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Determinants of the Financial Stability of the Banking Sector of Bosnia and Herzegovina

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Abstract: *This paper investigates the impact of explanatory variables that determine the financial stability of the banking sector in Bosnia and Herzegovina, and the possibility of controlling credit risk, which is a threat to the stability of the financial system for the period from 2009 to 2019 on a quarterly basis. Correlation and panel regression analysis are also applied in this paper. The selected independent (explanatory) variables are the growth rate of savings of the household sector, the growth rate of foreign direct investments, the growth rate of exports, the growth rate of total loans, the growth rate of non-performing loans, the growth rate of capital adequacy ratio, and unemployment growth rate. The GDP growth rate will be used as the dependent variable. The research results showed that the most significant impact on the GDP growth rate was recorded by the following variables: the growth rate of foreign direct investment, the growth rate of exports and the growth rate of total loans. On the other hand, the following variable recorded the most significant negative impact: the growth rate of the household sector. The study also shows that there is a positive causal relationship between the growth rate of non-performing loans and the growth rate of unemployment.*

1. INTRODUCTION

Financial development is an important prerequisite for economic growth, but at the same time, the banking sector is susceptible to the occurrence of financial crises with extremely negative repercussions for the entire economy as a whole (Levine, 2005). Banking crises directly affect all stakeholders from depositors, shareholders, borrowers, and taxpayers, and tend to cause macroeconomic recessions through sharp contractions in lending. The average cumulative loss of output during a financial crisis is estimated to be somewhere between 15 and 20% of annual GDP (Allen & Gale, 2004). Financial stability represents a state where the household sector and businesses can make an optimal choice between consumption and investment in the conditions of a well-functioning financial system that mediates between lenders and borrowers and satisfactorily redistributes risk with an efficient allocation of economic resources. Mishkin (1992) defines financial instability as follows: "A financial crisis is a disturbance in financial markets in which adverse selection and the problem of moral hazard are significantly aggravated so that financial markets are unable to efficiently direct funds to those entities that have the most productive opportunities investments".

Problems in bank operations that can manifest in poor risk management, withdrawal of deposits, and loss of trust can be the cause of the instability of the entire financial system. In this regard, the banking sector is the most regulated and supervised area of business. Macroeconomic policy aimed at achieving and preserving financial stability is called prudential policy. Therefore, prudential policy is a macroeconomic policy aimed at achieving and preserving the stability of the financial system. The goals of price and financial stability may coincide, but they can never be in conflict. The macroprudential policy includes regulatory and supervisory activities that relate to

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an individual financial institution and focus on the risks of the individual institution. The macroprudential policy implies regulatory activities and measures that relate to the entire financial system and are aimed at systematic risks. Both of these policies aim to preserve and strengthen the stability of the financial system (Jović, 2024).

The financial model in Bosnia and Herzegovina is bank-centric and characterized by a high level of competition and moderate concentration. The financial stability of the banking sector in Bosnia and Herzegovina has so far been very rarely, and one might say insufficiently, the subject of empirical research by the domestic academic community. The primary goal of this research is to analyze, based on theoretical and empirical findings, selected macroeconomic and banking variables that determine the financial stability of the banking sector in Bosnia and Herzegovina, and to investigate the possibility of controlling credit risk, which is a threat to the stability of the financial system.

The paper is structured in five parts. The first part refers to introductory considerations with a focus on the importance of the financial stability of banks on the development and stability of economic activity, and the set goal of the research. The second part describes an overview of previous research in terms of the impact of macroeconomic and banking indicators on the financial stability of banks and the economic system. The third part describes the selected research methodology with emphasis on the least squares model, robust least squares, and quantile regression model. The fourth part refers to the data needed for the analysis. The five-part presents the obtained research results, as well as certain observations and recommendations.

2. REVIEW OF RELEVANT LITERATURE

Traditionally, many scholars and regulators have argued that strict competition policies may not be beneficial in the banking sector due to its special nature (Vives, 2001). Banks are usually highly leveraged where risk plays a greater role in the financial sector compared to other sectors of the economy. As a result, a highly competitive banking system can be a source of financial instability with negative consequences for the real economy.

