

INTERRELATIONSHIP BETWEEN BANKS ASSETS QUALITY AND MACROECONOMIC VARIABLES OF PUBLIC AND PRIVATE SECTOR COMMERCIAL BANKS IN INDIA

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Abstract

The present study aims at finding out the interaction between Banks's Assets Quality and Macroeconomic Variables of public and private sector commercial banks in India. Banks Assets Quality is measured through the level of Non-Performing Assets. It specifically analyses the causality and statistically significant association between NPA and macroeconomic factors for the period 2003-2014. The study has applied various econometric tools such as unit root test, Granger Causality test, and Auto Regressive Heteroscedasticity Model. To analyse the NPA of commercial banks, the researchers have taken GNPA Ratio as proxy. The empirical results of ARCH model exhibited that macroeconomic variables such as inflation, credit growth, deposits growth, unemployment rate, weighted average lending rate and exchange rate are having statistically significant association with GNPA Ratios of commercial banks. Based on the analysis, it is inferred that exogenous variables such as GDP, inflation, credit growth and Exchange Rate are having unilateral relationship with GNPA whereas variables like Index of Industrial Production, Unemployment Rate and Weighted Average Lending Rate are having bivariate grange causal relationship with GNPA of Public and Private Sector Commercial Banks.

Keywords:

GNPA, Inflation, IIP, Deposits Growth and Exchange Rate

1. INTRODUCTION

Today the Indian banking system is the finest among the world because; Indian banks are productive on growth, asset quality and profitability. RBI and Government have made some notable changes in policies and regulation to help in strengthening the sector. These changes encompasses establishment of prudential norms, enhancing the payments system and integrating regulations of commercial banks. In terms of quality of assets and capital adequacy, the banks have clean, strong and transparent balance sheets relative to other banks in comparable economies in its region. The Banks need to strengthen their institutional skill levels particularly in areas such as financial product marketing, prompt service operations, credit risk management and holistic organizational performance and support human capital.

The major indicator for the healthy banking industry in a country is its level of Non-Performing Assets (NPA). One of the key issues perplexing the performance of commercial banks in the late 90's adversely affecting was the accumulation of huge non-performing assets (NPA). Reduced NPA generally give an impression that banks have strengthened their credit appraisal processes over the years and growth in NPA involves the requirement of provisions, which bring down the overall profitability of banks. Non-Performing Assets (NPA) have become an impediment for the Indian banking sector for the past

several years. To improve the efficiency and profitability of banks the NPA need to be concentrated and controlled.

With this few introductory notes, the study has been divided into 5 sections. Section 2 reviews available literature on Banks' NPA, section 3 describes the research design, section 4 presents the data analysis and interpretation and section 5 provides concluding remarks.

2. LITERATURE REVIEW

Maheswaran and Rao [1] provided a framework for establishing stress test on NPAs among priority sector. In this study, the exposure across multiple priority sectors of SBI was binned in line with economic activity. The study covered fund based outstanding which comprised of stressed assets under both standards and NPA. During the period 2011-2014, the fund based outstanding was increased by 49.6% and NPAs for priority sectors increased by 153%. The growth rate of GDP was estimated at current prices at 3 ranges baseline at 12%, promising at 20% and most promising at 25%. This indicated that NPA was equally significant and it responded to GDP changes effectively at baseline.

The regression results of return on equity on non-performing loans to total loans showed that non-performing loan of the financial institution had significant negative relationship with profitability. Furthermore, the results showed that banks with higher profit potentials could better absorb credit losses whenever they cropped up and recorded better performance.

Tarron Khemraj and Sukarishnalall Pasha [3] ascertained the determinants of non-performing loans in the Guyanese banking sector using a panel data set and fixed effect model for the year 1994-2004. The empirical result shown that macroeconomic factors such as the real effective exchange rate and growth in GDP impacted significantly on the level of NPLs. It were also found that banks which were more aggressive in the credit market were likely to incur lower NPLs. The results suggested a mixed relationship between inflation and non-performing loans.

