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# Determinants of non-performing advances in Indian banking system

## Abstract

This paper investigates the determinants of non-performing advances (NPA) in the Indian banking system with the help of panel data modeling. Panel dataset of 31 Indian banks with yearly data that spans the period from 2000 to 2012 totalling 372 firm years has been analyzed. The study examined the impact of macroeconomic variables and bank specific characteristics upon the non-performing advances of the banks. Macro-economic variables had greater impact on Gross NPA ratio compare to NNPA ratio. This is because NNPA depends upon the NPA provisions made by the bank. Among macro-economic variables GDP, construction expenditure, growth rate in per capita income, foreign exchange reserves, stock market index and volatility have statistically significant inverse relationship with NPA ratios. This infers that economic growth coupled with positive stock market and foreign exchange market performance will indicate the reduction in nonperforming loans and the banks can go forward with credit growth expansion plans.

**Keywords:** non-performing advances (NPA), gross domestic product (GDP), stock market index, volatility.
**JEL Classification:** G20, G21.

## Introduction

Rising non-performing advances (NPA) in Indian banking system in the post financial crisis is catching up attention of all the cross sections of stakeholders. Regulators, policy makers and rating agencies started investigating the reasons. Reserve bank of India, the central bank of the country started advising banks on proactive steps to manage and arrest the NPA growth.

Global rating agency Moody's, in its latest report of 2013, has downgraded Indian banking system's rating outlook from "stable" to "negative" (Business Standard, February 11, 2013). As per available statistics, non-performing advances (NPA) for all banks (functioning in India) rose to 3.6% in September and is expected to increase more in the coming financial periods. The Reserve Bank of India (RBI), in its second quarter review of monetary policy 2012-2013, has commented that the increase in NPA has been a matter of concern, and insisted banks to utilize various measures on recovery of bad loans and strengthen due diligence.

In general an asset/loan becomes non-performing when it ceases to generate income for the bank. The economic and financial costs of NPAs' are significant. In international best practices, NPA has been defined as credit in respect of which interest and/or instalment of principal has remained "overdue" for more than 90 days. Graham and Humphrey (1978) suggested that, banks with larger amounts of NPA have greater tendency to incur large amount of future losses, and hence, NPA should be included as an indicator of the banking system stability. Fofack (2005) pointed out that, these loans may negatively affect the level of private investment, increase deposit liabilities and constrain the scope of bank credit.



The economic development of a nation and stability of banking system are invariably interrelated. International experience shows that if NPA is not managed properly, it will lead to banking failures and nationwide financial fragility. Regular monitoring of loan quality is thus essential to ensure a sound financial system and possibly provides an early alarm to regulatory authorities of banking system.

Given the above discussion, it is necessary to identify the determinants of NPAs which is the major motivation for this study. Using panel data modelling, this study empirically investigates the determinants of non-performing advances in the Indian banking system. The purpose of this study is to provide insights into the linkages between macroeconomic factors and non-performing advances of banks functioning in India. Panel dataset of 31 Indian banks with yearly data that spans the period from 2000 to 2012 totalling 372 firm years has been analyzed. It is found that higher growth rate in GDP and per capita income is associated with lower NPAs in Indian banks. Higher interest and inflation rates contribute positively to rising non-performing loans.

The rest of the paper is organized as follows. Section 1 reviews the literature, section 2 provides methodology and presents analysis of macroeconomic factor and section 3 reports analysis of bank specific characteristics. The final section summarizes results and presents the conclusion.

## 1. Literature review

This section reviews the empirical work on the relationship between macroeconomic variables and non-performing bank advances.

Keeton and Morris (1987), one of the earliest investigations, reported the fundamental drivers of non-performing loans, using simple regression, for a sample of 2,500 US commercial banks for the period of 1979-1985. They found that loan losses are highly

positively related to adverse economic conditions. Gavin and Hausmann (1995) examined the relation between macroeconomic developments of 1990's and banking crises in Latin America. Their study supports the observations made by Keeton and Morris (1987).

