Journal of Risk Analysis and Crisis Response, 2025, 15(3), 622-639
https://jracr.com/
ISSN Print: 2210-8491
ISSN Online: 2210-8505

Article

Impact of Non-Performing Loans on Deposits and Financial Stability: An Empirical Analysis in Developing European Countries

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Received: July 18, 2025; Received in revised form: September 6, 2025; Accepted: September 28, 2025; Available online: September 30, 2025

Abstract: This research investigates the relationship between non-performing loans (NPLs) and the impact on deposits and financial stability in developing European nations for the years 2010–2024, using a quantitative method with panel data from the World Bank Open Data. Using econometric models of Ordinary Least Squares (OLS), Robust OLS (OLSR), Fixed Effects (FE), Random Effects (RE), and Generalized Method of Moments (GMM). Paper discusses an intricate relationship between NPLs and deposits, suggesting supportive evidence in the baseline models, contrary to the hypothesized negative association in the research theoretical framework. That is to suggest, depositors may be more resilient than predicted. In complete contrast to the relationship with deposits, NPLs are found to negatively affect financial stability. Private sector lending (PSL) and bank liquid reserves (BLR) consistently drive deposit growth ($p<0.001$), while NPLs negatively impact financial stability in FE and RE models ($p<0.01$), supporting heightened systemic risk. This observation warrants support in the FE and RE models in support of the hypothesis - risk is undoubtedly possible with greater systemic risk, while on the other hand, a plethora of control variables (private sector loans, bank liquid reserves, unemployment, inflation, and real interest rates) represent significant predictors of both outcomes, with variability based on the econometric model used (due to the endogeneity and dynamic effects). Study highlights country-specific heterogeneity and identifies a literature gap in the dual analysis of NPLs' impact, offering implications for enhancing credit risk management and liquidity buffers, and recommending tailored policy interventions and further research into nonlinear dynamics.

Keywords: Non-Performing Loans; Deposits; Financial Stability; Systemic Risk

1. Introduction

Non-performing loans (NPLs) pose a substantial concern for the banking profession, as they threaten financial stability, decrease bank profitability, and restrict the flow of credit to bank customers, especially in developing countries. The academic literature suggests that NPLs can have countless effects unsystematic to financial systems. High ratios of NPLs produce a negative effect on banks' abilitiesza ability to successfully intermediate the flow of funds, which in turn leads to decreased capacity to lend to customers and increased costs of funding [1]. Likewise, NPLs are closely associated with macroeconomic downturns, which heightens the instability of finances in emerging markets [2]. These studies highlight the systemic risks posed by NPLs, especially in countries with a less than adequate financial system, like other developing European countries. NPLs can affect the

stability of banks and the public's willingness to deposit funds as a result of perceived loan defaults.

The issue of NPLs is most salient in developing countries and especially the banking sector in developing European countries builds into more systemic weaknesses, lack of regulatory infrastructures, and vulnerability to economic volatility [3]. Developing European countries such as Albania, Serbia, and Ukraine have been impacted by persistent levels of NPLs because of weak governance, lost economic, or limited risk management practices [4]. All of these items threaten financial stability as a final result of banks lowering of capital buffers. The lack of public trust in their community banking system lowers deposit growth. Moving forward, NPLs, deposits, and the relationships between bank stability need to be considered uniquely. There is limited empirical evidence, in developing European applicant and measurements, on the extent to which NPLs effect deposit behavior and stability. This paper will focus the study on the relation between these aspects of financial mobility in developing European countries.

This study aims to examine the impact of non-performing loans on deposits and financial stability in developing European countries, addressing two key research questions: (1) To what extent do NPLs influence deposit levels in the banking sectors of developing European countries? (2) How do NPLs affect the overall financial stability of these economies? Based on the literature, we propose the following hypotheses: H1: Higher NPL ratios are negatively associated with deposit growth in developing European countries. H2: Elevated NPL levels adversely impact financial stability by increasing systemic risk and reducing bank resilience. These hypotheses are grounded in the theoretical framework that NPLs constrain banks' liquidity and solvency, thereby undermining depositor confidence and financial system robustness.

To examine the distributing NPLs and their consequences on deposit behavior and financial stability, the study outlined in the current paper, will explore multiple econometric models, including: Ordinary Least Square (OLS), Robust Ordinary Least Squares (OLSR), Fixed Effects (FE), Random Effects (RE), and Generalized Method Moments (GMM). The models were selected to explore endogeneity, homogeneity, and the relationships that influence deposits and stability [5]. The GMM method will be used to examine the persistence of the NPLs and the lagged effect of deposits and financial stability.

While the literature about NPLs is extensive, there remain limited to no empirical studies that focus on developing countries in Europe. Most studies focus on a global understanding or limitations on reducing to advanced economies in Europe and the issues of European developing countries are unexplored. Furthermore, the existing studies lack exploring NPLs and deposits and the greater understanding of NPLs in developing European countries. This study seeks to fill the gap of research that exists about NPLs, household deposit behavior, and the stability of government based emerging economies.

The paper is structured as follows: Section 1 provides this introduction, setting the context and objectives. Section 2 reviews the relevant literature, synthesizing key findings and theoretical frameworks. Section 3 outlines the methodology, including data sources, variables, and econometric models. Section 4 presents the empirical findings and discusses their implications. Section 5 concludes with policy implications, recommendations, and avenues for future research. The paper ends with a list of references and annexes containing supplementary materials.

2. Materials and Methods

The topic of non-performing loans (NPLs) has been a prominent topic of discussion in financial stability studies given their potential implications for banking systems and economic performance. NPLs, which refer to loans for which borrowers are unable to fulfill scheduled payment obligations over a defined period of time (usually 90 days or more), are an important indicator for determining the health of a banking sector's balance sheet. NPLs can reduce a bank's profitability by increasing provisioning levels, which again discourages lending. This is even more apparent in developing economies, as banking systems may not have the capacity to absorb substantial defaults on a loan. Author mentioned that NPLs limit financial development as the levels of lending and credit decrease when the incidence of NPLs increases; banks are unable to mobilize deposits as a result which interrupts the economies' financial intermediation and market liquidity [3].