M. Lalitha [4] assessed the financial performance and soundness of Scheduled Commercial Banks in India using Capital Adequacy, Resource Deployed, Asset Quality, management Quality, Earnings Quality and Liquidity Model (CRAMEL) and Bankometer model. The results of the CRAMEL model showed that SBI group and Foreign Bank Group were in better position. In terms of resource deployed, New Private Sector Banks and Foreign Bank Groups reported a good performance. SBI Group and Old Private Sector Bank Groups had shown a robust performance in terms of asset quality. The overall analytical results revealed that the financial performance of Foreign Banks

were ahead than their counterparts. The bankometer results indicated the financial soundness of all 67 sample banks. The multivariate analysis of the profitability model disclosed the relationship among the earnings and expenses factors on the profitability of the banks.

Aamir Azeem [5] examined the impact of NPLs of banking sector in Pakistan with data of sixteen major banks irrespective of size, ownership and functionality from 2006-2012 by using panel fixed effect model. The statistical results quantified that profitability and non-performing loans had negative relationship. Return on equity also revealed a negative relationship with non-performing loans. It was found that in 2007 to 2010, this relationship was negative and statistically significant compared to base year 2006. It was also observed that there was no significant relationship between stock returns and NPLs.

Kiran Jameel [6] evaluated the impact of banks' significant determinants on non-performing loans in the Pakistani banking sector. It was observed from the analysis that the total NPLs stood at Rs. 585 million for all banking sector in Pakistan. Out of total NPLs 69% came from the balance sheets of private sector banks, nearly 27% resided on the public sector bank's balance sheet, almost 6% came from the specialized banks and foreign banks were holding only 1% of the total NPLs in Pakistan. The correlation matrix showed that NPL ratio had been negatively associated with gross domestic product, credit to deposit ratio, maturity time period and capital adequacy ratio. This indicated that as gross domestic product, credit to deposit ratio, maturity time period and capital adequacy ratio decreased, NPLs of Pakistani commercial banks increased. The independent variables such as gross domestic product, weighted average lending rate, maturity time period and capital adequacy ratio were significantly related with NPL ratio.

Nguyen Thi Minh Hue [7] assessed the determinants of non-performing loans in the Vietnamese banking system for the period 2008-2012. The results confirmed a positive and significant relationship between growth rate and NPL ratio. The robustness test results revealed that only the previous year NPL ratio had a statistically significant influence on NPL ratio. The qualitative analysis showed that the number of NPLs in Vietnam Banks published by State Bank of Vietnam or other credit institutions might not reflect the situation of NPLs in Vietnam because of vast deviation in the estimation made by Moody's or Fitch.

Mehmet Islamoglu [8] examined the effect of macroeconomic variables such as commercial loan interest rates and public debt stock/GDP ratios on the consolidated non-performing loan ratio of banks involved in Borsa Istanbul (BIST) XBANK index. The Johansen Cointegration test results revealed that there was only one cointegration equation. It was found that $\log npl$ series negatively affected $\log intrades$ in the long run, it affected $\log debtgdp$ positively. It was observed that bilateral causality relationship was found between $\log npl$ and $\log intrates$ and a one-way causality relationship was found between $\log npl$ and $\log debtgdp$.

Muhamud Abdelaziz Tonmy and Mohamed Abdelhamed Shehab [9] examined the macroeconomic determinants of non-performing loans in some Arab countries through the period 1999-2000 to 2011-2012 using the dynamic panel data approach. The results of GMM model estimation showed that economic growth, capital investment as a percent of GDP and unemployment rate

had a negative impact on the level NPLs as it increased the viability of both households and firms to repay their loans. It was also observed that an increase of the aggregate debt burden had a positive impact on the level of NPLs. It was also confirmed from the analysis that expansionary monetary policy and improvement in terms of trade in petroleum countries had a significant negative effect on NPLs. However, this result was not clear in non-petroleum countries. The 2008 financial crisis dummy showed a negative effect on NPAs.

