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# BANKING AND MACROECONOMIC DRIVERS EFFECTS ON NON-PERFORMING LOANS: INSIGHTS FROM WESTERN BALKAN COUNTRIES

## ABSTRACT

The current research investigates a mixture of banking and macroeconomic drivers to identify and measure their effects on non-performing loans (NPLs) for the Western Balkan countries. The study includes a sample of 6 countries in this region covering 2012-2023. The econometric approach is the hybrid between OLS and Arellano-Bover/Blundell Bond estimation, and certain diagnostic tests are used to measure specific issues for heteroskedasticity, unit roots, and endogeneity. The results suggest that lending interest rate (LIR), loan-to-deposit (LDR), and inflation (INF) show an important statistical effect on NPLs. At the same time, GDP and foreign direct investment have important negative effects. A surprising result has caused the bank capital adequacy ratio to have a positive but statistically insignificant effect. The novelty and originality of this research are focused on the inclusion of countries, the econometric approach, and the gap filling on several drivers treated. Finally, the research aspires to create an academic background for a substantive debate between researchers and policy-making structures.

**Keywords:** non-performing loans, capital adequacy, lending interest rate, gross domestic products, inflation, panel data

**JEL Classification:** G11, O11, E31, C23

## INTRODUCTION

Western Balkans have been thriving for a long time during the political and economic transition. The health of the banking sector is one of the crucial points in the volatility for broadening and fastening economic stability. Two ways of effect drivers, macroeconomics to banking, and banking to macroeconomics, make a complex process of economic stability. Non-performing loans (NPLs) stand as a critical indicator of financial distress, not only threatening the viability of individual banks but also posing systemic risks to national and regional economies. This research examines the complex interactions between banking and macroeconomic drivers and the effect they have on NPLs in the Western Balkan countries - Albania, Kosovo, North Macedonia, Bosnia and Herzegovina, Montenegro, and Serbia- during the period from 2012 to 2023. The ideal situation would be one in which every debtor would pay off the debt they owed. Following that, the banks would lend an increasing amount of money to households and businesses, which would always return the debt, and thereby continue and beyond (Durguti, 2020).

Nevertheless, as stated by Foglia (2022), this perfect arrangement exists only within a hypothetical environment, outside of reality. If your expenditure is my income, then your obligation is my borrowing capacity, from which it follows that if I am in difficulties, you will be in bad shape as well. This is the stereotypical instance of the link between finance and the actual economy. Consider the repercussions of recent financial crises. Whenever the borrower is unable to pay, the lending institution will be left with unwell credits, also known as impaired credits. NPLs are the most critical credit risk variables; more credit risk equals a larger possibility of default. The downward trend of banks' credit quality is one of the most important causes of the financial sector's fragility, commonly leading to banking disasters (Bijsterbosch and Falagiarda, 2015; Konstantakis et

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al. 2016). The aftermath of the global financial crisis highlighted the vital necessity for strong financial institutions capable of absorbing economic shocks. The Western Balkans have experienced distinct problems in this setting, including changing economic growth, varying inflation rates, and diverse foreign investment environments. These factors overall impact the banking sector's health, as seen by the levels of non-performing loans (Durguti and Kryeziu, 2021). Consequently, Foglia (2022) within his academic article on the Italian economy, brings more insight into the macroeconomic effect on NPLs, i.e., on the credit risk of banks. Additionally, employing the ARDL strategy, in his analysis captures both the short- and long-run causal connection between impaired loans and the real economy. Through measuring modifications to the macroeconomic environment, he points out evidence that the adjustment of the long-run equilibrium is gradual, specifically, a shock in the real economy has an extensive effect on the dynamics of NPLs in the long run. Understanding these relationships is critical for politicians, financial regulators, and banks seeking to promote economic resilience and stability.

The soundness of the banking sector is a necessary prerequisite for a stable economy and sustained growth: exposing the determinants of NPLs is of great interest to banks, banking supervisors, and governments, since it allows them to take suitable preventive steps toward the unpredictability of the banking system and of the economic system across all sectors (Giammancoet et al. 2023). The corresponding proportion of NPLs to total gross loans is a measure of the overall stability of the banking sector. Banking institutions, that intend to profit in a long-term perspective, should reduce problematic loans to a minimum (Kuzucu and Kuzucu, 2019). There is a degree of threshold impact on the government's stability with the NPL connection. Specifically, the consequence of government stability on NPLs is negative and significant only if an explicit threshold level has been exceeded; up until then, the effect is insignificant (Abiad and Mody, 2015). Previous research has extensively examined the impact of economic indicators on NPLs; however, few studies have used a longitudinal dataset to include a comprehensive array of both banking-specific and macroeconomic variables in the context of the Western Balkans. Consequently, this investigation attempts to explore and analyze the effect of banking and macroeconomic determinants on NPLs in the stated countries. To achieve this objective, our research has delineated the subsequent questions:

