An Empirical Analysis on Nexus between Credit Risk of Nationalised Banks in India and Macroeconomic Factors – An Econometric Perspective

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ABSTRACT

This empirical study analyses the interaction between credit risk of nationalised banks and macroeconomic determinants for the period 2002-2003 to 2013-2014. The study aims to find the association between GNPA and macroeconomic factors with the help of econometrics tools such as Unit Root Test Analysis, Johanson Cointegration test, Granger Casualty Test and Auto Regressive Conditional Hetroscedasticity (ARCH Model). The analytical results revealed the long term relationship among GNPA of nationalised banks and macroeconomic factors during the study period. It is found that all the macroeconomic variables are cointegrated with GNPA and exogenous variable Inflation granger caused GNPA of nationalised banks in bi-directional mode. It is also observed from the results that exogenous variables such as GDP, inflation, credit growth, exchange rate, unemployment rate, annual growth of industrial production and weighted average lending rate are having significant relationship with GNPA of nationalised banks.

KEY WORDS : *Gross Non-Performing Assets, Macroeconomic Variables, Nationalised Banks, Cointegrating and Causal Relationship.*

1. INTRODUCTION

The best parameter for the healthy banking industry in a country is its level of credit risk. One of the major issues challenging the performance of commercial banks in the late 90's adversely affecting was the accumulation of huge non-performing assets (NPA's). Reduced NPAs generally gives an impression that banks have strengthened their credit appraisal processes over the years and growth in NPAs involves the requirement of provisions, which bring down the overall profitability of banks. Non-Performing Assets (NPAs) have become an irritant for the Indian banking sector for the past several years. To improve the efficiency and profitability of banks the NPA need to be reduced and controlled.

With this introductory note, the paper has been organised as follows: Section 2 reviews the existing literature related to credit risk management at global level. Section 3 presents the research design and methodology. Section 4 discusses the results and Section 5 concludes.

2. REVIEW OF LITERATURE

Nor Hayati Ahmed and Mohamed Ariff (2007) studied the key determinants of credit risk of commercial banks in emerging economy compared with developed economies. The R squared statistics of regression results showed the best accountability for the variations in the credit risk for countries like Mexico, Malaysia and Australia. MGT (denoted by earning assets to total

assets ratio) was significantly related to credit risk of abnks in Malaysia, India and France. Loan loss provisions to loans was significantly positively related to credit risk of banks in Australia, Japan, Mexico and Thailand. Loan to deposit ratio was a significant positive determinant of credit risk in Malaysia, US and France. The coefficient estimate of liquidity was significant positively related to credit risk in several countries like Australia, India, Korea and the US. Spread emerged significant determinants. **Abdelkader Boudriga, Neila Boulila Taktak and Sana Jellouli (2009)** empirically evaluated the determinants of non-performing loans and the potential impact of both business and institutional environment on credit risk exposure of banks in the MENA region (Tunisia, Algeria, Morocco, Egypt and United Arab Emirates The regression co-efficient indicated that credit growth was negatively related to problem loans. The results also suggested that banks concentrated on credit growth activities experienced low levels of NPL. The results showed that foreign participation from developed countries was statistically significant and improved credit quality. The presence of private credit bureaus in the MENA region had positive effect on credit quality. A negative relationship was observed between NPLs and the depth of credit information **Liu, Y and Yang, W (2010)** examined the determinants of non-performing loans (NPLs) of the Greek banking sector, separately for each type of loan (consumer, business and mortgage loans) using dynamic panel data techniques. The GMM estimation results of the analysis showed that the co-efficient was statistically significant for business and consumer loans. Mortgages were the least sensitive type of loans. Bank specific variables such as performance and efficiency indicators were found to possess additional explanatory power when added to the baseline model in the analysis. **Manoj Kumar Dash and Gaurav Kalra (2010)** examined the relationship between non-performing banks and several key macroeconomic and bank specific variables using pooled least square regression analysis and a panel data set covering 10 years from 1998-99 to 2008-09. The results revealed that growth in loan was negative and significantly related to NPLs at time t, t-1 and t-2 respectively. Commercial banks which extended relatively higher levels of credit were likely to incur lower non-performing loans. The study found a significant negative contemporaneous relationship between GDP and NPLs meaning that an improvement in the real economy was likely to see instantaneous reduction in the non-performing loan portfolios of commercial banks. **Muvanza Nkusu (2011)** analyzed the link between nonperforming loans and macroeconomic performance using panel regression and panel vector auto regressive model (PVAR). The study investigated the feedback between NPL and its macroeconomic determinants using a sample 26 advanced countries for the period from 1998-2009. The Impulsive Response Functions results revealed the important and central role of NPL in the macro financial linkages. The empirical evidence suggested a sharp increase in aggregate NPL fed on itself leading to an almost linear incremental after the initial shock. The confluence of adverse responses in key indicators of macroeconomic performance- GDP growth and unemployment led to a downward spiral in which banking system distress and the deterioration in economic activity reinforced each other.