Roman Angela and Bilan Irina [10] empirically evaluated the effects of macroeconomic factors on non-performing loans in European Union Countries for the period 2000-2013. The findings of the study confirmed that the annual real GDP growth rate had a major impact on the rate of NPLs. The coefficient of this variable was statistically significant and negatively related with NPLs. It was found from the analysis that unemployment rate had a positive and significant impact on non-performing loans. It was also observed from the analysis that the relationship between domestic credit variable and non-performing loans was positive and statistically significant. It was found from the analysis that the debt threshold was about 97% of GDP which was below the actual value of public debt registered in many countries viz., Greece, Portugal, Italy and Ireland. The prompting budget surpluses were proved to lead to a higher ratio of NPLs.

M.M. Rahman and A. Hai [12] analysed the major factors influencing NPLs of commercial banks in Bangladesh using a self-administered questionnaire collected from 100 officers and 50 borrowers. The results showed that reckless lending was the prime cause of increasing level of NPLs. Lack of monitoring and assessment of business was the reason for occurrence of Non-Performing Loans. Loan diversion, poor credit culture and willful default of the customers were the reasons for loan default from the customer's side.

K. Balakrishnan and A. Ertan [2] studied the nexus banks financial reporting frequency and loan asset quality for a period of 14 years from 2000 to 2014. It was found that quarterly financial reporting improved the loan portfolio. It was further noted that there was a relative decline in nonperforming loan portfolio of European banks after converting to quarterly reporting.

N. Kuzucu and S. Kuzucu [11] compared the determinants of Non-Performing Loans of emerging and advanced economies during pre and post crisis period using a dynamic panel data model. The estimates of the panel data model showed that real GDP growth was the crucial factor in determining the NPL of ratio. Exchange rate and FDI showed a positive and significant relationship with NPLs of sample banks during post crisis period. Bank-specific variables such as credit size and bank capital were negatively associated with NPLs.

Depending on the above reviews, it was observed that many researchers had focused on sectorial specific banks. Previous studies had shown a more inclination towards a particular group of banks. In this study, all the public and private sector banks' aggregate data have been taken for analysis. When more number of banks is considered for the analysis, it would increase the robustness of the statistical results. Moreover, analysis on all public and private sector commercial banks would present the holistic view of the trend prevailing in banking sector with respect to NPA.

3. RESEARCH DESIGN

In this section, detailed summary of statement of the problems, scope and objectives of the study are given.

3.1 STATEMENT OF THE PROBLEM

Banking sector in India has undergone a transformation during the last two decades since the implementation of banking sector reforms in 1991. According to the RBI's Financial Stability Report, gross NPAs of commercial banks stand at 10.2% in September 2019. Mounting level of NPAs poses a major threat to the commercial banks' performance. The performance of banks have been watched warily post US sub-prime crisis. In particular, financial performance of the banks is subjected to pressures from regulatory body Reserve Bank of India. Apart from this, banks performance is affected by macro-economic fluctuations such as GDP, inflation rate, interest rate and unemployment rate. Besides these external factors, there are some banks specific variables which affect the performance. Non-Performing Assets is the predominant factor which erodes not only the current profits but also swallows future profits in the form of huge provisions. With this introductory background, the researchers have taken a maiden attempt at finding answers for the following questions:

3.1.1 Research Questions:

1. Is there any causal and statistically significant long run association between macroeconomic variables and asset quality of selected banks?
2. If so, do the fluctuations in macroeconomic variables reflect on deteriorating assets quality of selected banks?

3.2 SCOPE OF THE STUDY

- The study is on banks assets quality measured in terms of Non-Performing Assets of SBI and its associates, Nationalised Banks, Old Private Sector and New Private Sector Banks and Macroeconomic Factors only. The entire research is restricted to the above mentioned group of public and private sector banks only.
- The study has taken totally 43 public and private sector commercial banks based on the availability of full-fledged data for the analysis.
- The study is analytical in nature and the present study uses the latest available secondary data published by RBI for the 12 years starting from 2002-2003 to 2013-2014.

