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# Assessing the Impact of Monetary Policy on Financial Stability through Non-Performing Loans

**Abstract**: This study investigates the relationship between monetary policy and financial stability by examining non-performing loans (NPLs) as a key indicator of credit risk in nine Southeast European countries over the period 2007–2022. The empirical framework is built on an unbalanced panel dataset and employs fixed effects (FE) estimation, feasible generalized least squares (FGLS), and panel-corrected standard errors (PCSE) to address potential econometric challenges and enhance the robustness of results. The findings reveal that lending interest rates are a significant determinant of NPLs, indicating that tighter monetary conditions increase repayment burdens and amplify credit risk. By contrast, the official exchange rate does not show a consistent effect on loan performance, a result that may reflect relative stability in currency markets and the presence of regulatory safeguards in the region. An unexpected but noteworthy outcome is the negative association between unemployment and NPLs, which could be attributed to more cautious borrowing behaviour in periods of economic uncertainty and the role of government support mechanisms. These results highlight the complex transmission channels through which monetary policy interacts with financial stability, while also underscoring the importance of country-specific conditions in shaping these dynamics. The study contributes to the literature by providing evidence from a region marked by transition, crisis episodes, and external vulnerabilities, offering insights into how monetary policy can be calibrated to safeguard the resilience of the banking sector.

**Keywords**: Monetary policy, Non-performing loans, Economic stability, Panel data analysis, Interest rates, Southeast Europe.

**JEL Classification**: E52, E58, C33, O52

## 1. Introduction

Monetary policy is one of the key instruments for achieving macroeconomic stability, and its effects are transmitted through complex mechanisms involving financial institutions, market expectations, and real economic activity. At the core of this process lies the transmission mechanism, through which changes in central bank reserves influence liquidity, lending behaviour, aggregate demand, and ultimately price stability (Fung & Hansen, 1993). In bank-centric financial systems, such as those of Southeast Europe, the credit channel plays a particularly prominent role, as banks serve as the primary conduit for transforming monetary impulses into real economic outcomes.

### 1.1. Linkages between monetary conditions, lending activity and NPLs dynamics

Bank lending activity, as an essential part of this transmission mechanism, is closely linked to monetary conditions. Liquidity, shaped by reserve requirements and interest rate levels, directly affects banks' ability and willingness to extend credit. A rise in reserves typically facilitates credit expansion, whereas tighter monetary policy may constrain lending and affect loan quality. NPLs defined as loans past due or unlikely to be repaid, represent a critical indicator of both banking sector health and systemic risk (Scarlat, 2015), (European Central Bank, 2017). A high level of NPLs signals weaknesses in credit risk management, borrower capacity, or broader economic instability.

The determinants of NPLs have been the subject of extensive research. Macroeconomic factors such as GDP growth, inflation, and unemployment are frequently cited as significant drivers (Ristić & Jemović, 2021), alongside bank-specific characteristics including capital adequacy, return on assets, and operational efficiency (Radivojević & Jovović, 2017). Empirical studies offer diverging findings, however. For example, while some highlight the role of inflation and real GDP growth in reducing credit risk, others suggest that rapid economic expansion may mask excessive risk-taking, eventually leading to a rise in NPLs during contractionary periods. Moreover, the global financial crisis of 2007–2008 exposed the vulnerability of credit systems to both endogenous and exogenous shocks, reinforcing the importance of monitoring credit quality as a tool for macroprudential oversight (Delova Jolevska & Andovski, 2015).

The link between monetary policy and NPLs is further complicated by institutional and regulatory factors. In countries such as Serbia, credit activity is moni-

tored through a comprehensive framework that includes credit standards, lending conditions, and borrower demand, segmented across household and corporate sectors. Risk perceptions, funding costs, and expectations about economic activity all shape the dynamics of lending, and consequently the quality of bank portfolios. Liquidity risk, capital adequacy, and credit ratings play an equally important role in determining banks' resilience to shocks (Zelenović & Vunjak, 2014; Gaćeša, 2009).

Despite the wealth of research, few studies have systematically examined how monetary policy variables influence NPLs across multiple emerging economies in a regional context. This study addresses that gap by analysing panel data from nine Southeast European countries over the period 2007–2022, employing econometric techniques that account for heterogeneity and potential endogeneity, including FE, FGLS, and PCSE. The aim is to assess how key monetary indicators, particularly interest rates and exchange rates, interact with NPL dynamics, while controlling for macroeconomic variables such as unemployment and GDP per capita.

The findings contribute to the ongoing debate about the role of monetary policy in ensuring financial stability. They suggest that the relationship between interest rates and NPLs is both significant and context-sensitive, reflecting the delicate balance that central banks must maintain between price stability and credit sustainability. These insights are especially relevant for policymakers and regulators in transition economies, where vulnerabilities in the banking sector can quickly translate into broader systemic risks.

### 1.2. Justifying country and timeframe choice

The research focuses on nine countries, namely Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Hungary, Montenegro, North Macedonia, Romania, and Serbia. These countries were selected because of their geographical concentration in Southeast Europe and their shared historical, cultural, and economic legacies (Obradović & Grubišić, 2025). Their common experience of socialist governance and subsequent transition to market-oriented systems provides a unique foundation for comparative analysis. Another decisive factor is their relationship with the European Union. Some are already EU members, while others remain candidates, actively shaping their policies to meet accession requirements. This contrast creates a natural laboratory for studying policy convergence, as EU alignment often drives monetary reforms and institutional modernization.

The timeframe of 2007–2022 was chosen for its relevance to major shocks and structural shifts. It spans the global financial crisis of 2008 (Jannsen et al., 2019), the Eurozone's turbulence (Gutiérrez-Diez & Pál, 2023), and the COVID-19 pandemic (Wei & Han, 2021), events that profoundly influenced monetary policy responses and economic trajectories across the region. By situating the study within this specific group of countries and this critical 16-year period, the research captures both shared vulnerabilities and divergent outcomes, offering insights into how transitional economies navigate the complex relationship between monetary policy and financial stability (through NPLs).

### 1.3. Objectives and principal contributions of the study

The primary objective of this study is to assess the impact of monetary policy on financial stability. The research aims to capture the extent to which monetary instruments influence macroeconomic performance in a region characterized by transitional dynamics, institutional heterogeneity, and varying degrees of integration into the European Union.

The study pursues three specific objectives:

1. To analyse the interaction between monetary policy and growth during periods of systemic stress, including the 2008 global financial crisis and the COVID-19 pandemic, both of which reshaped transmission mechanisms and policy effectiveness.
2. To examine convergence and divergence in monetary policy strategies between EU member states and aspiring candidate countries, thereby identifying how the accession process shapes monetary frameworks.
3. To construct and empirically test an econometric model that evaluates the relationship between monetary variables and economic growth across the selected countries, accounting for structural differences and external shocks.