**RQ<sub>1</sub>:** *What statistical effect may bank drivers exert on non-performing loans (NPLs)?*

**RQ<sub>2</sub>:** *Do macroeconomic drivers possess a considerable statistical effect on NPLs?*

This current investigation contributes to the literature via a hybrid econometric methodology that combines Ordinary Least Squares (OLS) with dynamic panel data approaches like Arellano-Bover/Blundell-Bond. This analytical rigour enables a more detailed understanding of how variables including bank capital adequacy ratios, lending interest rates, loan-to-deposit ratios, GDP growth, inflation, and foreign direct investment affect NPLs. Scholars Dell' Ariccia et al. (2008) contend that financial wellness and economic growth encourage each other. Countries undergoing economic collapse, especially, have impacted banking operations and business activities. For instances like this, it is challenging to obtain foreign financing, which affects GDP growth and credit. Therefore, from this perspective, it is pretty evident that economic expansion enhances financial stability (Ijaz et al. 2020). Monetary and financial services industries are described as being sound when lending institutions can provide financing to households within an appropriate volume, and slumps in the economy, and external and internal shocks are not sufficient to render them fragile (Idawati and Syafputri, 2022). This current research fills a gap in empirical research by giving empirical insights into how these variables interact to shape the landscape of non-performing loans. It also provides a core academic framework for serious conversation between scholars and policy-makers. The findings are likely to help guide targeted efforts to improve banking sector stability and economic progress within the Western Balkans countries.

## LITERATURE REVIEW

The soundness of the financial sector remains crucial for economic health in any geographical area, with NPLs acting as an imperative warning sign of possible financial distress in institutions. The dynamics of NPLs in the Western Balkans, a continent marked by transitional economies, offer valuable insights into the overall economic situation. Researchers Kjesovski and Petrovski (2017) uncovered both the macroeconomic and bank-level causes of NPLs and scientific evidence associated with the feedback effects of NPLs on the overall economy. Components of the data deployed reveal the empirical results of determinants of NPLs and have consequences for feedback from NPLs on actual economic activity employing a panel VAR approach. Macroeconomic drivers, GDP, inflation, and domestic lending to the private sector possess a substantial effect on NPLs. Additionally, equity to total assets, growth of gross loans, return on assets, and return on equity, exert a direct impact on NPLs (Kjosevski and Petkovski, 2017). Nonetheless, in the short term, GDP has an inverse statistically significant correlation with NPLs, despite inflation having been demonstrated to be statistically insignificant, even though the connection between them and NPLs has a similar trend as in the long-term simulation (Ristevska, 2020).

The strengthening of the regulatory environment is an effort that should react fast to the shifting nature of risks. Because of this, for the credit risk, it becomes fundamental to understand what affects debtors' repayment capacity to adopt appropriate prudential mechanisms to strengthen debtors' resilience to shocks. Shed light on the drivers of NPL ratios outcomes on support and indicate that negative macroeconomic trends as well as previous lending dynamics have been associated with elevated NPL (Tatarici et al. 2020). Researchers such as Beaton et al. (2016) point out those macroeconomic drivers at both national and global levels, coupled with bank-specific metrics, explaining the downward trend in portfolio quality. Their study points out that NPL growth can lead to an unpleasant cycle, with a detrimental effect on the macroeconomic dynamics, followed by an additional downturn within the financial sector, behaviours that reinforce each other.

In other words, an overall decline in worldwide economic activity becomes the foremost relevant risk for bank asset quality. At the same time, economic activity doesn't seem able to adequately explain the evolution of NPLs across economies and over time. The empirical findings signify that additional factors may negatively affect the quality of assets in countries with unique vulnerabilities. Regarding dynamic panel predictions, the following variables are found to strongly affect NPLs: real GDP, share prices, the exchange rate, and the lending interest rate (Beck et al. 2013). A boost in the capital adequacy ratio by banking institutions can help strengthen financial stability. Meanwhile, the capital adequacy ratio is excessively high, banks cannot efficiently leverage current capital sources, consequently reducing profits, which may lead to financial instability (Nguyen, 2021).

Krasniqi and Durguti (2023) concluded that elevated interest rates within the banking industry positively influenced SMEs' growth. NPLs from commercial banks exhibit a negative correlation with economic growth and are statistically negligible. Increasing the interest rate leads to capital being more costly, potentially rendering projects unsustainable if their internal rates of return fall below the cost of capital. Inversely, the increasing cost of borrowing could result in a decline in consumer aggregate demand, which reduces productivity and hinders overall economic expansion (Bernanke and Gertler, 1995). The recent study conducted by Mehmeti et al. (2024), analyzing investment portfolios through the dynamic GMM system approach, highlighted the need for banking institutions to productively diversify investments across sectors. The findings of this study suggest that investments in the manufacturing sector negatively influence bank profitability, whereas investments in the trade sector and short-term securities have demonstrated a positive impact on bank profitability. From the perspective of investments grounded in international practices, Serhiienko et al. (2024) examined, through a modern complex approach, the investment policies of commercial banks. The article highlights the methodological and model-based approaches and tools employed to analyze and forecast market conditions, risks, and profitability in the context of financial investments by banks.

Akalpler and Duhok (2018) explored the causal relationship between monetary policy and economic development in Malaysia. This research examined interest rates, inflation, and money supply as predictor variables and GDP as the outcome variable. The strategy described as OLS was applied to explore the interaction between the predictor and responding variables. Bredl (2022) identified an elevated positive correlation between interest rates and economic growth results confirming that an increased stock of NPLs is related to increasing lending rates. Fortunately, the overall amount of NPLs alters banks' idiosyncratic funding costs as well, the latter seems insufficient to indicate an important link between the stock of net NPLs and lending behaviour. This can be explained because the association between idiosyncratic funding costs and lending rates turns out to be comparatively weak. Additionally, NPLs don't significantly affect the banks' interest rate pass-through.