3.3 OBJECTIVES OF THE STUDY

1. To identify relationship between on Banks Assets Quality of SBI and its associates, Nationalised Banks, Old Private Sector and New Private Sector Banks and macroeconomic factors.
2. To evaluate the impact of macroeconomic factors on Banks Assets Quality i.e., Non-Performing Assets of SBI and its associates, Nationalised Banks, Old Private Sector and New Private Sector Banks.

3.4 STATEMENT OF HYPOTHESES

Based on the above mentioned objectives, the following hypotheses are framed and tested.

H_{01} : Gross Non-Performing assets of SBI and its associate banks, Nationalised banks, Old private sector banks and new private sector banks and Macroeconomic Factors are non-stationary during the study period.

H_{02} : Gross Non-Performing assets of SBI and its associates banks, Nationalised banks, old private sector banks and new private sector banks do not granger cause macroeconomic factors and vice versa.

H_{03} : Macroeconomic variables do not have statistically significant relationship with non-performing assets of SBI and its associates banks, Nationalised banks, old private sector banks and new private sector banks.

3.5 RESEARCH METHODOLOGY

This section presents the nature of the study, data extracted from different sources, sample banks included and research instruments used in the study.

3.5.1 Nature of the Study:

The study is descriptive in nature. It describes the state of Banks Assets Quality measured in terms of NPA of public and private sector commercial banks in India. The study analyses the relationship between macroeconomic factors and NPA of public and private sector commercial banks.

3.5.2 Sources of Data:

The study primarily depends on secondary data. The required data have been taken and compiled from "Report on Trends and Progress of Banking in India", published by Reserve Bank of India. The data taken from RBI are further classified and compiled for the suitability of analysis. NPA Ratios are heavily drawn from "Statistical Tables Relating to Banks in India". Data for macroeconomic factors have been compiled from "The Handbook of Statistics on Indian Economy". Dataset of public and private sector banks constitute the aggregate data. In addition to this, dataset from various issues of Economic Survey have been used for few economic variables. The scope of the study is limited to twelve years data starting from 2003 to 2014. Moreover, period has been chosen before the implementation of mergers of SBI and its associate banks.

3.5.3 Sampling Framework:

This study focuses on banks assets quality i.e., non-performing assets of 6 SBI and its associates, 19 nationalised banks, 13 old private sector banks and 5 new private sector banks. Comparison between public sector banks and private sector banks does not give unique feature of a particular sector. Therefore, all the public and private sector banks have been taken which may constitute the entire population of the study. Some of the Banks have been excluded due to the lack of consistency and availability of data. Apart from this, some of the banks were merged, so the merged banks are not taken for the study. But SBI and associates banks have been taken under public sector banks before merger took place.

3.5.4 Research Instruments:

For the purpose of analysis, the study has used two different analyses. The following statistical and econometric tools are used for analysis and data interpretation. They are:

1. Descriptive Statistics
2. Multiple Correlation
3. Unit Root Test
4. Granger Causality Test

4. AUTO REGRESSIVE CONDITIONAL HETROSCEASTICITY MODEL.

Descriptive Statistics provides the mean, standard deviation, minimum and maximum value of chosen variables. Multiple correlation analysis has been used to check the level of independency among the independent variables. These two statistical tools are used as preliminary tests for selecting the relevant variables. The study has employed the following econometrics tools for analysis of macroeconomic data.

Unit root test is used to check whether the time series data has stationary or non-stationary. Stationary refers to the movement data of time series around a mean value. Augmented Dickey

Fuller test has been applied to find out the stationary of time series. Granger causality is also employed in the analysis to examine whether one time series helps to predict another.

Granger causality consists of both bi-directional and unidirectional relationship between variables analysed.

