

MACROECONOMIC DETERMINANTS OF NPLS IN EU: A PANEL DATA ANALYSIS (2010–2023)

F. KASTRATI

Fatma Kastrati

Epoka University, Albania

<https://orcid.org/0009-0003-7223-9432>, E-mail: fkastrati23@epoka.edu.al

Abstract: *Non-performing loans (NPLs) present a significant risk to the banking systems, and become worse during periods of economic turmoil. This study aims to identify and quantify the macroeconomic determinants influencing non-performing loans in EU member states, using annual panel data from 2010 to 2023. A Pooled Ordinary Least Squares regression approach along with robust and cluster-robust standard errors are utilized to assess the effects of GDP growth, unemployment rate, and inflation on NPL ratios. The findings indicate that unemployment is the strongest factor affecting NPLs. GDP growth is positively connected with NPLs, contrary to prevailing expectations, suggesting that economic expansion might encourage over-leveraging. Inflation has no statistically significant effect, while NPL ratios tend to rise during recessions. The study highlights the importance of macroeconomic stability for protecting financial systems.*

Keywords: *non-performing loans, macroeconomic determinants, panel data, EU, pooled*

1. Introduction

According to the European Commission, non-performing loans are defined as bank loans for which borrowers are unable or unlikely to fulfill their repayment obligations, either because of a decline in their personal financial situation, or late payments piling up (European Commission, n.d.). When banks have accumulated too many of these bad loans, their balance sheets weaken, which leads to a reduction in their profits. Since banks use these funds to give out loans this situation consequently gives them less room to provide new credit to households and firms. Thus, it negatively affects the entire economy as a whole and the future investments as well (Klein, 2013).

After difficult periods of global disruptions such as the Covid-19 pandemic, the issue of non-performing loans became more evident. Particularly, greater levels of NPL ratios can slow down the period of economic recovery after the mentioned shocks, especially in those countries that are gravely exposed to adverse macroeconomic conditions. Even after the major policy regulations that have been taken at the EU level to address these NPLs, they continue to remain a concern for the adequate functioning of the financial system (Huljak et al., 2020).

Even though macroeconomic factors are so important, the majority of the existing research focuses on bank-specific determinants of non-performing loans. While cross-country analysis for the macroeconomic drivers, especially within the whole EU countries is rather limited. Moreover, most of the studies focus on short horizons, mainly only through the crisis periods and leave longer-term trends less explored. A growing strand of research applies machine learning and explainable artificial intelligence to NPL prediction. Durand et al. (2023) state that the complexity of the NPL phenomenon, would suggest that models powered by AI could aid credit risk analysis and decisions. But crucially, the author concludes that future studies should incorporate macroeconomic variables to identify optimal predictors of NPLs. The present study directly responds to that recommendation,

providing a panel econometric analysis of macroeconomic determinants that can serve as a foundation for, and complement, such AI powered credit risk frameworks.

The objective of this study is to carefully examine these macroeconomic factors of NPLs in EU countries using annual panel data over thirteen years, 2010 to 2023. More specifically, each determinant, including GDP growth, unemployment rate, inflation, and economic recession periods, will be analyzed for their effect. In this case, the recession will be incorporated as a regression dummy variable. This research provides this way a comprehensive assessment and offers insights for financial regulators and policymakers.

1.1 Research Questions

The study is guided by the following research questions:

- What are the main macroeconomic determinants of non-performing loans in EU countries?
- How do these macroeconomic determinants affect NPL ratios?
- Do recession periods significantly influence the level of non-performing loans?

