Impact of Macro Economic factors on Non-Performing Assets with reference to Indian Banking Sector

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Abstract

This study investigates the impact of macroeconomic factors on Gross Non-Performing Assets (GNPAs) in the Scheduled Commercial Banks (SCBs) using annual data from 1997 to 2024. The study adopts econometric model approach for analysis and incorporates key macroeconomic variables such as GDP growth, exchange rate, interest rate, inflation (CPI), fiscal deficit, Cash Reserve Ratio (CRR), and Statutory Liquidity Ratio (SLR). The Augmented Dickey-Fuller (ADF) test is employed to examine the stationarity properties of the variables, confirming a mixed order of integration. Accordingly, the Autoregressive Distributed Lag (ARDL) bounds testing approach is used to analyze both long-run and short-run relationships.

The bounds test results confirm the existence of a long-run equilibrium relationship between GNPAs and the selected macroeconomic variables. The long-run findings indicate that interest rate, fiscal deficit, CRR, and SLR significantly influence NPAs, highlighting the role of monetary and fiscal policies in determining banking sector stability. The error correction term is negative and statistically significant, suggesting a stable adjustment mechanism toward long-run equilibrium. Diagnostic and stability tests confirm the robustness of the model. The study emphasizes the importance of macroeconomic stability and coordinated policy measures in controlling NPAs in India.

Keywords: Non-Performing Assets; Macroeconomic Factors; ARDL Model; Scheduled commercial banks; Monetary Policy; Fiscal Deficit.

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Introduction

The banking sector is the backbone of economic growth, as it mobilizes savings and channels them into productive investments that support industrial expansion, employment generation, and overall economic development. In India, banks play a crucial role in providing credit to key sectors, facilitating trade, supporting government initiatives, and maintaining financial stability. However, this central role also exposes banks to significant risks, particularly credit risk arising from lending activities. When borrowers fail to repay loans, it directly affects banks' income and efficiency, making asset quality a critical concern for the Indian banking system.

Non-Performing Assets (NPAs) represent one of the most serious challenges faced by Indian banks, as they reduce interest income, erode capital, and threaten financial stability. As defined by the Reserve Bank of India, an asset becomes non-performing when interest or principal remains overdue for more than 90 days. RBI further classifies NPAs into substandard, doubtful, and loss assets based on the duration and recoverability of default. Rising NPAs not only weaken the profitability and capital position of individual banks but also pose systemic risks to the entire banking sector, highlighting the importance of understanding macroeconomic factors that influence their growth.

The need for this study arises from the growing concern over the rising levels of Non-Performing Assets (NPAs) in the Scheduled commercial banks, which threaten banks' profitability, capital adequacy, and overall financial stability. Despite several policy reforms and regulatory measures introduced by the Reserve Bank of India and the Government of India, the continued persistence of high NPAs suggests the influence of deeper macroeconomic factors beyond bank-specific issues. Macroeconomic variables such as GDP growth, inflation, interest rates, exchange rate movements, fiscal deficit, and unemployment significantly affect borrowers' repayment capacity, especially during periods of economic slowdown or instability. Understanding the relationship between these macroeconomic factors and NPAs is therefore essential to help banks, regulators, and policymakers identify early warning signals, manage credit risk more effectively, and design policies that support a stable and resilient banking system. The problem of Non-Performing Assets (NPAs) has become a major concern for the stability and profitability of the Indian banking sector. Rising NPAs erode banks' capital base, weaken their lending

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capacity, and adversely impact economic growth. Despite numerous policy reforms and regulatory interventions by the Reserve Bank of India (RBI) and the Government of India, the persistence of high NPAs indicates the presence of deeper, macroeconomic linkages that require systematic investigation.

Review of Literature

Sharma and Verma (2024), examined the macroeconomic determinants of Non-Performing Assets (NPAs) in the Indian banking sector for the period 2010–11 to 2022–23. Using panel regression analysis, the study found that GDP growth had a significant negative relationship with NPAs, whereas inflation and interest rates showed a positive association with rising NPAs. The authors concluded that stable macroeconomic conditions and effective credit appraisal systems are essential to maintain asset quality and reduce financial stress in banks.

Bharti, Singh, and Kumar (2023), conducted a trend analysis of Non-Performing Assets (NPAs) in Scheduled Commercial Banks in India, covering the period from 2008-09 to 201718. Their descriptive research highlighted the significant effect of NPAs on the performance of public, private, and foreign banks, with public-sector banks showing higher NPA levels. The study emphasizes the need for careful monitoring of defaulters and advocates for the introduction of innovative policies by the government and regulatory authorities to minimize NPAs and improve asset quality within the banking sector.