Fofack (2005) investigated the macroeconomic factors that led to the rise of non-performing loans in Sub-Saharan Africa in the 1990s. The study concluded that, exchange rates, interest rate, GDP per capita are robust significant macroeconomic factors that determine non-performing advances. Rinaldi and Sanchis-Arellano (2006) examined household NPAs for a panel of European countries and provide evidence that unemployment and monetary conditions are highly related with NPA's.

Tracey (2007) focussed on quantifying the effects of macroeconomic indicators on Jamaica's banking sector loan portfolio quality. They performed the test on monthly data series spanning the period of 1997-2006 and found that inflation, interest rate, and exchange rate play significant roles in shaping banks loan quality. Berge and Boye (2007) found that interest rates and unemployment have strong impact on NPAs, for the Nordic banking system over the period of 1993-2005.

Festic and Beko (2008) presented empirical evidence on the macroeconomic variables affecting non-performing loans in five Central European Economies (CEEs) by using ordinary least squares (OLS) and the VAR methodology. Regarding macroeconomic variables, two conclusions were highlighted: First, an improvement in economic conditions – through growth of real GDP – reduced the amount of NPA. Second, an increase in real interest rates result in large NPA ratio. On the same line, Bofondi and Ropele (2011) studied the main macroeconomic determinants of bank's loan quality, in Italy over the period of 1990-2010, and concluded that bad loans (NPA) are significantly related to annual growth rates, unemployment rate and interest rate. They also found that the changes in macroeconomic determinants affect the quality of loans with different time lags. Vogiazas et al. (2011) have supported the same view by the means of time series modeling for Romanian banks. In particular, they suggested that macroeconomic variables, specifically the construction expenditure, inflation, unemployment rate and GDP per capita influence the credit risk. Financial markets and interest rate indicators were not found significant.

Recently, Nkusu (2011) analyzes the link between the NPA and macroeconomic performance using panel data regression models on the sample dataset of 26 advanced countries that spans the period from 1998 to 2009. The results confirm that deterioration in the macroeconomic environment is associated with debt service problems, reflected into rising NPA. Conversely, a favorable macroeconomic environment is associated with subdued NPA. With categorization between loans as consumer, business and mortgage loans, Louzis et al. (2012) examined the determinants of NPAs by utilization of panel data set comprising nine Greek commercial banks from the first quarter of 2003 to the third quarter of 2009.

In literature, some studies have used the relationship between macroeconomic variables and non-performing loans to forecast non-performing loans. Greenidge and Grosvenor (2010) evaluate the association between bank failure and financial crises, and built a multivariate model to forecast non-performing loans in the banking sector of Barbados. Empirically they supported the view that macroeconomic factors have significant impact on the level of NPAs.

Only two research papers explored the determinants of nonperforming advances in India. Ranjan and Dhal (2003) empirically evaluated the influence of credit terms, bank size, and macroeconomic environment shocks (in particular, growth rate of GDP) in Public sector banks in India for the period of 1993-2003. They suggested that credit terms have significant effect on the bank's non-performing advances in the present macroeconomic shocks.

Swamy (2012) examined the impact of macroeconomic factors on non-performing advances (NPA) of various bank groups based on their ownership structure, during 1997-2009. This paper concludes that favorable macroeconomic conditions lower the NPA. They also found that large banks and private banks have lower NPA because of better credit risk management.

## 2. Methodology

Determinants of NPAs across 31 banks over a period of 12 years have been analyzed using the panel data modeling. Panel data combines both time series and cross-section, hence increases the number of observations and reduces collinearity among explanatory variables. It reduces the omitted variable bias.

In order to investigate the determinants of non-performing advances (NPA) at aggregate level, two sets of explanatory variables are considered, the first set refers to macro economic variables, and the second set refers to bank specific characteristics. In this section theoretical expectation of selected macroeconomic variables is provided along with the summary of the data set and the analysis.