The main contributions of this study are threefold. First, it isolates the Southeast European context, providing insights that are often overlooked in broader cross-country analyses. Second, it integrates both global crises into a single analytical framework, enabling a comparative understanding of how extraordinary shocks affect policy transmission. Finally, it offers policy-relevant evidence for central banks and governments in transition economies, highlighting the conditions under which monetary policy can support sustainable growth and macroeconomic stability, particularly in light of new technological challenges such

as the increasing reliance on artificial intelligence within the banking sector (Vučinić & Luburić, 2024).

## 2. Literature Review

Monetary policy has long been a focal point of economic research, with extensive literature analysing its instruments, objectives, and broader macroeconomic implications. Early foundational works, such as those by Fisher (1930) and Keynes (1936), laid the groundwork for understanding interest rate mechanisms, inflation expectations, and the role of monetary authorities in stabilizing economic fluctuations. Fisher's theory of interest rates emphasized the interaction between nominal rates, inflation, and real interest, while Keynesian theory introduced a more interventionist approach in which monetary policy could play a countercyclical role in stimulating investment and demand. In the post-Keynesian and modern monetarist eras, significant attention has been given to the channels through which monetary policy influences inflation and output. The Neo-Fisherian view, for example, posits that raising nominal interest rates may lead to higher inflation in the long run, an idea developed and debated in numerous studies (Bilbiie, 2022). More recent discussions center around whether these dynamics are regime-dependent and contingent on expectations and policy credibility (Uribe, 2022).

The relationship between monetary policy and financial stability has emerged as a central concern, especially in the wake of the global financial crisis and the COVID-19 pandemic. Several studies examine the interaction between monetary and macroprudential policies in promoting sustainable growth and mitigating systemic risks. For instance, Laeven et al. (2022) argue that while expansionary monetary policy can stimulate credit growth, it may also increase vulnerabilities in the banking sector, necessitating macroprudential countermeasures. Similarly, Liang (2019) explores how monetary policy tools may affect financial stability through credit booms, asset bubbles, and risk-taking incentives.

In the specific context of Southeast Europe, empirical analyses often focus on the effectiveness of monetary regimes in transitional economies and their role in reducing macroeconomic volatility. Grubišić and Ivanović (2012) provide a comparative study of five countries in the region, showing the importance of institutional quality and policy coordination. Studies by Grubišić and Marčetić (2013) further elaborate on external imbalances and the challenges of foreign borrowing, highlighting vulnerabilities that arise from inadequate monetary discipline.

The literature on NPLs also intersects with discussions of monetary policy effectiveness. High NPL levels weaken the monetary transmission mechanism, impair bank lending, and can threaten financial stability. Empirical studies such as those by Ilievski (2022), Vuković and Domazet (2013) and Morakinyo et al. (2018) investigate the causes, consequences, and policy responses related to NPLs in emerging markets. Moreover, strategic frameworks to reduce NPLs, as discussed by Nikolaieva (2022) and Ozili (2023), emphasize the necessity of coordinated regulatory action and macroeconomic stability. Deposits, as both a source of liquidity and a confidence indicator, are essential in understanding the health of banking systems. Martin et al. (2018) and Rainone (2021) highlight the behavioral aspects of depositors during stress periods, noting that uninsured deposits are especially sensitive to perceived risks and bank-specific information (Chen et al., 2022). Furthermore, Katsafados and Anastasiou (2022) present predictive models for deposit volatility, contributing to better risk management in the financial sector.

The role of unconventional monetary policy (UMP) has expanded significantly in response to low interest rate environments and financial crises. Gaffard (2018) and Diaconescu and Botezatu (2015) explore how central banks have adopted UMP tools such as asset purchases and forward guidance to maintain financial stability and stimulate demand. Alessandri et al. (2017) warn that prolonged monetary accommodation might induce excessive risk-taking and asset mispricing, thereby increasing systemic risk over time.

From a policy design perspective, achieving price stability while safeguarding financial health remains a delicate balance. Badea (2015) suggests that inflation targeting may not automatically ensure financial stability, especially in economies with underdeveloped financial markets. Ajello et al. (2022) review theoretical frameworks linking macroeconomic and financial vulnerabilities, reinforcing the idea that central banks must integrate broader indicators beyond inflation and output gaps into their decision-making processes.

At the European level, Bandoi et al. (2009) underline the necessity of coherent monetary strategies within the Economic and Monetary Union (EMU) framework, while Grubišić et al. (2014) document Serbia's path toward price stability and monetary credibility, aligning with Maastricht criteria.

Finally, the COVID-19 pandemic generated a surge of new literature on the flexibility and limitations of monetary policy during systemic shocks. Studies by Powell (2021), Brzoza-Brzezina et al. (2022), and Li et al. (2023) examine the

asymmetric effects of monetary interventions and the role of central banks in sustaining aggregate demand and market functioning during crises.

Taken together, the reviewed literature provides a comprehensive background on the complex and evolving role of monetary policy in fostering economic and financial stability. It emphasizes the importance of institutional settings, policy credibility, structural vulnerabilities, and macroprudential coordination in shaping outcomes. These insights inform the empirical analysis of this study, which focuses on Southeast European economies and seeks to assess the impact of monetary variables on key indicators of stability, such as NPLs and deposits, over an extended period marked by economic transformation and external shocks.

## 2.1. Monetary policy and non-performing loans: Evidence from previous studies

A substantial body of research highlights the close relationship between monetary policy and the dynamics of NPLs. Empirical studies consistently show that tighter monetary conditions, reflected in higher interest rates, tend to increase the burden on borrowers and thereby contribute to rising default rates. Louzis et al. (2012), using data from Greek banks, demonstrate that NPLs are strongly linked to macroeconomic variables, particularly GDP growth and lending rates. Their findings suggest that restrictive monetary policy amplifies financial stress within the banking sector by worsening debt servicing capacity. Similar results are reported by Nkusu (2011), who examines a panel of 26 advanced economies and concludes that increases in interest rates, alongside weaker economic activity, are systematically associated with higher levels of NPLs.

For transition and emerging European economies, the relationship between monetary policy and credit quality has been especially pronounced. Klein (2013), focusing on Central, Eastern, and Southeastern Europe, shows that both interest rate fluctuations and inflationary pressures are key drivers of deteriorating loan portfolios. In these countries, where financial systems remain more vulnerable to macroeconomic shocks, the transmission of monetary policy through credit quality is particularly pronounced. Collectively, this strand of literature underscores that monetary policy is not only a tool for stabilizing prices and output, but also an indirect determinant of banking sector stability through its effect on loan performance.