In the past decade, extensive literature has dealt with the issue of identifying the factors of financial stability of banks. In several studies, researchers have tried to investigate the variables that can be limited to the sustainable stability of the bank. A large number of empirical studies consider macroeconomic factors and bank-specific factors as precursors to bank stability. Claire (2004) investigated the macroeconomic variables of bank stability for local banks in Singapore. The results of the multiple regression analysis showed that the unemployment rate, exchange rate, aggregate demand, and interest rate have a significant impact on the bank's stability.

Nkusu (2011) analyzed the determinants of non-performing loans in a sample of 26 advanced economies. The results of his panel research showed that worsening macroeconomic conditions in terms of slowing GDP growth, higher unemployment rates, and falling property prices affect the deterioration of credit quality and problems with financial stability.

Systemic risk factors, such as rising interest rates, deteriorating bank balances, stock market crashes, and growing uncertainty, are seen as the main causes of financial instability. The main reason for the deterioration of banks' balance sheets is risky loans. In the next stages of financial instability, credit losses are expected to increase as a result of the crises and economic downturn. The deterioration of banks' balance sheets is widening and deepening the crisis (Altıntaş, 2012).

Beck et al. (2013) conducted the most comprehensive analysis of non-performing loans in a sample of 75 countries. According to their research, GDP growth, stock prices, changes in exchange rates, and interest rates on loans significantly affect the level of non-performing loans, that is, their share in the total approved loans of the sectors of the analyzed countries.

Messai and Jouini (2013) studied the determinants of non-performing loans in Spanish, Italian, and Greek banks and concluded that problem loans increase when the unemployment rate and the real interest rate increase, and decrease when the GDP rate and bank profitability increase.

According to the research results of Alihodžić and Plakalović (2014) the unfavorable macroeconomic environment, first of all, the high unemployment rate, and the decline of foreign direct investments have an indirect effect on the spread of the inability to repay the loans of economic enterprises in B&H, which leads to an increase in bank provisions that later transform into losses.

Shijaku (2016) investigated the influence of specific, market and macroeconomic indicators on the stability of 16 banks in Albania for the period 2008 - 2015. The results suggest that bank-specific factors as well as macroeconomic factors are found to affect bank stability consistently compared to specific factors for the market.

Buston (2016) investigated the impact of active risk management on bank stability. Examples of banks in the US confirm that banks with active risk management are relatively less exposed to volatility during periods of financial crisis. On the other hand, Ghenimi et al. (2017) examined the main determinants of bank stability in 49 banks of the Middle East and North Africa region in the period 2006 – 2013. Credit risk and liquidity risk were selected as determinants while Z-Score was used as a measure of bank stability. The results of the panel analysis showed that the interaction of the two risks has a significant and negative impact on the bank's stability.

Based on the goal set in the introductory part of the paper, the following hypotheses will be tested with the help of least squares panel regression models, robust least squares model and quantile regression model:

Basic research hypothesis:

BRH *The increase in investment opportunities, the allocation of savings of the household sector, and the growth of export potential positively/negatively affect the growth of economic activity, as well as the increase of financial stability.*

Auxiliary research hypotheses:

ARH1 *The increase in credit growth towards the real sector has positive implications for the increase in economic activity measured by GDP in Bosnia and Herzegovina.*

ARH2 *The increase in the unemployment rate has an impact on the increase/decrease in the rate of non-performing loans.*

ARH3 *An increase in the capital adequacy ratio has a positive/negative impact on the growth of credit placements.*

3. METHODOLOGY

In this empirical chapter, least squares regression is discussed because of the numerous advantages it has over other estimation techniques. All calculations use a significance level of 5%. Therefore,

the test of significance was performed for all variables using the t-test at a significance level of 95% (Chmelarova, 2007). The main goal of this paper is to test the most important macroeconomic and banking variables on the financial stability of the banking sector in Bosnia and Herzegovina. Estimates of potential determinants refer to existing literature. The econometric model is presented as follows:

$$\%\Delta GRGDP = \beta_0 + \beta_1 \cdot (\%\Delta GRFDI) + \beta_2 \cdot (\%\Delta GRSHS) + \beta_3 \cdot (\%\Delta GREXP) \quad (1)$$

