

NON-PERFORMING LOANS AND THEIR DETERMINANTS: INSIGHTS FROM ECO NATIONS

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ABSTRACT

Non-performing loans pose a significant threat to the stability and sustain. This study examines the determinants of non-performing loans in Economic Cooperation Organization countries. The study has used two separate models. The first model focuses on macroeconomic determinants of non-performing loans along with bank-specific factors, while second model explores the macroeconomic factors only which can contribute to the reduction of NPLs. By using the panel data of ten ECO countries for period 2010-2023. The study employs second-generation methodology by following CD-test which is employed to determine cross-sectional dependence among variables, then slope homogeneity test such as Delta and HAC adjusted data are conducted to determine homogeneity or heterogeneity of the variables. CS-ARDL approach is employed for estimating both short-run and long-run relationship between dependent and independent variables. The outcomes of the study reveal strong positive relationship between external debt stocks, unemployment, inflation, population growth, bank liquid reserves to bank assets ratio, domestic credit to private sector by banks, regulatory quality, government effectiveness, corruption control and NPLs, while GDPG and LR are negatively associated with NPLs.

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INTRODUCTION

Non-Performing Loans (NPLs) are loans that borrowers are unable to repay on time, either because they have stopped making interest payments or missed the repayment of the loan amount. In simple terms, these are "bad loans" for banks, as the money they gave to borrowers is not coming back as expected. When NPLs increase, banks face losses and have less money to lend to other people or businesses. A high level of NPLs is also a sign that the economy or certain sectors are struggling, because people or companies cannot generate enough income to repay their debts. Therefore, managing and reducing NPLs is very important for the stability of banks and the overall economy.

NPLs have been a tenacious issue in banking sector since many decades. During 18th -19th centuries early banking systems faced credit risk issues due to merchant defaults. Moreover, lending done by banks for agriculture sector also led to non-performing loans. The unusual crop failures and price fluctuations in agricultural commodities made the farmers unable to repay loans. In 1929, the stock market crash and credit crisis occurred which triggered the global economic downturn named as Great Depression, that lasted for almost a decade. The Great Depression (1929-1939) led to widespread defaults and loan failures which rose the ratio of NPL by almost 40%. In the era of World War 2, many governments took massive debts and faced crises due to economic disruption and trade destruction. After World War 2, banks and regulatory frameworks

reconstructed and strengthened regulations to combat the bad debts. The ratio of NPLs declined till 1970, but banking deregulation occurred in 1970-1980s which increased the lending and competition among financial institutions. The financial market faced a lending boom when banks destructively lent to emerging markets, industries and entities. Moreover, oil price shock in 1979 led to increased economic downturns, which was significant event to trigger the ratio of NPLs (Bellotti et al., 2020).

During early 1990s-2000s, Japan, Scandinavia, Asia and Russia faced increasing ratio of non-performing loans. The deregulation of banks, savings and loan crisis in US also contributed to the increased ratio of NPLs. The Global Financial Crisis (2007-2008) significantly triggered the performance of NPLs due to increased default rates, decreased bank capital buffers, reduced loan (mortgages) recovery, higher provisioning requirements and reduced lending activity (Bolognesi et al., 2020). Furthermore, COVID-19 pandemic had significant impacts on global economy which contributed to an increased ratio of NPLs in past few years. In present era, financial authorities aim to reduce NPLs through regulatory tightening and other strategies. But the existing economic outlook presents various risks that can also contribute towards high ratio of NPLs worldwide, such as rising interest rates, regulatory changes, geopolitical instability, inflation and slow business activities. NPLs have been found to be affected by macroeconomic variables and bank-related factors (Beck et al., 2015).

The significance of the study is underlined by numerous key factors. Firstly, the previous studies have predominantly relied on traditional methodologies like ARDL, fixed and random effects, OLS and GMM, while this study employs advanced technique namely CS-ARDL approach. This methodology offers more accurate analysis of the data as it utilizes cross-sectional dependence test and slope homogeneity tests. Secondly, the study contributes to the research mainly focused on ECO countries, offering inclusive understanding and new insights of NPLs in this region.

The study is well-organized across five section. Section 2 gives the summary of existing literature on non-performing loans. Section 3 presents the model specification used in the study, definitions of the variables, data and methodology. Section 4 describes the results. Section 5 concludes the study and offers recommendations for policymakers to mitigate the NPLs in ECO countries.

LITERATURE REVIEW

This section presents the review of the existing studies on the determinants of non-performing loans. Table 1 shows the summary of studies on determinants of non-performing loans.