2. Literature Review and Hypotheses Development

2.1 Unemployment and Non-Performing Loans

The relevant literature identifies the unemployment rate as one of the most important macroeconomic factors affecting non-performing loans. Aqifi et al. (2025) emphasized that the central role in explaining variations happening in loan performance is held precisely by unemployment. In a similar way, Bialas and Karafolas (2025) documented that there is a strong positive relationship between unemployment and NPLs, with higher unemployment bringing a larger share of these bad loans. Even from a broader international perspective provided by Salas et al. (2024), it turns out that unemployment has a significant and positive effect on NPL ratios all over the world, no matter of the geographical location of the banks. Additionally, Masurashvili (2024) has explained this repeated result throughout the papers but by a theoretical ground stating that rising unemployment reduces household income, thereby limiting borrowers' ability to repay their debt and raising default probabilities. Consistent with this view, Zawadzki (2023) validates the same hypothesis that higher unemployment weakens households' loan repayment capacity. Overall, the literature provides strong and consistent evidence that increases in unemployment rates lead to higher non-performing loan ratios.

2.2 GDP Growth and Non-Performing Loans

In literature for many years, the link between GDP growth and NPL ratios has been widely examined and results suggest both stabilizing and risk-enhancing effects. Several studies support the counter- cyclical relationship between them, arguing that a higher GDP growth brings a reduction of NPLs as income levels improve. Goyal et al. (2023) finds that economic expansions associated with GDP growth lower the likelihood of default, meaning that they reduce the NPLs. In a similar way Ahmed et al. (2021) documents a significant negative relationship between these two variables, so credit risk would reduce in the case of GDP growth. Staehr and Uusküla (2020) further support this view by identifying higher GDP growth as a factor for lower NPL ratios in the future.

However, other studies present a rather counterintuitive result, suggesting that periods of economic expansions may be related to higher non-performing loans. Beka and Abazi (2024) found that GDP growth has a positive impact on NPLs, especially in samples that include periods of significant economic disturbances such as COVID-19. Isakov (2024) provides a possible explanation for this outcome. He argues that during economic expansions, businesses and households tend to increase borrowing to finance consumption and investment. This might lead to excessive or poorly allocated credit which then leads to

increases of the NPL ratios. Further evidence from Southeast Europe provided by Cenaj (2025) similarly finds a notable relationship between economic growth and NPL dynamics in the region, reinforcing the view that this link may be particularly context-dependent. So generally, the literature indicates that the effect of GDP growth on non-performing loans is ambiguous and may depend on the economic context.

2.3 Inflation and Non-Performing Loans

The effect of inflation on non-performing loans remains ambiguous in the empirical literature, as there are studies reporting mixed and often context-dependent results. Some of the research suggest that inflation may cause a reduction of the real value of debt and this way ease the repayment burden. Le and Le (2023) observed an inverse correlation between inflation and NPLs, supporting the idea that higher inflation can constrain the accumulation of bad loans. Likewise, Lekupanai Leleok and Makori (2024) also reported a statistically insignificant but negative effect of inflation on NPLs in the long term; however, their findings also indicate a significant positive impact in the short term. This suggests that while inflation might not serve as a major determinant of non-performing loans over extended periods of time, it can still have a temporary effect on loan performance.

In contrast, other studies emphasize the adverse effects of inflation on borrowers' financial capacity. Khoirunisa and Karnasi (2023) state that high inflation increases production costs and reduces purchasing power, leading to lower revenues and a diminished ability of firms to meet their debt obligations, thereby increasing default risk. However, empirical evidence from Kawakibi and Mustikowati (2025) also show that inflation does not significantly affect NPLs in environments where inflation remains moderate and is effectively managed through monetary and fiscal policies. Altogether, as noted by Goyal et al. (2023), the literature presents conflicting findings regarding the impact of inflation on non-performing loans, indicating that its effect may depend on the magnitude, persistence, and economic context of inflationary pressures.