Countryside bank management is capable of keeping the NPL below 5% consequently in the long term it may enhance the performance of the bank by paying attention to the inclusion of third-party funds in a reasonable loan-to-deposit ratio so that management is free to develop the business by channelling credit to debtors more to obtain profit that will affect an enhancement of rural bank performance (Saleh and Winarso, 2021).

Hertina et al. (2022) exposed that LDR affected the return on assets. This means that the bank has optimized the existing capital to be channelled through credit so that the bank's profit is maximized, according to the test result with a value of 2,491 and a significance of 0.017. This means that the more NPLs the LDR will rise (Sari and Septiano, 2020). On the plus side, increased foreign investment (FDI) can offer huge benefits to a country. For instance, they can help to improve financial resources and make the domestic financial system more stable (Kaminsky and Schmukler, 2008), or they can encourage local enterprises to connect more with global supply chains and distribution networks (Imansyah and Nasrudin, 2016).

From a negative perspective, foreign capital can expose both the economic and financial systems to the danger of instability, raising the likelihood of a banking crisis (Kim and Singal, 2000). As a result, through other research such as (Lu and Luong, 2022) this field is investigating the effect of various types of international capital flows on the stability of banking

systems depending on country landscapes. The effect of FDI flows on the Z-score is statistically positive in all models, but FPI and FOI flows only have statistical significance in the baseline model. Furthermore, FDI flows contribute to increased banking stability, which is particularly obvious in nations with weaker trade openness.

## AIMS AND OBJECTIVES

This research aims to discover and quantify these characteristics by employing a diagnostic test for endogeneity, heteroskedasticity, and unit roots as part of an econometric strategy that combines OLS and Arellano-Bover/Blundell Bond. This method aims to shed fresh light on the effects of FDI, inflation, lending interest rates, the credit-deposit ratio, and GDP.

## METHODS

### *Study sample*

The research uses strong balanced panel data covering the 6 Western Balkan economies (Albania, Kosovo, Montenegro, North Macedonia, Bosnia & Herzegovina, and Serbia) with 72 observations covering 2012-2023. Data for all drivers included in the research are used and extracted from the World Bank database annually. The motivation for employing these data is that they are comprehensive and processed according to established standards. The bank-specific drivers in our research are NPLs, BCAR, LIR, and LDR, whereas the macroeconomic ones are GDP, INF, and FDI. Moreover, another additional motivation lies in the fact that many studies employed these sources for their research which are published on credible platforms (Salas et al. 2024; Saliba et al. 2023; Durguti et al. 2023; and Saom et al. 2022). Afterwards, within the map shape, we will provide the sample of countries analyzed, where Figure 1 displays their position based on their surface area.

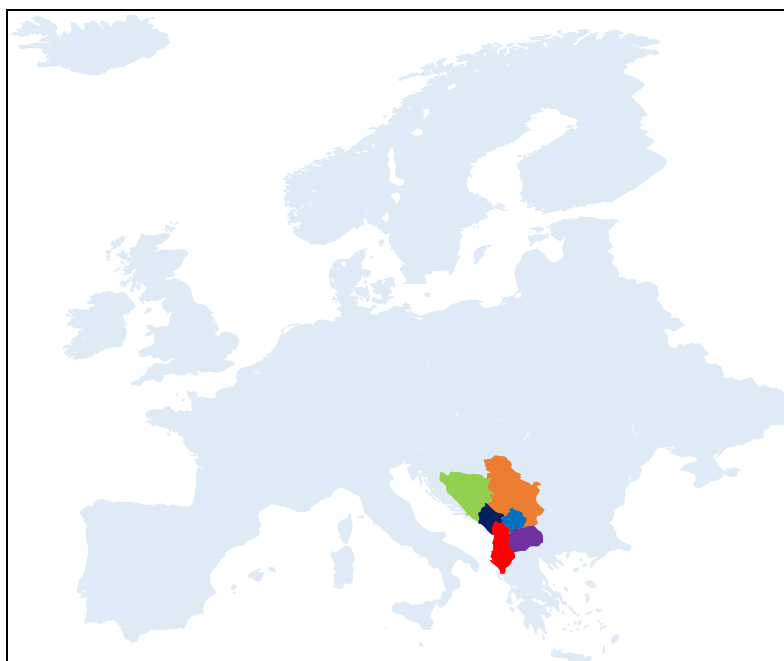


Figure 1: Map of countries included in the analysis

### *Variable selection*

Our research, based on the academic and empirical evidence generated up to now, settled on some of the likely drivers that may have multiple effects on NPLs, employing the six variables described above and drawing on the authors' works (Salas et al. 2024; Goyal et al. 2023; Alnabulsi et al. 2022). Therefore, before conducting our research, we developed the dependent variable NPLs, which represents the percentage of loans over 90 days to total loans. The independent variables encompass unique drivers (BCAR, LIR, and LDR) as well as macroeconomic factors (GDP, INF, and FDI). As a result, Table 1 thoroughly presents all of the variables included in this research, as well as the data sources and expected indications.