4.1.1 Limitations of the Study:

- The study has heavily dependent on secondary data which does not reflect the qualitative aspects in credit management.
- The study compares, SBI and its associates, nationalised banks, old private sector and new private sector banks which do not have equal sample units in each group.
- Some of the merged banks were not taken for analysis. Therefore it may not exhibit the exact picture of public and private Sector Banks.

Table.1. Summary of Expected Relationship between NPA and Macroeconomic Variables

Macroeconomic Variables		
Endogenous variable	Exogenous variables	Expected Relationship
GNPA – Ratio of Gross NPA to Gross advances	GDP– Gross Domestic Product	-
	INFL – Inflation Rate	+/-
	M3 – Money Supply	-
	CG – Credit Growth	-
	DG – Deposit Growth	-
	ER –Exchange Rate	+/-
	UR – Unemployment Rate	+

	AGRIIP – Annual Growth of Industrial Production	-
	WALR – Weighted Average Lending Rate	+

4.2 PRELIMINARY ECONOMETRIC ANALYSIS OF PUBLIC AND PRIVATE SECTOR COMMERCIAL BANKS

The empirical evidence on the nexus between macroeconomic determinants (Table.1) and Non-Performing Assets of Public and Private Sector Commercial banks in India is based on data of various macroeconomic indicators over the period 2003-2014 is presented in this section. The section highlights the descriptive statistics of the selected variable, the correlation matrix and finally the unit root test. These analyses have been done to ensure the validity and suitability of the time data for applying various econometric tools.

5. DESCRIPTIVE STATISTICS OF NPA AND MACROECONOMIC VARIABLES

The Table.2 presents the summary of descriptive statistics of the endogenous and exogenous variables captured in the Autoregressive Conditional Heteroscedasticity Model. It is particularly noted from the Table.2 that GNPA of Nationalised banks present a high disparity between banks with a minimum of 1.77% and a maximum of 10.76%. With respect to GNPA of SBI and its Associates Banks, it shows a mean value of 4.40% and the data deviated to the extent of 2.09 times from mean value. The GNPA of Old Private Sector Banks also reports a high disparity, as its minimum and maximum value ranges from 1.83% to 8.40%. The mean value of GNPA of New private sector Banks is 2.95% and the data deviated to the extent of 1.61 times from the mean value. Concerning the macroeconomic variables, Credit Growth (CG) has the highest standard deviation and it has a mean value of 21.50%. The economic growth as marked by GDP shows a moderate growth in terms of mean by 7.49% and it records a minimum of 3.88% and maximum of 9.57%. Additionally, for the same period, inflation rate presents a minimum of 3.40% and a maximum of 9.60%. The average money supply of the country is 16.63% during the study period and it has minimum and maximum of 22.10% and 13% respectively. The deposits growth rate has an average of 17.58% and its data has deviated to the extent of 4.04 times from the mean value. The exchange rate shows a high disparity of \$40.20 and \$60.50 in its minimum and maximum values during the study period and the average exchange rate is \$47.57. The average of unemployment rate is 8.85% and its minimum and maximum ranges from 8.60% to 10.80%. The annual growth rate of industrial production (AGRIIP) describes a high disparity of 2.50% and 15.50% in its minimum and maximum values and the average of AGRIIP is 7.32%.The standard deviation of Weighted Average Lending Rate (WALR) is 0.82% and its minimum and maximum ranges from 10.60% and 13.50%. It is also observed that the average of WALR is close to the median value. The summary statistics indicate that the macroeconomic series are normally distributed

with the Jarque-Bera statistics probability value greater than the benchmark of 0.05 (values ranges from 0.24 to 4.51) and no essential variables are omitted from the endogenous variables.