Table 1: Studies on determinants of non-performing loans

Reference (s)	Time Period	Country	Methodology	Main Results
Lan et al (2024)	2016-2022	Vietnam	FEM, REM, Pooled OLS	GDP and bank size had negative impact on NPL, while credit growth rate, loan to total assets ratio had negative impact on NPL.
Alnabulsi et al (2022)	2005-2020	Middle East and North Africa countries (MENA)	SGMM estimation technique	Bank-specific factors affect NPL more than macroeconomic factors. No impact of COVID-19 was observed.
Msomi (2022)	2008-2019	West countries	Random and fixed effects	Liquidity ratio, capital adequacy ratio and inflation rate
Golitsis (2022)	2005-2022	North Macedonia	ARDL	GDP had negative impact on NPL, while unemployment and inflation rate had positive impact.
Stefano & Dewi (2022)	2017-2019	Indonesia	Dynamic panel	Profitability had negative impact on NPL. Income diversification had positive impact while, bank capital and bank liquidity had no impact on NPL.
Hassan et al. (2022)	2008-2021	Pakistan	OLS	Internal and external factors had significant relationship with NPL's.
Fakhrunnas et al. (2022)	2005-2021	Indonesia	NARDL	An asymmetric relationship exists among macroeconomic variables and NPL.
Erdas & Ezanoglu (2022)	1998-2017	G20 countries	GMM	Credit growth, return on equity and credit costs had significant positive impact. capital adequacy and GDP had negative relation with NPL.
Anita et al (2022)	2008-2019	SAARC	OLS	GDP, money supply, inflation rate and foreign debt had negative impact on NPL.
Bukowski & Kosztowniak (2022)	2009-2021	Poland	VECM	GDP per capita and lending rate exert positive impact on NPL's. Real income exerts negative impact on NPL's.
Ferreira (2022)	1999-2019	All continents	GMM	Profitability, market stability and GDP had negative relation with NPL.
Karadima & Louri (2021)	2003-2020	Greece	ARDL	Macroeconomic variables affect NPL more than bank-specific variables.
Agic & Gagic (2021)	2004-2019	Bosnia and Herzegovina	Regression analysis	Credit growth rate had negative impact on NPL.
Purwanto & Sun (2021)	2010-2019	China	Multiple linear regression.	BIR and inflation rate had negative relation, while GDP, ROA and capital adequacy ratio had positive impact on NPL.
Masud & Hossain (2020)	2007-2016	Bangladesh	GMM	Return on assets had negative association, while GDP, inflation rate, stock prices had positive association with NPL.
Khafid et al. (2020)	2008-2019	Indonesia	Moderated regression	Credit risk and LDR ratio had positive relation with NPL, while CAR and NIM had no impact on NPL.
Kumar & Kishore (2019)	2008-2015	UAE	GMM, POLS, FE, RE, IV 2SLS	Bank specific factors had influence on NPL.
Zheng et al. (2019)	1979-2018	Bangladesh	ARDL and VEC	GDP profit, bank loan growth, unemployment had negative association, while bank liquidity, lending rates, domestic credit and exchange rates had positive association with NPL.
Farooq et al. (2019)	2009-2015	Gulf cooperation council countries	GMM	Bad management and bank profitability had negative link with NPL's.

Kjosvski et al. (2019)	2003-2014	Republic of Macedonia	ARDL and co-integration model.	Solvency and unemployment had positive impact, while profitability, GDP, growth of loans to enterprises and households had negative impact on NPL.
Koju et al. (2018)	2003-2015	Nepal	Static and Dynamic Panel estimation	Export to import ratio, assets size and inefficiency had positive influence, while inflation rate economic growth and CAR had negative influence on NPL.
Bayar (2018)	2000-2013	Emerging market economies	GMM	Public debt and unemployment had positive link with NPLs while economic growth and inflation rate had negative link.
Adusei (2018)	1998-2013	Ghana	Unrelated Regression Model and Principal Component Analysis.	Money supply, financial development and lending rate were significantly associated with NPL, while real income had negative association with NPL.
Wood and Skinner (2018)	1991-2015	Barbados	Multiple regression	LDR, ROE, GDP and interest rate were significant determinants of NPL's.
Wairimu & Gitundu (2017)	1998-2015	Kenya	Linear regression	Remittances and unemployment rate were significant macroeconomic factors of NPL's.
Rehman (2017)	1995-2015	South Asia	GMM	Macroeconomic factors affect NPL's hypercritically than bank-specific factors.
Waqas et al. (2017)	2000-2015	South Asian economies (Pakistan, India, Bangladesh)	GMM	Macroeconomic variables, bank-specific factors and other factors like skimping and bad management affect credit risk.
Kumarasinghe (2017)	1998-2014	Sri-Lanka	OLS regression analysis	GDP showed positive relationship with NPL.
Singh (2017)	2010-2016	Bhutan	Multiple regression analysis	GDP, inflation rate, fiscal policy, monetary policy had strong influence on NPL's.
Volos & Hadjiixenophontos (2017)	2008-2014	Cypriot	Correlation analysis and multiple regression analysis	Public debt was found to be most significant factor to affect NPL's, GDP had negative association while unemployment had positive association with NPL's.
Maude et al. (2017)	2010-2014	Nigeria	Correlation coefficient and multiple regression	LDR, bank size had significant positive relation, while ROA had negative relation with NPL's.
Ahmad (2017)	2005-2016	India	Correlation and linear regression analysis	Gross advances, gross advances with time lags and credit asset ratio had significant positive relation with NPL's.
Isik & Bolat (2016)	2006-2012	Turkey	Pooled OLS, FE, RE	Loan loss provisions and solvency had positive impact while profitability, economic growth, revenue diversification had negative impact on NPL's.
Raiha (2016)	2008-2012	Jordan	Panel data regression	Ratio of loans to total assets affected NPL's positively, while economic growth and inflation affected NPL's negatively.
Morakinyo & Sibanda (2016)	1998-2014	MINT countries	FEM, REM, GMM	Macroeconomic and bank-specific factors were causing bad debts.
Rifat (2016)	2003-2014	Bangladesh	OLS regression technique	Firm specific factors and money supply affect NPL's significantly.
Tsumake (2016)	2005-2014	Botswana	Linear multiple regression	Credit growth, profitability and macroeconomic variables had statistically significant association however, capitalization and diversification had statistically insignificant association with NPL's.