**Table 1. Definition of variables and source of data.**

Description	Acronyms	Sources	Expected indications
Non-Performing Loans	NPLs	WB	
Bank capital adequacy ratio	BCAR	WB	+
Lending interest rate	LIR	WB	+/-
Loan to deposit ration	LDR	WB	+
Gross domestic product	GDP	WB	-
Inflation	INF	WB	+/-
Foreign direct investment	FDI	WB	-

Considering the dynamic specifics of the examined data, all drivers are expressed in the form of percentages. This format was selected as an appropriate and standardized approach, being considered adequate for the further treatment of the data in an empirical examination. The expression in percentages benefits besides helping in the normalization of determining units however in enabling comparisons across variables, thereby contributing to the reliability and consistency of the insights obtained. This strategy attempts to ensure a clear understanding and scientific validity of the research conclusions.

### **Data analysis approach**

Given the dynamics of the strongly balanced panel data, including six countries for the research period 2012 to 2023, it is necessary to consider the stability over time of the structure of the variables involved, particularly the NPLs. To empirically evaluate banking and macroeconomic drivers' impact on NPLs the hybrid approach has been applied, namely the OLS and Arellano-Bover/Blundell-Bond. Therefore, underlining that the mutual relationships between the dependent and independent variables are considered dynamic and there are potential concerns about the issue of endogeneity, the use of the OLS approach may yield biased results (Bai, Choi, and Liao, 2021; Hansen, 2007). Another concern of this approach, which is considered a fundamental flaw, especially when dealing with panel data, is the failure to treat individual effects adequately. More specifically, as outlined earlier in the introduction, the objective of the research was to analyze the individual effects of these drivers. However, the application of this approach in this case will be performed to evaluate the degree of difference in results by comparing the two approaches applied. The general formula of OLS is expressed in equation 1, as follows:

$$Y_{it} = \alpha_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + \varepsilon_{it} \quad (1)$$

Therefore, given this general equation, we will transform it in our specific case and form equation 2 and it will look like the following:

$$NPL_{i,t} = \alpha_0 + \beta_1(BCAR_{i,t}) + \beta_2(LIR_{i,t}) + \beta_3(LDR_{i,t}) + \beta_4(GDP_{i,t}) + \beta_5(INF_{i,t}) + \beta_6(FDI_{i,t}) + \varepsilon_{it} \quad (2)$$

Where:  $\alpha_0$  - reflects the constant term in the analysis,  $\beta_1$  till  $\beta_6$  - reflects the regression coefficients, *BCAR*, *LIR*, *LDR*, *GDP*, *INF*, and *FDI* - reflect the independent variables treated,  $\varepsilon_{it}$  - reflects the error term of the variables towards NPL which are not included in the model.

Therefore, assuming the potential limitations specified by the OLS approach, and the predispositions that may be associated with endogeneity, and heteroscedasticity, and addressing the dynamic aspect of the data, the Arellano-Bover/Blundell-Bond approach is considered more appropriate in providing more reliable results. Another additional reason for applying the dynamic approach is also related to the T and N condition, which in our specific case is seen as having higher observation periods than the number of economies in the panel, and it is precisely in these cases that GMM estimation addresses such matters (Alvarez and Arellano, 2003). Therefore, based on these specified issues, Arellano and Bond (1991) proposed to eradicate these matters by extending the OLS equation, using the differences to avoid the correlation and unobserved effects at the individual level  $\eta_{i,t}$  and lagged  $NPL_{i,t-1}$ . According to Hailemariam and Dzhumashev (2020), employing the GMM approach in particular with panel data results in eliminating the problem of heteroskedasticity and endogeneity. Therefore, taking into account the issues highlighted by integrating the difference from equation 2, we obtain the following dynamic equation:

$$\Delta NPL_{i,t} = (\alpha + 1) (NPL_{i,t})_{-1} + \beta_1(BCAR_{i,t}) + \beta_2(LIR_{i,t}) + \beta_3(LDR_{i,t}) + \beta_4(GDP_{i,t}) + \beta_5(INF_{i,t}) + \beta_6(FDI_{i,t}) + \eta_{it} + \varepsilon_{it} \quad (3)$$

In certain instances, the GMM methodology may introduce bias in estimation, as noted by Roodman (2009), indicating that alterations in the differences of the GMM system may result in an increased likelihood of instrument proliferation. Within this scenario, it is essential to conduct the Sargan test to resolve this dilemma.

## RESULTS

### General statistics summary

The current portion presents detailed descriptive statistics for the study's variables in Table 2, including the mean, minimum, maximum, and standard deviation (SD). Regarding the NPL variable, it is noted that it has a mean value of 9.14, with an SD of 5.95 per cent. The lowest value recorded during this research period was recorded in 2019 in Kosovo with a value of 1.93 per cent, whereas the highest was recorded in 2013 in Albania with a value of 22.24 per cent. The overall results on the level of capitalization are noted to be stable and within the requirements set by the international and national frameworks.