**2.1. Sample data.** The sample dataset for NPA related variables is selected from the list of banks functioning in India, since 1999 till 2012 on continuous basis from the list provided by Reserve Bank of India (RBI). Based on the data availability, our sample includes 31 banks annual data, representing SBI & associates, nationalized banks, private sector banks and foreign banks. Sample dataset spans the

period of 2001-2012. Total sample consist of 31 banks with yearly data for 12 years, in total 372 observations for each NPA related variable. Macroeconomic data is collected from Reserve Bank of India (RBI) database, as well as from subscribed database Indiastata. Bank specific data is collected from CMIE database "Prowess" and from banks individual annual reports.

**2.2. Exogenous variables included in analysis.** Exogenous macro-economic variables included in this study are GDP at factor cost, construction expenditure, foreign exchange reserves, stock market index and volatility, inflation, exchange rate vis-à-vis dollar, growth rate in per capital income, repo rate, reverse repo rate, rate of unemployment, lending rates, for the period from 2001 to 2012.

Gross domestic product at factor cost (GDP): GDP is considered as an indicator of a country's standard of living. A growing economy is likely to be associated with rising incomes and reduced financial distress (Nkusu, 2011). Growth in GDP increases the capability of borrowers to repay their debt and is expected to contribute to a lower NPA.

Construction expenditure (*ConstrExp*): Construction sector expenditure at constant terms is an independent variable that is expected to influence non-performing advances (Vogiazas, 2011). High construction expenditure would not encourage individuals to go for home loans leading to lower loan losses for the banks.

Foreign exchange reserves (*ForEx*): It is a proxy for the growth in the international trade of the country and hence, the non-performing advances are expected to decrease with the rise of foreign reserves.

Stock market index (*StkMktInd*): Buoyant stock markets reflects outlook on firms' profitability and improved the financial health of the nation (Bofondi et al., 2011) that is likely to have impact on the non-performing advances. CNX Nifty Index is taken as proxy.

Stock market volatility: Merton's theory predicts that the probability of default is positively related to the stock market volatility (Simons, 2009).

Inflation: According to Qu (2008), it is viewed as a hidden risk pressure which provides an incentive for those with savings to invest, rather than have the purchasing power of those savings erode through inflation. On the other hand, Nkusu (2011) stated that higher inflation can make debt servicing easier by reducing the real value of outstanding loans. There is divided evidence on both the directions in the literature.

Exchange rate: According to Nkusu (2011), the increase in exchange rate can reduce the ability of investor to pay back. On the other hand, it can improve the debt servicing capacity of borrowers who borrow in foreign currency.

Growth rate in per capita income: It is a macroeconomic indicator which reflects the strength and behavior of per capital income. An increase in per capita income indicates a rise in the income level of people which increases the ability to pay back loans those result in less NPAs.

Repo/Reverse repo rate: Short-term interest rates such as repo rate and reverse repo rate have played a crucial role in RBI monetary policy stance, Roy (2011). RBI injects liquidity in the system through repos and absorbs liquidity from the system from reverse repos. The objective of monetary policy has been unidirectional to reduce inflation so the relationship is expected to be opposite with respect to inflation variable.

Rate of unemployment: Bofondi et al. (2011) mentioned that increase in the unemployment rate curtail the present and future purchasing power of household. Hence, it is expected to have a positive relationship with NPA.

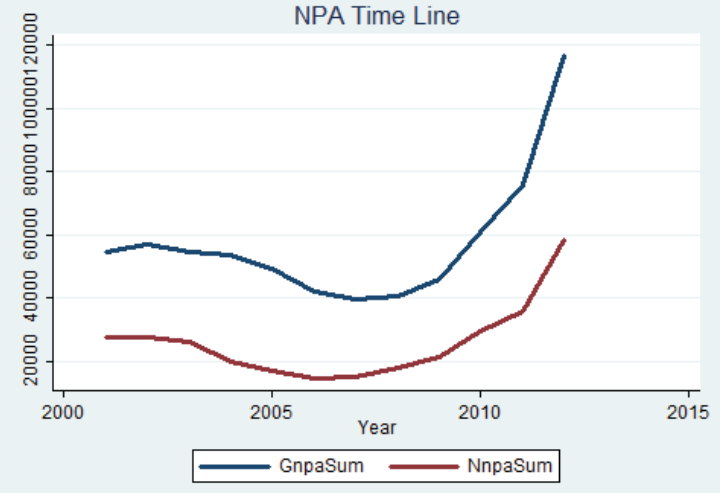
Lending rates (*LndRt*): This is a long-term interest rate and quantifies the cost of borrowing. The change in cost of borrowing increases the debt burden of borrowers in resulting default so it is expected to have positive relationship between interest rate and NPAs.