The available literature on determinants of non-performing loans that there are various factors which affect the NPLs in different regions at different time periods. The evaluation of the literature review has confirmed that macroeconomic variables such as GDP, export to import ratio, interest rate, public debt, inflation rate, remittances, unemployment rate and bank-specific variables like capital adequacy ratio, return on equity and profitability have strong impact on NPL ratio. The models such as GMM, ARDL, ECM, VECM, NARDL have been used to estimate the results in various countries mainly Bangladesh, Nigeria, SAARC, India, Malaysia, Botswana, China, Poland, Tanzania, Sri Lanka and Indonesia. The research gap which this study seeks to fill is, that there is not much work has been done on factors which determine the non-performing loans in ECO countries, thus there is much need of work to be done in this area. Moreover, the previous work has relied mainly on first generation techniques including GMM, ARDL and OLS. This study used second-generation methodology, namely CS-ARDL involving panel cointegration test, panel unit root test, which can examine the factors affecting non-performing loans in a much better way. This study aims at analyzing the factors which affect non-performing loans in ECO countries, to offer information that can be utilized in understanding this specific area.

MODEL, DATA AND METHODOLOGY

Model Specification

This part illustrates the specific model applied in the study. The core objective of this study is to determine the factors which affect non-performing loans in ECO countries.

Model 1: Determinants of Non-Performing Loans: Macroeconomic Variables along with Bank Specific Factors

This model investigates the factors which cause NPLs in ECO economies. The endogenous variable is NPL, while exogenous variables are external debt stocks, unemployment, inflation, GDP growth, lending interest rate, population growth, bank liquid reserves to bank assets ratio, domestic credit to private sector by banks.

External debt stocks have been utilized in the study because it shows significant impact on other macroeconomic indicators such as fluctuations in exchange rate, this may lead to default risks enabling

borrowers to pay back. Unemployment is a crucial variable used in study because high unemployment rates contribute to the increased ratio of bad debts in the economy. Likewise, inflation is also very important factor for determining NPLs ratio in any economy as hyperinflation reduces the purchasing power of individuals, making it difficult for borrowers to repay loans, thus leading to an increased ratio of default risks. GDP growth is incorporated because normally it indicates that high economic growth contributes to the reduced ratio of NPLs, as higher incomes of individuals, makes easier for them to repay loans on promising time. Lending interest rate has been included because it has a crucial impact on bad debts. Usually, high lending interest rate makes loans unattractive to many borrowers as they cannot pay higher interest amount on debt, thus contributing in the reduction of NPLs. Population growth is also a significant determinant as the population of an economy increases; this may lead to higher ratio of debt which automatically upsurges default risk. BLR and CREDIT are also significant variables to determine NPL ratio in an economy, these variables are based on bank lending behavior theory. The functional form of model 1 is represented as (Eq1) and econometric equation for model is as follows,

$$NPL = f(ED, UN, INF, GDPG, LR, PG, BLR, CREDIT) \quad (1)$$

The econometric equation for model 1 is given as:

$$NPL_{it} = \beta_0 + \beta_1 ED_{it} + \beta_2 UN_{it} + \beta_3 INF_{it} + \beta_4 GDPG_{it} + \beta_5 LR_{it} + \beta_6 PG_{it} + \beta_7 BLR_{it} + \beta_8 CREDIT_{it} + \varepsilon_{it} \quad (2)$$

Model 2: Determinants of Non-Performing Loans: Macroeconomic Variables

This model involves NPL as dependent variable and independent variables are external debt stocks, unemployment, inflation, GDP growth, lending interest rate, population growth, regulatory quality, government effectiveness and control of corruption. The variables like ED, UN, INF, GDPG, LR and PG are incorporated in the model on the basis of economic cycle theory. Regulatory quality, government effectiveness and control of corruption are examined on the base of agency theory.

For model 2, the functional form is organized as (Eq 3)

$$NPL = f(ED, UN, INF, GDPG, LR, PG, RQ, GE, CC) \quad (3)$$

The econometric functional form of model is exhibited as

$$NPL_{it} = \beta_0 + \beta_1 ED_{it} + \beta_2 UN_{it} + \beta_3 INF_{it} + \beta_4 GDPG_{it} + \beta_5 LR_{it} + \beta_6 PG_{it} + \beta_7 RQ_{it} + \beta_8 GE_{it} + \beta_9 CC_{it} + \varepsilon_{it} \quad (4)$$

Data

The study used panel data of ten ECO countries spanning from 2010-2023. Table 2 shows the description of key variables, unit of measurement and source of data collection.