The Table.3 presents the correlation matrix for all the variables incorporated into the model. The coefficient of correlation provides an index of the direction and the magnitude of the relationship between two set of scores without implying causality. The sign of the coefficient is an indication of the direction of the relationship. The absolute value of the coefficient indicates the magnitude. Correlation matrix is useful to the extent that it reveals it reveals that whether there are elements of multicollinearity in the data. Multicollinearity is the situation when some or all of the explanatory variables are highly related making it difficult to tell which of them is influencing the dependent variable. The severity of multicollinearity would be manifested in a situation where all p-values of regression coefficients are insignificant but overall model having significant F statistic. The Table.5 indicates the results of correlation matrix of nine macroeconomic variables. GDP has negatively associated with inflation rate (INFL), exchange rate (ER), unemployment rate (UR) and weighted average lending rate (WALR) which are -0.05, -0.50379, -0.338915 and -0.388073. The correlation coefficient of all macroeconomic variables implies the absence of multicollinearity problem as correlation co-efficient of all the variables are less than 0.80. The deposits growth rate has high

correlation coefficient with GDP followed by annual growth rate of index of industrial production.

The Table.4 displays the unit root test results GNPA of all the public and private sector commercial banks and macroeconomic variables. It is important that dependent and independent variables used in the study must be stationary. If the variables are not stationary, it is assumed that they include stochastic or deterministic trends. In order to check whether the time series data are stationary or non-stationary, Augmented Dickey-Fuller (ADF) Unit Root test has been applied. The analytical results reveal that all the endogenous and exogenous variables are stationary at level. The rejection of null hypothesis against the alternative hypothesis implies that all the time series variables are stationary and integrated the order of zero i.e., $I(0)$. To further validate and strengthen the results, first difference of the series has been taken to ensure stationary of the data.

The Table.5 represents the results of Granger Causality Test between GNPA of Public and Private Sector Commercial Banks in India and macroeconomic factors. Granger Causality Analysis is a statistical hypothesis test for determining whether one times series data is useful in predicting another. Granger causality test results have shown the bi-directional relationship between GNPA and GDP, Inflation, deposit growth and annual growth of industrial production whereas credit growth and unemployment rate have indicated a unidirectional causality relationship.

Table.2. Descriptive Statistics of NPA and Macroeconomic Variables

Variables	SBI GNPA	NAT GNPA	OPS GNPA	NPS GNPA	GDP	INFL	M3	CG	DG	ER	UR	AGRIIP	WALR
Mean	4.40	4.13	4.01	2.95	7.49	6.16	16.63	21.52	17.58	47.57	8.85	7.32	12.22
Median	3.80	3.05	2.77	2.55	7.57	6.25	16.00	19.50	16.65	45.95	8.85	6.55	12.15
Maximum	9.14	10.26	8.40	7.55	9.57	9.60	22.10	37.00	24.00	60.50	10.80	15.50	13.50
Minimum	2.52	1.77	1.83	1.72	3.88	3.40	13.00	13.90	13.00	40.20	6.80	2.50	10.60
Std. Dev.	2.09	2.78	2.45	1.61	1.88	2.06	3.10	7.30	4.04	5.23	1.25	3.65	0.82
Skewness	1.15	1.23	0.69	2.13	-0.69	0.16	0.45	0.85	0.50	1.33	0.02	1.09	-0.29
Kurtosis	3.28	3.19	1.86	6.77	2.43	1.91	1.87	2.66	1.83	4.41	2.16	3.44	2.64
Jarque-Bera	2.68	3.02	1.61	16.14	1.10	0.64	1.04	1.51	1.20	4.51	0.35	2.47	0.24
Probability	0.26	0.22	0.45	0.00	0.58	0.73	0.59	0.47	0.55	0.10	0.84	0.29	0.89
Sum	52.86	49.50	48.06	35.41	89.82	73.97	199.60	258.20	211.00	570.83	106.20	87.80	146.60
Sum Sq. Dev.	47.97	85.06	65.99	28.49	38.77	46.69	105.59	586.02	179.38	301.18	17.25	146.34	7.40