2.4 Economic Recessions and Non-Performing Loans

Economic recessions are thought to be periods when credit risk increases, and as a consequence, non-performing loan ratios tend to rise as well. Huljak et al. (2020) states that high NPL ratios continue to be a major problem in a number of euro area countries, and noticed that the COVID-19 pandemic is likely to cause a spike in non-performing loans throughout the region. A statement that proves further that periods of recessions like the one the world encountered during the aforementioned pandemic, do actually affect NPL ratios. Deteriorating macroeconomic conditions lower household income and business revenues, which usually happens during recessions and as a result also increases the likelihood of loan defaults. This statement is also mentioned by Giannopoulos and Kariofyllas (2025) which explain the fact that what recessions do is that they make it more difficult for businesses, particularly those with low creditworthiness, to get extra funding needed to meet their obligations because banks tighten their credit supply.

These adverse effects that recessions have on loan performance are even more clearly visible in less diversified economies. According to Elshani (2025), the likelihood of default increases profoundly during economic downturns, with a more noticeable nuance in developing European countries that are more susceptible to external shocks. From another perspective, the policy one, Bello, Umar, and Gawuna (2020) highlight the significance of implementing measures that aim to mitigate the grave impact of domestic economic crises on banks' non-performing loans during recessions. In a similar way Kostis (2020) contends that heightened uncertainty and economic contraction impact the dynamics of the credit supply, which thereby influences how NPLs evolve. Overall, research continuously shows

that economic recessions increase the so called credit risk and contribute to higher non-performing loan ratios.

2.5 Hypotheses

Based on the recent literature utilized for this research, the following hypotheses are proposed:

- H1: Higher unemployment rates increase non-performing loans.
- H2: GDP growth has a significant effect on non-performing loans.
- H3: Inflation has a significant effect on non-performing loans.
- H4: Economic recessions are associated with higher non-performing loan ratios.

3. Data and Methodology

3.1 Data Description

A balanced panel dataset was employed in this study, comprising of European Union (EU) countries from years 2010 to 2023. Due to missing observations on non-performing loans, Germany was excluded from the dataset. The final dataset is made up from 359 country–year observations, after removing observations with a high amount of missing dependent variables. Annual data were provided by the World Bank, to guarantee uniformity and comparability across all the countries studied.

The ratio of non-performing loans (NPLs), calculated as the percentage of total loans, serves as the dependent variable. While the explanatory variables include GDP growth, unemployment rate, inflation rate, and a recession in the format of a dummy variable. Macroeconomic performance is reflected in GDP growth which is calculated as the annual percentage change in real GDP. The unemployment rate reflects both the state of labor market and the ability of borrowers to repay debt. The real value of this debt can be impacted by inflation which is defined as the annual percentage change in consumer prices. And lastly, the recession dummy which helps the model to account for the effects of economic downturns and equals one for recession years and zero otherwise.

3.2 Descriptive Statistics

The summary statistics of the variables utilized are showcased in table 1. With a maximum value of 47.75% the average NPL ratio is 6.93%, with significant variation across countries. GDP growth averages 2.22%, while the unemployment rate has a mean of 8.38%. And inflation averages 2.54%, although the studied sample includes both periods of deflation and high inflation.

Table 1. Descriptive Statistics

Statistic	N	Mean	St. Dev.	Min	Max
NPLs	359	6.93	8.13	0.15	47.75
GDP Growth	359	2.22	3.75	−10.94	24.62
Unemployment	359	8.38	4.55	2.02	27.69
Inflation	359	2.54	3.21	−2.10	19.71

The dispersion of variables indicates meaningful cross-country heterogeneity, which validates the application of panel data methods.

3.3 Correlation Analysis

Pearson correlation matrix is reported on table 2. We can observe that non-performing loans show a strong positive correlation with unemployment (0.601), which suggests to us that the worsening of labor market conditions are linked with higher credit risk. Inflation is moderately negatively correlated with NPLs (−0.249), while GDP growth shows a weak negative relationship (−0.102).

Table 2. *Correlation Matrix*

	npl	gdp growth	unemployment	inflation
npl	1	-0.102	0.601	-0.249
gdp growth	-0.102	1	-0.228	0.074
unemployment	0.601	-0.228	1	-0.292
inflation	-0.249	0.074	-0.292	1

Most importantly, the correlations among the explanatory variables remain low, indicating that there are no immediate concerns regarding multicollinearity.