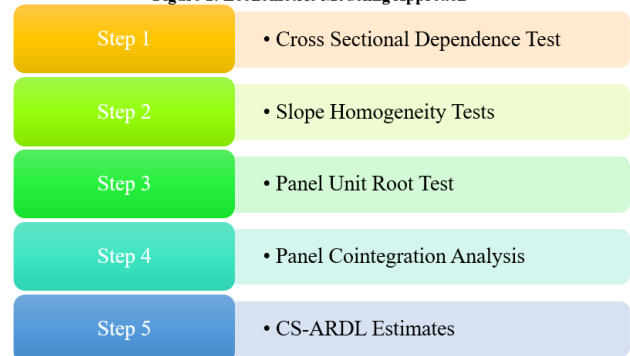
Table 2: Variables, Description, Unit of Measurement and Data source

Variables	Description	Unit of Measurement	Data Source
NPL	Bank non-performing loans to total gross loans	(%)	WDI
ED	External debt stocks	(% of GNI)	
UN	Unemployment, total	(% of total labor force)	
INF	Inflation, GDP deflator	(annual %)	
GDPG	GDP growth	(annual %)	
LR	Lending interest rate	(%)	
PG	Population growth	(annual %)	
BLR	Bank liquid reserves to bank assets ratio	(%)	
CREDIT	Domestic credit to private sector by banks	(% of GDP)	
RQ	Regulatory Quality	Estimate	
GE	Government effectiveness	Estimate	
CC	Control of Corruption	Estimate	

METHODOLOGY

This section frameworks the estimation of methodology of the study, which is divided into following steps. Initially, CD-test proposed by Pesaran et al. (2004) is used. Secondly, slope-homogeneity test is conducted to assess the hypothesis of homogeneity or heterogeneity among slope parameters across panel data. Thirdly, to check stationarity of the variables, CIPS second generation panel unit root test is used and then to determine long-run relationship among the key variables, panel cointegration tests are incorporated such as Westerlund, Kao, Pedroni tests. Lastly, CS-ARDL approach is employed to examine both short and long-run relationship. Figure1 presents the flowchart of the econometric modeling approach operated in the study.

Figure 1: Econometric Modeling Approach



The CS-ARDL model is a method that is employed in the analysis of panel data for determining long-run relationship among the variables by using autoregressive distributed lag (ARDL), cointegration and structural breaks among cross sectional units. The strength of CS-ARDL approach is that it can overcome the problem of exogeneity and endogeneity in order to estimate the impact of exogenous variables on endogenous variable as highlighted by Chudik and Pesaran, (2015) to ensure reliable and unbiased data. Secondly, CS-ARDL allows estimation for both short run and long run results among variables. Moreover, CS-ARDL also has some limitations as it is based on various assumptions and it involves a huge number of parameters which can lead to overfitting of the model.

RESULTS AND DISCUSSIONS

Summary Statistics

This section presents the descriptive statistics of key variables used in the study, including Non-Performing Loans (NPLs), external debt (ED), unemployment (UN), inflation (INF), GDP growth (GDPG), lending interest rate (LR), population growth (PG), bank liquid reserves ratio (BLR), domestic credit to the private sector (CREDIT), regulatory quality (RQ), government effectiveness (GE), and corruption control (CC). NPLs have a mean of 9.471%, median 7.332%, maximum 49.901%, minimum 0.709, and standard deviation 9.391, with positive skewness (2.346) and leptokurtic distribution (9.240). ED averages 53.949 with wide variation (SD 32.940), mild skewness (0.480), and platykurtic distribution (2.107). UN has a mean of 6.185, moderate variability (SD 3.163), slight skewness (0.688), and platykurtic distribution (2.507). INF averages 11.590, with high variability (SD 12.749), strong right skewness (4.615), and a leptokurtic distribution (25.064). GDPG averages 4.607, with high dispersion (min -20.739, max 14.326), negative skewness (-2.302), and leptokurtic distribution (14.431). LR averages 18.121, with SD 5.341, near-normal skewness (-0.057), and platykurtic distribution (2.088). PG averages 1.943 with low variability (SD 0.662), right skewness (0.800), and leptokurtic distribution (3.676). BLR has a mean of 26.439, high variability (SD 19.988), positive skewness (1.701), and leptokurtic distribution (5.291). CREDIT averages 23.763, with SD 17.091, right skewness (1.177), and leptokurtic distribution (3.588). RQ (mean -0.670) and GE (mean -0.655) both show small variation, near-normal skewness, and platykurtic distributions. CC averages -0.962 with low variability (SD 0.430), positive skewness (0.863), and near-mesokurtic distribution (2.905). Jarque-Bera tests across variables confirm varying levels of normality and significance.

Table 3: Summary Statistics

	NPL	ED	UN	INF	GDPG	LR	PG	BLR	CREDIT	RQ	GE	CC
Mean	9.471	53.949	6.185	11.590	4.607	18.121	1.943	26.439	23.763	-0.670	-0.655	-0.962
Median	7.332	47.282	5.090	9.206	4.800	18.665	1.896	19.723	19.530	-0.655	-0.664	-1.083
Maximum	49.901	132.263	13.730	96.036	14.362	29.647	4.078	97.849	70.897	0.463	0.432	0.161
Minimum	0.709	12.305	0.653	-2.198	-20.739	8.210	0.406	6.082	2.994	-1.730	-1.987	-1.645
Std. Dev.	9.391	32.940	3.163	12.749	4.318	5.341	0.662	19.988	17.091	0.569	0.526	0.430
Skewness	2.346	0.480	0.668	4.165	-2.302	-0.057	0.800	1.701	1.177	0.128	-0.041	0.863
Kurtosis	9.240	2.107	2.507	25.064	14.431	2.088	3.676	5.291	3.588	2.086	2.808	2.905
Jarque-Bera	213.359	6.442	5.491	2247.994	613.736	1.937	12.311	64.479	22.551	3.678	0.178	12.213
Probability	0.000	0.040	0.064	0.000	0.000	0.380	0.002	0.000	0.000	0.159	0.915	0.002

