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Sensitivity of Credit Risk to Bank Specific and Macro Economic Determinants: Empirical Evidence from Indian Banking Industry

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ABSTRACT

Both macroeconomic and bank-specific factors affect the Non-Performing Loan Ratio used as proxy for credit risk,. Using panel data this study identifies bank specific and macroeconomic factors that contribute to the rising credit risk in public and private Banks in India. Fourteen private banks and twenty six public banks listed on Bombay Stock Exchange have been studied for the period from 2000/2001 to 2015/2016. The annual reports of the Indian banks under study STATA 12 has been used to analyse the data. The empirical results shows that bank specific factors ROA , ROE, Credit Deposit, operating inefficiency , CAR and size are significant having inverse relationship and Credit growth significant and influences credit risk positively. Loan loss provision to total loss is insignificant but positively related. GDP growth rate, lending rate, unemployment rate and annual inflation rate are significant and are having inverse relation with non-performing loans, and exchange rate is significant and positively related suggesting significance of both bank specific and macroeconomic factors. The study concludes that that 55% variation in the percentage change in Non-Performing Loan to Total Loans (Credit risk) can be explained by the variation s in the bank specific and macroeconomic factors.

Keywords: Macroeconomic determinants; Bank specific determinants, Non-performing loans, credit risk, GDP, CAR, ROE, ROA, Panel Data, Fixed Effect Model, Random Effect Model.

INTRODUCTION:

Across the globe, the banking sector acts as the catalyst for the economy of any country and has become an indispensable segment of the economy ensuring economic development and economic growth of a country through their intermediation role and financial services that they provide to the community and the nation at large. In India, banking sector acts as a dominant sector and playing a significant role in socio-economic progress of the country after independence and accounts for more than half the assets of the financial sector. Banking which is a risky business run on a Public Money. Banks seek to maximize their profits by offering Loans and advances which constitute the primary and profitable source of income than any other assets. Therefore banks are willing to lend as much of their fund as possible, but lending by the banker is associated with the credit risk which is likely to arise because of the possibility that the expected cash flows from advances and securities held might not be received in full. Thus, loan is not only the major services but the most risky service provided by the bank due to the credit risk, which is directly related to non-performing loans, a loan that

borrower might not pay back as promised, thus endangering health of the financial sector which is a matter of policy concern. Among other risks faced by banks, credit risk plays an important role on banks' profitability since a large chunk of banks' revenue comes from loans from where interest is earned by the banks. Credit Risk is one of the oldest, greatest and a major risk faced by banks and is inherent to any business of lending funds to individuals, corporate, trade, industry, agriculture, transport, or banks and financial institutions. The Basel Committee on Banking Supervision (2001) defined credit risk as the possibility of losing the outstanding loan partially or totally, due to credit events (default risk) and empirically credit risk has been commonly measured by Non-performing loan to the gross loan amount, a dependent variable in the study. Credit risk is defined as the possibility of losses associated with a diminution in the credit quality of the borrowers or counterparties. It is the risk of loss of principal or loss of a financial reward stemming from a borrower's failure to repay a loan or otherwise meet a contractual obligation. It occurs when customers default or fail to comply with their obligation to service debt, triggering a total or partial loss. Credit Risk is the potential that a bank borrower or counter party fails to meet the obligations on agreed terms. There is always scope for the borrower to default from his commitments for one or the other reason resulting in crystallization of credit risk to the bank. These losses could take the form outright default or alternatively, losses from changes in portfolio value arising from actual or perceived deterioration in credit quality that is short of default.

India's banking system, one of the largest banking networks in the world, has witnessed a dynamic period of growth and reform over the years and resulted in bringing sea changes of liberalization, deregulation of interest rates, dilution of government stake in public sector banks and a monumental increase in the market share of private sector banks. There has been tremendous transition in the role performed by banks as a financial intermediary.