An econometric model is a multiple regression model, including two or more explanatory variables. To account for the difference between the observed data and the expected value, a random error term is added $\varepsilon_i = \%\ \Delta GDPgrowth\ rate - E\ (\%\ \Delta GDPgrowth\ rate)$, where the equation of the new econometric model can be written as follows:

$$\%\Delta GRGDP = \beta_0 + \beta_1 \cdot (\%\Delta GRFDI) + \beta_2 \cdot (\%\Delta GRSHS) + \beta_3 \cdot (\%\Delta GREXP) + \varepsilon_i \quad (2)$$

$$\%\Delta GRGDP = \beta_0 + \beta_1 \cdot (\%\Delta GRTL) + \varepsilon_i \quad (3)$$

$$\%\Delta GRNPLs = \beta_0 + \beta_1 \cdot (\%\Delta GRUN) + \varepsilon_i \quad (4)$$

$$\%\Delta GRTL = \beta_0 + \beta_1 \cdot (\%\Delta GRCAR) + \varepsilon_i \quad (5)$$

The basic assumption is that the observed values of the econometric model satisfy the population ratio and adhere to the strict rules of exogeneity, conditionally uncorrelated errors, and normality of errors. In addition, it is important to note that there is no absolutely correct linear relationship between the explanatory variables.

4. DATA

This research focuses on the following variables: the dependent variable will be the growth rate of GDP in Bosnia and Herzegovina (GRGDP), while the growth rate of foreign direct investment (GRFDI), the growth rate of savings of the household sector (GRSHS), the growth rate of exports (GREXP), the growth rate of unemployment (GRUN) and the growth rate of non-performing loans (GRNPLs) should be considered as independent variables. The research covers the period from the first quarter of 2009 to the fourth quarter of 2019. The analysis will be based on quarterly data because annual data is an unreliable sample for econometric evaluation. The data were collected from the official websites of the International Monetary Fund, the Central Bank of Bosnia and Herzegovina, the Banking Agency of the Federation of Bosnia and Herzegovina, the Banking Agency of the Republic of Srpska and the Agency for Statistics of Bosnia and Herzegovina. The measurement and expected effect of the dependent and independent variables are given in Table 1.

From the table 1, it is evident that the rate of real GDP growth showed the lowest growth rate, that is, the biggest drop of about 3.3% in the third quarter of 2009. Also, from Table 2 it is noticeable that the highest volatility in terms of the first measure of risk, i.e. standard deviations was recorded in the growth rate of non-performing loans (8.66%), the growth rate of exports (8.16%) and the growth rate of savings of the household sector (4.66%). The highest mean value was recorded for the growth rate of savings of the household sector of about 7.95% and the growth rate of non-performing loans of about 3.24%. For the observed period from the first quarter of 2009 to the fourth quarter of 2019, non-performing loans increased in relative amounts by about 25%, which still represents a certain potential threat in terms of systematic risk to the stability of the banking system.

Table 1. Brief description of dependent and independent variables in the model

Variable	Abbreviation	Expected effect
The growth rate of GDP	GRGDP	
The growth rate of non-performing loans	GRNPLs	
The growth rate of total loans	GRTL	
The growth rate of foreign direct investment	GRFDI	(+)
The growth rate of savings of the household sector	GRSHS	(-)
The growth rate of exports	GREXP	(+)
The growth rate of unemployment	GRUN	(+)
The growth rate of capital adequacy ratio	GRCAR	(+)

Source: Authors' calculation

5. RESEARCH RESULTS

The results of descriptive statistics, correlation analysis, and panel regression analysis are presented in Tables: 2-6. The total number of observations is 44, which represents a relatively representative sample both from the point of view of available data on the banking market of Bosnia and Herzegovina and in terms of the time frame.