Table.3. Correlation Matrix of Macroeconomic Variables

	GDP	INFL	M3	CG	DG	ER	UR	AGRIIP	WALR
GDP	1								
INFL	-0.053442	1							
M3	0.422669	-0.114	1						
CG	0.380688	-0.3056	0.14812	1					
DG	0.624017	-0.3547	0.66927	0.5103	1				
ER	-0.50379	0.11057	-0.5864	-0.5418	-0.5944	1			
UR	-0.338915	0.12303	-0.0778	-0.3835	-0.3937	0.1152	1		
AGRIIP	0.522319	-0.2339	0.43171	0.4589	0.5742	-0.559	-0.77	1	
WALR	-0.388073	-0.2073	-0.3964	0.1689	-0.1188	-0.063	-0.401	0.2069	1

Table.4. Unit Root Test of Dependent and Independent Variables

Variables	Augmented Dickey Fuller Test		
	Level	First Difference	Order of Integration
GNPA - SBI	-5.402050*	-6.078059*	I (0)
GNPA – Nationalised	-4.227900*	-6.696526*	I (0)
GNPA – Old Private	-12.35031*	-12.19016*	I (0)
GNPA – New Private	-3.355169*	-7.261099*	I (0)
Gross Domestic Product	-8.534348*	-27.19786*	I (0)
Inflation	-9.700191*	-13.06913*	I (0)
Money Supply – M3	-10.66316*	-12.52032*	I (0)
Credit Growth	-9.014334*	-13.52244*	I (0)
Deposit Growth	-8.451937*	-19.07930*	I (0)
Exchange Rate	-9.411962*	-14.34958*	I (0)
Unemployment Rate	-15.60947*	-18.01651*	I (0)
Annual Growth Rate of Industrial Production	-10.83281*	-18.05089*	I (0)
Weighted Average Lending Rate	-6.130225*	-8.678263*	I (0)

Note: The * indicates significance at 1%, ** at 5% and *** at 10%.

Table.5. Pairwise Granger Causality Tests between GNPA and Macroeconomic Variables

Null Hypothesis	F-Statistic	Prob.
GDP does not Granger Cause GNPA	1.55685	0.1578
GNPA does not Granger Cause GDP	2.55037	0.0193
INF does not Granger Cause GNPA	3.59005	0.0017
GNPA does not Granger Cause INF	1.00361	0.4221
M3 does not Granger Cause GNPA	3.37078	0.0029
GNPA does not Granger Cause M3	1.63779	0.1347
CG does not Granger Cause GNPA	2.49050	0.0220
GNPA does not Granger Cause CG	3.04642	0.0062
DG does not Granger Cause GNPA	3.62829	0.0016
GNPA does not Granger Cause DG	2.15832	0.0457
IIP does not Granger Cause GNPA	1.93670	0.0732
GNPA does not Granger Cause IIP	4.76990	0.0001
UR does not Granger Cause GNPA	1.92945	0.0744
GNPA does not Granger Cause UR	3.39415	0.0027
WALR does not Granger Cause GNPA	3.00469	0.0068
GNPA does not Granger Cause WALR	2.43257	0.0251
ER does not Granger Cause GNPA	4.68658	0.0001
GNPA does not Granger Cause ER	1.43006	0.2011

Table.6. Auto Regressive Conditional Heteroscedasticity Model of GNPA and Macroeconomic Variables

Dependent Variable: GNPA				
Method: ML - ARCH (Marquardt) - Normal distribution				
GARCH = C(11) + C(12)*RESID(-1)^2 + C(13)*GARCH(-1)				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-5.348141	12.15854	-0.439867	0.6600
GDP	0.090533	0.175855	0.514813	0.6067

INF	-0.882719	0.074967	-11.77478	0.0000
M3	-0.090916	0.113843	-0.798605	0.4245
CG	-0.046839	0.027910	-1.678200	0.0933
DG	-0.685362	0.059945	-11.43310	0.0000
IIP	-0.432539	0.112714	-3.837484	0.0001
UR	1.342909	0.318059	4.222207	0.0000
WALR	2.705593	0.426826	6.338866	0.0000
ER	-0.315987	0.063630	-4.965988	0.0000
Variance Equation				
C	6.987478	0.863259	8.094298	0.0000
RESID(-1)^2	1.678905	0.089597	18.73850	0.0000
GARCH(-1)	-7.52E-05	0.001857	-0.040514	0.9677
R-squared	0.780284	Mean dependent var		5.203259
Adjusted R-squared	0.791277	S.D. dependent var		11.23170
S.E. of regression	12.31026	Akaike info criterion		6.338018
Sum squared resid	76680.53	Schwarz criterion		6.444993
Log likelihood	-1622.209	Hannan-Quinn criter.		6.379938
Durbin-Watson stat	1.463540			