Thus Indian banks have been going through rapid changes brought about by financial sector reforms, which are being implemented in a phased manner and converting Indian banking sector into a sound, strong and vibrant system capable of playing its role efficiently and effectively. Though Indian Banking industry is a large financial sector in the country and the backbone of strengthening the country's economic situation has shown tremendous growth but facing huge problems on account of mounting amount of Non Performing Loans which is the result of credit activities. NPA account represents a situation where the credit risk has crystallized, where default has taken place. Non-performing assets has been the single largest cause of irritation of the banking sector of India. As a result quality of assets in Indian Banking Sector has been worsening where NPAs have outpaced the credit growth over the last couple of years. The Indian banking system continued to battle falling asset quality issues and the need to maintain capital adequacy in the light of piling bad loans. A high and rising proportion of banks stressed loans, particularly those of Public Sector Banks (PSBs) and a consequent increase in provisioning for Non-Performing Assets (NPAs) continued to weigh on credit growth reflecting their lower risk appetite and stressed financial position.

A Non-Performing Asset is defined as a credit facility in respect of which the interest and/or installments of principal has remained 'over-due' for a specified period of time (90 days). These are those assets that cease to provide any income for the banks. Increase in NPLs is often referred as the result of failure of credit policy. Almost all research on the causes of bank failures find that failing institutions have large proportions of non-performing loans prior to the failure which are statistically significant predictor of insolvency. A bank failure brings in massive effects and costs not only to the Banks but also to the economy of a country at large and as such demands assessment of causes of non-performing loans. In many previous studies NPL has been used to measure credit risk level in the banks. This study uses Ratio of NPL to Gross Loans as a proxy for credit risk in public and private banking industry.

Mixed approaches have been used by the researchers in the literature to analyse the factors influencing the credit risk in banks. Some studies exclusively use Bank Specific Factors or Macroeconomic Indicators whereas others have used both Macro and bank specific factors.

Thus empirical literature reviewed on banking fragility in most of the studies brings to light two types of factors influencing credit risk Viz., Micro also called as Bank Specific Factors and Macroeconomic Indicators and our study uses both Bank Specific and Macro determinants of Credit Risk

Micro Level / Internal Factors/ Bank Specific Factors:

The distinctive features of the banking sector and the policy choices of each particular bank with respect to their efforts to maximise efficiency and bring improvements in their risk management influences the credit risk. At the micro level, financial institutions weaknesses are the main causes of bank failure.

Earlier studies focus on the individual bank's balance sheet data and try to identify micro variables which have been the main causes of Non Performing Loans and individual bank's failure.

Various Bank specific financial ratios which have been used to evaluate the condition of banks include ROA, ROE, Credit Deposit, Credit Growth, Operating Efficiency, CAR, Ownership Structure, Loan Loss Provision and ...

Macroeconomic Variables:

By provision of different financial services banks play a major role in economic activity of a country and thereby have influence on economic activities and as a result macroeconomic factors also affect activities of commercial banks in a given country.

Macroeconomic factors focuses on external events which are likely to affect the borrowers' capacity to repay their loans. The macroeconomic determinants of credit risk account for the impact of macroeconomic instability and the macro-policy environment on banking sector Credit Risk.

The macro economic factors used in the previous study include GDP growth rate, Inflation rate, Unemployment Rate, Exchange Rate and Interest Rate. Our study also uses these macroeconomic indicators as the determinants influencing credit risk.

LITERATURE REVIEW:

Ahmad, N. H., & Ariff, M. (2007), using cross-sectional data performed Multi-Country Study on Bank Credit Risk Determinants covering nine countries over a crisis-prone period from 1996 to 2002. Study using regression analysis and Correlation finds that Regulatory capital is significant for those banking systems that offer multi products and management quality is critical in the cases of loan-dominant banks in emerging economies. An increase in loan loss provision consistently emerges, as in prior studies, to be a significant determinant of potential credit risk. The credit risk in emerging economy banks is higher than that in developed economies and that risk is the result of by a large number of bank-specific factors in emerging economies compared to their counterparts.

Das, A., & Ghosh, S. (2007), empirically investigated the determinants of Credit Risk in Indian State Owned Banks from 1994-2005. The regression analysis reveals that at the macro level, GDP growth and at the bank level, real loan growth and bank size play an important role in influencing problem loans.