Sengupta and Bhardhan (2018), argued that regulatory forbearance did not facilitate resolution and could actually worsen the banking crisis by providing incentives to the banks to defer NPA recognition and delaying actions for loan recovery. Restructuring of a loan should be the commercial decision of a bank and should not automatically qualify for regulatory concessions in terms of deferment of recognition of NPAs.

Samantaraya (2015), studied on pro cyclical credit growth and bank Non-Performing Assets in India focusing on various issues for surging Non-Performing Assets for the period 2009-10 to 2013-14 and found economic slowdowns aggravated loan delinquencies in banks.
Excessive credit growth at the time of economic boom might have resulted in NonPerforming Assets.

Ghosh Roy (2014), analysed trends of Non-Performing Assets for the period 1996-97 to 2012-13 in Indian banks and its determinants with several financial parameters applying panel regression and found GDP growth, change in

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exchange rate and global volatility had major effects on Non-Performing Assets level on Indian banking sector.

Karim et al. (2010), investigated the relationship between non-performing loans and bank efficiency in Malaysia and Singapore. Authors on the basis of Tobit simultaneous equation regression results, clearly specified that higher non-Performing loans reduced cost efficiency and poor management in banking institution resulting in bad quality loans.

Das and Ghosh (2003), empirically examined non-performing loans of India's public sector banks in terms of various indicators such as asset size, credit growth and macroeconomic condition, and operating efficiency indicators.

Kannan (1999), examined the issue of Non-Performing Assets (NPAs) in Indian commercial banks in the post-liberalization period. The study highlighted that the rising level of NPAs was mainly due to weak credit appraisal systems, directed lending policies, and poor recovery mechanisms. The author emphasized the need for stronger prudential norms and strict supervision by the Reserve Bank of India (RBI) to improve asset quality and ensure financial stability.

Objectives of the Study

- To analyse the trend of NPAs of Schedule Commercial Banks (SCBs).
- To analyze the trend and pattern of Gross Non-Performing Assets in the Scheduled Commercial banks over the study period.
- To examine the stationarity properties of macroeconomic variables and GNPAs using the Augmented Dickey-Fuller (ADF) test.
- To investigate the existence of a long-run relationship between GNPAs and selected macroeconomic variables using the ARDL bounds testing approach.
- To estimate the long-run impact of GDP Growth, Exchange Rate, Interest Rate, Inflation, Fiscal Deficit, CRR, and SLR on GNPAs.
  To analyze
- the short-run dynamics and speed of adjustment toward equilibrium using the Error Correction Model (ECM).
- To evaluate the stability and robustness of the estimated model through diagnostic and stability tests.

Research Methodology

The study adopts a quantitative research design using annual time-series data from 1997 to 2024. An econometric approach is employed to estimate the relationship between GNPAs and selected macroeconomic variables. The Autoregressive

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Distributed Lag (ARDL) model is used because it allows estimation of both short-run dynamics and long-run equilibrium relationships among variables integrated of order I(0) and I(1).

Variables Used in the Study

Dependent Variable: GNPA**s** – Gross Non-Performing Assets of Scheduled Commercial Banks, considering SCBs as proxy for banking sector.

Independent Variables: The macro economic variables considered are

1) GDP (Growth Rate) **–** Indicator of economic performance
2) Exchange Rate (ER) **–** INR per USD
3) Interest Rate (IR) **–** Policy/Bank lending rate
4) Inflation (CPI) **–** Consumer Price Index
5) Fiscal Deficit (FISCAL) **–** Government fiscal deficit as % of GDP
6) CRR **–** Cash Reserve Ratio
7) SLR – Statutory Liquidity Ratio

Software: All econometric estimations and diagnostic tests are performed using EViews 12 Student Lite Version.

Sources of data: Table 1 presents the sources of data from where the data was drawn.

S No:	Variable	Name	Source
1	Dependent Variable	Gross Non Performing Assets	www.rbi.com
2	Independent Variable	GDP (Growth)	www.worldbank.com
		Exchange Rate	
		Interest Rate	
		Inflation (CPI)	
		Fiscal Deficit	
		CRR	www.rbi.com
		SLR	
Table 1: Sources of data.			