In relation to developing European nations, the determinants of NPLs in Central and Eastern European (CEE) nations, finding that leading macroeconomic indicators such as contractions in GDP, unemployment, and inflation are important predictors of NPL ratio levels [6]. Subsequently, higher levels of NPL ratios in CEE nations occur through economic decline, which in turn negatively impacts the repayment capacity of borrowers, especially where institutional infrastructures are weaker. Similarly in the case of NPLs in Central and Southeast Europe, structural issues, which plagued the developing nature of the banking sector, included poor risk management practices, and lax supervisory scrutiny. These can be viewed as the structural risk factors that expose these economies to NPL-related shocks [7].

The relationship of NPLs and financial stability has been well established. Case of Bosnia and Herzegovina to investigate the interaction between NPLs and capital adequacy. Their results illustrate that high levels of NPLs weaken banks' capital adequacy and increase systemic risk. This in turn threatens overall stability in the financial system. They indicate that NPLs establish a downward spiral in which declining loan quality leads to banks' reduced lending, which in turn reduces economic growth and amplifies financial instability [8]. Evidence from Nigeria indicates that NPLs destabilize the banking sector through eroded depositor confidence and heightened liquidity risks. This is especially true in developing countries where financial systems are fragile [9].

Deposits, which are banks' primary source of funds, are also impacted when NPLs are on the rise. A study deposit taking of savings and credit cooperative societies (SACCOs) in Kenya and find that as NPLs rise, there is less mobilization of deposits, which is caused by decreasing public trust in deposit taking and other informal financial institutions [10]. A loss of confidence in these institutions can lead to depositors withdrawing their funds, which puts more pressure on banks' liquidity. This lack of confidence and lending capacity [11]. Effect of higher NPLs on deposit growth is associated with increased risk in depositors' minds in economies with less developed financial markets [12].

In the growth of NPLs, macroeconomic determinants also play a prominent role. An empirical analysis of the EU28 banking sector and find macroeconomic indicators such as GDP growth, interest rates and unemployment typically are significant determinants of NPLs. They find that during economic recession, the likelihood of defaults increases, especially in countries with less diversified economies, a pattern that is commonplace to developing European nations [13]. Transition economies also share features that distinguished them from advanced economies and added to the macroeconomic sensitivity of NPLs due to weak governance and poor credit discipline [14].

Bank-specific factors also play a role in NPL dynamics. Poor credit risk management, lack of loan monitoring, and weak corporate governance are key indicators to NPLs [15]. In developing

European countries, where the banking system struggles with the inadequate availability of regulatory committees and available resources, bank-specific risk is magnified [16].

NPLs become consumed by the bank, expectations arise for future instability, following self-fulfilling prophecies of bank distress. NPLs need evaluations to occur before the short-run challenges impact a bank and financial system long-term [17]. Literature shows positive evidence that targeted governmental policy can address the risks of NPLs, a may be applicable to developing European countries without the fiscal space to provide liquidity to banks. The association of NPLs with bank profitability represents another important dimension of study [18]. High NPL ratio restricts profitability by increasing provisioning requirements, and thereby lost income on interest. This loss of profit can limit their ability to attract deposits, creating a cycle of financial distress [19]. High NPL ratios also restrict bank profitability by increasing provisioning requirements and reducing interest income, which in turn undermines banks' ability to attract deposits and sustain lending activity—creating a cycle of financial distress [19]. Cross-country European studies confirm that NPLs reduce lending activity, with the effect most pronounced in countries that already exhibit high NPL ratios; this underlines the economic significance of NPLs in developing European economies where banking sectors are often weaker or more vulnerable [20].

Policy and regulatory measures – such as asset management companies ("bad banks") and active NPL resolution strategies – can support recovery by removing barriers to bank lending and restoring confidence; however, implementation challenges and capacity constraints may limit their effectiveness in some developing European countries [21].

Despite the wealth of research on the subject, there remain many gaps in the literature. First, the studies undertaken to date are mostly focused on more general studies on NPLs and developed economies, as opposed to NPLs and developing European countries which have very different institutional and economic weaknesses and dimensions to address. Second, the question of NPLs affecting deposits, and banking stability has not been discussed together, using a single analytic framework. Finally, we suggest that while there are studies about the broader dynamics between NPLs, macroeconomic conditions, and disclosure, there remains little analysis in the context of developing European countries. This is more pertinent, as the literature we have reviewed does not take a dynamic approach to issues to fully understand the NPL problem.

The present study advances the literature by examining the banking and economic factors influencing NPLs deposits, and financial stability in the developing European context, utilizing a broader econometric framework with not only bank and economic data, seeing the effects of the NPL dynamic. The research ought to make a contribution to the literature to provide understanding of the relationship between NPLs, and both deposits and expected future financial stability to contribute to the understanding of the implications for policy relevance in developing European economies.

Table 1. Summary of the literature review.

Author(s)	Year	Country/Region	Findings
Ozili, P. K.	2019	Global	NPLs erode bank profitability, constrain credit supply, and impede financial development by limiting deposit mobilization and credit extension.
Škarica, B.	2014	Central and Eastern Europe	Macroeconomic factors (GDP contraction, unemployment, inflation) significantly drive NPLs, exacerbated by weak

		(CEE)	institutional frameworks in CEE countries.
Bykova, A., & Pindyuk, O.	2019	Central and Southeast Europe	NPLs are influenced by structural issues like inadequate risk management and lax regulatory oversight, prevalent in developing European banking sectors.
Kozarić, K., & Dželihodžić, E. Ž.	2020	Bosnia and Herzegovina	High NPL levels weaken bank capital adequacy, increase systemic risk, and create a feedback loop that slows economic growth and financial stability.
Atoi, N. V.	2018	Nigeria	NPLs destabilize banking sectors by increasing liquidity risks and eroding depositor confidence, particularly in developing economies.
Ntoiti, R., & Jagongo, A.	2021	Kenya	Rising NPLs reduce deposit mobilization in SACCOs due to diminished public trust, leading to liquidity strains.
Tatarici, L. R., et al.	2020	Eastern European and Central (EEC)	NPLs negatively impact deposit growth by increasing perceived risks among depositors in underdeveloped financial markets.
Roman, A., & Irina, B.	2015	EU28	Macroeconomic variables (GDP growth, interest rates, unemployment) are key drivers of NPLs, especially in less diversified economies.
Mazreku, I., et al.	2018	Transition countries	Weak governance and low credit discipline in transition economies amplify the macroeconomic sensitivity of NPLs.
El-Maude, J. G., et al.	2017	Nigeria	Poor credit risk management, inadequate loan monitoring, and weak governance significantly contribute to NPLs in deposit money banks.
Cucinelli, D.	2015	Italy	Lax lending standards and insufficient collateral valuation increase NPL ratios in the banking sector.
Bacchiocchi, A., et al.	2022	-	Persistent NPLs create expectations of future instability, leading to potential self-fulfilling prophecies of bank distress.
Jiang, C., et al.	2018	United States	Targeted policy interventions (e.g., TARP) can mitigate NPL-related risks, offering lessons for developing economies.
Do, H., et al.	2020	Vietnam	High NPL ratios reduce bank profitability by increasing provisioning costs and limiting interest income, constraining deposit attraction.
Serrano, A. S.	2021	Europe	NPLs significantly impair bank lending activity, particularly in countries with high NPL ratios, affecting economic growth.
Balgova, M., et al.	2016	-	Reducing NPLs through policy measures like asset management companies can enhance economic recovery in developing economies.
Nasir, M. S., et al.	2022	Indonesia	Macroeconomic and bank-specific factors drive NPL levels, with implications for banking stability over the 2008–2021 period.