3. RESEARCH DESIGN

3.1. Statement of the Problem

Credit risk is one of the crucial issues of the commercial banks. It is the much debated topic in the banking sector. Among various risks, credit risk is assumed to be significant one due to its inherent nature of ripple effect on commercial banks' liquidity and solvency position. The extent of credit risk is measured through the level of non-performing assets of commercial banks. NPA is also globally termed as Non Performing Loans (NPLs). It has implication on banks future credit policy and profitability. If mounting NPA is not curbed timely, it will lead bankruptcy conditions in banking sector. NPAs not just erode present profits, but also affect future profits as internally generated funds are diverted to huge amount of provisions. Credit risk of commercial banks is not just determined by bank-specific or institutional attributes, but also influenced by macroeconomic conditions prevailing in an economy. In this context, the researcher has taken a maiden effort to analyze the association between credit risk and macroeconomic factors.

3.2. Objectives of the Study

The study has framed the following objectives.

1) To analyse the long run and causality relationship between GNPA and macroeconomic variables.
2) To ascertain the impact of macroeconomic factors on credit risk of Nationalised Banks.

3.3. Statement of Hypotheses

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

H_{01} Macroeconomic determinants and GNPA of Nationalised Banks do not have stationary.

H_{02} Gross Non-Performing assets of Nationalised Banks are not cointegrated with macroeconomic factors.

H_{03} Gross Non-Performing assets of Nationalised Banks do not granger cause macroeconomic factors and vice versa.

H_{04} Macroeconomic variables are not having significant relationship with non-performing assets of Nationalised banks.

3.4. RESEARCH METHODOLOGY

3.4.1. Nature of the Study

The study is descriptive and analytical in nature. It describes the state of credit risk conditions in Nationalised Banks in India. The study analyses the relationship between macroeconomic indicators and NPA of Nationalised Banks.

3.4.2. Sources of Data

The study primarily depends on secondary data. It consists of various financial statements like Balance Sheet, Profit & Loss account, Annual Reports and Ratio Analysis. The required data have been taken and combined 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. Ratios and other financial variables are heavily drawn from "Statistical Tables Relating to Banks in India". The scope of the study is limited to twelve years data. Data for macroeconomic factors have been compiled from the various issues of Economic Survey starting from 2002 to 2014.

3.4.3. Sampling Framework

Most of the studies on Non-Performing Assets (NPAs) are comparison between Public Sector Banks and Private Sector banks. But this study focuses on Non-Performing Assets of 19 Nationalised Banks in India. Comparison between Public Sector Banks and Private Sector Banks does not give unique feature of a particular sector. Therefore all Nationalised 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.

3.4.4. Research Instruments

The study has employed the following econometrics tools for analysis of macroeconomic data on GNPA of Nationalised Banks.

1. Unit Root Test 2. Johanson Cointegration Test 3. Granger Causality Test and 4. Auto Regressive Condition Hetroscedasticity Model

Unit root test is used to check whether the time series data has stationary or non-stationary. Stationary refers to the movement of time series around a mean value. Augmented Dickey Fuller test has been applied to find out the stationary of time series data. After stationary of data has been confirmed, the analysis has proceeded to check the cointegration between the endogenous and exogenous variables. The study has used Johanson Cointegration Test to analyse the cointegrating relationship among the selected variables. Cointegration analysis validates the long run relationship between endogenous and exogenous variables. In this study, bivariate cointegration has been taken into consideration for analysis. 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 uni-directional relationship between variables analysed. Vector Error Correction Model is adopted to assess the cointegration.