3.4 Econometric Model

This study estimates a pooled Ordinary Least Squares (OLS) regression model so to examine effects of the macroeconomic factors on non-performing loans :

$$NPL_{it} = \beta_0 + \beta_1 GDP_{it} + \beta_2 UNEMP_{it} + \beta_3 INF_{it} + \beta_4 RECESS_{it} + \varepsilon_{it} \quad (1)$$

where i denotes the country and t represents time. The error term ε_{it} captures unobserved factors affecting NPL ratios. Pooled OLS is suitable as a baseline specification for determining the average relationship between macroeconomic variables and banking sector risk across EU countries.

3.5 Diagnostic Tests and Residual Analysis

A number of diagnostic tests were performed to confirm the validity of the pooled OLS assumptions. These consist of checks for normality, heteroskedasticity, autocorrelation, and multicollinearity.

Stationarity: The Augmented Dickey–Fuller test or ADF was utilized in order to check if the variables have a unit root. As reported in Table 3, the null hypothesis of a unit root is rejected for all variables at the 1% significance level. This confirms us that the series are firstly stationary and also suitable to be used for the regression analysis, reducing like this the risk of sporadic results.

Table 3. *Augmented Dickey–Fuller Unit Root Test*

Variable	Test Statistic	Lag Order	p-value
Non-performing Loans (NPL)	-4.507	7	<0.01
GDP Growth	-5.011	7	<0.01
Unemployment	-4.530	7	<0.01
Inflation	-10.569	7	<0.01

Normality of Residuals The Shapiro–Wilk test in Table 4 strongly rejects the null hypothesis of normally distributed residuals ($W = 0.854$, $p < 0.001$). This indicates that residuals are not normally distributed, a violation of the classic assumption.

Table 4. *Normality Test (Residuals)*

	Test	Statistic	p-value
	Shapiro-Wilk	0.854	
			<0.001

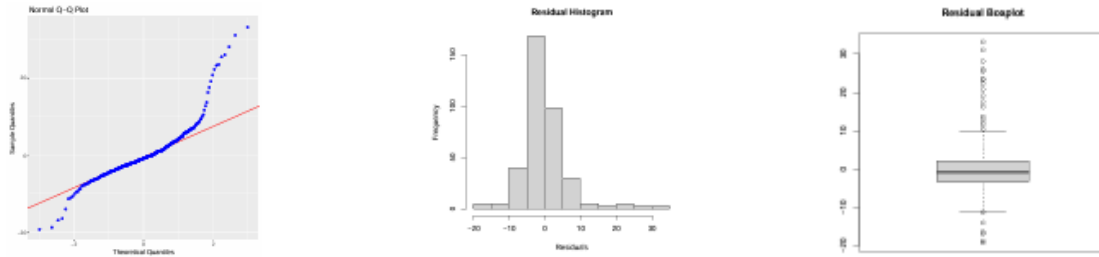
Three visual diagnostics for normality of residuals are displayed in Figure 1: a Q-Q plot, histogram, and boxplot of the residuals. The Q-Q plot shows minor deviations from the diagonal, while the histogram indicates that there is some slight skewness. The boxplot shows a few outliers, but overall the residuals are reasonably symmetric. So these graph results give the same answer as the Shapiro–Wilk test, that we do not have a normality of residuals. However, given that the sample size is quite large and over thirty, the violation of strict normality is unlikely to bias the OLS coefficient estimates due to the Central Limit Theorem.

Figure 1. Residual Diagnostics

Normal Q-Q plot of residuals

Histogram of residuals

Boxplot of residuals



Heteroskedasticity: Heteroskedasticity is detected using the Breusch–Pagan test ($BP = 58.14$, $p < 0.001$; Table 5), showcases that the variance of residuals is not constant across observations, which means that we have heteroskedasticity present in the model.