Model Specification: The general functional form of the model is:

GNPAs=f(GDP,ER,IR,CPI,FISCAL,CRR,SLR)

Results and Discussion: To analyse the trend of Non-Performing Assets (NPAs), annual data starting from 1997 to 2024 was taken into consideration, Net NPAs of

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Scheduled Commercial banks is presented using a line graph and presented in figure 1.
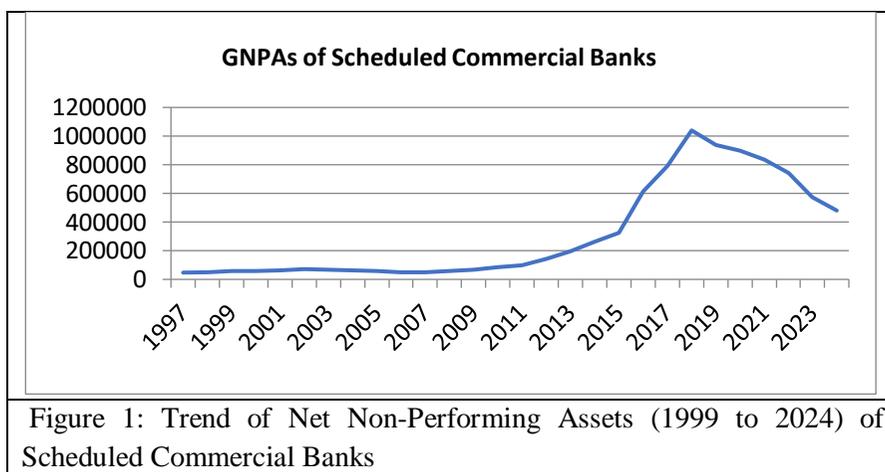

Figure 1: Trend of Net Non-Performing Assets (1999 to 2024) of Scheduled Commercial Banks

The graph shows that GNPAs of Scheduled Commercial Banks remained relatively low and stable from 1997 to around 2011. From 2012 onwards, there was a sharp rise, peaking around 2018, indicating a severe banking asset quality crisis. After 2018, GNPAs steadily declined, showing improvement in banks' financial health. By 2024, the level of bad loans had reduced significantly compared to the peak period.

Stationarity of the Series: Stationarity is tested to ensure that the time series data do not produce spurious or misleading regression results and testing for stationarity ensures validity, reliability, and proper model specification in the analysis. The Augmented Dickey–Fuller (ADF) unit root test was conducted to examine the stationarity properties of the variables used in the study. The output of the summary of all the variables are presented in Table 2.The results indicate that GDP growth is stationary at level, as its p-value (0.0004) is significant at the 5 percent level, implying that it is integrated of order zero, I(0). However, Gross Non-Performing Assets (GNPAs), exchange rate, interest rate, inflation (CPI), fiscal deficit, CRR, and SLR were found to be non-stationary at their levels since their probability values exceeded 0.05. After taking first differences, all these variables became statistically significant at the 5 percent level, indicating stationarity at first difference. Therefore, these variables are integrated of order one, I(1). Since the variables exhibit a mixed order of integration, with some being I(0) and others I(1), and none integrated of order two, the Autoregressive Distributed Lag (ARDL) bounds testing approach is considered appropriate for examining the long-run

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relationship between macroeconomic factors and GNPAs in the Scheduled commercial banks.

S No.	Variable	level		1st lag	
		t-Statistic	Prob.	t-Statistic	Prob.*
1.	GNPAs	-3.0789866	0.1326	-3.708918	0.0443*
2.	GDP (Growth)	-4.984729	0.0004*		
3.	Exchange Rate	-1.014875	0.9250	-4.854742	0.0033*
4.	Interest Rate	-2.714049	0.0847	-6.150621	0.0000*
5.	Inflation (CPI)	-2.554881	0.1145	-7.543127	0.0000*
6.	Fiscal Deficit	-1.929421	0.6117	-4.713680	0.0045*
7.	CRR	-2.704411	0.0863	-4.747113	0.0008*
8.	SLR	-0.552402	0.8638	-0.552402	0.0004*

Table 2: Augmented Dickey Fuller Test Results
Source: Eviews output.
* significant at 5 percent level of significance.