3.4.5. Period of the Study

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. Though the data have been collected from 2002-2003 to 2013-2014, few years data set could not be used as lags are used in econometric tools to analyse the impact of lagged variables.

3.4.6. Limitations of the Study

1. The study has heavily dependent on secondary data which does not reflect the qualitative aspects in credit risk management.
2. Some of the merged banks are not taken for analysis. Therefore, it may not exhibit the exact picture of public Sector Banks.
3. The study can describe only the changes in the financial variables related to Non-Performing Assets due to macroeconomic factors but could not explain the reasons for fluctuations.

3.4.7. Summary of Relation between GNPA of Nationalised Banks and Macroeconomic Variables

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Insert Table 1 about here

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4. ANLAYSIS AND DISCUSSION OF EMPIRICAL RESULTS

4.1 – Econometrics Analysis of Relationship between GNPA of Nationalised Banks and Macroeconomic Variables

The empirical evidence on the macroeconomic determinants of Non-Performing Assets of commercial banks in India based on data of banks over the period 2003-2014 is presented in this section. This section highlights the descriptive statistics of the selected variables, the correlation matrix and finally the empirical model. The data was diagnosed for the presence of autocorrelation and heteroscedasticity. An econometric specification for the NPA has been estimated using Auto Regressive Conditional Heteroscedasticity.

Insert Table 2 about here

Table 2 presents the summary of descriptive statistics of the endogenous and exogenous variables captured in the Autoregressive Conditional Hetroscedasticity Model. These statistics are generated to give overall description of the data used in the model and enable to screen the data for any suspicious figure. The key descriptive measures are the mean, standard deviation, the minimum and the maximum values of the variables over the period under consideration. Mean explains the average value of observations and standard deviation indicates deviation/ change of data from mean. It is particularly noted from the table that GNPA of Nationalised banks present a high disparity between banks with a minimum of 1.77% and a maximum of 10.76%. 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.

4.1.2 – Correlation Matrix of Macroeconomic Variables

Insert Table 3 about here

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. Table 5.1.2 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. But, these two variables do not exceed the limit of 0.80.

4.1.3 - Unit Root Test of GNPA of Nationalised Banks and Macroeconomic Variables

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Insert Table 4 about here

Table 4 displays the unit root test results of all the public and private sector commercial banks. It is important that macroeconomic 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., 1(0). To further validate and strengthen the results, first difference of the series has been taken to ensure stationary of the data.

4.2– Bivariate Cointegration Test of GNPA of Nationalised Banks and Macroeconomic Variables

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Insert Table 5 about here

After checking the time series of properties of each macroeconomic variable through Unit Root Test, the study is proceeded to test the cointegrating relationship between endogenous and exogenous variables of Nationalised banks. Johansen Cointegration analysis helps to determine whether there is a cointegrating relationship between the variables or not. It enables to identify more than one cointegration relationship between time series data. The study has applied Johansen Maximum Likelihood method of cointegration to find

whether there is more than one cointegration relationship among the variables. In order to accept the cointegrating relationship between variables, Trace and Max-Eigen Statistics value should be higher than the critical value at 5% significance level. The results exhibit that all the variables are cointegrated with endogenous variable GNPA.

4.3 – Granger Causality Test of GNPA of Nationalised Banks and Macroeconomic Variables

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Insert Table 6 about here

Table 6 represents the results of Granger Causality Test of Nationalised Banks. 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 Inflation. Whereas, credit growth, exchange rate and annual growth of industrial production have showed an uni-directional causality relationship with GNPA of Nationalised banks.

4.4– Auto Regressive Conditional Hetroscedasticity Model of GNPA of Nationalised Banks and Macroeconomic Variables