The relationship between monetary policy and economic stability, viewed through the prism of NPLs, is inherently complex. Monetary tightening, through

higher interest rates, often increases debt-servicing costs and reduces the repayment capacity of households and firms, leading to a deterioration in loan quality. On the other hand, prolonged accommodative policy may ease repayment pressures in the short term but can also create distortions by encouraging excessive credit growth and risk-taking. This duality makes the connection between policy stance and loan performance highly nuanced, with effects that may vary across time horizons. The sensitivity of NPLs to monetary policy also depends on a wider set of structural and institutional factors. The stage of the business cycle, the resilience of the labour market, and the overall pace of economic growth are crucial determinants of whether policy changes stabilize or destabilize financial conditions. In addition, the strength of banking supervision, the efficiency of judicial systems in resolving defaults, and the internal risk management practices of banks all shape the ultimate outcome. As a result, the impact of monetary policy on NPLs cannot be understood in isolation: it is mediated by the broader macroeconomic environment and by the institutional capacity to absorb and manage shocks.

## 2.2. Identification of gaps and limitations in the literature

Although the relationship between monetary policy and NPLs has received growing attention, several important gaps remain in the existing body of research. Much of the literature emphasizes the direct effect of interest rates on loan quality, yet the broader transmission mechanisms through which monetary policy influences credit risk are less systematically explored. For example, the interaction between monetary policy and labor market conditions, corporate sector leverage, or household indebtedness is often treated only tangentially, despite their central role in shaping repayment capacity.

Another limitation is that many studies are highly context-specific, focusing on advanced economies or single-country cases, which makes it difficult to generalize findings to emerging and transition economies. In regions with weaker institutional frameworks or more fragile banking systems, the dynamics between monetary policy and NPLs may differ significantly, but empirical evidence remains scarce. Additionally, existing research often treats banking systems as homogenous, overlooking heterogeneity across banks in terms of capitalization, risk management, and exposure to different types of borrowers. These omissions reduce the explanatory power of current models and limit their usefulness for policy design.

Finally, the literature has not fully addressed the nonlinear and potentially asymmetric effects of monetary policy on NPLs. Periods of crisis, when default risk rises sharply, may reveal dynamics that differ substantially from those observed in more stable times. Yet, the distinction between normal and stress conditions is rarely made explicit, leaving a gap in our understanding of how monetary policy contributes to financial stability under varying macroeconomic circumstances.

## 3. Materials and Methods

This study is based on a panel dataset covering nine Southeast European countries over a sixteen-year period (2007–2022), resulting in 144 country-year observations. The panel includes both cross-sectional (N = 9) and time-series (T = 16) dimensions, enabling the simultaneous assessment of temporal dynamics and country-specific effects. Given that the number of time periods exceeds the number of units, this dataset is classified as time-series cross-sectional (TSCS), which requires special attention to issues such as heteroskedasticity, serial correlation, and non-stationarity (Zhu, 2013). The period selection captures critical macroeconomic phases such as the 2008 global financial crisis, post-crisis recovery, and the economic repercussions of the COVID-19 pandemic, making it particularly suitable for examining monetary policy effects under different economic conditions.

Given the abundance of research on this topic, we decided to include in the model those variables that could have a significant impact on the inflation rate. The selection of variables was not only based on theoretical relevance but also on data availability and the suitability for econometric modelling. Incorporating both demand-side and supply-side indicators allows for a more balanced and comprehensive analysis of financial stability. This multidimensional approach helps capture the complexity of monetary policy, especially in the context of economies undergoing structural and monetary transitions. The data were primarily sourced from the World Bank and the International Monetary Fund. In instances where specific data points were missing or incomplete, supplementary information was obtained from national statistical offices and official publications of the respective countries. This approach ensured that the dataset remained comprehensive, comparable, and methodologically consistent across all observations. By carefully integrating multiple reliable sources, the research maintains a high level of data validity and robustness, which is essential for producing credible and accurate analytical outcomes. Additionally, this thorough data collection strategy helps to mitigate potential biases or gaps, thereby strengthening the overall quality of the study's findings. Panel methods are applied to data covering nine economies

over a sixteen-year horizon. Using a longitudinal design with repeated country observations, we follow the same economies across years. This dual nature of the dataset facilitates a more nuanced analysis of economic trends and policy impacts over time (Wooldridge, 2010):

$$NPL_{\{it\}} = X'_{\{it\}}\beta + Y_{\{it\}} \; and \; Y_{\{it\}} = \alpha_{\{i\}} + \varepsilon_{\{it\}}$$

Where i= 1,…N, index countries (N=9) and t = 1,…T, index years (T=16).

In this formulation, $NPL_{\{it\}}$ denotes the ratio of NPLs for country *i* at time *t*. The vector $X'_{\{it\}}$ represents the set of explanatory variables, including both macroeconomic indicators and monetary policy variables, while $\beta$ is the corresponding vector of coefficients that captures the magnitude and direction of their influence on NPLs. The error term $Y_{\{it\}}$ is decomposed into two parts: the individual-specific effect $\alpha_{\{i\}}$, which accounts for unobserved heterogeneity across countries that is constant over time, and the idiosyncratic error component $\varepsilon_{\{it\}}$, which reflects random shocks and measurement errors that vary across both cross-sectional units and time.

This structure allows the model to control for unobservable factors unique to each unit, whilst capturing the role of time-varying explanatory variables. By doing so, it provides a framework suitable for panel data analysis and improves the reliability of the estimated relationship between monetary policy indicators and loan quality outcomes. Due to these varying characteristics of the stochastic process that generates panel data, the choice of an appropriate regression method is crucial for obtaining valid and reliable results. For example, if present characteristics such as heteroskedasticity or autocorrelation are not recognized, using standard estimation methods can lead to systematic errors in the analysis results. Therefore, careful consideration of these aspects is essential when analysing panel data.

### 3.1. Research methodology and variable description

The model measuring the impact of monetary policy on economic growth includes one dependent and eleven independent variables (Table 1).

**Table 1: Variable explanation**

| Variable Name | Abbreviation | Variable Explanation | Unit of measure | Source |
|---|---|---|---|---|
| Bank non-performing loans to gross loans | NPL | The amount of loans recorded as non-performing includes the gross value of loans reported on the balance sheet, not just the overdue amount. | Ratio of non-performing to total loans | World Bank, IMF |
| Official exchange rate | OER | The exchange rate determined by national authorities or the rate established on a legally authorized foreign exchange market. | Local currency against the US dollar | World Bank |
| Lending interest rate | LIR | The bank rate that typically meets the short-term and medium-term financial needs of the private sector. | Percentage | World Bank, national publications |
| Inflation, consumer prices | ICP | Annual change in the cost of goods and services purchased by the consumer (annual change in consumer spending costs or annual change in consumer prices). | Percentage | World Bank, national publications |
| Bank credit to bank deposits | BCBD | Financial resources that domestic banks provide to the private sector in relation to total deposits | Loan-to-deposit ratio | World Bank |
| Bank regulatory capital to risk-weighted assets | CA | The ratio of total regulatory capital to its risk-weighted assets. It represents capital adequacy. | Ratio of regulatory capital to risk-weighted assets | World Bank |
| Domestic credit to private sector by banks | DCPS | Financial resources provided by banks to the private sector such as loans, purchases of non-government securities, and trade credits and other accounts receivable that establish a claim for repayment. | Percentage of GDP | World Bank |
| GDP per capita | GDPpc | The level of economic activity in a country, expressed as the total GDP value divided by the country's population | Current US dollar | World Bank |
| Unemployment | UnE | The share of the labour force that is unemployed but available and seeking employment | Percentage of the total labour force | World Bank |

