10.13106/jafeb.2018.vol5.no2.35

Sinkey, J. F. J. (1989). Commercial Bank Financial Management in the Financial-Services Industry, third edition, NewYork: Macmillan Publishing Co.

Škarica, B. (2014). Determinants of non-performing loans in Central and Eastern European countries', *Financial Theory and Practice*, *38*, 37–59. https://doi.org/10.3326/fintp.38.1.2

Vaskov, M., Ilievska, M., & Debnikov, P. (2012). Macroeconomic determinants of Non-performing loans in Macedonian banking system, Panel data analysis, presentation, April 2012, National bank of the Republic of Macedonia.

https://hr.wikipedia.org

www.investopedia.com

www.bankingsupervision.europa.eu