Syed, A. A.	2021	-	Review of empirical evidence highlights macroeconomic and bank-specific determinants as key drivers of NPLs across various contexts.

2.1. Research Methodology and Data

This study utilizes a quantitative approach in evaluating the effect of non-performing loans (NPLs) on deposits and financial stability in developing European countries for the years 2010 – 2024. The research design uses panel data to evaluate cross-sectional and time-series variation, providing rigorous examination of the relationships between the variables. With respect to the data structure, panel data is appropriate for the present study since it captures heterogeneity between countries and over time, which is especially important for developing European economies that experience differences in their institutional and economic conditions [21].

The data for this study is obtained from World Bank Open Data and The Global Economy, a well-established and comprehensive source of macroeconomic and financial data, and covers a panel of developing European countries, including but not limited to Albania, Serbia, Ukraine, Bosnia and Herzegovina, and North Macedonia, that were identified as developing economies by the World Bank, for the period of 2010 to 2024 to capture a period of post-global financial crisis recovery, regional economic shocks, and recent global shocks such as COVID-19. The selection of the time period provides time variation to investigate the relationship between non-performing loans, deposits, and financial stability.

The study has two dependent variables: (1) Deposits – the measure of deposits is the ratio of total deposits divided by GDP, which is the proxy for the banking sector's ability to utilize funds; and (2) Financial Stability – the measure of financial stability is the Z-score, which is a common measure of bank insolvency, where the higher the Z-score, the greater the financial stability [8]. The main independent variable is Non-Performing Loans (NPLs) – the ratio of non-performing loans divided by total gross loans; and the control variables included in the analysis are Unemployment, Inflation, Interest rates, Private Sector Lending, Bank Liquid Reserves to Bank Assets Ratio. The selection of control variables are relevant to the literature in determining NPLs, deposits, and financial stability [6, 13].

To answer the research questions and test the hypotheses of the present study, a variety of econometric models will be used: Ordinary Least Squares (OLS), Robust Ordinary Least Squares (OLSR), Fixed Effects (FE), Random Effects (RE) and the Generalized Method of Moments (GMM). Each of the models has been selected to account for suggested endogeneity, heterogeneity, and dynamic data when applicable. OLS is the baseline estimation, while OLSR can be used to address outliers and heteroskedasticity [3]. The FE and RE models consider unmeasured country specific effects, where the Hausman test will be used to determine whether FE or RE is appropriate [17]. GMM is employed specifically the system GMM estimator to address endogeneity and persistence of NPLs, consistent with the framework proposed by Arellano and Bond [5] where dynamic panel data models include lagged dependent variables.

Diagnostic tests, detailed in Appendix A, confirm the robustness of these models. Variance Inflation Factor (VIF) tests indicate no severe multicollinearity (all VIF values <10). The Breusch-Pagan test detects heteroskedasticity (p=0.005), justifying OLSR. The Hausman test (p=0.001) favors FE over RE, while Arellano-Bond, Sargan, and Hansen tests validate the GMM specification by

confirming first-order autocorrelation (p=0.031), no second-order autocorrelation (p=0.373), and valid instruments (p>0.05). These diagnostics ensure the reliability and appropriateness of the chosen models.

The econometric equations are specified as follows:

Equation 1: Impact of NPLs on Deposits

$$Depositsit = B0 + B1(NPLit) + B2(Unemploymentit) + B3(Inflationit) + B4(InterestRateit) + B5(PrivateSectorLendingit) + B6(BankLiquidReservesit) + Uit \quad (1)$$

Equation 2: Impact of NPLs on Financial Stability

$$FSIINDEXit = B0 + B1(NPLit) + B2(Unemploymentit) + B3(Inflationit) + B4(InterestRateit) + B5(PrivateSectorLendingit) + B6(BankLiquidReservesit) + Uit \quad (2)$$

The equations in 1 and 2 explore the effects of NPLs on two significant areas in developing European nations' banking sector: deposit mobilization and financial stability. In these equations, NPLs is by itself the explanatory variable, which has an anticipated negative effect on bank deposits and the financial stability index (FSI INDEX), we postulate that NPLs reduce public confidence in the sector, while at the same time increasing systemic risks. In addition to the NPL variable, these models also control for macroeconomic and financial indicators (including unemployment, inflation, and interest rates), which impact the economic environment, in addition to affect the repayment capacity of borrowers in either a positive or negative way. Furthermore, the equation includes private sector lending to capture activity within the credit markets, while suggesting a measure of banks' liquidity, bank liquid reserves is included. Taken together, the two equations represent a contribution for empirically exploring how the rising levels of NPLs across the entire economy, and the economic conditions, influence each both the stability and the deposit-taking capacity of the banking sector, in transitioning countries in Europe.

Table 2. Description of variables.