Given the mixed order of integration among the variables, the Autoregressive Distributed Lag (ARDL) bounds testing approach developed by Pesaran et al. (2001) is employed to examine the long-run relationship between macroeconomic variables and Gross Non-Performing Assets (GNPAs) in the Scheduled commercial banks. The ARDL approach is particularly suitable as it can be applied irrespective of whether the regressors are purely I(0), purely I(1), or mutually cointegrated, provided none of the variables is integrated of order two. Furthermore, the ARDL model is appropriate for small sample sizes and allows for the simultaneous estimation of both long-run equilibrium relationships and short-run dynamic adjustments through an Error Correction Model (ECM). Accordingly, the optimal lag length is selected using the Akaike Information Criterion (AIC), and the bounds test is conducted to determine the existence of cointegration among the variables. The output of ARDL model is presented below. The ARDL(1,1,0,1,1,1,0,1) model selected using the Akaike Information Criterion (AIC) shows a strong overall fit. The R-squared value of 0.9868 and adjusted R-squared of 0.9736 indicate that approximately 98 percent of the variation in Gross Non-Performing Assets (GNPAs) is explained by the included macroeconomic variables. The F-statistic (74.7132) is highly significant ($p < 0.01$), confirming the joint significance of the regressors. The Durbin–Watson statistic of 2.118 suggests the absence of autocorrelation, indicating that the model is dynamically well specified. The coefficient of the lagged dependent variable, GNPAS(-1), is positive and

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statistically significant (p = 0.0242), indicating persistence in non-performing assets. This suggests that past levels of NPAs significantly influence current levels, reflecting structural rigidity in the banking sector.

Dependent Variable: GNPAS
Method: ARDL
Date: 02/12/26   Time: 21:03
Sample (adjusted): 1998 2024
Included observations: 27 after adjustments
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): GDP ER IR CPI FISCAL CRR SLR
Fixed regressors: C
Number of models evaluated: 128
Selected Model: ARDL(1, 1, 0, 1, 1, 1, 0, 1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
GNPAS(-1)	0.449446	0.176243	2.550141	0.0242
GDP	-2376.860	8454.873	-0.281123	0.7830
GDP(-1)	-16471.99	5452.086	-3.021227	0.0098
ER	14724.80	7807.308	1.886028	0.0818
IR	-26771.64	10328.25	-2.592080	0.0223
IR(-1)	-11054.64	7871.026	-1.404472	0.1836
CPI	-3999.354	10757.73	-0.371766	0.7161
CPI(-1)	-11808.64	7705.271	-1.532541	0.1494
FISCAL	-0.232248	0.166260	-1.396895	0.1858
FISCAL(-1)	-0.418921	0.166645	-2.513854	0.0259
CRR	48271.26	15816.08	3.052037	0.0093
SLR	-67374.41	31868.64	-2.114129	0.0544
SLR(-1)	-34880.12	16405.47	-2.126128	0.0532
C	2165665.	1198334.	1.807230	0.0939

R-squared	0.986792	Mean dependent var	323734.4
Adjusted R-squared	0.973584	S.D. dependent var	341970.4
S.E. of regression	55580.22	Akaike info criterion	24.99519
Sum squared resid	4.02E+10	Schwarz criterion	25.66711
Log likelihood	-323.4351	Hannan-Quinn criter.	25.19499
F-statistic	74.71232	Durbin-Watson stat	2.118488
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

Among the macroeconomic variables, the exchange rate (ER) has a positive and statistically significant impact (p = 0.0188), implying that currency depreciation increases GNPAs, possibly due to higher repayment burdens on borrowers exposed to foreign currency fluctuations. Interest rate (IR) shows a negative and significant contemporaneous effect (p = 0.0223), suggesting that tighter monetary policy may improve credit discipline and reduce NPAs in the short run, although its lagged value is not statistically significant.

GDP and its lag are not statistically significant, indicating that economic growth does not have a direct short-run impact on asset quality during the study period. Inflation (CPI) and fiscal deficit do not show strong contemporaneous significance; however, the lagged fiscal deficit variable is statistically significant (p = 0.0259), suggesting that expansionary fiscal conditions influence banking sector stress with a time lag.

CRR is positive and highly significant (p = 0.0093), indicating that changes in reserve requirements significantly affect GNPAs, possibly through liquidity and

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lending channel effects. The lagged value of SLR is negative and marginally significant (p = 0.0532), suggesting that stronger liquidity regulations may reduce non-performing assets over time.

Overall, the results indicate that exchange rate movements, monetary policy instruments (interest rate and CRR), and fiscal deficit play a significant role in determining the dynamics of non-performing assets in the Scheduled commercial banks, while GDP growth and inflation exhibit limited direct influence during the study period.