All the above variables are included as exogenous in this research study. The variables with absolute rupee values were quantified using natural logarithmic values. In respect of other variables growth rates were used to proxy the exogenous variable.

**2.3. Endogenous variables considered.** In literature, NPA's are either measured by gross NPA or net NPA reported by banks. Gross NPAs reflect the quality of loans portfolio of banks and net NPAs show the actual load on the banks.

A bank in the growth phase with credit expansion sanctions higher amount of advances and, in turn, may incur larger NPAs as well. Apart from absolute value, it is very important to look at what proportion of the total loan has become non-performing. Hence ratio indicators are used as proxy for absolute NPA to quantify bank specific credit risk. Percentage ratio of gross NPA to total advances and percentage ratio of net NPA to total advances have been considered as dependent variables for the analysis.

**2.4. Analysis and inferences.** Figure 1 shows the movement in Gross NPA and Net NPA from 2001 to 2012. Figure shows the increasing trend of Gross NPA and Net NPA in last 12 years. Upward trend in the absolute values of Gross NPA and Net NPA is quite visible in the last 3 years, which requires further investigation.




Note: Total GNAP and NNPA data for each year across 31 Indian banks has been computed presented in the graph.

*2.4.1. Descriptive statistics and correlation matrix.* Table 1 presents the descriptive statistics of NPA proxies for 31 Indian banking firms across the sample period of 12 years. The overall value reflects random statistics, between provides cross-sectional average and within represents time series data.

It has been observed from the Table 1 that average, minimum and maximum values of GNPA, NNPA and total advances differ significantly both for across the firm and over the time indicating higher standard deviation reported in the table. Both GNPA and as well as NNPA values are related to the total advances sanctioned by the firm in any year. Hence to stabilize the dependent variable values the ratio of GNPA to total advances and ratio of NNPA to total advances has been computed. This ratio reflects the amount of NPA suffered by the banks out of total advances sanctioned and outstanding in that year. There is a large difference between minimum and maximum values both across the firm and over the time in the total amount of advances sanctioned.

The standard deviation of GNPA and NNPA across the time is less than the standard deviation across the companies of the same variable. This suggest that the GNPA and NNPA are more fluctuating across the companies, rather than for a company over a time period.

Table 1. NPA values and ratios: descriptive statistics

| Variable | | Mean | Std. dev. | Min | Max | Observations |
|---|---|---|---|---|---|---|
| *GNPA* | Overall | 1871.75 | 3343.81 | 63.21 | 39676.46 | *N* = 372 |
| | Between | | 2978.98 | 106.27 | 16892.10 | *n* = 31 |
| | Within | | 1589.80 | -5392.21 | 24656.11 | *T* = 12 |
| *NNPA* | Overall | 859.05 | 1606.70 | 18.56 | 15818.85 | *N* = 372 |
| | Between | | 1420.54 | 58.80 | 8078.91 | *n* = 31 |
| | Within | | 763.15 | 2308.46 | 8598.98 | *T* = 12 |
| *TotAdv* | Overall | 55817.90 | 102249.90 | 880.09 | 867578.90 | *N* = 372 |
| | Between | | 68090.26 | 3023.99 | 378923.70 | *n* = 31 |
| | Within | | 77118.15 | 209515.50 | 737478.50 | *T* = 12 |
| *GnpaToTotAdv* | Overall | 5.74 | 5.12 | 0.25 | 27.54 | *N* = 372 |
| | Between | | 2.21 | 1.85 | 10.56 | *n* = 31 |
| | Within | | 4.64 | 3.72 | 23.95 | *T* = 12 |
| *NnpaToTotAdv* | Overall | 2.59 | 2.93 | 0.11 | 18.29 | *N* = 372 |
| | Between | | 1.17 | 0.88 | 6.19 | *n* = 31 |
| | Within | | 2.69 | 2.67 | 14.68 | *T* = 12 |