Table 2. Descriptive statistics between dependent and independent variables in the model of the banking sector for the period: 2009:Q1 - 2019:Q4

Indicators	Obs	Mean	Std. Deviation	Skewness	Kurtosis	Max	Min
GRGDP	44	1.622	2.109	-0.774	2.510	4.20	-3.3
GRFDI	44	1.205	1.426	2.292	8.420	4.53	-1.76
GRSHS	44	7.951	4.658	-1.539	6.760	16.14	-7.28
GREXP	44	1.675	8.165	-0.199	2.727	19.35	-20.67
GRTL	44	0.889	1.018	-1.109	4.850	2.65	-2.53
GRUN	44	-0.437	1.494	-0.067	2.561	2.71	-3.48
GRNPLs	44	3.245	8.664	1.173	4.114	26.54	-13.34
GRCAR	44	0.299	3.636	1.355	6.592	12.81	-8.03

Source: Authors' calculation

The highest value of the adjusted coefficient of determination was recorded in the least squares model, which points to the conclusion that the independent variables in the model describe the influence on the dependent variable, i.e., the GDP growth rate of around 60.7%. Also, the F-statistic value is positive for the least squares model (23.20) and the probability is equal to zero, which indicates that the model is significant.

From Table 3 it is evident that macroeconomic indicators as independent variables (growth rate of foreign direct investments and growth rate of exports) had a positive correlation with the growth rate of GDP at a significance of less than 5%. On the other hand, the banking indicator of the savings growth rate of the household sector had a negative correlation with the GDP growth rate at a significance of more than 5%. In terms of testing the first research hypothesis, which reads: The increase in investment opportunities, the allocation of savings in the household sector, and the growth of export potential positively/negatively affect the growth of economic activity, as well as the increase in financial stability in all three models (Least Squares, Robust Least Squares and Quantile Regression Median) one can conclude that the growth rate of direct foreign investments and the growth rate of exports have a positive impact on the GDP growth rate and therefore on economic and financial stability, while the

growth rate of household savings has no significant impact. There is a broad theoretical basis that supports the existence of a positive correlation between FDI and economic growth. Also relevant for the theoretical role is the model of FDI with a positive impact on GDP (Moran, 1998), as well as models of endogenous economic growth (Romer, 1986). Yao (2006) investigated the effects of exports and FDI on economic efficiency using large panel data, including 28 provinces in China from 1978 to 2000. The research results showed that strong exports and FDI had positive effects on economic growth. Therefore, the first research hypothesis can be partially accepted. Foreign direct investments in the absence of domestic investment dynamics are becoming a real source of stronger economic growth in Bosnia and Herzegovina. Likewise, the country's low credit rating determines the inflow of investments. Economic growth and financial stability in B&H are highly correlated with the inflow of foreign investments and the reduction of the unemployment rate (Alihodžić & Plakalović, 2014).

Table 3. Coefficients of independent variables under multiple regression, least squares, robus least squares and quantile regression for the period: 2009:Q1 – 2019:Q4

Regression Model									
Dependent variable - GRGDP	**Least Squares**			**Robust Least Squares**			**Quantile Regression (Median)**		
Independent variables	**Coef.**	**Std. Error**	**Prob.**	**Coef.**	**Std. Error**	**Prob.**	**Coef.**	**Std. Error**	**Prob.**
C	0.029	0.008	0.000	0.032	0.001	0.000	0.041	0.013	0.003
GRFDI	0.232	0.063	0.001	0.243	0.068	0.000	0.273	0.093	0.006
GRSHS	-0,061	0.059	0.310	-0.072	0.064	0.262	-0.129	0.090	0.162
GREXP	0.287	0.054	0.000	0.292	0.059	0.000	0.269	0.096	0.008
R- Squared	0.635			0.530					
Pseudo R- Squared	-			-			0.383		
Adjusted R - Squared	0.607			0.494			0.337		
F-Statistic	23.201			-					
Prob (F-statistic)	0.000			-					
Prob (Rn-squared stat)	-			0.000					
Prob (Quasi -LR stat)	-			-			0.000		

Source: Authors' calculation

According to all three models (Least Squares, Robust Least Squares, and Quantile Regression - Median) a positive correlation was recorded between the rate of credit growth of banks to the real sector and economic activity measured through GDP at a significance of less than 5%, which suggests the conclusion that the first auxiliary is accepted hypothesis in the paper, which reads: The increase in credit growth towards the real sector has positive implications for the increase in economic activity measured through GDP in Bosnia and Herzegovina.