The Table.6 presents the results of ARCH Model of Public and Private Sector Commercial Banks and macroeconomic variables. The estimation results showed that Gross Domestic Product (GDP) is having a positive relationship as against the expectation and its coefficient is having in significant relationship with GNPA of Public and Private Sector Commercial Banks. The coefficient of inflation (INFL) as measured by CPI indicates a negative relationship with GNPA. At the same time, its coefficient has been significantly related with endogenous variable GNPA. This result implies that 1% increase in inflation rate reduces GNPA to the point of 0.882719. The exogenous variable money supply (M3) is negatively associated with GNPA and having an insignificant relationship with GNPA. It can be inferred from the analysis that as money supply increases in the economy, borrowers are having surplus cash flow to settle their loan dues. In contrary to our expected result, Credit growth has shown a negative relationship with GNPA of Public and Private Sector Commercial Banks. The coefficient of Credit Growth (CG) is significant at 10% level of significance. This result showed the Gross Non Performing Assets are adequately controlled during the phase credit growth expansion. Deposit Growth (DG) has shown a negative and statistically significant relationship with GNPA. The result explains that 1% increase in annual growth rate of industrial production decreases NPA to the point of 0.432539. It can be interpreted that loans given to industries are repaid to some extent. However, exceptional case like Punjab National Bank has to be excluded. In accordance with the expectation, the coefficient of unemployment rate shows a positive association with endogenous variable GNPA and significantly related with GNPA at 1% level of significance. This result denotes that as unemployment increases, it leads to surge in GNPA. Unemployment rate affects borrowers' earning capacity. As a consequence, they do not service their debt obligations. The result also shows a positive relationship between exchange rate and non-performing assets. Similarly, there exists a positive and significant relationship between weighted average lending rate

(WALR) and non-performing assets of Public and Private Sector Commercial Banks. As interest rate increases, borrowers find it difficult to repay the loan amount. Hence, it can be inferred that interest rate is one of the factors for mounting NPAs in the banks. The coefficient of exchange rate is significantly related with GNPA at 1% level of significance. It can be inferred that exchange rate leads to decrease in non-performing rate due to favourable conditions to traders in foreign exchange market. As a result, loans extended to importers/exporters become performing assets. The influence of macroeconomic factors on GNPA of public and private Banks is to the extent of 79% as R2 value of the model explains the endogenous variable. Likewise, the adjusted R2 value is fairly good. These statistics imply the goodness of fit of the model. The Durbin-Watson statistics indicates the absence of autocorrelation as its value is lesser than 2.

6. CONCLUSIONS

In this analysis, assets quality of public and private sector commercial banks in India measured in terms of Gross Non-Performing Assets Ratio and macroeconomic determinants have been studied using multiple regression analysis and econometrics tools such as unit root test analysis, Granger Causality test and Auto Regressive Conditional Heteroscedasticity. Based on the observations made in the analysis, it can be inferred that to the results of ARCH model exhibited that macroeconomic variables such as inflation, credit growth, deposits growth, unemployment rate, weighted average lending rate and exchange rate exerted a statistically significant association with GNPA Ratio of public and private sector commercial banks. Further it is inferred that exogenous variables such as GDP, inflation, credit growth and Exchange Rate are having unilateral relationship with GNPA whereas other macroeconomic variables like Index of Industrial Production, Unemployment Rate and Weighted Average Lending Rate are having bivariate grange causal relationship with GNPA of public and private sector commercial banks.

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