Aver, B. (2008), analysed 25 credit risk factors of the Slovenian banking to establish which macroeconomic factors influence the systematic credit risk of the Slovenian banking loan portfolio. The study uses loans given to the non-banking sector/ gross loans to the non-banking sector as a measure of credit risk The study applies the method of multi linear regression and the result shows credit risk of the loan portfolio depends on the employment or unemployment rate, short and long-term interest rates and value of the Slovenian stock exchange index but doesn't depend on the inflation rate , the growth of GDP (industrial production), exchange rates or the growth of Slovenian import and export.

Al-Smadi, M. O. M. (2010), studies Credit Risk, Macroeconomic and Bank Specific Factors in 23 Jordanian Banks from 1995-2008 and uses 12 independent variables consisting of seven bank specific variables and five macroeconomic variables. The result of OLS Regression Model shows that all the macroeconomic variables together explain 51.9% of variation in Credit Risk and bank specific factors explain 73% of credit risk thus affecting credit risk more than macro economic factors and indicating close association.

Zribi, N. and Younes, B. (2011), examined macroeconomic and microeconomic factors influencing bank credit risk in Tunisia for ten commercial banks over a period from 1995 to 2008. The regression results show that the public ownership increases the bank credit risk and the prudential regulation of capital decreases the credit risk taken by Tunisian banks. The ratio of return on assets is positively related with credit risk and the ratio of capital adequacy is negatively associated with credit risk. Then, the results indicate that the bank credit risk-taking decisions are also related to bank macroeconomic indicators.

Louzis, D. P., Vouldis, A. T., & Metaxas, V. L. (2012) using dynamic panel data methods examined Macroeconomic and Bank-Specific Determinants of Nonperforming Loans in Greece for each type of consumer, business and mortgage loans from 2003-2009 and the result show difference in the quantitative impact of macroeconomic factors among types of loans as non-performing mortgages being the least responsive towards changes in the macroeconomic conditions. The real GDP growth rate, the unemployment rate and the lending rates have a strong effect on the level of NPLs.

Gunsel, N. (2012), by employing multivariate logit regression model and panel data of 24 commercial banks empirically investigated Micro and Macro determinants of bank fragility in North Cyprus economy from 1984 to 2008. The study considers microeconomic variables that are identified in the CAMELS context and three sets of macro variables viz. real GDP growth, the inflation rate, the real interest rates and external conditions which include terms of trade, real exchange rate and market pressure index in Turkey. The study finds that, capital

adequacy, lower income, lower bank size, high inflation rate, lower growth rate, adverse terms of trade shocks and market pressure in Turkey are important determinants of banking sector distress in North Cyprus.

wamy, V. (2012), using panel regression analysis, studied the determinants of bank asset quality and rofitability for the period from 1997-2009. The study reveals that Priority sector credit and credit by rural ranches is not significant in affecting the NPAs. Study also reveals that capital adequacy and investment ctivity significantly affect the profitability of commercial banks apart from other accepted determinants of rofitability; asset size has no significant impact on profitability.

Pestova, A., & Mamonov, M. (n.d.) (2012), using panel data evaluated Macroeconomic and bank-specific determinants of credit risk in Russia from 2004-2011. The result reveals that banks' loan quality was affected by deterioration in macroeconomic conditions. GDP growth rates show significant and inverse influence on the percentage of overdue loans. During the periods of economic expansion credit risk tends to be lower and loan quality get deteriorated during contraction period Result indicates that sudden stop of income and asset price inflation reduces borrowers' debt sustainability. There is also significant influence of exchange rates devaluation on the quality of loans denominated in foreign currency.

Garr, D. K. (2013), using unbalanced panel data set from 33 commercial banks covering 21-year period from 1990 to 2010 examined bank-specific, industry-specific and macroeconomic factors that influence credit risk (CR) in commercial banks in Ghana. Results of panel data regression shows that credit risk in Ghana is significantly influenced by management efficiency, GDPPC, Government borrowing and the financial sector development. Government borrowing and financial sector development have a negative relationship with credit risk while management inefficiency and GDPPC have a positive relationship.