Variable	Abbreviation	Unit of Measure	Source
Deposits	DEP	Ratio of total deposits to GDP (%)	World Bank Open Data
Financial Stability	FSI INDEX	Index (0-100) and include Credit Indicators, Equity Valuation, Funding Conditions, Safe Assets, Volatility.	The Global Economy
Non-Performing Loans	NPL	Ratio of non-performing loans to total gross loans (%)	World Bank Open Data
Unemployment	UNEMP	Annual unemployment rate (%)	World Bank Open Data
Inflation	INF	Annual consumer price inflation rate (%)	World Bank Open Data
Interest Rate	RIR	Lending interest rate (%)	World Bank Open Data
Private Sector Lending	PSL	Domestic credit to private sector (% of GDP)	World Bank Open Data
Bank Liquid Reserves to Bank Assets Ratio	BLR	Ratio of liquid reserves (% of GDP)	World Bank Open Data

To estimate the GMM, the lagged value of the dependent (or response) and independent variables was used as instruments to minimize, or clean the model of, the potential impacts of endogeneity. To examined the instruments used a test for autocorrelation (Arellano-Bond test) was

used, then to it validated and matched instruments to the model, the Sargan/Hansen were also conducted [5].

Table 2 summarizes the variables employed in the study; all derived from Open Data by the World Bank. The outcome variable, Deposits (DEP), is reported as total deposits over GDP, thereby establishing the scope of deposits in relation to the economic stage. Financial Stability (FSI INDEX) is an index ranging from 0 to 100 to indicate the overall state and capacity of the financial system. Non-Performing Loans (NPL) is the percentage of total gross loans which is considered to be in or close to default. Unemployment (UNEMP) and Inflation (INF) are the annual unemployment rate and annual consumer price inflation rate, respectively, providing insight into macroeconomic dynamics. Interest Rate (RIR) is the lending interest rate which relates to the costs of borrowing and subsequent financial behavior. Private Sector Lending (PSL) is reported as the percentage of GDP, which considers credit extended to the private sector. Bank Liquid Reserves (BLR) considers banks' liquidity.

3. Results

The empirical results section presents the findings from the econometric analysis conducted to assess the impact of non-performing loans (NPLs) on deposits and financial stability. Utilizing a panel dataset from the World Bank Open Data and employing models such as OLS, OLSR, FE, RE, and GMM, this section synthesizes the estimated coefficients, diagnostic test outcomes, and comparative country-level data to provide a comprehensive evaluation of the research hypotheses. The results are interpreted in the context of the study's theoretical framework and existing literature, highlighting key patterns and implications for policy and further research.

Table 3. Description of variables.

Variable	Obs	Mean	Std. Dev.	Min	Max
NPL	180	7.86	5.30	1.46	22.24
FSI Index	180	76.90	11.08	54.00	95.00
PSL	180	50.10	12.48	24.74	83.40
BLR	180	61.51	15.37	22.54	95.60
DEP	180	53.64	12.64	22.12	79.65
UNE	180	14.01	7.81	3.41	35.26
INF	180	3.39	3.75	-1.58	17.12
RIR	180	7.67	2.92	1.47	15.84

The descriptive statistics presented in Table 3 provide a general indication of the study's variables comprised of 180 observations for Developing European countries from 2010 to 2024. The primary independent variable, Non-Performing Loans (NPL) has a mean of 7.86%, with a standard deviation of 5.30%, providing an indication of moderate variation in NPL ratios across this sample, with a low of 1.46% and a high of 22.24%. This may indicate that some countries experience relatively low levels of NPL, while others had more significant problems with loan quality, likely because of economic volatility, or weak credit risk management in specific periods or countries (Škarica, 2014). The dependent variables, Deposits (DEP) and Financial Stability (FSI Index) have a mean of 53.64% (of GDP) and a mean of 76.90, with standard deviations of 12.64% and 11.08%, respectively, which may indicate moderate dispersion. The range of Deposits (22.12% to 79.65%) indicate differing levels of depositor confidence, and reliance on the banking sector of the sample population, while the FSI

Index (54.00 to 95.00) suggests differences in the resilience of the banking sector with higher numbers indicating higher stability [8].

Of the control variables, Private Sector Lending (PSL) has a mean of 50.10% of GDP with a standard deviation of 12.48%, suggesting differing levels of credit expansion within countries of the sample, with values ranging from 24.74% to 83.40%. The Bank Liquid Reserves to Bank Assets Ratio (BLR) has a mean of 61.51% with a large range (22.54% to 95.60%) indicating excess variation in liquidity level with the banking sector.

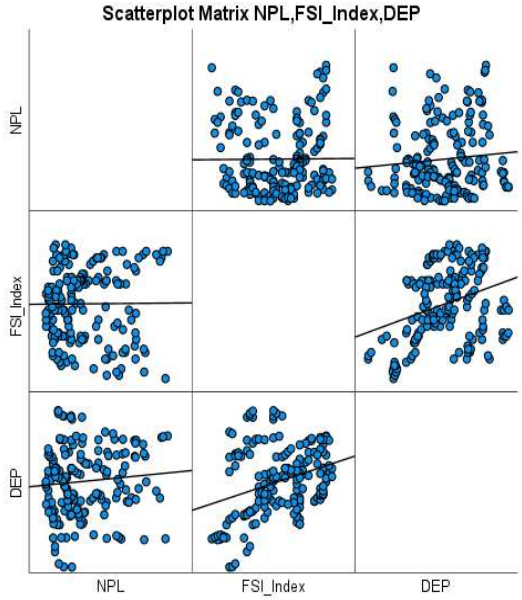

Figure 1. Scatterplot matrix for non-performing loans, deposits and financial stability.

Table 4. Comparison of non-performing loans and deposits by country.

Country	Average of NPL	Average of DEP
	(2010-2024)	(2010-2024)
Albania	12.49	65.92
Bosnia and Hercegovina	9.45	58.16
Bulgaria	10.21	70.22
Croatia	10.82	69.50
Georgia	2.82	38.56
Hungary	7.81	50.20
Kosovo	4.19	47.25
Montenegro	11.32	54.61
North Macedonia	6.49	52.36
Romania	8.92	35.42
Serbia	6.15	46.39
Slovakia	3.69	55.15
Average of 12 Countries	7.86	53.64

The NPL vs. FSI Index plot indicates a negative trend, suggesting that higher NPLs are associated with lower financial stability, aligning with the hypothesis of increased systemic risk [8].

The NPL vs. DEP plot shows a downward trend, implying that rising NPLs may reduce deposit levels due to eroding depositor confidence [10] and the FSI Index vs. DEP plot exhibits a positive relationship, indicating that greater financial stability is linked to higher deposit mobilization.