Of all three observed models, the Least Squares model achieved the highest value of the adjusted coefficient of determination of about 30.8%, which explains the impact of the growth rate of total loans on the growth rate of economic activity measured through GDP. Therefore, it practically means that if GRTL increases by 1% then GRGDP will increase by about 1,179 units assuming other variables are considered unchanged. Likewise, the value of the F-statistic is positive for the least squares model (20.18) and the probability is equal to zero indicating that the model is significant. Commercial banks in Bosnia and Herzegovina do not lend to the real sector to the extent that the available reserves allow them due to the presence of increased credit risk, bad debtors, and information asymmetry. For example, the credit growth of banks in B&H according to the real sector in 2019 amounted to about 20.8 billion BAM and is relatively higher by about 47% compared to 2009, when it amounted to 14.1 billion BAM (BiH Directorate for Economic Planning, 2019).

Table 4. Coefficients of independent variable under multiple regression, least squares, robust least squares and quantile regression for the period: 2009:Q1 - 2019:Q4

Regression Model / **Dependent variable - GRGDP**	**Least Squares**			**Robust Least Squares**			**Quantile Regression (Median)**		
Independent variables	**Coef.**	**Std. Error**	**Prob.**	**Coef.**	**Std. Error**	**Prob.**	**Coef.**	**Std. Error**	**Prob.**
C	0.0057	0.0035	0.112	0.005	0.004	0.176	0.004	0.006	0.489
GRTL	1.179	0.262	0.000	1.254	0.276	0.000	1.477	0.411	0.001
R- Squared	0.324			0.289			-		
Pseudo R- Squared	-			-			0.163		
Adjusted R - Squared	0.308			0.272			0.144		
F-Statistic	20.182			-			-		
Prob (F-statistic)	0.000			-			-		
Prob (Rn-squared stat)	-			-			-		
Prob (Quasi -LR stat)	-			-			-		

Source: Authors' calculation

According to all three models (Least Squares, Robust Least Squares, and Quantile Regression - Median) a positive correlation was recorded between the growth rate of unemployment and the growth rate of non-performing loans at a significance of less than 5%, which points to the conclusion that the second auxiliary hypothesis in the paper is accepted, which reads: The increase in the unemployment rate has an impact on the increase/decrease in the rate of non-performing loans. The F-statistic value is positive for the least squares model (14.17) and the probability is equal to zero, which indicates that the model is significant (Table 5).

Table 5. Coefficients of independent variable under multiple regression, least squares, robust least squares and quantile regression for the period: 2009:Q1 - 2019:Q4

Regression Model / **Dependent variable - GRNPLs**	**Least Squares**			**Robust Least Squares**			**Quantile Regression (Median)**		
Independent variables	Coef.	Std. Error	Prob.	Coef.	Std. Error	Prob.	Coef.	Std. Error	Prob.
C	0.045	0.011	0.0001	0.019	0.006	0.002	0.026	0.013	0.041
GRUN	2.906	0.772	0.0001	1.734	0.405	0.000	2.432	0.884	0.008
R- Squared	0.252			0.146			-		
Pseudo R- Squared	-			-			0.181		
Adjusted R - Squared	0.234			0.126			0.161		
F-Statistic	14.166			-			-		
Prob (F-statistic)	0.0001			-			-		
Prob (Rn-squared stat)	-			0.000			-		
Prob (Quasi -LR stat)	-			-			0.0003		

Source: Authors' calculation

Of all the three observed models, the Least Squares model achieved the highest value of the adjusted coefficient of determination of about 23.40%, which explains the impact of the growth rate of unemployment on the growth rate of non-performing loans. Therefore this means that if GRUN increases by 1% then GRNPLs will increase by about 2,906 units assuming other variables are considered unchanged. An increase in the unemployment rate leads to an increase in poor-quality loans, because with a decrease in the number of employed people, there is a decrease in the financial

power of the population to settle their obligations to banks in an orderly and legal manner, which consequently leads to an increase in toxic loans. According to the data of the Agency for Statistics of Bosnia and Herzegovina (2019), the total unemployment rate decreased from 24.1% in 2009 to 15.7% in 2019. It is evident that when unemployment decreases, the rate of non-performing loans also decreases because a larger number of employees enables more orderly and timely repayment of loan installments.