Table 5. Breusch-Pagan Test for Heteroskedasticity

Test	Statistic	df	p-value
Breusch-pagan	58.14	4	<0.001

Multicollinearity: (Table 6) shows that Variance Inflation Factors (VIFs) have a range between 1.09 and 1.83, which is well below the conventional threshold of 10, confirming that multicollinearity is not a concern for the model.

Table 6. Variance Inflator Factors

Variable	VIF
GDP Growth	1.83
Unemployment	1.72
Inflation	1.09
Recession	1.12

Autocorrelation: The Durbin–Watson test used to check for autocorrelation or differently known as serial correlation, reveals positive serial correlation in residuals ($DW = 0.386$, $p < 0.001$; Table 7), suggesting that residuals are correlated within countries over time. A statement that means we have the violation of autocorrelation present in the model.

Table 7. Durbin-Watson Test for Autocorrelation

Test	Statistic	p-value
Durbin–Watson	0.386	<0.001

Functional Form: The RESET test fails to reject the null hypothesis of correct functional form ($F = 0.048$, $p = 0.952$; Table 8), supporting the linear specification of the model.

Table 8. RESET Test for Functional Form

Test	Statistic	df1	df2	p-value
RESET	0.048	1	354	0.952

3.6 Robust Estimation Strategy

To address the violations that were detected above with the particular tests conducted; this study employs Robust standard errors and Cluster-Robust standard errors. Robust standard errors correct for the bias due to a non-constant variance, while cluster-robust standard errors account concurrently for heteroskedasticity and within-country autocorrelation.

Clustered standard errors at the country level are considered the preferred specification for inference in this study. Table 9 presents the results from the pooled OLS regression after cluster-robust standard errors.

4. Empirical Results

In table 9 it is shown the pooled OLS regression results after the cluster-robust standard errors has been applied to fix the problems with the model.

Table 9. Pooled OLS Regression

<i>Dependent variable:</i>	
Non-Performing Loans (NPL)	
GDP Growth	0.256***
	(0.098)
Unemployment Rate	1.02***
	(0.320)
Inflation	−0.214
	(0.159)
Recession Dummy	2.512*
	(1.348)
Constant	−2.181
	(2.299)
Observations	359
R ²	0.377
Adjusted R ²	0.370
Residual Std. Error	6.453 (df = 354)
F Statistic	53.525*** (df = 4; 354)
<i>Note:</i> *p<0.1; **p<0.05; ***p<0.01	

Coefficient of determination illustrates us that the model explains approximately 37.7% of the variation in non-performing loans ($R^2 = 0.377$), a number that indicates a moderate explanatory power.

Unemployment because of a high significance can be considered as the strongest predictor of NPLs ($p < 0.01$). The NPL ratio increases by roughly 1.025 percentage points for every percentage point increase in unemployment. This result leads to supporting the hypothesis borrowers' repayment capacity is reduced due to weaker labor market conditions.

GDP growth showcases a positive and statistically significant coefficient (0.256, $p < 0.01$). Although it goes against the traditional expectations of a countercyclical relationship between GDP and NPLs, this result may be a reflection of periods of credit expansion during economic upturns. And what happens in these cases is that borrowing increases leading to a breach where it can subsequently elevate default risk.

Inflation carries a negative coefficient (−0.214) but is not statistically significant, which suggests that price dynamics were not a primary driver of loan performance in the EU during the sample period. The dummy variable used consisting of recession is positive (2.512) and marginally significant only at the 10% level, which leads to the conclusion that economic downturns are related to higher levels of bad loans. This aligns well with the theoretical expectations from literature reviewed that tighter financial conditions lead to default probabilities.

Overall, the findings from the model highlight how important macroeconomic stability is in order to maintain banking sector resilience.