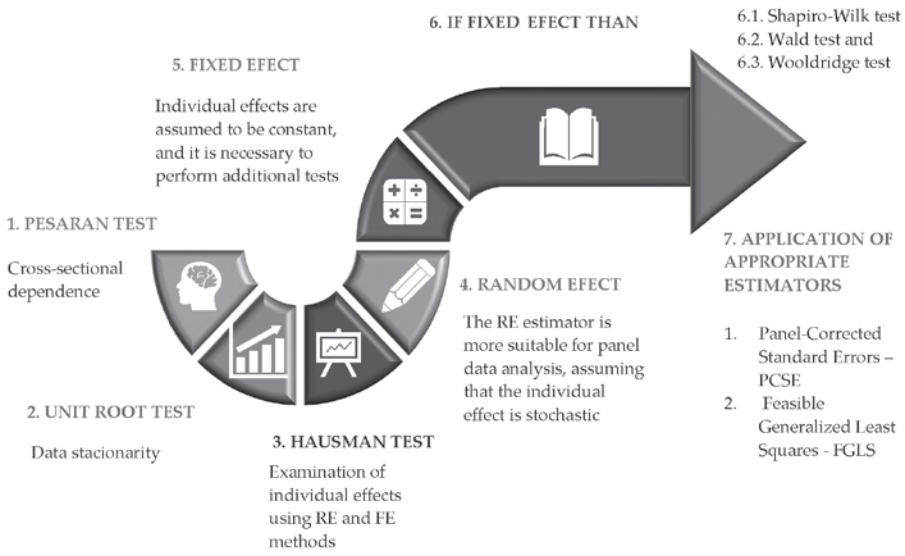
Source: Authors

### 3.2. Multivariate analytical framework

The model measuring the impact of monetary policy on financial stability includes one dependent and eight independent variables. To comprehensively examine the determinants of financial stability, a carefully selected set of macroeconomic and banking indicators has been included, based on their theoretical relevance and empirical significance as established in prior literature. The chosen variables capture both internal characteristics of the banking sector such as the level of NPLs, capital adequacy, and the credit-to-deposit ratio, as well as broader macroeconomic conditions, including inflation, unemployment, exchange rate movements, and economic growth. All variables are quantitatively defined, consistently operationalized, and sourced from reliable databases. Their inclusion in the model enables the identification of potential risks to financial stability and facilitates a deeper understanding of the mechanisms through which macroeconomic dynamics influence the banking sector. Beyond their individual roles, particular attention is given to the interrelations among variables, acknowledging the complex nature of the modern financial system.

Given the complexity of time-series cross-sectional (TSCS) data, a sequence of diagnostic procedures was implemented to ensure the validity and robustness of the model (Figure 1). Cross-sectional dependence was first examined using the Pesaran CD test (Pesaran, 2015), while panel stationarity was verified through unit root testing (Im et al., 2003). To evaluate individual country-specific effects, FE and RE specifications were estimated, with the Hausman test employed to determine the more appropriate model (Hausman, 1978). When the Hausman results favoured the FE estimator, additional diagnostics were conducted. These included residual normality tests, using both the Shapiro-Wilk and Kolmogorov-Smirnov procedures (Midway & White, 2025), as well as tests for heteroskedasticity through the Wald statistic (Wald, 1943) and for serial correlation via the Wooldridge test (Drukker, 2003). Cross-sectional dependence was subsequently re-examined to confirm the consistency of the model assumptions.

**Figure 1: Preliminary diagnostic tests**




Source: Authors

To further strengthen the reliability of the empirical results, three estimation techniques were applied. The FE estimator was used to account for unobserved heterogeneity across countries (Mundlak, 1978), FGLS was employed to correct for potential heteroskedasticity and serial correlation (Parks, 1967), and the PCSE approach was implemented to adjust standard errors in the presence of contemporaneous correlation and heteroskedasticity (Beck & Katz, 2012). Together, this rigorous sequence of tests and estimations provided a robust framework for analysing the relationship between monetary policy and NPLs in the selected panel of Southeast European economies.

The analysis of individual effects in panel data involves assessing how unit-specific characteristics influence the dependent variable. This requires distinguishing between the particular attributes of each cross-sectional unit and formally testing whether they should be modelled as fixed or random. The Hausman test is the standard procedure applied for this purpose. The logic behind the test rests on the assumption that the FE estimator remains consistent even in the presence of correlation between regressors and unobserved effects, while the RE estimator is efficient only under stricter assumptions. A statistically significant discrepancy

between the two sets of estimates implies that one of them is inconsistent, in which case the Hausman test favours the FE specification over the RE.

When the test results support the RE estimator, the individual effects are treated as stochastic, and no further corrections for heteroskedasticity, serial correlation or cross-sectional dependence are generally required. In contrast, if the FE specification is indicated, additional diagnostic procedures are recommended to ensure the robustness of the results. In the present study, these robust techniques were employed alongside the standard FE estimator in order to mitigate potential biases arising from heteroskedasticity, autocorrelation, or contemporaneous correlation across units. Comparative results obtained from FE, FGLS, and PCSE estimations were then reported to demonstrate the effect of monetary policy on economic growth. All statistical analyses and estimations were carried out using STATA software.

## 4. Dataset and variables

The data employed in this research were obtained from internationally recognized statistical and financial databases. In cases where gaps existed, supplementary information from official national sources was incorporated in order to maintain comparability and methodological consistency. This approach ensured the reliability of the dataset and reinforced the validity of the empirical results.

### 4.1. Sample characteristics and composition

A review of the descriptive statistics (Table 2) reveals that the dataset is unbalanced (as indicated in the Observations column), indicating the presence of missing values. This model shows substantial differences between the minimum and maximum values, primarily reflecting the varying levels of economic development among the observed countries, as well as the time dimension of the research. The ratio between the standard deviation and the mean provides insight into the extent of fluctuations in the data. When the standard deviation is significantly higher than the mean, it may indicate the presence of large fluctuations or high variability in the data. Conversely, if the standard deviation is close to or relatively low compared to the mean, it may suggest smaller fluctuations or more stable values in the dataset. The NPL ratio ranges from 0.934 to 23.493, the loan-to-deposit ratio varies from 47.939 to 168.837, while GDP per capita spans from 3,595.04 to 18,753.05.