Notes: The overall standard deviation (SD) shows the total standard deviation in the variables. The "between" standard deviation shows the deviation across the companies, while the "within" deviation shows the deviation over time. *GNPA*: gross non performing advances, *NNPA*: net non-performing advances, *TotAdv*: total advances, *GnpaToTotAdv*: ratio of *GNPA* to total advances and *NnpaToTotAdv*: ratio of NNPA to total advances. Values of *GNPA*, *NNPA*, *TotAdv* are in Crores and of ratio are in percentage.

The following Table 2 summarizes the macroeconomic data for the 12 year period. Stock market index has very high standard deviation with large difference in Min and Max values, which suggest that Indian market is highly volatile; the same is confirmed by stock market volatility variable statistics. Mean value of inflation rate is towards its maximum value, which suggests that the inflation in India has very few low experiences. The difference between minimum and maximum of construction expenditure is large reflecting rising inflation. Rate of unemployment is 8.9%.

Table 2. Macro economic variables: descriptive statistics

| Variable | | Mean | Std. dev. | Min | Max |
|---|---|---|---|---|---|
| *GDP* | Overall | 4233549.000 | 1984318.000 | 1991982.000 | 8232652.000 |
| *ConstrExp* | Overall | 331718.100 | 180014.700 | 119897.000 | 670735.000 |
| *Infl* | Overall | 2.436 | 1.0693 | -0.340 | 3.850 |
| *ExchRt* | Overall | 46.309 | 2.925 | 39.970 | 53.463 |
| *GrRtPc* | Overall | 11.540 | 3.447 | 5.220 | 15.643 |
| *FoEx* | Overall | 843766.800 | 449603.800 | 197204.000 | 1506130.000 |
| *RRt* | Overall | 7.021 | 1.074 | 4.750 | 8.500 |
| *RevRRt* | Overall | 5.542 | 1.109 | 3.250 | 7.500 |
| *RtUnEmp* | Overall | 8.959 | 1.290 | 6.800 | 10.800 |
| *StkMktInd* | Overall | 3201.788 | 1714.251 | 978.200 | 5833.750 |
| *MktVol* | Overall | 25.449 | 7.453 | 15.750 | 42.058 |
| *LndRt* | Overall | 10.729 | 1.034 | 8.250 | 12.250 |

Notes: *GDP*: gross domestic product at factor cost (in crores), *ConstrExp*: Construction expenditure (in Crores), *Infl*: inflation (in %), *ExchRt*: exchange rate, *GrRtPC*: growth rate in per capital income in NNP (in %), *ForEx*: foreign exchange reserves (in Crores), *RRT*: repo rate (in %), *RevRRt*: reverse repo rate (in %), *RtUnEmp*: rate of unemployment (in %), *StkMktInd*: stock market index, *MktVol*: calculated stock market annual volatility, *LndRt*: long-term lending rate (in %).

*2.4.2. Correlation matrix.* Table 3 summarizes the correlation between the macro-economic variables included in the analysis. GDP, construction expenditure, growth rate, foreign reserves and stock market index are highly correlated, which suggest that stock market, reflects the movement in major economic indicators of economy. This high correlation is expected because all variable are essential for economic growth of a nation. Inflation and exchange rate are highly correlated, which indicates the intertwining relationship between domestic and global economic factors. Rate of unemployment is unrelated (linearly) with almost with all other variable included in the analysis indicating that the economic growth did not make significant impact on employment level in the economy. Stock market volatility is also unrelated (linearly) with most of the other variables, but highly correlated with long term lending rate which suggests that market reflects the movement in borrowing and lending rates.