**Table 2. Descriptive statistics.**

Variables	Observation	Mean	Standard. D.	Min	Max
NPLs	72	9.138	5.951	1.933	22.244
BCAR	72	9.320	1.275	7.259	12.001
LIR	72	6.487	1.976	3.072	12.666
LDR	72	85.259	18.616	50.370	118.060
GDP	72	2.699	3.772	-15.307	13.043
INF	72	2.595	3.337	-1.582	14.205
FDI	72	6.076	3.437	0.062	17.260

The capital adequacy ratio (BCAR) has a mean value of 9.32 per cent with a low SD of 1.28 per cent. The minimum value recorded for this indicator was in 2019 in Serbia at only 7.26 per cent, while the highest was recorded in 2017 in Kosovo at 12.00 per cent. Continuing further, the variable lending interest rate (LIR) is noted to have a higher variation compared to other indicators, which shows that these countries have a higher differentiation in terms of financing. The mean value of LIR during the observation period was recorded at 6.49 per cent, with an SD of 1.98 per cent. The minimum value of LIR was recorded in 2020 in Bosnia & Herzegovina at 3.07 per cent, which also presents a more favourable rate, while the maximum value was recorded in 2012 in Kosovo at 12.67 per cent. The perspective of the highest variation during the observed period turns out to be the loan-to-deposit ratio (LDR), which provides evidence that some banking systems have a greater use of deposits to finance loans. The mean value of LDR is 85.25 per cent with an SD of 18.62 per cent, which verifies the finding of a high variation among the observed countries. The minimum value recorded during this period was 50.37 per cent in 2016 in Albania, while the maximum was recorded in 2012 in Serbia at 118.06 per cent.

On the other hand, the macroeconomic variable GDP has resulted in a mean value of 2.69 per cent with an SD of 3.77 per cent. The lowest value recorded is in 2020 in Montenegro of -15.31, while the maximum value recorded was 13.04 in 2021 in Montenegro. The inflation variable has a significant fluctuation, passing into the period of deflation (-1.58) in 2016 in Bosnia & Herzegovina, and into the period of inflation of 14.21 in 2022 in North Macedonia. The mean value of INF is 2.59 per cent with an SD of 3.33 per cent. Additionally, FDI results in a mean of 6.08 per cent of GDP, with a standard error of 3.44 per cent. Most of the countries included in this investigation are known for their large diasporas, which explains why the volume of foreign direct investment varies considerably. Serbia had the lowest reported figure in 2023 at 0.06 per cent, while Montenegro had the highest recorded value in 2015 at 17.26 per cent.

### Correlation analysis

To measure the association between NPLs and other variables, correlation analysis was performed and its results are comprehensively reflected in Table 3.

**Table 3. Correlation analysis.**

	<b>NPLs</b>	<b>BCAR</b>	<b>LIR</b>	<b>LDR</b>	<b>GDP</b>	<b>INF</b>	<b>FDI</b>
NPLs	1.000						
BCAR	-0.372	1.000					
LIR	0.291	-0.113	1.000				
LDR	0.164	0.148	-0.126	1.000			
GDP	-0.164	-0.052	0.002	-0.154	1.000		
INF	-0.193	-0.269	-0.179	-0.009	0.152	1.000	
FDI	0.159	-0.508	0.280	-0.134	0.044	0.235	1.000

The outcomes of this analysis display that NPL has a negative association with BCAR at a moderate level, more specifically this result suggests that well-capitalized banks tend to have lower levels of NPLs compared to those that do not have adequate capital. A slight negative association was also found between GDP and INF. This result signals that economies that have low GDP growth and higher inflation rates tend to have higher levels of NPLs. Moderate positive movement is highlighted with LIR, while slight positive movement is recorded with LDR and FDI. Furthermore, based on the coefficients of this analysis, it is observed that none of them ( $r \geq 0.5$ ) has a coefficient greater than 0.5, which means that the applied data do not have concerns with multicollinearity. Wang et al. (2022) have emphasized that if the value of the coefficients within the analysis has a value lower than or equal to  $r \leq 0.80$ , it is considered that the data do not have concerns on this issue.

### ***Multicollinearity analysis***

The research to eradicate the dilemma regarding the multicollinearity within the data, in addition to the correlation breakdown, has also employed the variance inflation factor (VIF). This tool is very effective and useful, especially when dealing with panel data as in our scenario, therefore this is an additional motive for applying this valuation.

**Table 4. Variance inflation factor.**

<b>Variable</b>	<b>VIF</b>	<b>1/VIF</b>
<b>FDI</b>	1.50	0.655
<b>BCAR</b>	1.41	0.711
<b>INF</b>	1.20	0.833
<b>LIR</b>	1.18	0.851
<b>LDR</b>	1.06	0.941
<b>GDP</b>	1.05	0.953

Wooldridge (2012) has underlined that if the value of the individual coefficients does not exceed the range by more than  $\geq 5$ , then it can be considered that the applied panel data do not have multicollinearity concerns. Beginning from this premise, our results presented in Table 4 have revealed that the highest value is for the FDI with  $VIF = 1.50$ , which gives us indications that we are within the defined range in statistical terms. Following the same methodology, the researchers Marcoulides and Raykov (2019), have reached identical conclusions through simulated cases, and underscore that the range determined by Wooldridge (2012) provides consistent evidence that the data applied in the regression should not have a value greater than 5. Therefore, more explicitly, what has been underlined in the context of the correlation breakdown on the issue of multicollinearity is also verified through the VIF valuation, therefore the study aims to provide scientifically consistent results.