**Table 2: Descriptive statistics**

| Variable | Observations | Mean | Std. deviation | Min | Max |
|---|---|---|---|---|---|
| NPL | 144 | 10.06205 | 5.79519 | 0.9347138 | 23.49278 |
| OER | 144 | 56.90684 | 81.60906 | 0.6799227 | 372.5958 |
| LIR | 144 | 7.753746 | 3.37655 | 1.470968 | 17.57292 |
| ICP | 144 | 3.326052 | 3.638587 | -1.584 | 15.32526 |
| BCtD | 135 | 94.44157 | 24.18092 | 47.93907 | 168.8366 |
| CA | 144 | 18.18532 | 3.005042 | 10.4 | 27.9 |
| DCPS | 144 | 92.14897 | 132.6448 | 24.62327 | 524.5151 |
| GDPpc | 144 | 8737.371 | 3959.119 | 3595.038 | 18753.05 |
| UnE | 144 | 14.27833 | 7.714316 | 3.42 | 35.23 |

Source: Authors

Using panel data regression techniques, including FE, RE, and robust estimators such as FGLS and PCSE, this study empirically explores the relationship between monetary policy and financial stability across nine Southeast European countries. The methodological approach allows for the control of unobserved heterogeneity and accommodates issues of heteroskedasticity, autocorrelation, and cross-sectional dependence, ensuring more reliable estimates.

The analysis reveals nuanced interactions between monetary instruments and key indicators of economic and financial stability, emphasizing the multifaceted nature of policy transmission. The findings underscore that the effectiveness of monetary policy cannot be assessed in isolation but must account for a broader set of macroeconomic variables and country-specific dynamics. These results advocate for sensitive policy design, adapted to the structural and cyclical characteristics of individual economies. Importantly, the study also reflects the impact of extraordinary economic episodes during the observation period, including the aftermath of the global financial crisis and the COVID-19 shock. Acknowledging such events enables a more realistic interpretation of monetary policy outcomes and sheds light on the limitations of standard models. In turn, this opens the door for building more flexible and forward-looking monetary frameworks in the region.

By applying the IPS test, stationarity of the data was examined both with and without a trend. The first-generation unit root test indicates that almost all variables (both dependent and independent) require some form of transformation. For greater reliability, a second-generation unit root test was applied, which essentially represents an improved version of the first-generation test. The CIPS test is considered more effective in detecting stationarity in time series, especially when there is heterogeneity and cross-sectional dependence in panel data. More-

over, it is often more robust to various forms of heteroskedasticity and autocorrelation. The results of this test indicate that some variables are stationary, namely the lending interest rate and inflation, and therefore do not require transformation through differencing.

These variables are retained in their original form, while the others are transformed. Differencing is applied to non-stationary variables to eliminate trends and seasonal movements. It is applied until the CIPS test indicates that the previously non-stationary variable has become stationary. A common issue with differencing data to achieve stationarity is the reduction in the number of observations, particularly when applied to time series. When we difference time series, we typically subtract the value of the previous period from the current one in order to eliminate trends or seasonal components and achieve stationarity. This results in the loss of the first period of data, as there are no previous values to compute the difference.

After achieving stationarity in the data, individual effects were analysed using FE and RE estimators. The Hausman test (Table 3) showed that the differences between the coefficients of the two estimators are systematic, indicating that the model is most appropriately represented by the FE estimator.

**Table 3: Hausman test**

| Variable | Coefficients | | | |
|---|---|---|---|---|
| | (b) | (B) | (b-B) | sqrt(diag(V_b-V_B)) |
| | Fixed | Random | Difference | S.E. |
| dNPL | | | | |
| dOER | -0.0371054 | -0.018932 | -0.0181734 | 0.0089844 |
| LIR | 0.4767277 | 0.3530669 | 0.1236608 | 0.0397513 |
| ICP | 0.190965 | 0.1047834 | 0.0861817 | 0.0652025 |
| dBCBD | -0.0215842 | -0.0429016 | 0.0213174 | 0.0104897 |
| d2CA | -0.0319836 | -0.0333024 | 0.0013188 | . |
| dDCPS | 0.0094418 | 0.0096081 | -0.0001663 | . |
| dGDPpc | -0.0000959 | -0.0001266 | 0.0000307 | . |
| dUnE | 0.4939419 | 0.5691501 | -0.0752083 | 0.0368946 |

Source: Authors

The Hausman test showed that, with a probability of 0.000 (i.e., significance level below 1%), we can reject the null hypothesis that the differences between the coefficients are not systematic, indicating that the model can be appropriately explained using FE estimator (Table 4).

**Table 4: Fixed effect model**

| Variable | Coefficient | Std. Error | z | P>z | [95% confidence interval] | |
|---|---|---|---|---|---|---|
| dNPL | | | | | | |
| dOER | -0.0371054 | 0.0360469 | -1.03 | 0.306 | -0.1086215 | 0.0344107 |
| LIR | 0.4767277 | 0.0976711 | 4.88 | 0 | 0.282951 | 0.6705044 |
| ICP | 0.190965 | 0.1419238 | 1.35 | 0.181 | -0.0906078 | 0.4725379 |
| dBCBD | -0.0215842 | 0.0393763 | -0.55 | 0.585 | -0.0997056 | 0.0565372 |
| d2CA | -0.0319836 | 0.1276651 | -0.25 | 0.803 | -0.2852676 | 0.2213004 |
| dDCPS | 0.0094418 | 0.0264165 | 0.36 | 0.722 | -0.0429677 | 0.0618513 |
| dGDPpc | -0.0000959 | 0.0003365 | -0.29 | 0.776 | -0.0007635 | 0.0005717 |
| dUnE | 0.4939419 | 0.157817 | 3.13 | 0.002 | 0.1808375 | 0.8070462 |
| _cons | -3.816806 | 0.6966419 | -5.48 | 0 | -5.198924 | -2.434688 |

Source: Authors

## 5. Empirical Analysis

Given that the application of the FE estimator is more suitable for explaining the model, additional tests were conducted to examine the limitations of such a model. The observed model indicates that the ratio of NPLs is influenced by the following variables:

- The lending interest rate, significant at the 1% level, with a coefficient of 0.476; and
- The first difference of unemployment, significant at the 1% level, with a coefficient of 0.494.

Using the FE estimator, the obtained $R^2$ value is 0.5376, indicating that 53.76% of the variation in the dependent variable can be explained by the defined model. Since the testing of the FE model continues, the Pesaran test is applied, yielding a value of 2.429 with a probability of 0.0152. Therefore, we reject the null hypothesis of no cross-sectional dependence.

The next step is testing the normality of residuals. Using previously mentioned graphical and non-graphical tests, it was determined that the residuals of the FE model are not normally distributed, prompting continuation with other model adequacy tests. The modified Wald test is conducted to detect panel heteroskedasticity in FE models. The test value is 531.13, representing the test statistic used to assess the presence of heteroskedasticity. Higher values of this statistic indicate

greater deviation from the assumption of homoskedasticity. The test's p-value, which in this case is 0, suggests a very low probability that this result would be obtained if there were no heteroskedasticity in the data. Since a 0.05 significance level is used, this p-value indicates statistically significant heteroskedasticity.