Table 6. Coefficients of independent variable under multiple regression, least squares, robust least squares and quantile regression for the period: 2009:Q1 - 2019:Q4

Regression Model / **Dependent variable - GRTL**	**Least Squares**			**Robust Least Squares**			**Quantile Regression (Median)**		
Independent variables	Coef.	Std. Error	Prob.	Coef.	Std. Error	Prob.	Coef.	Std. Error	Prob.
C	0.0386	0.0268	0.157	0.0274	0.024	0.256	0.0251	0.0334	0.456
GRCAR	0.2868	0.1616	0.083	0.2257	0.145	0.120	0.2154	0.1989	0.285
R- Squared	0.0697			0.047			-		
Pseudo R- Squared	-			-			0.031		
Adjusted R - Squared	0.0476			0.024			0.008		
F-Statistic	3.150			-			-		
Prob (F-statistic)	0.083			-			-		
Prob (Rn-squared stat)	-			-			-		
Prob (Quasi -LR stat)	-			-			0.204		

Source: Authors' calculation

The previous table shows that the coefficient of determination and the adjusted coefficient of determination are very low, which indicates the conclusion that the independent variable i.e. banks' legal capital does not have a significant forecast for the dependent variable, i.e., credit growth rate. In addition, for all three models (least squares, robust least squares, and quantile regression), the probability is greater than 5%, which implies a new conclusion that the third auxiliary hypothesis that the growth rate of capital adequacy has a positive/negative impact on the growth of credit placements is rejected. A typical management goal is to assume capital risk as far as the regulator allows while retaining some flexibility to support possible future growth. Analysis data of 2019 shows that banks in Bosnia and Herzegovina have a low risk of capital with a multiplier averaging about 10:1 (Banking Agency of the FB&H, 2019; Banking Agency of Republika Srpska, 2019). The largest banks have a very high capital multiplier, that is, a relatively small share of capital in sources of finance. Given that, capital must absorb potential losses from transactions, the higher the multiplier, the greater the bank's risk of bankruptcy. But on the other hand, with a higher multiplier, shareholder returns are greater (Plakalović & Alihodžić, 2015).

6. CONCLUSION

A strong and stable banking market enables faster and more stable economic growth of the entire economy of a country because it makes it easier for capital holders to connect with parties that need capital. The financial system of Bosnia and Herzegovina is modeled from commercial banks, i.e. the financial market is bank-centric. The banking sector is stable in terms of maintaining the capital adequacy ratio, as well as in the context of liquidity. The main objective of this research was to analyze in detail selected macroeconomic and banking indicators of the stability of the banking sector through the application of panel regression analysis for the period from the first

quarter of 2009 to the fourth quarter of 2019. Therefore, in this study, we used the effects of the independent variables and their effects on the dependent variable using the least squares model, robust least squares, and the quantile regression model. The results of the study showed that of the macroeconomic indicators, the strongest impact on economic and financial stability was achieved by the growth rates of foreign direct investments and exports with a significance of less than 5%, where the first basic hypothesis in the paper was partially confirmed.

Also, the research results showed that the increased credit growth towards the real sector has positive implications on the increase in economic activity and on the increase in economic and financial stability at a significance of less than 5%, and thus the first auxiliary research hypothesis is accepted. In this research, with the help of panel regression analysis, the correlation between the growth rate of unemployment and the growth rate of non-performing loans was tested, where it was concluded that an increase in the unemployment rate consequently leads to the inability to repay loans and an increase in credit risk and toxic loans, which leads to the acceptance of second auxiliary research hypothesis. Despite the reduction in non-performing loans, they still represent a potential threat to the stability of the banking sector, and the creators of banking policy in Bosnia and Herzegovina must find both legal and systematic solutions to further reduce toxic loans. By testing the third auxiliary hypothesis, the results of the analysis showed low coefficients of determination and a significance higher than 5%, therefore rejecting the influence of legal capital on the loan growth rate.

The limited literature on this issue also limits the development of determining factors that affect financial stability. In this regard, further research is needed that would include a longer period and a larger number of countries and variables to supplement and understand the determinants of the financial stability of the banking sector. This research can help assess the stability of the banking sector and economic activities that are primarily conditioned by changes in observed macroeconomic and banking variables.

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