### ***Unit root analysis***

As it has been emphasized in the previous sections that we are dealing with balanced panel data, it is recommended to perform a unit root test since there is a possibility that any of the variables included in the analysis may be non-stationary. Therefore, based on this assumption, the research has applied Levin-Lin-Chu which is based on the argument in a common coefficient per unit of the panel. The outcomes of this examination are offered in Table 5, at the level and the first difference.

**Table 5. Levin-Lin Chu unit root.**

Variable	At level		1st difference	
	Statistic	p- value	Statistic	p- value
NPLs	-6.017	0.000	-5.697	0.000
BCAR	-3.558	0.000	-9.190	0.000
LIR	-4.882	0.000	-4.069	0.000
LDR	-4.689	0.000	-3.785	0.000
GDP	-4.886	0.000	-9.455	0.000
INF	-5.074	0.009	-6.619	0.000
FDI	-3.200	0.079	-14.733	0.000

After performing this analysis, the conclusion is that all variables are stationary at the level except FDI, which has shown to be insignificant at the  $\alpha = 0.05$  confidence level. Therefore, by testing entirely variables at the first difference  $I(1)$ , all variables have met the criterion set at the  $\alpha = 0.05$  confidence level. The basic premise of this valuation is that, if the value (p-value) is  $\alpha \geq 0.05$  then the unit root is existed, and the basic hypothesis is approved. However, if the value (p-value) is  $\alpha \leq 0.05$ , then the alternative hypothesis should be supported (Levin-Lin-Chu, 2002). Thus, respecting the specified conditions in our specific instance, it is observed that all the data in the setting of the first difference  $I(1)$  are stationary and fully support the alternative hypothesis.

### Estimation models

To evaluate in the econometric context, the research has applied the hybrid approach between OLS and Arellano-Bover/Blundell Bond, and their results are presented in Table 6. However, it should be emphasized that our focus will be on the dynamic approach since it is more preferred when dealing with panel data on the one hand, and eliminating several dilemmas around heterogeneity and endogeneity. Nevertheless, it should be emphasized that there is a slight difference in the results generated, what is worth stressing is that according to the OLS approach, the BCAR has resulted in a significant effect on NPLs, whereas according to the Arellano-Bover/Blundell Bond approach, it has resulted to have an insignificant effect. Similarly, GDP has a significant difference where according to the OLS approach it turns out to be insignificant, despite the fact according to the dynamic approach it has resulted in a significant negative effect on NPLs.

**Table 6. Regression results.**

	OLS		Arellano-Bover/Blundell Bond		Arellano-Bover/Blundell Bond Robust (vce)	
	$\beta$	$\rho \geq [z]$	$\beta$	$\rho \geq [z]$	$\beta$	$\rho \geq [z]$
NPLs - L1	"_"	"_"	0.769	0.000	0.769	0.000
BCAR	2.244	0.000	-0.135	0.661	-0.135	0.672
LIR	0.718	0.032	0.620	0.000	0.620	0.003
LDR	0.076	0.025	0.080	0.000	0.080	0.154
GDP	-0.177	0.279	-0.086	0.036	-0.086	0.002
INF	-0.438	0.029	0.128	0.035	0.128	0.047
FDI	-0.099	0.642	-0.254	0.005	-0.254	0.020
_cons	21.134	0.003	-6.639	0.068	-6.639	0.284
Screening tests						
Observation	72	"_"	72	"_"	72	"_"
F-test	5.67	0.000	"_"	"_"	"_"	"_"
R <sup>2</sup>	0.344	"_"	"_"	"_"	"_"	"_"
Heteroskedasticity	21.703	0.1106	"_"	"_"	"_"	"_"
Westerlund test	2.055	0.020	"_"	"_"	"_"	"_"
Wald chi2	"_"	"_"	1064.500	0.000	5796.01	0.000
AR <sub>1</sub>	"_"	"_"	"_"	"_"	-1.7309	0.084
AR <sub>2</sub>	"_"	"_"	"_"	"_"	0.9725	0.3308
Sargan J- test	"_"	"_"	78.618	0.1160	"_"	"_"

In the context of measuring the heteroskedasticity concern, it is concluded that the data do not have such concerns since the value is greater  $\alpha \geq 0.05$  ( $p = 0.110$ ). Additionally, to measure the degree of cointegration in the long term, the Westerlund test for cointegration was performed and the value of this test resulted in 2.055 with  $p = 0.020$ , which offers us indications that the variables are correlated in the long term. In the background of the robustness and stability of the econometric approach the R2 model in the OLS model has a value of 0.344 or expressed in other words that the independent variables explain the NPLs at a level of 34.4 per cent. Meanwhile, in the Arellano-Bover/Blundell Bond approach, the stability result of the Wald chi2 model has resulted to be 1,064.50 with a probability value of  $p = 0.000$ , correspondingly, another test on the adequacy of the adjustment of the instruments within the model, the Sargan test has been applied which has resulted to have a value of 78.618 with a probability value of  $p = 0.116$ , which proves that the instruments are adequately adjusted and that the model has stability. The results presented in Table 6, according to the Arellano-Bover/Blundell Bond approach, have revealed that lending interest rate (LIR), loan-to-deposit (LDR), and inflation (INF) have a significant positive effect on NPLs. Meanwhile, a statistically significant negative effect is observed on GDP, and FDI on NPLs in the setting of the observed period. For more in-depth discussions, they will be presented in 4.4 of the research.