Castro, V. (2013) studied macroeconomic determinants of the credit risk in the banking system in the case 5 European countries, GIPSI (Greece, Ireland, Portugal, Spain and Italy. The study employs dynamic panel data approaches and the result of regression analysis shows that the banking credit risk is significantly affected by the macroeconomic environment and the credit risk increases when GDP growth and the share price indices decrease and rises when the unemployment rate, interest rate, and credit growth increase. It is also positively affected by an appreciation in the real exchange rate.

Mehmood, B., Younas, Z. I., & Ahmed, N. (2013), empirically tested the macroeconomic and bank-specific covariates of non-performing loans for a panel of 13 commercial banks for a period from 2003-2012. The results of regression reveal that findings in this study conform to other studies in Asian countries including India and Bangladesh. Market share is found to be significant and reduces the non-performing loans. NPL shows a negative relationship with return of equity and return on asset. Statuary liquidity ratio and GDP decreases the NPL Both regressor inflation rate and interest rate is showing positive relationship with NPL.

Washington, G. K. (2014), investigates the effects of Macroeconomic Variables on Credit Risk in the Kenyan Banking System from 1990 to 2013. OLS regression model reveals that only GDP per capita growth rate is significantly related to credit risk and in the long run however all variables are significant in explaining credit risk. Exchange rates between the US dollar and the Kenyan Shilling, Domestic Credit to Private Sector, Inflation Were Found to be negative and significantly related to credit risk. Lending interest rates were positive and significant to credit risk.

Tilahun Aemiro Tehulu et al., (2014) using a balanced panel data of 10 commercial banks both state-owned and private owned for the period from 2007 to 2011 examined the bank- specific determinants of credit risk in Ethiopian commercial banks. The regression results revealed that credit growth and bank size have negative and statistically significant impact on credit risk. Whereas, operating inefficiency and ownership have positive and statistically significant impact on credit risk. Finally, the results indicate that profitability, capital adequacy and bank liquidity have negative but statistically insignificant relationship with credit risk.

Waemustafa, W., & Sukri, S. (2015), analyses Bank specific and macroeconomics dynamic determinants of credit risk in Islamic banks and conventional banks using Multivariate Regression analysis and finds that risky sector financing; regulatory capital and Islamic Contract are significant to credit risk of Islamic banks. For Conventional Banks, loan loss provision, debt-to-total asset ratio, regulatory capital, size, earning management and Liquidity are significant factors influencing credit risk. Amongst macroeconomic factors only Inflation and M3 are significant to credit risk for both Islamic and Conventional banks.

Ahmad, N. H., & Ahmad, S. N. (2016) studied key factors influencing Credit Risk of Islamic Bank: A Malaysian Case and makes comparison between Islamic and conventional banking operations from 1996 to 2002. The result of regression analysis shows that management efficiency, risk-weighted assets and size of total assets have significant influence on credit risk of Islamic banking, while conventional banking credit risk are significantly affected by loan exposure to risky sectors, regulatory capital, loan loss provision and risk-weighted assets. Both

banks observe similar effects of leverage, funding cost, risk-weighted on credit risk. Islamic banking experience different impact of management efficiency, regulatory capital and loan loss provisions on their credit risk. Tesfa Getachew (2016) using panel data examined the determinants of Ethiopian Private Commercial Banks Asset Quality and studied sixteen private commercial banks from 2004-2005 to 2012-2013. The empirical results of regression shows that GDP growth and annual inflation rate are positively related to non-performing loans. A negative relationship of CAR and ROE with the volume of private commercial banks non-performing loans was also found. Contrary to previous studies, the findings also showed an insignificant relationship among real lending rate and NPLs of Ethiopian private commercial bank. Sandada Maxwell and Kanhukamwe Agness, (2016) analysed the factors leading to rising credit risk in the Zimbabwean banking sector and considered macroeconomic, industry and bank specific factors on rising credit risk in Zimbabwe. The results reveal that macroeconomic and bank specific factors are the most significant factors leading to credit risk in the Zimbabwean banking sector. The industry factors do not show significant influence on the rising credit risk.