ARDL Long Run Form and Bounds Test
Dependent Variable: D(GNPAS)
Selected Model: ARDL(1, 1, 0, 1, 1, 1, 0, 1)
Case 2: Restricted Constant and No Trend
Date: 02/12/26   Time: 21:14
Sample: 1997 2024
Included observations: 27

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2165665.	1198334.	0.000000	0.0000
GNPAS(-1)*	-0.550554	0.176243	-3.123829	0.0081
GDP(-1)	-18848.85	10050.10	-1.875488	0.0834
ER**	14724.80	7807.308	1.886028	0.0818
IR(-1)	-37826.28	13840.33	-2.733048	0.0171
CPI(-1)	-15807.99	10811.79	-1.462107	0.1675
FISCAL(-1)	-0.651169	0.105631	-6.164587	0.0000
CRR**	48271.26	15816.08	3.052037	0.0093
SLR(-1)	-102254.5	38530.54	-2.653856	0.0199
D(GDP)	-2376.860	8454.873	-0.281123	0.7830
D(IR)	-26771.64	10328.25	-2.592080	0.0223
D(CPI)	-3999.354	10757.73	-0.371766	0.7161
D(FISCAL)	-0.232248	0.166260	-1.396895	0.1858
D(SLR)	-67374.41	31868.64	-2.114129	0.0544

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP	-34236.13	19815.68	-1.727729	0.1077
ER	26745.41	17513.35	1.527144	0.1507
IR	-68705.79	29331.75	-2.342370	0.0357
CPI	-28712.87	16624.16	-1.727177	0.1078
FISCAL	-1.182751	0.403896	-2.928357	0.0118
CRR	87677.54	29905.37	2.931833	0.0117
SLR	-185730.1	52278.70	-3.552691	0.0035
C	3933607.	1721254.	2.285314	0.0397

EC = GNPAS - (-34236.1255*GDP + 26745.4096*ER -68705.7934*IR
  -28712.8651*CPI -1.1828*FISCAL + 87677.5401*CRR -185730.0997
  *SLR + 3933607.0411)

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	6.934280	10%	1.92	2.89
k	7	5%	2.17	3.21
		2.5%	2.43	3.51
		1%	2.73	3.9
Actual Sample Size	27		Finite Sample: n=35	
		10%	2.196	3.37
		5%	2.597	3.907
		1%	3.599	5.23
			Finite Sample: n=30	
		10%	2.277	3.498
		5%	2.73	4.163
		1%	3.864	5.694

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Bounds Test for Cointegration: The ARDL bounds testing approach confirms the existence of a long-run equilibrium relationship between Gross Non-Performing Assets (GNPAs) and the selected macroeconomic variables. The computed F-statistic (6.934) exceeds the upper bound critical value at the 5 percent level of significance, leading to the rejection of the null hypothesis of no long-run relationship. This result indicates that GDP, exchange rate, interest rate, inflation, fiscal deficit, CRR, and SLR move together over time and share a stable long-run association during the period 1997–2024.

Long-Run Relationship: The long-run estimates reveal that interest rate, fiscal deficit, CRR, and SLR significantly influence GNPAs. The interest rate exhibits a statistically significant negative relationship with GNPAs, suggesting that tighter monetary policy may enhance credit discipline and reduce non-performing assets over time. Fiscal deficit also shows a significant long-run impact, indicating that sustained fiscal imbalances can structurally affect banking sector stability. CRR has a positive and significant long-run effect, implying that reserve requirement adjustments influence liquidity conditions and asset quality. In contrast, SLR demonstrates a negative and highly significant impact, suggesting that stronger statutory liquidity requirements contribute to improving banking stability and reducing NPAs. However, GDP, exchange rate, and inflation do not show statistically significant long-run effects, indicating that their influence is primarily short-term rather than structural.

Short-Run Dynamics and Error Correction Mechanism: The error correction term (ECT) is negative and statistically significant, with a coefficient of approximately -0.55, implying that about 55 percent of short-run disequilibrium is corrected within one year. This indicates a relatively rapid adjustment toward long-run equilibrium following economic shocks. In the short run, exchange rate, interest rate, CRR, and SLR exhibit significant effects on GNPAs, highlighting the immediate impact of monetary and regulatory policy instruments on banking sector performance. These findings suggest that while macroeconomic growth variables may not exert strong structural effects, policy-driven variables play a crucial role in influencing the dynamics of non-performing assets in the Scheduled commercial banks.

Diagnostic Test: Diagnostic tests are applied after estimating the ARDL model to ensure that the model satisfies the classical regression assumptions and that the results are reliable. Even if the model shows significant relationships, the estimates cannot be trusted without proper diagnostic checking. The Breusch–Godfrey LM

test is used to detect serial correlation in the residuals. The Breusch–Pagan–Godfrey test checks for heteroskedasticity. Additionally, CUSUM and CUSUMSQ tests are conducted to verify parameter stability over time. Passing these tests confirms that the ARDL model is econometrically sound and suitable for inference.