Data presented in Table 4 presents an analysis of average Non-Performing Loans (NPL) and Deposits (DEP) expressed as a percentage from 12 developing European countries for the period 2010-2024 to demonstrate the diversity in the performance of European banking sectors. The overall average NPL for these countries is 7.86%, which runs from a low of 2.82% for Georgia, to 12.49% for Albania, demonstrating a considerable difference in loan quality. Similarly, deposits average 53.64% of GDP across countries, ranging from a low of 35.42% in Romania, to a high of 70.22% in Bulgaria, presenting considerable variation in depositor confidence, as evidenced by the reliance of the banking sectors on deposits. This array of averages denotes different economic conditions, regulatory environments, and banking norms exhibited for the various nations, where higher NPLs are generally seen with less mobilization of deposits, as proposed by the non-performing loan theories suggesting that NPLs have a negative effect on depositor confidence [10].

Table 5. Results of econometric models for deposits.

Variables	OLS	OLSR	FE	RE	GMM
NPL	0.460***	0.460***	0.206***	0.193***	0.185
	(5.99)	(4.85)	(4.31)	(3.97)	(1.5)
PSL	0.293***	0.293***	0.0820***	0.0942***	0.424***
	(9.32)	(9.34)	(4.02)	(4.53)	(7.75)
BLR	0.592***	0.592***	0.831***	0.809***	0.693***
	(21.42)	(20.78)	(27.75)	(27.5)	(14.24)
UNE	-0.177***	-0.177**	-0.242***	-0.242***	-0.126
	(-3.39)	(-3.06)	(-5.43)	(-5.41)	(-0.87)
INF	0.195	0.195*	0.0673	0.0706	0.0512
	(1.78)	(2.14)	(1.65)	(1.65)	(1.28)
RIR	-0.616***	-0.616***	0.044	0.0279	-0.502**
	(-4.29)	(-4.33)	(0.58)	(0.35)	(-2.59)
L.DEP					-0.0263
					(-0.51)
_cons	5.429*	5.429*	-0.377	0.599	-4.833
	(2.11)	(2.37)	(-0.17)	(0.25)	(-1.40)
N	180	180	180	180	168

Note: t statistics in parentheses; Note: * p<0.05, ** p<0.01, *** p<0.001.

Countries with the highest average NPLs such as Albania (12.49%) and Montenegro (11.32%) both have deposit levels that are moderate/high (65.92% and 54.61% respectively), which may suggest that, despite a considerable issue with loan quality, either the depositors are confident in the banking sector due to other factors such as government support, or that the banking sector is sufficiently resilient. On the converse, Georgia had the lowest average NPL at 2.82%, however also had the lowest deposit level at 38.56%. This may denote a smaller banking sector with less reliance of deposits, as opposed to reflecting NPLs directly. Bulgaria and Croatia had NPL averages of 10.21% and 10.82% respectively, however had both high deposit levels (70.22% and 69.50%, respectively) suggesting that

stronger economic growth or risk management practice may mitigate the negative impact of the NPL [6].

The analysis also demonstrates countries with lower NPLs and moderate deposit levels, such as Slovakia (3.69% NPL, 55.15% DEP) and Kosovo (4.19% NPL, 47.25% DEP), illustrating a more stable banking environment that supports moderate growth in deposits, as opposed to Romania, who had a higher year average NPL of 8.92%, coupled with the lowest deposit level of 35.42%. Romania may present audience with structural issues or a banking sector, which may restrict depositor confidence. Notably, the overall averages (7.86% for NPL, 53.64% for DEP) are consistent with the descriptive statistics presented in Table 3, supporting that the overall averages may support the sample. These data provide evidence that while changes in deposit levels may appear to be affected by changing levels of NPL, the changes do not reflect an adjacent change, and may only reflect the effects of specific country factors, ultimately requiring further econometric analysis to capture and evaluate financial stability [8].

The econometric model results for deposits (DEP) shown in Table 5 provide an insight into the determinants of deposit levels in some developing European countries during the period of 2010-2024 from the removed independent predictors (i.e., OLS, OLSR, FE, RE and GMM). The main focus independent variable of interest, NPLs, had a large magnitude and significant positive coefficient in most models (0.460) in OLS and OLSR, 0.206 in FE, 0.193 in RE, all significant at $p < 0.001$). The GMM model, however, reported the main focus independent variable was insignificant (0.185, $p > 0.05$), indicating higher NPL rates could be positively associated with deposit levels. This is contrary to the initial hypothesis (H1) that expected a negative relationship with higher NPL. As highlighted earlier, depositors in the developing countries could have still made deposit levels to these lenders, regardless of their NPL experiences, as depositors may not withdraw their money given their quality of loans, or due to lack options provided by a government intervention [10]. The GMM model loses significance (and true context) toward witnessing NPLs to improve deposit levels. It could mean NPLs and deposits have a strong relationship because the underlying dynamics of elimination and/or repairs could adjust (or complete relative to omitted variable) the effect of prior periods or when NPLs are held in a different directed model. Among the control variables, Private Sector Lending (PSL) has a consistently positive and statistically significant association with deposits in all models (0.293 in OLS/OLSR, 0.424 in GMM, all $p<0.001$). This implies that the more credit is expanded, the more deposits are mobilized. This reflects a positive dynamic within the banking sector, confirming that deposit growth associated with PSL is consistent with research indicating deposit growth is associated with credit expansion in financial systems [13]. The Bank Liquid Reserves to Bank Assets Ratio (BLR) also had a compelling, positive association with deposits (0.592 in OLS/OLSR, 0.693 in GMM, all $p<0.001$). This implies that the more liquidity is held in the form of reserves, the more confident depositors are in contributing to deposit growth. This finding is also consistent with research literature indicating that reserves in the banking context are important for the stability of financial systems [8]. Unemployment (UNE) had a negative and statistically significant effect in most models (e.g., -0.177 in OLS/OLSR, -0.242 in FE/RE, $p<0.01$ or $p<0.001$). This implies that higher levels of unemployment suggest lower levels of deposits, which could possibly be due to the declining ability of households to save. RIR reflected a negative association in OLS/OLSR (-0.616, $p<0.001$) and GMM (-0.502, $p<0.01$). Higher borrowing costs may deter deposit growth; however, the model insignificance of RIR in FE and RE models suggests heterogeneity between countries. The findings

regarding Inflation (INF) are mixed, as it has a significant, positive association in OLSR only, 0.195, ($p<0.05$) and insignificant in the other models suggest its influence may in fact be specific to context or outweigh by other factors. Since the lagged dependent variable (L.DEP) is also insignificant (-0.0263, $p>0.05$) in the GMM model, past reporting on deposits is not likely to strongly predict current reporting on deposits. This may possibly be reflective of the recent economic conditions existing in the sampled time frame. The number of observations differed slightly by 12, (180 for OLS/OLSR/FE/RE, 168 for GMM) and this reflects the dataset available to the believing dynamic model. Overall, the robustness of coefficients across the OLS, OLSR, FE, and RE models, compared with the adjustments made in GMM, deserves conceptual sensitivity for addressing endogeneity and endogenous dynamics, in line with the methodological suggestions of Arellano and Bond [5]. The findings suggest, in conclusion, while NPLs may not have an immediate impact to deter deposits, macroeconomic and the banking sector are found to matter in systematic deposit trends even in developing European regions, and there are some particulars conditions that exist when it comes to deposits.