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Insert Table 7 about here

Table 7 exhibits the summary results of ARCH Model of Nationalised Banks. The estimation results show that Gross Domestic Product (GDP) is having a positive relationship as against the expectation and its coefficient is significantly associated with NPA of Nationalised Banks at 1% level of significance. 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 0.399246. The exogenous variable money supply (M3) is positively associated with GNPA. It implies that the increase in money supply leads to the growth in NPA. However, this relationship proves to be statistically significant thereby ignoring the positive effect. In accordance with the expected relationship, Credit growth has shown a positive relationship with GNPA of Nationalised Banks. The coefficient of credit growth (CG) is significant at 5% level of significance. This result shows the lack of proper credit appraisal process by nationalised banks when credit is growing rapidly. Deposit Growth (DG) has a positive and insignificant relationship with GNPA. In line 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. The coefficient of exchange rate is significantly related with GNPA at 1% level of significance. It can be inferred that exchange rate leads to increase in non-performing assets due to unfavourable conditions to traders in foreign

exchange market. As a result, loans extended to importers/exporters become loss assets. The coefficient of annual growth of industrial production (AGRIIP) is having a positive association with GNPA of Nationalised Banks. The result explains that 1% increase in annual growth rate of industrial production increases NPA to the point of 0.358347. It can be interpreted that loans given to industries turn out to be NPA. Similarly, there exists a positive and significant relationship between weighted average lending rate (WALR) and non-performing assets of Nationalised 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 influence of macroeconomic factors on GNPA of Nationalised Banks is to the extent of 60% as R^2 value of the model explains the endogenous variable. Likewise, the adjusted R^2 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 less than 2.

5. Concluding Remarks:

This empirical study has analysed the interaction between macroeconomic factors and credit risk conditions in Nationalised Banks in India using the econometrics tools for the period 2003-2014. The bivariate cointegration results revealed that all the macroeconomic variables are cointegrated with GNPA of Nationalised Banks. It is also found from the analysis that exogenous variables such as credit growth, exchange rate and annual growth of industrial production have showed an uni-directional causality relationship with GNPA of Nationalised banks whereas inflation granger causes GNPA in bidirectional way. It can be concluded that macroeconomic variables like Gross Domestic Product, inflation, credit growth, exchange rate, unemployment rate, annual growth of industrial production and weighted average lending rate are the macroeconomic determinants those explain the credit risk conditions of Nationalised Banks.

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Annexure – 1

Table 1 - Summary of Relationship between Macroeconomic Variables and GNPA of Nationalised Banks

NPA VARIABLE	MACROECONOMIC 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	+

Table 2 - Preliminary Econometric Analysis of GNPA of Nationalised Banks and Macroeconomic Variables

	GNPA	GDP	INFL	M3	CG	DG	ER	UR	AGRIIP	WALR
Mean	4.13	7.49	6.16	16.63	21.52	17.58	47.57	8.85	7.32	12.22
Median	3.05	7.57	6.25	16.00	19.50	16.65	45.95	8.85	6.55	12.15
Maximum	10.26	9.57	9.60	22.10	37.00	24.00	60.50	10.80	15.50	13.50
Minimum	1.77	3.88	3.40	13.00	13.90	13.00	40.20	6.80	2.50	10.60
Std. Dev.	2.78	1.88	2.06	3.10	7.30	4.04	5.23	1.25	3.65	0.82
Skewness	1.23	-0.69	0.16	0.45	0.85	0.50	1.33	0.02	1.09	-0.29
Kurtosis	3.19	2.43	1.91	1.87	2.66	1.83	4.41	2.16	3.44	2.64
Jarque-Bera	3.02	1.10	0.64	1.04	1.51	1.20	4.51	0.35	2.47	0.24
Probability	0.22	0.58	0.73	0.59	0.47	0.55	0.10	0.84	0.29	0.89
Sum	49.50	89.82	73.97	199.60	258.20	211.00	570.83	106.20	87.80	146.60
Sum Sq. Dev.	85.06	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 GNPA of Nationalised Banks and Macroeconomic Variables

Variables	Augmented Dickey Fuller Test		
	Level	First Difference	Order of Integration
GNPA – Nationalised	-4.227900*	-6.696526*	I (0)
Gross Domestic Product	-8.534348*	-27.19786*	I (0)
Inflation Rate	-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– Bivariate Cointegration Test of GNPA of Nationalised Banks and Macroeconomic Variables

Pair wise	Eigen Value	Trace Statistic	Critical Value (5%)	Max-Eigen Value	Critical Value (5%)
GNPA - GDP	0.309659	118.8290	15.49471	82.63718	14.26460
	0.149810	36.19179	3.841466	36.19179	3.841466
GNPA - INFL	0.290139	147.9283	15.49471	76.41889	14.26460