Table 3. Correlation matrix of macro-economic variables

| | *GDP* | *ConstrExp* | *Infl* | *ExchRt* | *GrRtPc* | *ForEx* | *RRt* | *RevRRt* | *RtUnEmp* | *StkMktInd* | *MktVol* | *LndRt* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *GDP* | 1 | | | | | | | | | | | |
| *ConstrExp* | .996** | 1 | | | | | | | | | | |
| *Infl* | -178 | -174 | 1 | | | | | | | | | |
| *ExchRt* | .228 | .189 | -783** | 1 | | | | | | | | |
| *GrRtPc* | .745** | .788** | .072 | -273 | 1 | | | | | | | |
| *ForEx* | .945** | .968** | -169 | .059 | .871** | 1 | | | | | | |
| *RRt* | .084 | .040 | .478 | .005 | -169 | -142 | 1 | | | | | |
| *RevRRt* | .357 | .319 | .520 | -072 | .129 | .138 | .906** | 1 | | | | |
| *RtUnEmp* | .343 | .278 | .205 | .026 | -090 | .072 | .476 | .612 | 1 | | | |
| *StkMktInd* | .903** | .920** | .112 | -162 | .868** | .919** | .129 | .416 | .306 | 1 | | |
| *MktVol* | .060 | .114 | -469 | .057 | .186 | .252 | -.537 | -508 | -591 | .046 | 1 | |
| *LndRt* | -332 | -280 | -165 | -146 | -050 | -119 | -.357 | -536 | -771** | -206 | .617* | 1 |

Notes: *GDP*: gross domestic product at factor cost (in Crores), *ConstrExp*: construction expenditure (in Crores), *Infl*: inflation (in %), *ExchRt*: exchange rate, *GrRtPC*: growth rate in per capital income in NNP (in %), *ForEx*: foreign exchange reserves (in Crores), *RRT*: repo rate (in %), *RevRRt*: reverse repo rate (in %), *RtUnEmp*: rate of unemployment (in %), *StkMktInd*: stock market index, *MktVol*: calculated stock market annual volatility, *LndRt*: long-term lending rate (in %).

*2.4.3. Bivariate analysis.* Panel data regression with repeated cross section of macro-economic variables taking ratio of Gross NPA and Net NPA to Total advances as the dependent variable and one by one macro-economic variable as independent variable has been estimated. Fixed effects model estimates the impact of time series information within the independent variables upon the dependent variable. In the between effects model, mean values are calculated for each of the firm across the time periods, and cross-sectional influence of independent variables is observed. Random effects model estimates the matrix weighted average impact of fixed effect and between effects. The coefficients corresponding to all the independent variables in random effect and fixed effect estimates are similar. Hausman test result indicates that random effects are better suited to model the data. Hence coefficients from bivariate random effect model are reported in Tables 3 and 4.

Table 4. Cross-section random effect estimates between ratio of gross NPA to total advances and macro-economic variables

| Dependent variable | *GnpaToTotAdv* | | |
|---|---|---|---|
| Independen *t* variable | Coefficient | *z* value | *R*-square |
| *GDP* | -0.00000158** | -16.77 | 0.3725 |
| *ConstrExp* | -0.0000183** | -18.47 | 0.4124 |
| *Infl* | 34.70581 | 1.32 | 0.0043 |
| *ExchRt* | 0.1620733* | 2.04 | 0.0102 |
| *GrRtPc* | -1.06961** | -23.84 | 0.5186 |
| *ForEx* | -0.00000799** | -22.31 | 0.4902 |
| *RRt* | 0.8289627** | 3.58 | 0.0308 |
| *RevRRt* | -0.1702862 | -0.75 | 0.0013 |
| *RtUnEmp* | 0.2020521 | 1.24 | 0.0043 |
| *StkMktInd* | -0.0019928** | -19.94 | 0.4447 |
| *MktVol* | -0.1246302** | -3.76 | 0.0327 |
| *LndRt* | -0.000906 | 0.00 | 0.0000 |