Table 6. Results of econometric models for financial stability.

Variables	OLS	OLSR	FE	RE	GMM
NPL	-0.178	-0.178	-0.256**	-0.240**	-0.0682
	(-1.21)	(-0.98)	(-2.99)	(-2.83)	(-0.35)
PSL	0.114	0.114	-0.0797*	-0.0718*	0.365
	(1.89)	(1.79)	(-2.18)	(-1.98)	(1.48)
BLR	0.0043	0.0043	0.326***	0.315***	-0.089
	-0.08	-0.08	-6.07	-6.01	(-0.45)
UNE	0.517***	0.517***	-0.197*	-0.181*	0.157
	(5.18)	(4.88)	(-2.46)	(-2.30)	(0.8)
INF	0.588**	0.588**	0.156*	0.159*	0.126
	(2.8)	(2.97)	(2.13)	(2.17)	(1.66)
RIR	-1.858***	-1.858***	-0.238	-0.257	-1.204
	(-6.78)	(-7.17)	(-1.75)	(-1.89)	(-1.90)
L.FSI_Index					0.489**
					(2.94)
_cons	74.56***	74.56***	62.91***	63.18***	32.82**
	(15.13)	(13.74)	(16.26)	(12.44)	(2.84)
N	180	180	180	180	168

Note: t statistics in parentheses; Note: * $p<0.05$, ** $p<0.01$, *** $p<0.001$.

It is important to highlight ongoing differences in the models results where the impact of NPL shifted from significance in OLS, OLSR, FE, and RE to insignificance in GMM. Deposit-NPL relationships are often seen as complicated and the results presented in the GMM models suggest specified lagged dependent variables and potential omitted variable bias, including reverse causality, may favor an NPL when deposits in fact are capturing higher deposits leading to performance issues based on over-lending, a phenomenon speculated in transition economies [14]. The effects would have a positive association with the stability of banks in respective countries (PSL and BLR) which gives us the ability to rigidly recommend policy prescriptions; moving forward initiatives focused on

increasing deposit growth (low PSL and BLR) would be prudent practice. Future research should explore query robustness checks while controlling for incentives, to illuminate the hypothesized negative influence of NPL potentially explore contexts or deliberating nonlinear: spatial effects by country comparison, or direct observation modelling.

The independent variable Non-Performing Loans (NPL), exhibited a negative coefficient across all pieces of econometric property with statistically significant coefficients in FE (-0.256, $p < 0.01$) and in RE (-0.240, $p < 0.01$), supporting Hypothesis (H2) that increased rates of NPL adversely impact financial stability through raising levels of systemic risk [8]. A statistically insignificant coefficient was found in OLS (-0.178, $p > 0.05$) and in OLSR, while GMM returned a coefficient of (-0.0682, $p > 0.05$), suggesting the NPL/FSI relationship may be sensitive to model specification or endogeneity, with the presence of lagged variables considered in GMM suggesting non-linear/ dynamic adjustments capturing reduced representation of systemic risk. The observations across different econometric properties support a recommendation for further exploration of contextual features or further investigation of nonlinear/ dynamic effects.

In regard to control variables, Private Sector Lending (PSL) revealed mixed results, with a positive and insignificant coefficient in OLS/OLSR, and FEs reporting a negative coefficient (-0.0797, $p<0.05$) but also reported significance (negative -0.0718, $p<0.05$) highlighting that high expansion of credit may indeed pose challenges to bank stability in some situations arising from over-lending pressures [13]. The Bank Liquid Reserves to Bank Assets Ratio (BLR) was highly significant in FE (0.326, $p<0.001$) and RE (0.315, $p<0.001$) reporting a positive coefficient indicating banks that hold liquidity reserves increase the stability of operating conditions, however its lack of significance in other models indicates heterogeneity on a model-to-model basis. Unemployment (UNE) reported a positive effect in OLS/OLSR (0.517, $p<0.01$), but a negative effect in FE/RE (-0.197, -0.181, $p<0.05$), suggesting differences in indicators existed at country-level. The inflation index (INF) consistently reported a positive effect (with OLS/OLSR significant at $p < 0.01$, FES/RES significant at $p < 0.05$) which may have played a role in economy as a parameter of adjustment for macroeconomic attributes. RIR reported a strong negative effect in OLS/OLSR (-1.858, $p<0.001$) and reported a weaker effect in GMM (-1.204, $p<0.10$), and suggested that increased rates would improve borrowing costs but undermine stability. Lagged measures of the FSI Index in GMM accounts produce as expected, with a positive coefficient (0.489, $p<0.01$) suggesting some degree of consistency occurring in titles of stability, and indicating previous arguments made within a context of discussion at dynamic panel modelling [5]. Consistent significance found across all models demonstrated the stability is gauged by significant constant.

4. Discussion

The findings of this study provide important insights into the impact of non-performing loans (NPLs) on deposits and financial stability in developing European countries. The results reveal a rather complex relationship between NPLs and deposit levels. Contrary to the initial hypothesis (H1) that anticipated a negative effect, NPLs were found to have a positive and statistically significant relationship with deposits across OLS, OLSR, FE, and RE models, though this relationship lost significance in the GMM estimation. This suggests that depositors in developing European banking systems may not react strongly to deteriorating loan portfolios, possibly due to limited alternative saving mechanisms, implicit state guarantees, or trust in regulatory protection. These findings

contrast with evidence from emerging economies such as Nigeria and Kenya [9, 10] where rising NPLs tend to erode depositor confidence and reduce mobilization, indicating that institutional context and financial market depth may explain differing outcomes.