	0.274337	71.50942	3.841466	71.50942	3.841466
GNPA – M3	0.383249	154.0702	15.49471	107.7736	14.26460
	0.187474	46.29657	3.841466	46.29657	3.841466
GNPA - CG	0.355779	145.4730	15.49471	98.05617	14.26460
	0.191546	47.41680	3.841466	47.41680	3.841466
GNPA - DG	0.417451	167.9590	15.49471	120.4964	14.26460
	0.191712	47.46265	3.841466	47.46265	3.841466
GNPA - ER	0.429894	171.8702	15.49471	125.3112	14.26460
	0.188430	46.55897	3.841466	46.55897	3.841466
GNPA - UR	0.588847	283.8758	15.49471	198.2002	14.26460
	0.319002	85.67562	3.841466	85.67562	3.841466
GNPA - AGRIIP	0.408649	200.1775	15.49471	117.1520	14.26460
	0.310861	83.02549	3.841466	83.02549	3.841466
GNPA - WALR	0.508356	192.4733	15.49471	158.3303	14.26460
	0.141962	34.14295	3.841466	34.14295	3.841466

Table 6– Granger Causality Test of GNPA of Nationalised Banks and Macroeconomic Variables

Null Hypothesis H_o	F- Statistic	P - Value	Conclusion
GDP does not Granger Cause GNPA	33.5178	2.E-13	Accepted H_o
GNPA does not Granger cause GDP	18.0692	5.E-08	Accepted H_o
INFL does not Granger Cause GNPA	4.71019	0.0099	Rejected H_o
GNPA does not Granger cause INFL	8.91952	0.0002	Rejected H_o
M3 does not Granger Cause GNPA	23.3679	6.E-10	Accepted H_o
GNPA does not Granger cause M3	57.4354	8.E-21	Accepted H_o
CG does not Granger Cause GNPA	18.6953	3.E-08	Accepted H_o
GNPA does not Granger cause CG	93.7780	3.E-30	Rejected H_o
DG does not Granger Cause GNPA	18.6953	3.E-08	Accepted H_o
GNPA does not Granger cause DG	93.7780	3.E-30	Accepted H_o
ER does not Granger Cause GNPA	81.9647	2.E-27	Accepted H_o
GNPA does not Granger cause ER	9.02434	0.0002	Rejected H_o
UR does not Granger Cause GNPA	1.80333	0.1672	Accepted H_o
GNPA does not Granger cause UR	9.93327	7.E-05	Accepted H_o
AGRIIP does not Granger Cause GNPA	7.39359	0.0008	Rejected H_o
GNPA does not Granger cause AGRIIP	14.4847	1.E-06	Accepted H_o

WALR does not Granger Cause GNPA	0.08989	0.9141	Accepted H_o
GNPA does not Granger cause WALR	13.4679	3.E-06	Accepted H_o

Table 7– Auto Regressive Conditional Hetroscedasticity Model GNPA of Nationalised Banks and Macroeconomic Variables

Dependent Variable: GNPA

Method: ML - ARCH (Marquardt) - Normal distribution

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-96.22200	20.71125	-4.645880	0.0000
GDP	0.370355	0.161810	2.288827	0.0221
INFL	-0.399246	0.141380	-2.823932	0.0047
M3	0.023167	0.095840	0.241726	0.8090
CG	0.085994	0.036351	2.365631	0.0180
DG	0.081670	0.079463	1.027778	0.3041
UR	2.519822	0.561824	4.485075	0.0000
ER	0.411213	0.114539	3.590169	0.0003
AGRIIP	0.358347	0.154969	2.312386	0.0208
WALR	4.266396	0.535136	7.972548	0.0000
Variance Equation				
C	3.937258	0.518419	7.594743	0.0000
RESID(-1)^2	0.691711	0.200665	3.447089	0.0006
GARCH(-1)	-0.332015	0.067496	-4.918991	0.0000

R-squared	0.606360	Mean dependent var	4.313716
Adjusted R-squared	0.590109	S.D. dependent var	3.628043
S.E. of regression	2.322773	Akaike info criterion	4.133277
Sum squared resid	1176.170	Schwarz criterion	4.328809
Log likelihood	-458.1935	Hannan-Quinn criter.	4.212168
Durbin-Watson stat	0.794711		