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 1 lag

F-statistic	0.120500	Prob. F(1,12)	0.7345
Obs*R-squared	0.268429	Prob. Chi-Square(1)	0.6044

Test Equation:
Dependent Variable: RESID
Method: ARDL
Date: 02/12/26 Time: 21:24
Sample: 1998 2024
Included observations: 27
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GNPAS(-1)	0.067914	0.267566	0.253820	0.8039
GDP	-2.798680	8756.261	-0.000320	0.9998
GDP(-1)	1269.060	6726.623	0.188662	0.8535
ER	325.2828	8139.727	0.039962	0.9688
IR	-113.3305	10701.39	-0.010590	0.9917
IR(-1)	1208.482	8863.876	0.136338	0.8938
CPI	-269.0812	11168.13	-0.024094	0.9812
CPI(-1)	2001.760	9845.446	0.203318	0.8423
FISCAL	-0.020882	0.182393	-0.114490	0.9107
FISCAL(-1)	0.027736	0.190183	0.145838	0.8865
CRR	-3858.138	19794.66	-0.194908	0.8487
SLR	7431.337	39339.58	0.188902	0.8533
SLR(-1)	3083.662	19172.42	0.160838	0.8749
C	-283021.5	1484906.	-0.190599	0.8520
RESID(-1)	-0.158934	0.457850	-0.347131	0.7345

R-squared	0.009942	Mean dependent var	-2.43E-11
Adjusted R-squared	-1.145126	S.D. dependent var	39301.15
S.E. of regression	57561.45	Akaike info criterion	25.05927
Sum squared resid	3.98E+10	Schwarz criterion	25.77918
Log likelihood	-323.3002	Hannan-Quinn criter.	25.27334
F-statistic	0.008607	Durbin-Watson stat	1.992663
Prob(F-statistic)	1.000000		

Breusch–Godfrey Serial Correlation LM Test: The Breusch–Godfrey LM test was conducted to examine whether the residuals of the ARDL model suffer from serial correlation up to lag 1. The null hypothesis of the test states that there is no serial correlation in the residuals. The results show that the F-statistic probability is 0.7345 and the Obs*R-squared (Chi-square) probability is 0.6044, both of which are greater than the 5% significance level (0.05). Therefore, we fail to reject the null hypothesis.

This indicates that there is no evidence of serial correlation in the residuals of the model. In other words, the residuals are independent over time, and the model does not suffer from autocorrelation problems. This confirms that the ARDL

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specification is appropriate and that the estimated coefficients are reliable and unbiased.

Additionally, the Durbin–Watson statistic (approximately 1.99) is very close to 2, further supporting the conclusion that there is no first-order autocorrelation.

Heteroskedasticity Test: To check whether variance of residuals is constant, Breusch-Pagan-Godfrey (BPG) Test for heteroskedasticity was applied and the output generated by eviews presented below This test determines whether the variance of the errors in regression model is constant (homoskedasticity) or changes with the independent variables (heteroskedasticity). The p-value for the Obs*R-squared is 0.3733, as it is greater than 0.05 we conclude that there no evidence of hetroskedascity in the model.

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null Hypothesis: Homoskedasticity

F-statistic	1.078270	Prob. F(13,13)	0.4470
Obs*R-squared	14.00842	Prob. Chi-Square(13)	0.3733
Scaled explained SS	4.144326	Prob. Chi-Square(13)	0.9896

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 02/12/26   Time: 22:48
Sample: 1998 2024
Included observations: 27

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-4.58E+10	5.12E+10	-0.894542	0.3873
GNPAS(-1)	1492.645	7532.512	0.198160	0.8460
GDP	1.95E+08	3.61E+08	0.539681	0.5985
GDP(-1)	-1.20E+08	2.33E+08	-0.516408	0.6142
ER	6.19E+08	3.34E+08	1.856242	0.0862
IR	-7.61E+08	4.41E+08	-1.724717	0.1083
IR(-1)	-4.02E+08	3.36E+08	-1.194821	0.2535
CPI	-3.30E+08	4.60E+08	-0.718559	0.4851
CPI(-1)	-2.61E+08	3.29E+08	-0.791489	0.4429
FISCAL	-350.8417	7105.833	-0.049374	0.9614
FISCAL(-1)	-11605.07	7122.274	-1.629404	0.1272
CRR	8.66E+08	6.76E+08	1.281066	0.2226
SLR	1.22E+09	1.36E+09	0.893468	0.3878
SLR(-1)	-1.99E+08	7.01E+08	-0.284167	0.7808