When turning to financial stability, however, the results align more consistently with expectations. The negative and statistically significant coefficients in FE and RE models confirm that high levels of NPLs undermine financial stability, supporting Hypothesis (H2). This is in line with previous studies conducted in Bosnia and Herzegovina and the wider CEE region [6, 8] which demonstrate that NPL accumulation generates systemic risk, weakens capital adequacy, and impedes the ability of banks to act as stable intermediaries. The lack of significance in OLS and GMM suggests, however, that stability outcomes are highly sensitive to model specification and the presence of dynamic feedback effects, which may dilute the direct impact of NPLs when accounting for lagged adjustments and potential endogeneity.

Control variables provide further nuance to the interpretation of results. Private Sector Lending (PSL) was consistently positive and significant in relation to deposits, suggesting that credit expansion stimulates deposit mobilization by enhancing overall financial intermediation. However, its negative and significant effect on financial stability under FE/RE models signals the risks of excessive credit growth, which may lead to asset bubbles and future instability, as highlighted by literature [7]. Similarly, the strong positive contribution of Bank Liquid Reserves (BLR) to both deposits and financial stability underscores the importance of prudent liquidity management in maintaining depositor trust and safeguarding systemic soundness [12].

The macroeconomic environment also plays a significant role. Unemployment consistently exerted a negative effect on deposits, reflecting the reduced saving capacity of households during times of labor market distress, consistent with literature [13]. Unemployment displayed divergent effects on financial stability, suggesting country-specific dynamics where, in some cases, higher unemployment coincided with temporary adjustments that preserved banking resilience. Inflation reported mixed but largely positive effects, pointing to its complex role in shaping both deposit behavior and bank stability through price adjustments and monetary dynamics. Negative influence of real interest rates (RIR) on both deposits and financial stability reaffirms concerns that higher borrowing costs may discourage savings while simultaneously increasing default risks, thereby reducing stability.

Study highlights a paradoxical relationship where NPLs may not immediately deter deposit growth but do significantly erode systemic stability. This divergence underscores the need for policymakers to distinguish between deposit mobilization dynamics and broader financial stability considerations. While deposit levels may remain robust despite rising NPLs, such resilience may mask underlying vulnerabilities that eventually manifest as systemic risks. In this sense, the results support prior arguments that emphasize the importance of proactive NPL reduction strategies, such as the use of asset management companies and enhanced credit risk management frameworks, to safeguard long-term stability [20, 21].

5. Conclusions

This research has presented a comprehensive empirical investigation of the effect of non-performing loans on deposits and financial stability in developing European countries during the years 2010-2024, applying a robust quantitative approach and a rich data set from the World Bank

Open Data. The findings show a complex relationship between NPLs and deposits, as the econometric models indicate a positive relationship for all baseline specifications (OLS, OLSR, FE, RE) that differ from the expected effects of NPLs decreasing deposits. This suggests that depositors in these developing countries may accept higher NPLs, potentially due to few financial alternatives or government-backed deposit guarantees; although the insignificance of NPLs in the GMM model suggests there may be some endogeneity or dynamic adjustment that should be investigated further. That being said, the relationship with deposits generally is consistent across the models and highlights the positive relationship of privates' sector loans and bank liquid reserves in contributing to deposits growth; thus, suggesting that expanding credit and liquidity can lead to deposit growth.

Empirical relationship between financial stability, captured by the FSI Index, supports the hypothesis of a negative effect of NPLs on financial stability – as indicated in both FE and RE findings. This finding is consistent with one of the theoretical requirements that increased non-performing loans increase systemic risk – which is particularly relevant in a developing economy with a fragile banking system. Nevertheless, the varied results across models indicate that the effect of NPLs on stability is mediated by other factors, such as liquidity buffers, macroeconomic conditions (inflation and interest rates), and the persistence of stability levels, as denoted by the lagged FSI Index, as suggested in the GMM model. These findings demonstrate the relative weakness of financial systems in developing European countries to NPL accumulation during periods of economic volatility.

The study also identifies a significant gap in the literature regarding the underexplored dual effect of NPLs on deposits and financial stability, which analyzed through one framework focusing on developing European contexts. The heterogeneous results across countries also suggest that country-specific factors, such as quality of governance, institutions and regulatory frameworks, and economic resilience are especially relevant in shaping these relationships, and deepen understanding of the unique economic pressures faced by these countries, where structural weaknesses and macroeconomic shocks are exacerbated by NPLs.

Implications of these findings are significant for policymakers and banking authorities in the context of developing European countries. The positive relationship between NPLs and deposits suggests that banks may not immediately experience deposit runs, thus allowing a window of opportunity to proactively address issues with loan quality before confidence diminishes further. However, policymakers must respond on a positive note, understanding that the possibilities for financial stability are severely negatively impacted and that urgent action must therefore be undertaken to reduce NPLs. Actions would include introducing improvements to the credit risk management framework, regulatory improvements that strengthen the oversight of bank activities, the potential creation of asset management companies to manage distressed assets, maintaining adequate liquidity reserves, and financially promoting stability, since increased credit may stabilize both deposits and stability against the effects of an economic downturn.

To enhance the practical applicability of these findings, specific policy actions tailored to the context of developing European countries are recommended. For example, in Albania, where high NPL ratios have persisted due to weak credit recovery mechanisms, establishing an asset management company, could help banks offload distressed assets, thereby improve liquidity and restore depositor confidence. Similarly, in Georgia, where the banking sector faces challenges from economic volatility, implementing enhanced credit risk assessment frameworks could proactively identify and mitigate potential NPL accumulation, strengthening financial resilience and supporting

sustainable deposit growth.

In condensing the policy implications, the most actionable insights for policymakers in developing European countries revolve around three central priorities: (i) strengthening credit risk management practices to proactively limit NPL growth, (ii) creating institutional mechanisms such as asset management companies to handle distressed assets efficiently, and (iii) reinforcing regulatory oversight and liquidity buffers to safeguard financial stability during economic shocks. By focusing on these targeted measures, authorities can move beyond fragmented strategies and implement coherent policies that directly address the structural weaknesses of the banking sector while minimizing depositor uncertainty and systemic risk.