To further validate the model's robustness, we applied the robust model to the Arellano-Bover/Blundell Bond, addressing potential concerns with heteroscedasticity, autocorrelation, and other issues. As a result of this strategy, it is observed that NPLs – L1. Despite applying a robust valuation, there is a probability  $p = 0.000$ , indicating that the results are steady and reliable even after accounting for these difficulties. Meanwhile, the results for the dependent variables, although statistically significant, have a slight change even after applying the robust approach (for example, LIR has a probability shift from  $p = 0.000$  to  $p = 0.003$ ; LDR from  $p = 0.080$  to  $p = 0.154$ ; GDP from  $p = 0.036$  to  $p = 0.002$ ; INF from  $p = 0.035$  to  $p = 0.047$ ; and FDI from  $p = 0.005$  to  $p = 0.020$ ). The robust technique produced an AR2 autocorrelation of  $p = 0.3308$ , indicating an absence of autocorrelation at the second level and validating the model's validity. Finally, the exceptionally large Wald Chi-Square value 5796.01 and  $p = 0.000$  indicate that the model is statistically significant and effectively fitted.

## DISCUSSION

The results of the Arellano-Bover/Blundell-Bond dynamic approach presented in Table 6 confirm the effect of the LIR with a statistically important valuation on NPLs. Therefore, the structure of LIR applied by banks that are operating in the countries included in the analysis provides solid evidence of their importance. However, the management structures of these institutions should take concrete steps by revising them from time to time since they have a fundamental difference compared to the European Union countries. The results obtained align closely with our anticipations and fully concur with Atichasari et al. (2023), who examined the association and consequence of LIR on NPL employing a qualitative methodology, explicitly questionnaires, underscoring the favourable connection among these variables. Serrano (2021) examined a sample of 75 banks in Europe, concluding that banks with elevated interest rates along with certain other parameters are correlated with a reduced rise in NPLs, indicating a positive association between these variables.

However, it should be highlighted that there are findings that oppose our findings, for instance, the scholars Gjeçi et al. (2023) used a sample of 42 economies that are part of the EU and outside the EU and found that the association between NPLs and credit growth (which directly depends on financial potential and LIR) is more pronounced for well-capitalized banks, whereas the opposite may reflect a negative effect. Loan-to-deposit (LDR) indicates the capacity of financial institutions to finance businesses and reflects the proportion of deposits allocated for business funding. The coefficient  $\beta = 0.080$  with a probability  $p = 0.000$  indicates a statistically significant positive effect on NPLs. The results demonstrate that a one per cent increase in the LDR corresponds to an increase of 0.08 percentage points in NPLs, assuming all other variables stay constant. Furthermore, this indicates a positive correlation between both of them suggesting that any rise in LDR may result in a decline in asset quality, thereby impacting the increase in NPLs.

Our results are in the spirit of the study conducted by Rachmawati et al. (2024) who explored the relationship between these two variables by investigating the period 2019 to 2022, and concluded that there is a healthy positive relationship between them.

Serrano (2021) arrived at analogous conclusions from an alternative perspective by examining European banks from 2014 to 2018, determining that the lending level correlates with asset quality, specifically concerning non-performing loans. Moreover, this study demonstrates that banks who manage to minimize the NPL rate likely to help the real economy more.

Our results on the macroeconomic drivers of GDP, as per the dynamic approach, indicate a statistically significant effect at the 1 per cent confidence threshold, supported by a  $p$ -value of 0.002 and a coefficient of  $\beta = -0.086$ . This conclusion

indicates that each unit rise in GDP corresponds to a reduction of 0.086 units in NPL, assuming the *ceteris paribus* criterion is upheld. The results appear to align with our predictions, as theoretical and academic perspectives have always maintained that stability in the growth of GDP should correspond with improvements in every dimension of social well-being.

The conclusions of our analysis align with the research conducted by Salas et al. (2024), which emphasizes a negative correlation between GDP and NPL, employing both static and dynamic methodologies, specifically the GMM technique. Their sample is categorized into seven regions, which include the European region. Radojevic and Jovovic (2017) have similarly concluded a negative link between these two drivers, based on a cross-country examination of 25 nations employing a static technique.

Ongoing through the macroeconomic driver's inflation (INF), the outcomes display a significant positive effect on NPLs. We underline this conclusion based on the value of the coefficient ( $\beta = 0.128$ ) generated as well as the probability value ( $p = 0.035$ ), which means that for every one-unit increase in INF, it is reflected in a positive increase of 0.128 units of NPLs, bearing in mind that all other variables remain constant. Regarding the effect of inflation on NPLs, there is no stable consensus since the findings are mixed, therefore the outcomes of our study are in the spirit of the discoveries provided by the authors Sayed and Aidyngul (2020), who have underlined the positive relationship between them. Their examination encompassed the dynamic GMM system methodology through a comparative analysis of developed and developing countries.

Nevertheless, the research undertaken by Salas et al. (2024) presents discoveries indicating that inflation exerts a positive influence, even though that is statistically insignificant, through an analysis of seven distinct regions on the worldwide level.