Correlation Analysis

This segment examines if there exists any relationship among key variables, Table 4 shows result of correlation analysis of significant variables used in the research. The first variable bank non-performing loan to total gross

loans has a positive weak correlation with ED, PG, BLR, CC, negative weak correlation with UN, LR, CREDIT, GE, negative moderate correlation with INF, RQ and GDPG. The second variable external debt has a strong positive relationship with RQ, moderate positive relationship with LR, CREDIT, weak positive relationship with GE and CC, negative weak relationship with UN, INF, GDPG, PG and BLR. The third variable unemployment has moderate positive correlation with BLR, weak positive correlation with INF, LR, PG, negative moderate with RQ and CC, while weak negative correlation with GDPG, CREDIT and GE. Inflation GDP deflator has moderate positive correlation with GE, weak positive correlation with GDPG, LR, CREDIT, moderate negative correlation with BLR, weak negative correlation with PG, RQ, CC. GDPG has positive weak relationship with PG, BLR and negative weak relationship with LR, CREDIT, RQ, GE, CC.

Lending rate has moderate positive correlation with CREDIT, RQ and weak positive correlation with PG, GE, while moderate negative correlation with CC and weak negative correlation with BLR. Population growth has strong positive relationship with BLR, while strong negative relationship with GE, moderate negative with CC and weak negative relationship with CREDIT and RQ. Bank liquidity ratio has strong negative correlation with GE, CC and moderate negative correlation with CREDIT, while weak negative correlation with RQ. CREDIT has moderate positive association with RQ, GE and CC. Regulatory quality is found to have moderate positive correlation with CC and weak positive correlation with GE. Government effectiveness has moderate positive association with CC.

Table 4: Correlation Analysis

	NPL	ED	UN	INF	GDPG	LR	PG	BLR	CREDIT	RQ	GE	CC
NPL	1.000											
ED	0.250	1.000										
UN	-0.218	-0.265	1.000									
INF	-0.321	-0.010	0.330	1.000								
GDPG	-0.301	-0.294	-0.176	0.188	1.000							
LR	-0.163	0.692	0.158	0.298	-0.164	1.000						
PG	0.002	-0.027	0.100	-0.124	0.263	0.047	1.000					
BLR	0.220	-0.199	0.352	-0.332	0.049	-0.059	0.751	1.000				
CREDIT	-0.135	0.532	-0.089	0.241	-0.281	0.410	-0.196	-0.587	1.000			
RQ	0.590	0.780	-0.369	-0.187	-0.298	0.346	-0.179	-0.227	0.376	1.000		
GE	-0.170	0.187	-0.081	0.354	-0.189	0.021	-0.754	-0.847	0.517	0.231	1.000	
CC	0.203	0.037	-0.365	-0.103	-0.117	-0.362	-0.586	-0.701	0.419	0.413	0.646	1.000

Cross-Sectional Dependence Test

This segment elaborates the results of cross-sectional dependence test. To check the cross-sectional dependence among significant variables we have applied CD-test. The null hypothesis is that there is no cross-sectional dependence and alternate hypothesis is that there exists cross-sectional dependence among variables. There is cross-sectional dependence among UN, LR, PG, RQ, GE and CC, excluding ED, INF, GDPG, BLR, CREDIT. Table 5 shows the results of cross-sectional dependence test

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Table 5: Cross-Sectional Dependence Test

Variable	CD-test	P-value
NPL	-1.623	0.105
ED	7.007	0.000
UN	0.029	0.977
INF	6.353	0.000
GDPG	5.243	0.000
LR	-1.112	0.266
PG	-0.770	0.441
BLR	3.379	0.001
CREDIT	-2.187	0.029
RQ	-0.729	0.466
GE	-1.390	0.164
CC	-0.498	0.618

Slope Homogeneity Test

This segment presents results of the slope-homogeneity test. The results from Table 6 indicate that the null hypothesis of slope homogeneity is accepted. With all p-values of 0.000 for both Delta and HAC robust adjusted delta tests, there is strong evidence that the slope homogeneity exists across all the cross-sectional units.

Table 6: Slope Homogeneity Test

		(Pesaran and Yamagata, 2008)		(Blomquist and Westerlund, 2013)	
		Delta Test	P-Value	HAC Robust Adjusted Delta Test	P-Value
1	Adj	-2.863	0.000	-2.768	0.000
	Un-Adj	2.544	0.000	2.753	0.000
2	Adj	3.954	0.000	3.437	0.000
	Un-Adj	3.566	0.000	3.908	0.000

Panel Unit Root Test

This segment conducts a unit root test to check stationarity or non-stationarity of the variables. Table 7 displays the unit root analysis using the CSDIPS second generation panel unit root test reveals if unit root exists or not.