## 5.1. Results

The presence of autocorrelation in panel data is tested using the Wooldridge test, whose null hypothesis states that there is no first-order autocorrelation. Given the test value of 0.899 and the corresponding probability of 0.3709, we accept the null hypothesis and conclude that there is no first-order autocorrelation.

Since we have identified limitations in the FE model in the form of cross-sectional dependence and heteroskedasticity, we will proceed by applying robust estimators and present all results in a comparative table (Table 5).

**Table 5 - Evaluation of the model using FE, FGLS, and PCSE estimators**

| Variable | Estimator | | |
|---|---|---|---|
| dNPL | FE | FGLS | PCSE |
| dOER | -0.0371 | -0.0442 | -0.0189 |
| t statistics | (-1.029) | (-1.480) | (-0.564) |
| LIR | 0.477*** | 0.433*** | 0.353*** |
| t statistics | (4.881) | (4.432) | (4.119) |
| ICP | 0.191 | 0.118 | 0.105 |
| t statistics | (1.346) | (0.931) | (0.865) |
| dBCBD | -0.0216 | -0.0193 | -0.0429 |
| t statistics | (-0.548) | (-0.592) | (-1.177) |
| d2CA | -0.0320 | -0.00833 | -0.0333 |
| t statistics | (-0.251) | (-0.0760) | (-0.259) |
| dDCPS | 0.00944 | 0.00627 | 0.00961 |
| t statistics | (0.357) | (0.265) | (0.377) |
| dGDPpc | -0,000959 | -0.000136 | -0.000127 |
| t statistics | (-0.285) | (-0.450) | (-0.379) |
| dUnemploy | 0.494*** | 0.482*** | 0.569*** |
| t statistics | (3.130) | (3.278) | (3.861) |
| _cons | -3.817*** | -3.383*** | -2.799*** |
| t statistics | (-5.479) | (-4.529) | (-4.329) |
| Observations | 117 | 117 | 117 |
| R -sq | 0,5376 | | 0,45 |

Source: Authors

Displaying the results of the FE model alongside the results of FGLS and PCSE estimators provides additional validation of the findings, demonstrates the stability of parameter estimates, and allows for a better understanding and interpretation of the research results. Comparing results across multiple models facilitates a simpler interpretation and analysis of differences between them. Instead of analysing each model separately, results are directly compared. Presenting the results in this manner offers a more comprehensive overview of the influence of various factors on the outcomes of the analysis.

## 5.2. Discussion

The empirical analysis confirmed a statistically significant and positive relationship between lending interest rates and changes in the NPL ratio. This result proved to be robust across all three estimation techniques (FE, FGLS, and PCSE) and is consistent with the predictions of established economic theory. Higher interest rates increase the cost of borrowing and place additional strain on households and firms, thereby reducing their capacity to meet debt obligations. The effect is particularly pronounced in economies where variable-rate lending dominates, as borrowers are more directly exposed to fluctuations in monetary policy. This evidence supports the theoretical proposition that restrictive monetary policy, while aimed at controlling inflation and stabilizing macroeconomic conditions, may inadvertently generate financial stress within the banking sector. By raising repayment burdens, tighter monetary conditions contribute to a deterioration in credit quality and a rise in NPLs, especially in periods characterized by fragile growth or external shocks. The finding underscores the delicate balance faced by central banks in transition economies: while interest rate adjustments remain a key instrument for achieving price stability, their broader implications for financial stability cannot be ignored. Hence, effective monetary policy in the region requires careful calibration and coordination with macroprudential measures to prevent unintended destabilizing effects on the credit system.

Contrary to expectations, the official exchange rate did not exhibit a statistically significant impact on NPL ratios. This outcome can be attributed to several factors. First, most Southeast European countries maintained relatively stable exchange rate regimes throughout the 2007–2022 period, either through managed floats or by anchoring their currencies to the euro. Such arrangements limited the magnitude of exchange rate volatility and, consequently, reduced the extent to which currency movements could affect borrowers' debt-servicing capacity, particularly for loans denominated in foreign currency. Second, the presence of prudent monetary and regulatory policies, including tighter supervision of for-

eign-exchange lending and macroprudential measures introduced after the global financial crisis, contributed to shielding the financial system from exchange rate–induced credit risks. Furthermore, in several countries, banking sectors underwent structural adjustments that reduced exposure to foreign currency mismatches, thereby mitigating vulnerabilities associated with exchange rate movements. Taken together, these elements suggest that in the Southeast European context, exchange rate dynamics play a less direct role in shaping loan quality compared to other macroeconomic factors such as interest rates or unemployment. While exchange rate shocks can still affect financial stability through trade balances, capital flows, or inflationary pressures, their immediate transmission to NPL ratios appears to have been contained by institutional safeguards and policy frameworks during the observed period.

A key finding of the analysis is the positive and statistically significant relationship between changes in the unemployment rate and NPL ratios. This result is consistent across all three estimators, indicating that higher unemployment tends to increase credit risk by reducing the repayment capacity of households and firms. Rising unemployment typically undermines income stability, which in turn heightens the probability of loan defaults and weakens the resilience of the banking sector. These results underscore the importance of labour market dynamics in shaping financial stability and highlight the role of coordinated policy responses. When unemployment increases, not only is monetary policy challenged to mitigate financial stress, but complementary fiscal measures and social safety nets also become essential in containing the deterioration of credit quality.

The model also shows that GDP per capita does not have a statistically significant impact on financial stability, but it does indicate a positive association between the two, which diverges from conventional expectations. One possible explanation is that an increase in GDP per capita, especially when unevenly distributed, can boost optimism and borrowing among households and businesses, thereby raising debt levels and the associated credit risk. In contexts where income gains are concentrated within certain segments of the population, the broader population may still face economic hardship, which can lead to greater credit vulnerability despite overall economic growth.

These findings underscore the complex and sometimes nonlinear transmission mechanisms of monetary policy to financial stability indicators, such as NPLs. They also highlight the importance of considering broader socioeconomic and institutional factors, such as credit culture, income distribution, and crisis-response policies, when interpreting empirical relationships. The observed discrepancies between theoretical expectations and empirical results warrant further

investigation, particularly through disaggregated analyses that examine household- and firm-level data or incorporate institutional variables such as banking regulation, supervision, and financial literacy.

## 6. Conclusion

The analysis confirms that monetary policy exerts a significant influence on financial stability in Southeast European countries, as reflected through the dynamics of NPLs. The empirical results demonstrate that lending interest rates are the most critical determinant of loan quality, with tighter monetary conditions increasing repayment burdens and thereby amplifying credit risk. This finding is consistent across estimators and aligns with the broader literature, which identifies interest rate sensitivity as a central channel through which monetary policy affects banking sector resilience.