5. Analysis and Discussion

This section covers the analysis of the result coming from the pooled OLS regression regarding the macroeconomic determinants of non-performing loans (NPLs) in European Union countries between 2010 and 2023. The estimated model is expressed as follows:

$$NPL_{it} = -2.181 + 0.256 GDP_{it} + 1.025 UNEMP_{it} - 0.214 INF_{it} + 2.512 RECESS_{it} + \varepsilon_{it} \quad (2)$$

As aforementioned, the model explains roughly 37.7% of the variation in NPL ratios ($R^2 = 0.377$, Adjusted $R^2 = 0.370$), considered as a moderate explanatory power for cross-country macroeconomic analysis. Another important values is the F-statistic which is highly significant (53.525, $p < 0.01$), confirming the joint significance of the explanatory variables.

5.1 Discussion

H1: For unemployment, the regression coefficient is 1.025 and is statistically significant at the 1% level. Thus, assuming that all other factors are kept constant, a one percentage point increase in the unemployment rate increases NPLs by approximately 1.025 percentage points. This finding supports the first hypothesis that higher unemployment reduces the repayment capacity for borrowers which then leads to more non-performing loans. The result is consistent with the previous studies taken into account such as the ones by Bialas and Karafolas (2025), Masurashvili (2024), Ahmed et al. (2021), and Salas et al. (2024), which also identify unemployment as one of the strongest macroeconomic drivers for credit risk. This is explained by the logic that during periods of rising unemployment, households face reductions in their income and firms as well experience shortfalls in their revenues, meaning that they have little liquidity and the chance of default increases. All of these ultimately contribute to an accumulation of NPLs higher than the before situation.

H2: GDP growth, contrary to the traditional expectation which would be countercyclical, has a positive coefficient (0.256) and is considered as significant at the 5% level. This signifies that with a one percentage point rise in GDP growth, NPLs increase with a 0.256 percentage point, *ceteris paribus*. This counterintuitive result suggests that during periods of economic expansion, both households and firms may increase borrowing due to optimism about their income growth. While on one side this can initially stimulate investment and consumption, some borrowers may over-leverage leading to defaults later or an inability to pay their debts. Similar observations were reported by Beka & Abazi (2024) and Isakov (2024), particularly during periods that tend to have economic volatility such as the COVID-19 pandemic. Therefore, rapid GDP growth may paradoxically be linked to higher NPLs in certain contexts, showing that it is important to have a prudent credit management even during expansionary periods.

H3: Inflation, although having a negative coefficient (-0.214), it is not statistically significant ($p \approx 0.18$). This result tells us that inflation does not have a strong impact on NPLs in the EU during the period used in the sample. Some literature (Le & Le, 2023; Huljak et al., 2020) suggests that inflation may reduce the real burden of debt, but in our analysis, this effect appears negligible. On the other hand, high inflation could reduce purchasing power and increase default risk, but EU countries experienced relatively moderate and controlled inflation rates during the studied period. Overall, inflation appears to be a secondary factor in explaining variations in NPLs.

H4: Economic Recession used as a dummy has a positive coefficient of 2.512 and is marginally significant ($p \approx 0.06$), results that can be interpreted as NPLs increase during recession years compared to non-recession ones. This observed result aligns with theoretical expectations which state that recessions reduce economic activity, weaken business revenues, and constrain households' repayment capacity, thereby increasing defaults. Literature by Giannopoulos & Kariofyllas (2025), Elshani & Nezirai (2025), and Bello et al. (2020) all similarly show that recessions elevate credit risk and result after all in higher NPL ratios. Despite the effect being borderline significant, it emphasizes the importance of monitoring credit exposure during economic downturns.

5.2 Limitations and Future Research

The limitations of this study mainly stem from data constraints and methodological choices. First limitation was the exclusion of Germany due to a large number of missing data on NPLs which might limit the generalization of the findings to the entire EU. Additionally, the study focuses only on the macroeconomic variables that mean omitting bank specific determinants such

as liquidity, capital adequacy, and management quality, which are also factors that influence credit risk. As for the methodology, the use of pooled OLS does not fully account for unobserved country-specific effects. For future research, applying other methods such as Fixed Effects, Random Effects, or GMM models could provide more accurate results and have a better control for country-level differences. Combining macroeconomic indicators with bank-level data would also allow for a more comprehensive understanding of NPL determinants and improve the predictive power of the model. Additionally, future research could extend these findings by incorporating the macroeconomic variables validated here into deep learning or AI powered models for NPL prediction as recommended by Durand et al. (2023), potentially improving both predictive accuracy and interpretability in credit risk analysis.