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R-squared	0.518831	Mean dependent var	1.49E+09
Adjusted R-squared	0.037661	S.D. dependent var	2.42E+09
S.E. of regression	2.38E+09	Akaike info criterion	46.32094
Sum squared resid	7.34E+19	Schwarz criterion	46.99285
Log likelihood	-611.3327	Hannan-Quinn criter.	46.52073
F-statistic	1.078270	Durbin-Watson stat	2.324659
Prob(F-statistic)	0.446997		

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Normality Test: Jarque-Bera Normality Test output is presented below, which evaluates whether the residuals of your model follow a normal distribution. Since the Probability (p-value) of 0.361206 is greater than the 0.05, fail to reject the null hypothesis and conclude that the residuals are normally distributed. This is supported by the Skewness (-0.61) and Kurtosis (3.55), which are reasonably close to the ideal values of 0 and 3 for a perfectly normal distribution. Overall, these results confirm that the normality assumption for your regression model holds true
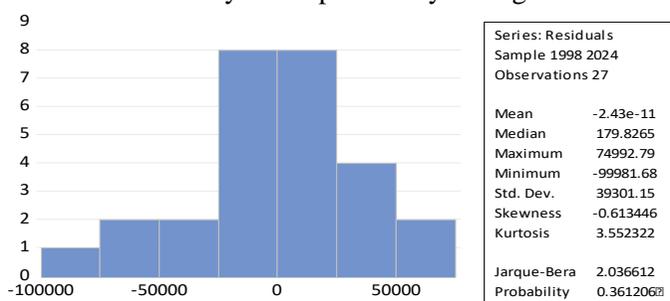
Stability Test: To examine the structural stability of the estimated ARDL model, the Cumulative Sum (CUSUM) and Cumulative Sum of Squares (CUSUMSQ) tests were performed. These tests assess whether the estimated coefficients remain stable over the sample period (1997–2024). Based on the EViews output given below figure, the CUSUM plot lies within the critical bounds throughout the sample period, indicating that the estimated coefficients are stable and do not exhibit systematic structural change. Similarly, the CUSUMSQ plot remains within the 5 percent significance lines, confirming variance stability and absence of structural breaks. The results suggest that the ARDL model is structurally stable and reliable for policy inference. Therefore, the estimated long-run and short-run coefficients can be considered robust over the study period.

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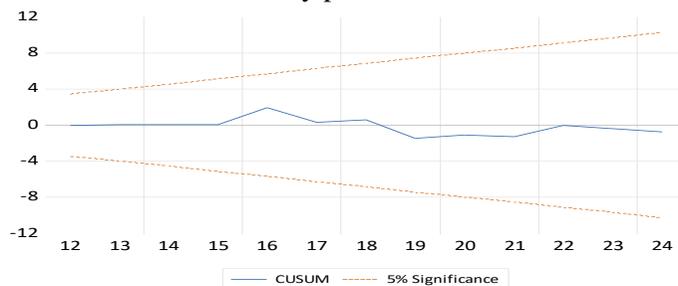
CUSUM of Squares (CUSUMSQ) Test: The CUSUM of Squares (CUSUMSQ) test was conducted to examine the structural stability of the estimated ARDL model over the sample period 1997–2024. Unlike the CUSUM test, which checks the stability of coefficients, the CUSUMSQ test primarily detects sudden structural changes and instability in the variance of residuals. The test result is evaluated by observing whether the cumulative sum of squared recursive residuals remains within the 5 percent critical bounds. Based on the EViews output given below, the CUSUMSQ plot remains within the upper and lower critical bounds throughout the study period. Since the plotted line does not cross the critical limits, the null hypothesis of parameter stability cannot be rejected. This indicates that there are no significant structural breaks or sudden shifts in the model during the sample period. Therefore, the ARDL model is structurally stable, and the estimated long-run and short-run coefficients are reliable for inference and policy recommendations.
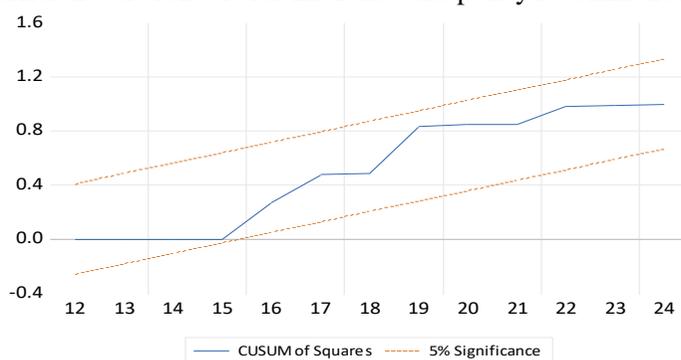
Policy Implications