In contrast, the exchange rate does not display a consistent or statistically significant effect on NPLs, a result that can be explained by relative currency stability and the presence of regulatory safeguards during the observed period. The analysis further highlights a strong and positive relationship between unemployment and NPLs, indicating that labour market distress directly undermines borrowers' capacity to service their debts and thereby raises systemic vulnerabilities. These results should be interpreted with caution, given the limitations of working with an unbalanced panel dataset, but they nevertheless provide robust evidence of the transmission mechanisms that link monetary conditions and credit risk.

This study contributes to the literature by delivering new evidence from a group of transition economies that are often underrepresented in empirical research. By explicitly accounting for systemic shocks such as the global financial crisis and the COVID-19 pandemic, the analysis demonstrates how extraordinary events reshape the effectiveness of monetary policy in safeguarding financial stability. The findings underscore the need for central banks to calibrate interest rate decisions carefully, while also recognizing that monetary tools alone are insufficient to maintain resilience in the banking sector. Complementary fiscal and macroprudential measures are essential to mitigate risks arising from adverse economic conditions.

Ultimately, the study suggests that in emerging European economies, monetary policy should be designed not only to maintain price stability but also with full consideration of its broader implications for credit markets and financial sector soundness. Strengthening this dual perspective, by integrating monetary, regula-

tory, and fiscal dimensions, can help build resilience against external shocks and support long-term, sustainable economic development in the region.

## Declaration of AI use

*The authors did not use AI tools in the preparation of this manuscript.*

## References


1. Ajello, A., Boyarchenko, N., Gourio, F., & Tambalotti, A. (2022). Financial stability considerations for monetary policy: Theoretical mechanisms. *Finance and Economics Discussion Series*, 2022-005. https://doi.org/10.17016/FEDS.2022.005.
2. Alessandri, P., Conti, M. A., & Venditti, F. (2017). *The financial stability dark side of monetary policy (Temi di Discussione No. 1121)*. Bank of Italy. https://dx.doi.org/10.2139/ssrn.302602.
3. Badea, I.-R. (2015). Monetary policy under the border between price stability and financial stability. *Finance – Challenges of the future*, XV(17), 158-166. https://ideas.repec.org/a/aio/fpvfcf/v1y2015i17p158-166.html.
4. Bandoi, A., Berceanu, D., & Danciulescu, D. (2009). Price stability and financial stability in the context of the Eurosystem's monetary policy. *European Research Studies*, XII(4), 19-36. https://doi.org/10.35808/ersj/241.
5. Beck, N., & Katz, J. (2012). What to do (and not to do) with time-series cross-section data. *American Political Science Review*, 89(3), 634-647. https://doi.org/10.2307/2082979.
6. Bilbiie, F. (2022). Neo-Fisherian policies and liquidity traps. *American Economic Journal: Macroeconomics*, 14(4), 378-403. https://doi.org/10.1257/mac.20200119.
7. Brzoza-Brzezina, M., Kolasa, M., & Makarski, K. (2022). Monetary policy and COVID-19. *International Journal of Central Banking,* 18(1), 41-80. https://www.ijcb.org/journal/ijcb22q1a2.htm.
8. Chen, Q., Goldstein, I., Huang, Z., & Vashishtha, R. (2022). Bank transparency and deposit flows. *Journal of Financial Economics*, 146(2), 475-501. https://doi.org/10.1016/j.jfineco.2022.07.009.
9. Delova Jolevska, E., & Andovski, I. (2015). Non-Performing loans in the banking systems of Serbia, Croatia and Macedonia: Comparative analysis. *Ekonomika*, 61(1), 115-130. https://doi.org/10.22004/ag.econ.200275.
10. Diaconescu, D. R., & Botezatu, H. P. (2015). Unconventional monetary policy. *Annals of the „Constantin Brâncuşi" University of Târgu Jiu*, 1(1), 264-270. https://ideas.repec.org/a/cbu/jrnlec/y2015v1ip264-270.html.
11. Drukker, D. (2003). Testing for serial correlation in linear panel-data models. *The Stata Journal*, 3(2), 168-177. https://doi.org/10.1177/1536867X0300300206.
12. European Central Bank. (2017). Guidance to banks on non-performing loans. https://www.bankingsupervision.europa.eu/ecb/pub/pdf/guidance_on_npl.en.pdf.
13. Fisher, I. (1930). The Theory of interest, as determined by impatience to spend income and opportunity to invest it. Macmillan.

14. Fung, A., & Hansen, E. (1993). Bank credit and monetary policy. *Reserve Bank Bulletin*, 56(1), 32-47. https://www.rbnz.govt.nz/hub/publications/bulletin/1993/rbb1993-56-01-02.
15. Gaćeša, R. (2009). A short review of international credit rating. *Bankarstvo*(11-12), 120-130. https://www.casopisbankarstvo.rs/Portals/0/Casopis/2009/11_12/B11-12-2009-Gacesa.pdf.
16. Gaffard, J.-L. (2018). Monetary theory and policy: The debate revisited. Sciences Po Press.
17. Grubišić, Z., & Ivanović, P. (2012). Influence of different monetary regimes on financial stability in SEE countries. *Journal of Central Banking Theory and Practice* 1(1), 91-106. https://www.cbcg.me/slike_i_fajlovi/fajlovi/journal/vol1/monetary_regimes.pdf
18. Grubišić, Z., & Marčetić, M. (2013). Influence of fiscal and monetary policy on external imbalance in Serbia. *Ekonomske Teme*, 51(1), 21-35. http://economic-themes.com/pdf/et2013en1_02.pdf.
19. Grubišić, Z., Kamenković, S., & Raičević, I. (2014). Analysis of fulfillment of the Maastricht convergence criteria in Serbia. *Finansije*(1-6), 59-72. https://mfin.gov.rs/upload/media/xYOzTH_6017e4637aba6.pdf.
20. Gutiérrez-Diez, P., & Pál, T. (2023). Monetary policy models: lessons from the Eurozone crisis. *Humanities & Social Sciences Communications*, 10(1), 1-19. https://doi.org/10.1057/s41599-023-02030-0.
21. Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica*, 46(6), 1251-1271. https://doi.org/10.2307/1913827.
22. Ilievski, A. (2022). Non-Performing loans in North Macedonia - Lessons learned? *Acta Polytechnica Hungarica*, 19(8), 91-109. https://doi.org/10.12700/APH.19.8.2022.8.6.
23. Im, K. S., Pesaran, H., & Shin, Y. (2003). Testing for unit roots in heterogeneous panels. *Journal of Econometrics*, 115(1), 53-74. https://doi.org/10.1016/S0304-4076(03)00092-7.
24. Jannsen, N., Potjagailo, G., & Wolters, M. (2019). Monetary policy during financial crises: Is the transmission mechanism impaired? *International Journal of Central Banking*, 15(4), 81-125. https://www.ijcb.org/journal/v15n4/monetary-policy-during-financial-crises-transmission-mechanism-impaired.
25. Katsafados, A., & Anastasiou, D. (2022). Short-term prediction of bank deposit flows: Do textual features matter? (MPRA Paper No. 111418). Munich Personal RePEc Archive. https://mpra.ub.uni-muenchen.de/111418/.
26. Keynes, J. M. (1936). The general theory of employment, interest and money. Macmillan.