Table 7: Results of Second-Generation Panel Unit Root

Second Generation Panel Unit Root Test						
Cross-Section-Dependence based Im-Pesaran-Shin (CSDIPS) Unit Root Test						
Variables	Without Trend			With Trend		
	Lags	Zt Statistics	P-Value	Lags	Zt Statistics	P-Value
NPL	0	-2.624	0.004	0	-2.195	0.014
ED	1	0.441	0.670	1	-1.178	0.119
UN	0	-2.852	0.000	0	-3.965	0.000
INF	0	-4.926	0.000	0	-4.415	0.000
GDPG	0	-5.172	0.000	0	-2.605	0.005
LR	0	-0.379	0.352	1	1.179	0.881
PG	0	0.815	0.793	1	1.845	0.967
BLR	0	0.176	0.570	1	-0.889	0.187
CREDIT	1	2.954	0.998	1	0.994	0.840
RQ	0	2.788	0.000	1	-1.240	0.108
GE	1	1.631	0.949	1	1.707	0.056
CC	0	1.025	0.847	1	0.217	0.586

A small p-value indicates the rejection of null hypothesis that the series has a unit root such as in case of following variables; NPL, UN, INF, GDPG, RQ. NPL, UN, INF, GDPG and RQ are stationary at 0 lag without trend while GDPG and RQ are non-stationary at 1 lag with trend.

A large p value indicates that the series have a unit root like ED, LR, PG, BLR, CREDIT, GE, CC are non-stationary. ED, CREDIT and GE are non-stationary at 1 lag without trend while LR, PG, BLR and CC are non-stationary at 0 lag without trend and at 1 lag with trend.

Panel Cointegration Analysis

This segment inspects presence of cointegration among key variables. Table 8 illustrates the different tests like Westerlund with models Gt, Ga, Pt, Pa, Kao test with Modified dickey fuller, dickey fuller, augmented dickey

fuller, unadjusted modified dickey, unadjusted dickey fuller and Pedroni with modified Phillips perron, Phillips-perron, Augmented Dickey Fuller model.

The cointegration test for panel data suggests if there is existence of long-run relationship or not among variables. The p-value of all other test suggest existence of long-run relationship except Kao dickey fuller and Pedroni modified Phillips perron test.

Table 8: Panel Cointegration Tests

Models		Gt	Ga	Pt	Pa
1	Westerlund Test	-2.061 (0.043)	-2.542 (0.044)	-3.659 (0.003)	-3.664 (0.002)
2		-1.466 (0.041)	-2.870 (0.024)	-4.189 (0.000)	-2.6522 (0.099)
D i c k e y - F u l l e r					
		Modified Dickey-Fuller	Augmented Dickey-Fuller	Unadjusted Modified Dickey	Unadjusted Dickey-Fuller
1					
	Kao Test	1.725 (0.042)	1.931 (0.026)	-4.960 (0.000)	-5.768 (0.000)
2					
		1.325 (0.072)	2.249 (0.012)	-4.869 (0.000)	-1.015 (0.015)
P e d r o n i					
		Modified Phillips-Perron	Phillips-Perron	Augmented Dickey-Fuller	
1	Pedroni Test	-0.577 (0.281)	-6.939 (0.000)	-5.098 (0.000)	
2		1.760 (0.039)	-1.786 (0.037)	-1.497 (0.067)	

CS-ARDL Estimates

This segment provides the empirical results of CS-ARDL model, detailing both short-run and long-run effects of determinants of non-performing loans in ECO countries. Table 9 displays CS-ARDL (Cross-Sectional Autoregressive Distributed Lag) model estimates for short run and long-run effects.

Table 9: CS-ARDL Estimates

Variables	Model 1	Model 2
Short-Run		
$\Delta ECT (-1)$	-0.606*** (0.209)	-0.987** (0.490)
ΔED	-0.237** (0.0974)	0.0385 (0.0290)
ΔUN	-0.559* (0.290)	-0.895* (0.511)
ΔINF	-0.348*** (0.134)	-0.433*** (0.130)
$\Delta GDPG$	-0.0132 (0.278)	0.0860 (0.521)
ΔLR	-0.513*** (0.162)	-0.714** (0.306)
ΔPG	0.0251* (0.0136)	0.0262* (0.0134)
ΔBLR	0.0273* (0.0161)	
$\Delta CREDIT$	-0.714** (0.306)	
ΔRQ		-0.987** (0.490)
ΔGE		0.0273* (0.0161)
ΔCC		-0.513*** (0.162)

ED	0.0924*	0.0784*
	(0.0511)	(0.0426)
UN	0.782**	0.665**
	(0.368)	(0.285)
INF	0.0923*	0.0832**
	(0.0448)	(0.0311)
GDPG	-0.0432**	-0.0442**
	(0.0196)	(0.0187)
LR	-0.0376***	-0.0377***
	(0.0113)	(0.0107)
PG	0.0380***	0.340**
	(0.0143)	(0.135)
BLR	0.537**	
	(0.221)	
CREDIT	0.0788*	
	(0.0453)	
RQ		-0.0458*
		(0.0249)
GE		-0.0382*
		(0.0204)
CC		-0.439**
		(0.186)
Constant	4.556**	2.950**
	(2.270)	(1.459)

There are two models developed in the study. In the first model, bank non-performing loans to total gross loans (NPL) is taken as dependent variable, external debt stocks, unemployment, inflation GDP deflator, GDP growth, lending interest rate, population growth, bank liquid reserves to bank assets ratio, domestic credit to private sector by banks as independent variables. In second model, dependent variable is same but independent variables are external debt stocks, unemployment, inflation GDP deflator, GDPG, lending interest rate, population growth, regulatory quality, government effectiveness and control of corruption.