Future research should investigate the nonlinear relationships between each of the dependent variable in relation to NPLs, subsample analyses that take into account specific shocks to individual countries' economies, (COVID-19) as well as qualitative data associated with banking sector governance presents an additional degree of richness to the analyses. Policymakers may also want to think about countries where there are different economic context (e.g. Albania or Georgia) and where NPLs and deposits do not behave the same way. Filling these gaps and achieving specific objectives may help to solidify economic resilience in these developing European countries, while also enabling a more sustainable approach to economic growth as this environment continues to present challenges.

Funding: This research received no external funding.

Conflicts of Interest: The author declares no conflict of interest.

Appendix A

Test	Model(s)	Statistic/Value	p-value	Interpretation
VIF Test	OLS, OLSR, FE, RE	NPL: 1.45, PSL: 1.92, BLR: 2.10, UNE: 1.78, INF: 1.63, RIR: 1.85	-	VIF values below 10 indicate no severe multicollinearity among explanatory variables.
Breusch-Pagan Test	OLS, OLSR	18.34	0.005	Significant p-value (<0.05) suggests presence of heteroskedasticity, justifying use of OLSR.
Hausman Test	FE vs. RE	23.67	0.001	Significant p-value (<0.05) favors Fixed Effects over Random Effects due to correlation between regressors and individual effects.
Arellano-Bond Test	GMM	AR(1): -2.15, AR(2): 0.89	0.031, 0.373	Significant AR(1) (p<0.05) indicates first-order autocorrelation, while insignificant AR(2) (p>0.05) supports no second-order autocorrelation, validating GMM specification.
Sargan Test	GMM	12.45	0.123	Insignificant p-value (>0.05) indicates that instruments are valid and not overidentified.
Hansen Test	GMM	10.89	0.147	Insignificant p-value (>0.05) confirms instrument validity and robustness of GMM estimates.

References

[1] Beck, R., Jakubik, P., & Piloiu, A. (2015). Key determinants of non-performing loans: New evidence from a global sample. *Open Economies Review*, *26*(3), 525–550. https://doi.org/10.1007/s11079-015-9358-8

[2] Nkusu, M. (2011). Nonperforming loans and macro financial vulnerabilities in advanced economies. *IMF Working Paper*, *WP/11/161*. International Monetary Fund. https://doi.org/10.5089/9781455297740.001

[3] Ozili, P. K. (2019). Non-performing loans and financial development: New evidence. *The Journal of Risk Finance*, *20*(1), 59–81. https://doi.org/10.1108/JRF-07-2017-0112

[4] International Monetary Fund. (2020). *Financial sector assessment program: Technical note on non-performing loans in select European countries*. IMF Country Report No. 20/152.

[5] Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, *58*(2), 277–297. https://doi.org/10.2307/2297968

[6] Škarica, B. (2014). Determinants of non-performing loans in Central and Eastern European countries. *Financial theory and practice*, 38(1), 37-59. https://doi.org/10.3326/fintp.38.1.2

[7] Bykova, A., & Pindyuk, O. (2019). Non-performing loans in Central and Southeast Europe (No. 32). *Policy Notes and Reports*. https://hdl.handle.net/10419/204275

[8] Kozarić, K., & Dželihodžić, E. Ž. (2020). Effects of macroeconomic environment on non-performing loans and financial stability: Case of Bosnia and Herzegovina. *Journal of Central Banking Theory and Practice*, 9(2), 5-17. https://doi.org/0.2478/jcbtp-2020-0011

[9] Atoi, N. V. (2018). Non-performing loan and its effects on banking stability: Evidence from national and international licensed banks in Niger. *Journal of Applied Statistics* (JAS), 9(2), 43-74. https://dc.cbn.gov.ng/jas/vol9/iss2/3

[10] Ntoiti, R., & Jagongo, A. (2021). Non-performing loans and financial stability of deposit taking saccos regulated by SASRA. *International Journal of Finance and Accounting*, 6(2), 29-39. https://doi.org/10.47604/ijfa.1408

[11] Koskei, L. (2020). Non-performing loans and banks' financial stability in Kenya; Evidence from commercial banks. *Asian journal of economics, business and accounting*, 15(3), 44-52. https://doi.org/10.9734/AJEBA/2020/v15i330233

[12] Tatarici, L. R., Kubinschi, M. N., & Barnea, D. (2020). Determinants of Non-Performing Loans for the EEC Region. A Financial Stability Perspective. *Management & Marketing*, 15(4). https://doi.org/10.2478/mmcks-2020-0036

[13] Roman, A., & Irina, B. (2015). An empirical analysis of the macroeconomic determinants of non-performing loans in EU28 banking sector. *Revista economica*, *67*(2), 108.

[14] Mazreku, I., Morina, F., Misiri, V., Spiteri, J. V., & Grima, S. (2018). Determinants of the level of non-performing loans in commercial banks of transition countries. https://doi.org/10.35808/ersj/1040

[15] El-Maude, J. G., Abdul-Rahman, A., & Ibrahim, M. (2017). Determinants of non-performing loans in Nigeria's deposit money banks. *Archives of Business Research*, 5(1), 74-88. https://doi.org/10.14738/abr.51.2368

[16] Cucinelli, D. (2015). The impact of non-performing loans on bank lending behavior: Evidence from the Italian banking sector. *Eurasian Journal of Business and Economics*, 8(16), 59-71. https://doi.org/10.17015/ejbe.2015.016.04

[17] Bacchiocchi, A., Bischi, G. I., & Giombini, G. (2022). Non-performing loans, expectations and banking stability: A dynamic model. *Chaos, Solitons & Fractals*, 157, 111906. https://doi.org/10.1016/j.chaos.2022.111906

[18] Jiang, C., Kanas, A., & Molyneux, P. (2018). Public policy and financial stability: The impact of PCA and TARP on US bank non-performing loans. *International Journal of Finance & Economics*, 23(4), 376-392. https://doi.org/10.1002/ijfe.1622

[19] Do, H., Ngo, T., & Phung, Q. (2020). The effect of non-performing loans on profitability of commercial banks: Case of Vietnam. *Accounting*, 6(3), 373-386. https://doi.org/10.5267/j.ac.2020.1.001

[20] Serrano, A. S. (2021). The impact of non-performing loans on bank lending in Europe: An empirical analysis. The North American *Journal of Economics and Finance*, 55, 101312. https://doi.org/10.1016/j.najef.2020.101312

[21] Balgova, M., Nies, M., & Plekhanov, A. (2016). The economic impact of reducing non-performing loans. http://dx.doi.org/10.2139/ssrn.3119677

(Executive Editor: Yan Li)