27. Klein, N. (2013). Non-Performing loans in CESEE: Determinants and impact on macroeconomic performance. (*IMF Working Paper* No. WP/13/72). International Monetary Fund. https://doi.org/10.5089/9781484318522.001.
28. Laeven, L., Maddaloni, A., & Mendicino, C. (2022). Monetary policy, macroprudential policy and financial stability. *(ECB Working Paper Series* No. 2647). European Central Bank. https://www.ecb.europa.eu/pub/pdf/scpwps/ecb.wp2647~0a0b3030e1.en.pdf.
29. Li, X., Zhou, X., Ruoxi, Z., & Wan, Y. (2023). Growth preference or inflation preference: An investigation on the nonlinear monetary policy response of central banks. *Research Square preprint*. https://doi.org/10.21203/rs.3.rs-2423812/v1.
30. Liang, N. (2019). Financial stability and monetary policy. *Business Economics*, 54(3), 163-164. https://doi.org/10.1057/s11369-019-00123-w.
31. Louzis, D., Vouldis, A., & Metaxas, V. (2012). Macroeconomic and bank-specific determinants of non-performing loans in Greece: A comparative study of mortgage, business and consumer loan portfolios. *Journal of Banking & Finance*, 36(4), 1012-1027. https://doi.org/10.1016/j.jbankfin.2011.10.012
32. Martin, C., Puri, M., & Ufier, A. (2018). Deposit inflows and outflows in failing banks: The role of deposit insurance. (NBER Working Paper No. 24589). *National Bureau of Economic Research*. https://doi.org/10.3386/w24589.
33. Midway, S., & White, W. (2025). Testing for normality in regression models: mistakes abound (but may not matter). *Royal Society Open Science* 12(4), 241904. https://doi.org/10.1098/rsos.241904.
34. Morakinyo, A., Muller, C., & Sibanda, M. (2018). Non-performin loans, banking system and macroeconomy. *Studia Universitatis Babeș-Bolyai Oeconomica*, 63(2), 67–86. https://doi.org/10.2478/subboec-2018-0009.
35. Mundlak, Y. (1978). On the pooling of time series and cross section data. *Econometrica*, 46(1), 69-85. https://doi.org/10.2307/1913646.
36. Nikolaieva, A. (2022). Strategy of the bank for reducing non-performing loans. *Economic Forum* 12(4), 208-214. https://doi.org/10.36910/6775-2308-8559-2022-4-26.
37. Nkusu, M. (2011). Non-performing loans and macrofinancial vulnerabilities in advanced economies. (*IMF Working Paper* No. WP/11/161). International Monetary Fund. https://doi.org/10.5089/9781455297740.001.
38. Obradović, L., & Grubišić, Z. (2025). The impact of monetary policy on economic growth in SEE countries: A multivariate approach. *Journal of Central Banking Theory and Practice*, 14(2), 91-119. https://doi.org/10.2478/jcbtp-2025-0015.

39. Ozili, P. (2023). Sustainable development and bank non-performing loans: Are they correlated? *Arab Gulf Journal of Scientific Research*, 40(1), 551–565. https://doi.org/10.1108/AGJSR-01-2023-0028.
40. Parks, R. (1967). Efficient estimation of a system of regression equations when disturbances are both serially and contemporaneously correlated. *Journal of the American Statistical Association*, 62(318), 500-509. https://doi.org/10.1080/01621459.1967.10482923.
41. Pesaran, H. (2015). Testing weak cross-sectional dependence in large panels. *Econometric Reviews*, 34(6-10), 1089-1117. https://doi.org/10.1080/07474938.2014.956623.
42. Powell, J. (2021). Monetary policy in the time of COVID (speech). Federal Reserve Bank of Kansas City Economic Policy Symposium, Jackson Hole, WY. https://www.federalreserve.gov/newsevents/speech/files/powell20210827a.pdf.
43. Radivojević, N., & Jovović, J. (2017). Examining of determinants of non-performing loans. *Prague Economic Papers*, 26(3), 300-316. https://doi.org/10.18267/j.pep.615.
44. Rainone, E. (2021). Identifying deposits' outflows in real-time. (Temi di Discussione No. 1319). Bank of Italy. https://doi.org/10.32057/0.TD.2021.1319.
45. Ristić, K., & Jemović, M. (2021). Analysis of non-performing loans' determinants in the banking sector of the Republic of Serbia. *Economic Themes*, 59(1), 133-151. https://doi.org/10.2478/ethemes-2021-0008.
46. Scarlat, V. (2015). Non-performing loans' evolution during 2008-2014. (Working Paper No. 2015-08). Ecological University of Bucharest, Department of Economics. http://ueb.ro/RePEc/eub/wp2015/2015-08.pdf.
47. Uribe, M. (2022). The neo-fisher effect: Econometric evidence from empirical and optimizing models. *American Economic Journal: Macroeconomics*, 14(3), 133-162. https://doi.org/10.1257/mac.20200060.
48. Vučinić, M., & Luburić, R. (2024). Artificial intelligence, fintech and challenges to central banks. *Journal of Central Banking Theory and Practice*, 13(3), 5-42. https://doi.org/10.2478/jcbtp-2024-0021.
49. Vuković, V., & Domazet, I. (2013). Non-performing loans and systemic risk: Comparative analysis of Serbia and countries in transition CESEE. *Industrija*, 41(4), 59-73. https://doi.org/10.5937/industrija41-4276.
50. Wald, A. (1943). Tests of statistical hypotheses concerning several parameters when the number of observations is large. Transactions of the *American Mathematical Society*, 54(1), 426-482. https://doi.org/10.1090/S0002-9947-1943-0012401-3.

51. Wei, X., & Han, L. (2021). The impact of COVID-19 pandemic on transmission of monetary policy to financial markets. *International Review of Financial Analysis*, 74, 101705. https://doi.org/10.1016/j.irfa.2021.101705.
52. Wooldridge, J. (2010). Econometric analysis of cross section and panel data. (2nd ed.). MIT Press.
53. Zelenović, V., & Vunjak, N. (2014). Capital adequacy ratio of the banking sector in Serbia. *Anali Ekonomskog fakulteta u Subotici* (31), 3-18. https://scindeks-clanci.ceon.rs/data/pdf/0350-2120/2014/0350-21201431003Z.pdf.
54. Zhu, L. (2013). Panel data in public administration: Substantive and statistical considerations. *Journal of Public Administration Research and Theory* 23(2), 395-428. https://doi.org/10.1093/jopart/mus064.