DATA AND METHODOLOGY:

This section deals with the research methodology used in the study, selection of sample, the data collection methods as well as tools used to analyse the data.

Data:
The study uses Secondary Data which takes the form of bank specific variables and the macroeconomic indicators and the data has been collected from following sources:
Out of five macroeconomic indicators the data on three economic indicators viz. GDP Growth Rate, Unemployment Rate and Inflation Rate has been collected World Bank Data Base. For the remaining two macroeconomic indicators viz. Exchange Rate and the Lending Rate the study uses Reserve Bank of India website www.rbi.org.in.
Bank specific variables on 24 public sector banks and 16 private sector banks for the period from 2000 – 2001 to 2015- 2016 have been collected from the annual reports of individual banks retrieved from the websites of the banks under study.
The dataset consist of unbalanced Panel of 40 Banks and 16 years from 2000-01 to 2015-16, resulting in 640 observations and uses STATA 12 to extract panel regression results.

Selection of Sample:
The study deals with 40 Indian Commercial Banks of which 24 are public banks and 16 are private banks. The selection criteria is based on inclusion of all those banks which were listed on Bombay Stock Exchange as on 31-3-2016 and as such there were 43 listed banks of which 03 banks viz. SBI Patiala, SBI Hyderabad and IDFC have been dropped due to unavailability of annual reports.

Public Sector Banks:

Oriental Bank of Commerce	Allahabad Bank	Andhra Bank	Bank of Baroda
SBI	Punjab National Bank	Punjab and Sind Bank	SBI Bikaner And Jaipur
Vijaya Bank	SBI Mysore	United Bank of India	State Bank of Travancore
Syndicate Bank	UCO Bank	Bank of India	Bank of Maharashtra
Canara Bank	Central Bank of India	Corporation Bank	Dena Bank
IDBI	Indian Bank Ltd	Indian Overseas Bank	Union Bank of India

Private Sector Banks:

Axis Bank	City Union Bank Ltd	DCB Bank	Dhanlaxmi Bank Ltd
Federal Bank	HDFC Bank	ICICI Bank	Indusind Bank
Jammu & Kashmir	Karnataka Bank	RBL Bank	Karur Vysya Bank
South Indian Bank	Lakshmi Vilas Bank	Yes Bank Ltd	Kotak Mahindra Bank

Operational Definitions of Variables:

Definition and Expected signs of Micro variables:

Based on the literature reviewed following variables have been selected as determinants of credit risk and have been defined and expected sign is shown, which represents researchers' hypothesis.

Variables	Definition	Expected sign
Dependent Variable:		
Non-Performing loans	Ratio of Non-performing loans to Total Gross Loan	
Independent Variable		
A) Bank-specific variable		
1) Return On Asset	Profit after Tax to Total Assets	Negative
2) Return On Equity	Profit after Tax to Total Equity	Negative
3) Credit Deposit Ratio	Total deposit as a percentage of total loans	positive
4) Credit Growth	Current Years Loan – Previous Years Loan/Previous Years Loan	positive
5) Loan Loss Provision Ratio	Loan Loss Provision to Total Loans	positive
6) Operating Efficiency	Operating Expenses to Total Income	Negative
7) Capital Adequacy Ratio	Capital to Risk Weighted Assets	Negative
8) Size	Total Asset	Negative
9) Ownership Structure	Public and Private Banks, 0 for Public Banks, 1 for Private Banks	
B) Macroeconomic Indicators		
1) GDP Growth Rate	The growth rate of real GDP	Negative
2) Inflation Rate	The inflation rate	Positive/Negative
3) Unemployment Rate	The Unemployment Rate	Positive
4) Exchange Rate	The Exchange Rate	Positive
5) Interest Rate	The Lending Rate	Positive/Negative

DATA ANALYSIS AND ECONOMETRIC MODEL:

Table 1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Size	607	4.809504	0.841343	2.990525	9.224428
ROA	607	0.195133	0.898455	-1.25	19.55
ROE	501	3.374563	8.334037	-33.11	55.82
Exchange Rate	628	50.46927	7.703987	41.3485	67.1953
Unemp_rate	628	3.848408	0.290708	3.5	4.4
Lending Rate	628	10.48917	0.995954	8.25	12.25
Inflation Rate	628	6.837483	2.766097	3.684807	11.9923
GDP_Growth	628	7.281482	1.939421	3.803975	10.25996
oper_ineffec	599	208.6957	2198.852	0.001953	37658.07
CD RATIO	566	69.65778	14.57674	8.87	202.84
CAR	616	12.96915	3.779843	0.3434	59.42
Credit_Gr	552	-0.19956	0.203717	-0.91564	0.999879
llp_ln	558	0.044222	0.220984	-0.00711	3.046902
GNPA_per	498	4.454325	3.655989	0	24.11

Source: Software Results based on data retrieved from websites of banks, RBI, World Bank Data base

The summary of descriptive statistics giving general descriptions about the data ,both dependent and independent variables with regard to mean, standard deviation, minimum and maximum values of each variable have been used to show the overall trend of the data over a period of 16 years under consideration. The mean of NPL of all the 40 banks under study over the 16 years is 4.454325. This suggests that banks could not recover 4.45 percent of every loan provided to the borrowers. The highest NPL ratio is 24.11 while the lowest is 0.00.

4.45 percent average NPL, is lower than the Basel standard limit of NPLs ratio which is 5%. But high... 24.11 % is much higher. The standard deviation of 3.656 % in NPLs shows the variation of NPLs among th... With regard to bank specific independent variable Return on Asset, the highest Return on Asset was 19.23... the lowest was percentage was -1.25%. That means, the most profitable banks earned 19.23 % of ... from assets and the minimum was -1.25 %. ROA revealed the standard deviation 0.898455 % from its ma... Among the macro-economic variables the mean GDP growth rate over the test period was 7.28 ... the highest growth of 10.260 percent and the lowest growth of 3.80.

The highest and lowest exchange rate was 67.20 and 41.35 respectively, with a mean of 50.47 an... deviation of 7.703.

Correlation Matrix:

	GNPA_Per	Size	ROA	ROE	Exchange	Unemp_rate	Lending	Inflaton Rate	GDP_Growth	Oper_inefncy-c	CDRATIO	CAR	Gr_lml	Credit	llp_ln
GNPA per cent	1.0000														
Size	-0.1090	1.0000													
ROA	-0.0591	0.0366	1.0000												
ROE	-0.1702	0.1527	0.2723	1.0000											
Exchange Rate	0.1956	0.2911	-0.0782	-0.2079	1.0000										
Unem. rate	0.0954	-0.3185	0.0006	0.0570	-0.6773	1.0000									
Lending	-0.1289	-0.1673	-0.0578	0.1656	-0.5119	0.3561	1.0000								
Inflation	-0.5133	0.1444	0.0404	0.1596	-0.1922	-0.2252	0.1175	1.0000							
GDP_Growth	-0.0721	-0.0680	-0.0046	0.0274	-0.1749	-0.0600	0.0918	-0.0136	1.0000						
Oper_ineffec	-0.0187	-0.0546	-0.0213	-0.0421	-0.0750	0.1685	0.0146	-0.1096	-0.0131	1.0000					
CD RATIO	-0.3544	0.3062	-0.1813	-0.0142	0.3207	-0.3970	-0.1536	0.2393	0.0292	0.0778	1.0000				
CAR	-0.1863	-0.1594	-0.0586	-0.0524	-0.0930	-0.0041	0.0017	0.1746	0.0313	0.0059	0.1371	1.0000			
Gr_ln	0.0125	0.6117	0.02289	0.0767	0.0266	-0.0469	0.0372	0.0622	0.0215	-0.0154	0.0481	-0.0284	1.0000		
Credit_Gr	0.3277	0.1868	-0.0113	-0.0196	0.3159	-0.1628	0.1489	0.1410	-0.0635	0.0492	0.0188	0.1849	0.0015	1.0000	
llp_ln	-0.0625	0.0317	-0.0090	-0.0627	-0.0860	0.0431	0.0861	0.0629	0.0404	-0.0158	0.0079	0.0525	-0.0263	-0.1093	1.0000

Source: Regression resultsusing panel data

Correlation is used to study the strength of relationship between the dependent variable, measured by Non Performing Loan to Total Loans and independent variables bank specific and macroeconomic determinants used in the study.