6. Conclusions

Applying a panel data from 2010 to 2023, this research looked at the macroeconomic determinants of non-performing loans (NPLs) across European Union countries. The empirical results demonstrate the critical role that macroeconomic conditions have in what is called shaping the banking sector stability.

As we saw from results, amongst all the variables analyzed, unemployment was the most significant predictor of NPLs, confirming that like in the relevant literature, deteriorating labor market conditions significantly weaken borrowers' repayment capacity. GDP growth results, which were positive and highly significant in relation with NPL, showcased us that that periods of economic expansion might serve as a factor to encourage excessive borrowing and risk-taking behavior that later materializes in higher default rates. Inflation did not appear to have a considerable effect, although negatively related to NPLs, indicating that under the observed periods price dynamics were not a primary driver of loan performance. Lastly, recession episodes show signs of increases in NPL ratios, meaning that economic downturns as predicted cause banking systems to become vulnerable.

Overall, the results tell us that maintaining macroeconomic stability should be one of the focuses for safeguarding financial systems. Policymakers should prioritize labor market resilience, closely monitor credit expansion during growth periods as it might lead to bad loans as much as the good ones, and strengthen preventive regulatory frameworks to mitigate the credit risk before it escalates further. Despite providing important evidence, this study is still subject to certain limitations mentioned earlier, so future research could incorporate in models bank-specific variables and apply advanced panel techniques such as Fixed Effects or Generalized Method of Moments (GMM) to better capture unobserved heterogeneity and improve estimation robustness.

REFERENCES

1. Ahmed, S., Majeed, M. E., Thalassinou, E., & Thalassinou, Y. (2021). The impact of bank specific and macro-economic factors on non-performing loans in the banking sector: Evidence from an emerging economy. *Journal of Risk and Financial Management*, 14(5), Article 217. <https://doi.org/10.3390/jrfm14050217>
2. Aqifi, E., Salihi, S., & Emini, E. (2025). Unemployment as a main determinant of non-performing loans: The case of Western Balkan countries. *Economic Vision – International Scientific Journal in Economics, Finance, Business, Marketing, Management and Tourism*, 12(23–24), 63–70. <https://doi.org/10.62792/ut.evision.v12.i23-24.p3163>
3. Beka, A., & Abazi, H. (2024). The impact of economic growth on non-performing loans in Western Balkan countries. *InterEULawEast: Journal for the International and European Law, Economics and Market Integrations*, 10(2). <https://www.researchgate.net/publication/377231058>
4. Bello, M. A., Umar, K., & Gawuna, M. S. (2020). Domestic economic crisis and banking sector non-performing loans in period of economic recession in Nigeria. In *Sustainable transformation of public and corporate management in the digital age: Perspectives, challenges & prospects* (p. 372).