The empirical results indicate that macroeconomic variables significantly influence Gross Non-Performing Assets (GNPAs) of SCBs, implying that asset quality is closely linked to overall economic management.

First, the significant impact of interest rates suggests that monetary policy must be carefully calibrated. Excessive tightening may increase borrowers' repayment burden and worsen NPAs, while stable and predictable rate policies can support financial stability.

Second, the significance of CRR and SLR highlights the importance of liquidity regulation. Maintaining adequate reserve and liquidity requirements can strengthen banking resilience and reduce vulnerability to credit risk. However, abrupt regulatory changes should be avoided to prevent liquidity stress.

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Third, the long-run effect of fiscal deficit indicates that fiscal discipline is essential for banking sector health. Persistent fiscal imbalances can create macroeconomic instability, indirectly increasing NPAs. Coordinated fiscal and monetary policies are therefore crucial.

Finally, the adjustment toward long-run equilibrium suggests that timely regulatory intervention and continuous monitoring of asset quality are effective in correcting short-term imbalances. Strengthening supervisory mechanisms and early warning systems can further help in controlling NPAs.

Summary & Conclusion

This study examined the impact of selected macroeconomic variables on Gross Non-Performing Assets (GNPAs) in the Scheduled commercial banks using annual data from 1997 to 2024. The variables included GDP growth, exchange rate, interest rate, inflation (CPI), fiscal deficit, Cash Reserve Ratio (CRR), and Statutory Liquidity Ratio (SLR). The analysis employed the Augmented Dickey-Fuller (ADF) unit root test and the Autoregressive Distributed Lag (ARDL) bounds testing approach.

The ADF test results indicated that the variables were integrated of mixed order, $I(0)$ and $I(1)$, with none integrated at $I(2)$, thereby justifying the use of the ARDL methodology. The ARDL model selected based on the Akaike Information Criterion (AIC) was ARDL(1,1,0,1,1,1,0,1). The bounds test confirmed the existence of a long-run equilibrium relationship among GNPAs and the selected macroeconomic variables, as the computed F-statistic exceeded the upper bound critical value at the 5 percent level of significance.

The long-run results revealed that interest rate, fiscal deficit, CRR, and SLR significantly influence GNPAs. Interest rate exhibited a negative relationship with GNPAs, suggesting that tighter monetary policy may help reduce non-performing assets over time. Fiscal deficit showed a significant long-run impact, indicating that fiscal imbalances contribute to banking sector stress. CRR had a positive and significant effect, implying that changes in reserve requirements affect liquidity and credit conditions. SLR displayed a negative and highly significant impact, suggesting that stronger liquidity regulations enhance banking stability. GDP growth, exchange rate, and inflation did not show significant long-run structural effects.

In the short run, exchange rate, interest rate, CRR, and SLR were found to significantly affect GNPAs, highlighting the importance of monetary and regulatory instruments in influencing banking sector performance. The error correction term

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was negative and statistically significant, with a magnitude of approximately 0.55, indicating that nearly 55 percent of deviations from long-run equilibrium are corrected within one year. This confirms a relatively fast adjustment process.

Diagnostic tests confirmed that the model is econometrically sound. The Breusch–Godfrey LM test showed no evidence of serial correlation, and the Durbin–Watson statistic was close to 2. The model demonstrated strong explanatory power, with an R-squared value exceeding 0.98, and the overall regression was statistically significant.

Conclusion

The empirical findings of the study suggest that macroeconomic and policy variables play a significant role in determining non-performing assets in the Scheduled commercial banks. While economic growth does not appear to exert a strong direct impact on NPAs, monetary policy instruments such as interest rate and CRR, along with regulatory measures like SLR, significantly influence asset quality. Fiscal discipline also emerges as an important factor affecting long-term banking sector stability.

The presence of a stable long-run relationship indicates that banking sector stress is systematically linked to macroeconomic fundamentals. The significant error correction mechanism further confirms that short-run deviations adjust toward long-run equilibrium at a moderate speed.

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