For first model, in the short run, the Error Correction Term (ECT (-1)) is -0.606 and statistically significant, representing strong and significant adjustment towards equilibrium. The speed of convergence is approximately 49-50 days.

In long-run results of the first model the first variable external debt stocks have a coefficient value of 0.0924 and p-value is 0.0511 and in the second model, the coefficient value is 0.0784 and p-value is 0.0426, indicating that ED has a positive relationship with NPL, which is statistically significant. There are various reasons behind this effect, primarily high level of external debt in an economy can make it vulnerable to economic stresses which may contribute to higher ratios of NPL. Secondly, currency depreciation in an economy and currency appreciation in another economy can contribute to the burden of external debt. Thirdly, fiscal imbalances like large budget deficits leads to high level of external debt also increase the risk of NPLs (Ahiase et al. 2024).

The second variable is UN having coefficient value of 0.782 and p-value is 0.368 in first model and having coefficient value of 0.665 and p-value of 0.665 in second model, representing a positive relationship with NPL which is statistically significant. There are several reasons, firstly when unemployment increases, per capita income reduces which makes it difficult for borrowers to repay loans leading to an increase in NPLs. Secondly, high unemployment leads to the economic downturns thus, increasing ratio of NPLs in economies. Lastly, income reduces and purchasing power decreases when unemployment rises in an economy (Golitsis, 2022).

INF has a coefficient value of 0.0923 and p-value is 0.0448 in first model, coefficient value of 0.0832 and p-value of 0.0311 showing positive impact on NPL, which is highly significant. Primarily, inflation reduces the purchasing power of individuals as a result of this borrower may face difficulties in repaying debts. Secondly, businesses might face expensive input costs which can lead to the business cycle disturbances leading to high NPL ratio. Thirdly, central banks raise the interest rate in order to combat inflation in the economy. The fluctuations in interest rate leads to many disturbances in the economy, which contribute to the increased ratio of non-performing loans. (Golitsis, 2022), Masud & Hossain, 2020). These findings are opposite to Purwanto & Sun, (2021) and Bayar, (2018) findings.

In first model, GDPG has a coefficient value of -0.0432 and the p-value is 0.0196 and -0.0442 and p-value of 0.0187 in second model, indicating a negative impact on non-performing loans which is highly statistically significant. Primarily, increase in economic growth tends to increase income of individuals which enables them to repay loans, thus reducing the risk of NPLs. Moreover, GDP growth leads to an increase in investment. Lastly, rise in GDP growth improves the financial stability of banks thus mitigating the ratio of NPL in economy. The results are similar to the results analyzed by Ferreira (2022) and contrary to the Anita et al (2022), Bukowski & Kosztowniak (2022).

The variable LR having coefficient value of -0.0376 and a p-value of 0.0113 in first model and in second model coefficient value is -0.0377 and p-value is 0.0107, represents a negative relationship with NPL, that is statistically significant. There are several reasons behind this affect such as when interest rate rises, the cost of borrowing also increases thus making loans unattractive to the borrowers, as

individuals and businesses would not like to pay high interest on loans. This reduces the lending activity, as a result risky credits can be avoided. Secondly, high interest rates can attract the savers to save more as they enjoy high interest amount, resulting in increased savings in the financial system. Last but not the least, higher lending rates can contribute to the improved credit quality as banks can lend more carefully, lowering the risk of non-performing loans. The results are similar to the findings of (Bukowski & Kosztowniak, 2022) and contrary with the outcomes of (Ferreira, 2022).

Population growth has a coefficient value of 0.0380 and p-value recorded is 0.0143 in the first model and in second model coefficient value is 0.340 and p-value is 0.135. This reveals that population growth has a positive relationship with NPL. The main reason behind this positive relationship is that when the population growth increases the demand for credit also increases, as individuals have to meet their daily base needs. But this increase in the lending activity of banks often leads to unpaid loans thus, contributing to the high ratio of NPLs. Additionally, population growth can lead to income inequality as all individuals can not earn the same income in economy, which can increase the risk of credit default among individuals with lower income. Lastly, rapid growth of population can increase the unemployment in economy as growing workforce would not be able to secure jobs, this can cause higher ratio of non-performing loans because unemployed persons might face difficulties in repaying loans (Ahiase et al. 2024).

BLR has a coefficient value of 0.537 and p-value observed is 0.221, shows that bank liquid reserves to bank assets ratio has a positive relationship with NPL, which is statistically significant. There are some reasons behind this relationship such as when banks hold assets as liquid reserves their lending activity decreases, due to less capital allocated for lending practices. In order to sustain profitability, banks might lend to risky borrowers which will increase the ratio of non-performing loans. The second reason can be the low confidence of investors as in economic stress periods, investors might modify their investments from risky assets to safe assets. This modification can lead to the risk of non-performing loans. Moreover, banks can lend loans without acknowledging the behavior of borrowers and their credit history, this might result in higher ratio of non-performing loans (Ahmad, 2017).

The last variable of first model is CREDIT, which has a coefficient value of 0.0788 and p-value is 0.0453,

which indicates a positive impact of domestic credit to private sector by banks on non-performing loans which is statistically significant. There are many reasons for this relationship such as when banks credit to private sector more this causes lending to the borrowers with weak credit history, which results in increased loan defaults. The results are similar to the findings done by Erdas & Ezanoglu, (2022) and contradictory to the results obtained by Agic & Gagic, (2021).