There is weak correlation ship between dependent variable and bank specific and macroeconomic independent variables considered under the study with the exception of one macroeconomic indicator Inflation rate where the relationship is moderate.

DIAGNOSTIC ANALYSIS FOR AUTOCORRELATION:

Serial Autocorrelation:

Serial Autocorrelation applies to macro panels with long time series data and not a problem in micro panels, with few years. Micro panels are usually characterized by having a large number of individuals N over relatively short periods of time T. When the number of the individuals (N) is much greater compared to the number of time periods (T), then the data set is called as micro-panel data.

Dataset used by the researcher to deal with the research problem is the micro-panel data as the study deals with 40 Indian commercial banks comprising of 24 Public Sector Banks and 16 Private Sector Banks covering a period of 16 years beginning from 1-04-2000 and ending on 31-03-2016

To check autocorrelation, Whooldridge test for autocorrelation in panel data is applied. If the p-value is significant < 0.05 reject Null Hypothesis.

HO: There is no first order autocorrelation.

Result show f test value 0.3359, which is greater than 0.05, so we failed to reject Null Hypothesis and there is no first order autocorrelation.

Hausman Test:

Hausman test is a statistical hypothesis tests in econometric. To decide between Random Effect and Fixed Effect Model Hausman Test is run, where the Null Hypothesis is that the preferred model is Random Effects Vs the alternative Fixed Effect .It basically tests whether the unique errors are correlated with the regressor.

The Null Hypothesis is:

HO: Unique Errors are not correlated with the regressor.
If the p-value is significant < 0.05, then use Fixed Effects, otherwise use Random Effects.
The result shows 0.0001, requiring the use of Fixed Effect Model.

Random and Fixed Effect Model:

Variables	Random GNPA_per cent	Fixed GNPA_per cent
ROA	-0.450 ***	-0.444***
	(0.129)	(0.124)
ROE	-0.0636 ***	-0.0791***
	(0.0220)	(0.0230)
Ownership	-1.338 *	
	(0.712)	
Exchange Rate	0.0744 ***	0.179***
	(0.0288)	(0.0314)
Unemployment Rate	-0.170	-1.753**
	(0.743)	(0.740)
Lending Rate	-0.138	-0.298**
	(0.143)	(0.137)
Inflation Rate	-0.394 ***	-0.241***
	(0.0605)	(0.0615)
GDP Growth Rate	-0.0916	-0.130*
	(0.0756)	(0.0719)
Operating Inefficiency	-0.000116	-0.000140*
	(7.78e-05)	(7.54e-05)
CD Ratio	-0.100 ***	-0.0810***

Variables	Random GNPA_per cent	Fixed GNPA_per cent
	(0.0153)	(0.0166)
	-0.0290	-0.0796**
CAR	(0.0365)	(0.0364)
	2.707 ***	1.935***
Credit Growth	(0.754)	(0.723)
	0.724	0.635
Loan Loss Prov. To Loan	(0.675)	(0.682)
	-0.991 **	-6.408***
Size	(0.398)	(0.925)
	19.61***	46.28***
Constant	(5.246)	(6.411)
Observations	356	356
R- Squared		0.551
Number of Code	35	35
Standard errors in parantheses	*** p < 0.01.** p< 0.05 * p< 0.1	

Source: Authors Results using panel Data Regression Output

Results of Fixed Effect Model have been presented as follows:

Variables	Significance & Relationship	Interpretation
ROA & ROE	Both the variables are significant at 1 % and share inverse relationship	ROE and ROA demonstrate the efficiency of bank in generating its income by using equity and assets. A well diversified bank with sophisticated investment policy would be able to generate satisfactory return from the usage of its equity and assets, resulting in inverse relation with NPL.
Credit Deposit	Significant at 1 % and inversely related.	Credit Deposit Ratios predicts that the bigger the loan portfolio relative to deposit size the higher should be the probability of loan default. The result shows bigger the CD ratio lesser is the amount of NPL
Credit Growth	Significant at 1 % and positively related	Credit growth which implies credit expansions and results in excessive rapid loan growth are the indications of deterioration in the financial health of banks and can be employed as early warning signals to future problem loans. Growth in Bank Credit is also one of the factors that determine the emergence of NPAs. Result shows growth in credit leads to high level of NPL Studies by Das and Ghosh, 2007, Hess, Grims and Holmes, 2009 and others show similar results.
Size	Significance at 1 % and there is inverse relationship	Larger banks are likely to be more skilled in risk management and have also better diversification opportunities and competence therefore the bank size is negatively related to the level of credit risk. Studies by Saunders et al. (1990), Chen et al. (1998), Cebenoyan et al. (1999) and Megginson (2005); Salas and Saurina, (2002); Hu et al (2006)), support inverse relationship.
Operating Inefficiency	Level of Significance is 10% and inverse related.	There is an inverse relation between cost inefficiency and non-performing loan of a bank .Result shows that NPL enhances with high operating cost or low cost efficiency. .Studies by Ali, Akhtar and Sadaqat 2011, Salas and Saurina, 2002 show similar results.

Variables	Significance & Relationship	Interpretation
CAR	Significant at 5% and there is inverse relationship	Capital adequacy is the level of capital required by the banks to enable them to absorb the potential losses on account risks and acts as a cushion against uncertainties. The results shows higher capital of the banks results into lower level of NPAs. Studies by Hussain and Hassan (2004), Nor and Mohamed (2007), Goldlewski (2004) have shown a negative relationship between capital Adequacy ratio and credit risk
Loan Loss Provision to Total Loans	Not significant but there is positive relationship.	The result positive relationship indicates that higher LLP ratio signals potentially higher credit risk as banks need to make greater provisions against potentially greater non-performing loans.
Exchange Rate	Significant at 1% and having positive relationship.	Results reveal that changes in the real effective exchange rate have a positive impact on NPLs.
Inflation Rate	Significant at 1%, and has inverse relationship.	There is an empirical evidence for significant, positive and negative and insignificant relationship between the inflation in the economy and the credit risk indicator non-performing loans. Results show inflation is significant and has negative impact on loan defaults, loan default decreased as inflation increased. Higher Inflation can make debt servicing easier by reducing the real value of outstanding loans.
Unemployment Rate	Level of Significance is 5 % and there is inverse relationship.	An increase in the unemployment rate negatively influences the cash flow streams of households resulting in increased debt burden. Similarly with regard to firms, increases in unemployment results in decreased production and effective demand leading to decreased revenues and a fragile debt condition. Study result Shows that increase in unemployment rate leads to decrease in NPL.
Lending Rate	Significant at 5 % and inversely related.	Lending Rates play a significant role as cheaper the rates the more is the recovery rate and higher the lending rates the higher will be the defaults. To account for this argument, Lending Rate has been considered and the results show an inverse relationship between these two variables. The negative but strong relationship means that as nonperforming loans goes up; lending rates tend to move in a different direction.
GDP Growth Rate	Significant at 10% and there is inverse relationship.	The inverse relationship shows that the ability of repayment of loan depend on the phase of the economic cycle and therefore when there is a slowdown in economic growth or lower GDP growth, non-performing loan increases. The non-performing loan will decrease when there is an upturn in economic growth for different types of loan. A strong economic cycle influences the business' ability to repay its loans. During economic gain period, the ability to repay a loan increases but when it comes to the recession, their ability to repay the loan will tend to be lowers.

CONCLUSION:

This study investigated bank specific and macroeconomic determinants of credit risk in 40 Indian Public and Private Banks. The overall explanatory power of the above model is high with R- square of 0.551 which implies that 55% variation in the percentage change in Non-Performing Loan to Total Loans, proxy for credit risk can be explained by the variations in the bank specific and macroeconomic factors, thus the study concludes that both bank specific and macroeconomics variables have influences the credit risk in public and private banks in India.

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