5. Bialas, M., & Karafolas, S. (2025). Macroeconomic and other factors contributing to the emergence of non-performing loans: An analysis of five EU countries. *Journal of Accounting and Auditing: Research & Practice*, 2025, Article 296180. <https://doi.org/10.5171/2025.296180>
6. Cenaj, A. (2025). Non-performing loans and economic growth in Southeast Europe. *Agora International Journal of Economical Sciences*, 19(2), 86–95. <https://univagora.ro/jour/index.php/aijes/article/view/7312>
7. Durand, R., Jouneau-Sion, C., Olanrewaju, T., & Doumpos, M. (2023). Determinants of non-performing loans: An explainable ensemble and deep neural network approach. *Finance Research Letters*, 55, Article 104084. <https://doi.org/10.1016/j.frl.2023.104084>
8. Elshani, A. N. (2025). Impact of non-performing loans on deposits and financial stability: An empirical analysis in developing European countries. *Journal of Risk Analysis and Crisis Response*, 15(3), 17. <https://doi.org/10.54560/jracr.v15i3.679>
9. Giannopoulos, V., & Kariofyllas, S. (2025). When models fail: Credit scoring, bank management, and NPL growth in the Greek recession. *International Journal of Financial Studies*, 13(3), Article 152. <https://doi.org/10.3390/ijfs13030152>
10. Goyal, S., Singhal, N., Mishra, N., & Verma, S. (2023). The impact of macroeconomic and institutional environment on NPL of developing and developed countries. *Future Business Journal*, 9(1), Article 16. <https://doi.org/10.1186/s43093-023-00216-1>
11. Huljak, I., Martin, R., Moccero, D., & Pancaro, C. (2020). *The macroeconomic impact of NPLs in Euro Area countries*. SUERF. https://www.suerf.org/wp-content/uploads/2023/12/f_6e16f49067dd5601bc1afc8296ab580115979suerf.pdf
12. Isakov, O. (2024). Factors affecting non-performing loans: Empirical evidence from commercial banks in Uzbekistan. *Journal of Economics and Financial Analysis*, 8(2), 1–21.
13. Kawakibi, A. A., & Mustikowati, R. I. (2025). The effect of interest rates and inflation on credit demand through non-performing loans: A study of banks listed on the IDX. *Brilliant International Journal of Management and Tourism*, 5(3), 155–172. <https://doi.org/10.55606/bijmt.v5i3.5836>
14. Khoirunisa, H., & Karnasi, R. (2023). Factors affecting non-performing loans of conventional banking in Indonesia Stock Exchange. *Jurnal Ekonomi, Akuntansi dan Manajemen*, 2(2), 31–55.
15. Klein, N. (2013). Non-Performing Loans in CESEE: Determinants and Impact on Macroeconomic Performance. IMF Working Papers, 13(72), 1. <https://doi.org/10.5089/9781484318522.001>
16. Kostis, P. C. (2020). Increased uncertainty, credit supply, and non-performing loans in the Eurozone. *Journal of Business Accounting and Finance Perspectives*, 2(1), Article 11.
17. Le, C. D. H., & Le, A. H. (2023). Macroeconomic determinants of non-performing loans: A quantile regression approach—Evidence from Vietnam’s banking system. *Journal of Eastern European and Central Asian Research*, 10(5), 813–825. <https://www.ieeca.org/journal>
18. Leleok, L., & Makori, D. (2024). Effect of inflation on non-performing loans of non-listed commercial banks in Kenya. *Strategic Journal of Business & Change Management*, 11(4). <https://doi.org/10.61426/sjbcm.v11i4.3135>
19. Masurashvili, N. (2024). *Nexus between unemployment and non-performing loans: Evidence from the Euro area* [Master’s thesis, Université catholique de Louvain]. <https://hdl.handle.net/2078.2/38205>
20. Non-performing loans (NPLs) - European Commission. (n.d.). https://finance.ec.europa.eu/banking/non-performing-loans-npls_en
21. Salas, M. B., Lamothe, P., Delgado, E., Fernández-Miguélez, A. L., & Valcarce, L. (2024). Determinants of nonperforming loans: A global data analysis. *Computational Economics*. Advance online publication. <https://doi.org/10.1007/s10614-023-10543-8>
22. Staehr, K., & Uusküla, L. (2020). Macroeconomic and macro-financial factors as leading indicators of non-performing loans. *Journal of Economic Studies*, 48(3), 720–740. <https://doi.org/10.1108/jes-03-2019-0107>
23. Zawadzki, A. (2023). Macroeconomic determinants of credit risk on the example of non-performing loans. *Central European Economic Journal*, 10(57), 275–286.