In second model, regulatory quality has coefficient value of -0.0458 and p-value is 0.0249, revealing negative relationship with non-performing loans which is significant. The reasons behind this negative relationship are effective regulations done by banks such as credit assessments, improved risk management and loan monitoring while advancing loans. By managing lending practices and robust regulations ratio of non-performing loans can be declined (Rajha, 2016). Banks with improved lending regulations that enforce penalties for delaying loan payments have reduced ratios of non-performing loans as it restricts the borrowers to repay loans on time and to fulfill loan obligations (Farooq et al, 2019).

GE has coefficient value of -0.0382 and p-value is 0.0204, indicating negative relationship with NPL, which is non-significant. The reasons which justify this negative relationship includes government regulation in maintaining economic stability which will reduce the ratio of NPLs in the economy. Furthermore, by implementing strong fiscal policies expansionary or contractionary as needed for the soundness and macroeconomic constancy of the economy. Last but not the least, by executing rules and laws for encouragement of borrowers to pay loans back thus mitigating the ratio of NPLs and creating a stable environment for banks to perform their functions efficiently (Ahiase et al. 2024).

Control of Corruption has a coefficient value of -0.439, p-value of 0.186, showing negative relationship with non-performing loans. The reasons behind this relationship are that higher level of corruption control contributes to the sound banking sector in which loans are advanced on the base of creditworthiness. Furthermore, factors like political connections and bribery cannot influence the lending activities of banks which mitigates the ratio of NPLs. Lastly, low levels of corruption boost the confidence of investors and depositors in financial markets, thus enhancing the financial stability of economy (Ahiase et al. 2024). The findings are contrary with the outcomes obtained by (Ahmad, 2013).

CONCLUSIONS

The study purpose is to examine the factors that determine non-performing loans in ECO countries. The main goals of study are: to identify the determinants of non-performing loans and to suggest policy recommendations for the management and reduction of NPLs. In order to achieve these objectives, the study used two separate models. The first model focuses on recognizing the determinants of non-performing loans, while second model explores the factors which can contribute to the reduction of NPLs. By using the panel data of ten Economic Cooperation Organization (ECO) countries (Afghanistan, Azerbaijan, Iran, Kazakhstan, Kyrgyzstan, Pakistan, Tajikistan, Turkmenistan, Turkey, Uzbekistan) for period 2010-2023. The study employs second-generation methodology by following CD-test which is employed to determine cross-sectional dependence among variables, then slope homogeneity test such as Delta and HAC adjusted data are conducted to determine homogeneity or heterogeneity of the variables. Following this panel unit root test is used to check the data stationarity and then panel co-integration test including Westerlund test, Kao test and Pedroni test, revealing solid evidences of co-integration among variables are used. At last, CS-ARDL approach is employed for estimating both short-run and long-run relationship between dependent and independent variables. The first model includes NPLs as dependent variable and independent variables used are ED, UN, INF, GDPG, LR, PG, BLR and CREDIT. The second model used NPLs as dependent variable and ED, UN, INF, GDPG, LR, PG, RQ, GE and CC are taken as independent variables. The outcomes of the study reveal strong positive relationship between ED, UN, INF, PG, BLR, CREDIT, RQ, GE, CC and NPLs, while GDPG and LR are negatively associated with NPLs.

POLICY RECOMMENDATIONS

The section suggests policy recommendations based on findings of the study.

- The outcomes of the study reveal that external debt stocks have positive relationship with non-performing loans. As the increase in external debt stocks will contribute to the increased NPL ratio, thus policy makers should focus on strategies to control external debt stocks which can reduce the risk of non-performing loans in ECO countries.
- The findings indicate positive relationship among unemployment and NPLs. It is recommended that policymakers should adopt

such policies which can provide employment opportunities for the masses.

- The study indicates direct relationship between inflation and NPLs, so it is recommended that proposers should adopt such policies, which aim at stabilizing the general price levels and controlling inflation to mitigate NPLs.
- The outcomes of the study reveal that GDPG has negative relationship with non-performing loans. As the increase in GDPG will contribute to the reduced NPL ratio, thus policy makers should focus on strategies which can expand the economic stability in ECO economies.
- The results reveal significant negative relationship between LR and NPL, meaning that rise in lending interest rate will reduce the ratio of non-performing loans as lending activities by borrowers will reduce. Thus, banks should focus on raising lending interest rate to mitigate non-performing loans in ECO nations.
- The study indicates positive relationship among population growth and non-performing loans. Thus, government should spread awareness about family planning for controlling population which can reduce the ratio of NPLs in ECO countries.
- The analysis revealed positive relationship between BLR and NPLs. The banks should focus on improving management and to reduce lending activities to mitigate NPLs ratio in ECO economies.
- The work revealed direct relationship between CREDIT and NPLs, it is recommended that regulatory authorities should implement penalty policies and loans should be granted to creditworthy borrowers. This will help to decrease the high ratio of non-performing loans in ECO states.
- The findings of the study show negative relationship among RQ and NPLs. Thus, it is advised that regulators should focus on developing effective strategies such as improved lending regulations to avoid loan risk defaults to decline the ratio of non-performing loans in ECO countries.
- The study exhibits negative relationship between GE and NPLs, so it is proposed that authorities must pay attention towards sustainable growth projects and offer such policies which provides welfare for the public, as it will contribute to the reduction of NPLs in ECO region.

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