Meanwhile, a controversial verdict with our outcomes is provided by Arham et al. (2020) examining developing countries in Asia. The preceding driver in the background of our examination is FDI, which based on the value of the coefficient ( $\beta = -0.254$ ) generated as well as the probability value ( $p = 0.005$ ), is observed to have a significant negative effect on NPLs. This discovery provides strong evidence that the countries explored have low levels of FDI, which in reality means that for every unit increase in FDI, it will be reflected in the derivation by -0.254 units of NPLs.

The discoveries of this research correspond to the study conducted by Mustaqe et al. (2024) who explored the case of Albania and provided evidence that FDI has a significant effect on the reduction of NPLs. Furthermore, the same conclusion was reached by Ozili et al. (2020) applying the OLS approach, and their empirical findings show that an increase in the level of FDI affects the reduction of the percentage of NPLs.

## CONCLUSIONS

Our evaluation of banking and macroeconomic effects on non-performing loans (NPLs) is derived from a sample of six Western Balkan countries stretching the period from 2012 to 2023, encompassing a total of 72 observations. The methodology employed for examining bank-specific and macroeconomic determinants is the integrated static (OLS) and dynamic (Arellano-Bover/Blundell Bond) approach. The results revealed represent an additional contribution and added value to understanding and identifying their effect on NPL. Explicitly, the research discoveries suggest that some of the drivers have a significant positive and statistically reliable effect on NPLs, such as interest rate (LIR), loan-to-deposit ratio (LDR), and inflation (INF). On the other side, GDP and foreign direct investment (FDI) have been found to have significant negative and statistically significant effects. A surprising result is produced on the capital adequacy ratio (BCAR), which shows positive signs but with imperfect statistical significance. Hence, starting from the summary of these results, the research presents an additional contribution in the theoretical and empirical aspects. From the perspective of limitations, the research undoubtedly has limitations, where first the short observation period is considered a limitation, second the inclusion of more banking industry factors, and finally from the econometric context the chosen approach which is unbearable to include all econometric assumptions. However, what is important is that the discoveries presented cannot be compromised in any way.

From the perspective of policy implications, some of the most vital will be highlighted, e.g., high interest rates have a clear tendency to worsen NPLs, making it difficult for businesses and households to have sufficient liquidity to repay their obligations to banks. Therefore, financial institutions, namely banks, that aim to have a low percentage of NPLs should implement adequate policies that will not interfere with the growth of NPLs. From a macroeconomic perspective, drivers such as FDI, GDP, and INF have shown significant results, which gives us indications that these economies should redesign policies to attract FDI, pay attention to GDP growth, and maintain an adequate level of inflation.

The results of this research offer useful insights into the causes of non-performing loans (NPLs) in six Western Balkan countries. Nevertheless, future research could expand the understanding of these dynamics. Stretching the time frame and extending the number of samples tested could enable a more robust examination of patterns and associations over a longer period. Additionally, applying more banking-specific variables, such as credit risk management techniques and lending sectoral distribution, could offer a more nuanced perspective. Considering alternating econometric approaches, such as nonlinear modelling or methods based on machine learning, could better capture complicated interactions. Sector-specific and cross-country comparative research could identify distinct and shared drivers of NPLs, expanding the policy discourse. Lastly, evaluating the impact of exogenous shocks, such as financial crises or geopolitical upheavals, will provide insights into resilience methods for banking institutions. This potential can greatly contribute to the stability and efficiency of banking institutions in the region and beyond. Finally, the results show clear indications that policymakers should carefully review banks' capital policies, focusing on other factors such as risk management and the definition of sound lending policies.

## ADDITIONAL INFORMATION

### AUTHOR CONTRIBUTIONS

*All authors have contributed equally.*

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### CONFLICT OF INTEREST

*The Authors declare that there is no conflict of interest.*

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## ВПЛИВ БАНКІВСЬКИХ І МАКРОЕКОНОМІЧНИХ ФАКТОРІВ НА НЕПРАЦЮЮЧІ КРЕДИТИ: ДОСВІД ЗАХІДНОБАЛКАНСЬКИХ КРАЇН

Це дослідження вивчає комбінацію банківських і макроекономічних чинників із метою виявлення та вимірювання їхнього впливу на проблемні кредити (ПК) для країн Західних Балкан. У дослідженні розглянуто вибірку з 6 країн цього регіону за період 2012-2023 років. Економетричний підхід є гібридом між OLS та оцінкою за методом Arellano-Bover / Blundell Bond, також використані певні діагностичні тести для вимірювання специфічних проблем, таких як гетероскедастичність, одиничні корені та ендогенність. Результати свідчать, що процентна ставка за кредитами (LIR), коефіцієнт кредитів до депозитів (LDR) та інфляція (INF) мають важливий статистичний вплив на ПК. Водночас ВВП та прямі іноземні інвестиції мають значний негативний вплив. Несподіваний результат полягає в тому, що коефіцієнт капіталу банку має позитивний, але статистично незначущий ефект. Новизна та оригінальність цього дослідження зосереджені на включенні країн, економетричному підході та заповненні прогалів у вивченні різних факторів. Дослідження прагне створити академічну базу для змістовної дискусії між дослідниками та політичними структурами, що займаються ухваленням рішень.

**Ключові слова:** непрацюючі кредити, достатність капіталу, процентна ставка за кредитами, валовий внутрішній продукт, інфляція, панельні дані

**JEL Класифікація:** G11, O11, E31, C23