Notes: ** Indicates significance at 1% level. * Indicates significance at 5% level. *GnpaToTotAdv*: ratio of GNPA to total advances, *GDP*: gross domestic product at factor cost (in Crores), *ConstrExp*: construction expenditure (in Crores), *Infl*: inflation (in %), *ExchRt*: exchange rate, *GrRtPC*: growth rate in per capital income in NNP (in %), *ForEx*: foreign exchange reserves (in Crores), *RRT*: repo rate (in %), *RevRRt*: reverse repo rate (in %), *RtUnEmp*: rate of unemployment (in %), *StkMktInd*: stock market index, *MktVol*: calculated stock market annual volatility, *LndRt*: long-term lending rate (in %).

Table 4 presents cross section random effect estimates between ratio of gross NPA to total advances and macro-economic variables. It is found that GDP at factor cost, construction expenditure, exchange rate, growth rate in per capita income in NNP, foreign exchange reserves, stock market index and stock market volatility had statistically significant inverse relationship with the ratio of gross NPA. This infers that positive growth in economic variables contributes to reduction in GNPA ratio. Repo rate which is a proxy for short-term interest rates has a positive and statistically significant relationship while the long-term lending rate which is closely related to home loan has negative and insignificant relationship. This indicates though housing loans are related to term lending rate; it is the short-term interest rate that has an impact on loan repayments. Also, inflation showing positive relationship with the ratio of gross NPA to total advances, supports the findings of Qu (2008) and Vogiazas (2011). Higher inflation and rate of unemployment result in higher NPAs. These results are as expected, as in reviewed literature, except that the rate of unemployment (ROUE) variable is not significant, which was significant in reviewed research paper (Louzis, 2011).

Table 5. Cross-section random effect estimates between ratio of net NPA to total advances and macro-economic variables

| Dependent variable | *NnpaToTotAdv* | | |
|---|---|---|---|
| Independent variable | Coefficient | *z* value | *R*-square |
| *GDPCurr* | -0.000000803** | -13.22 | 0.2919 |
| *ConstrExp* | -0.00000947** | -14.67 | 0.3327 |
| *Infl* | 3.482348 | 0.23 | 0.0001 |
| *ExchRt* | 0.1643493** | 3.6 | 0.0318 |
| *GrRtPcCurr* | -0.6359707** | -24.36 | 0.5415 |
| *ForEx* | -0.00000428** | -18.2 | 0.4224 |
| *RRt* | 0.641838** | 4.82 | 0.0558 |
| *RevRRt* | 0.0087024 | 0.07 | 0.0000 |
| *RtUnEmp* | 0.1233906 | 1.48 | 0.0066 |
| *StkMktInd* | -0.00107** | -16.7 | 0.3862 |
| *MktVol* | -0.05024922** | -2.69 | 0.0179 |
| *LndRt* | 0.0506306 | 0.36 | 0.0003 |

Notes: ** Indicates significance at 1% level. * Indicates significance at 5% level. *NnpaToTotAdv*: ratio of net NPA to total advances, *GDP*: gross domestic product at factor cost (in Crores), *ConstrExp*: construction expenditure (in Crores), *Infl*: inflation (in %), *ExchRt*: exchange rate, *GrRtPC*: growth rate in per capital income in NNP (in %), *ForEx*: foreign exchange reserves (in Crores), *RRT*: repo rate (in %), *RevRRt*: reverse repo rate (in %), *RtUnEmp*: rate of unemployment (in %), *StkMktInd*: stock market index, *MktVol*: calculated stock market annual volatility, *LndRt*: long-term lending rate (in %).

Table 5 presents cross section random effect estimates between ratio of Net NPA to total advances and macro-economic variables. These results are very similar to those reported results for the ratio of gross NPA. However, the impact of macro-economic variables as indicated by *R*-squared values was much higher in GNPA ratio compare to that of NNPA ratio. This is because GNPA reflects loss loans suffered by the bank in the year which will have a direct interaction with macro-economic variables. NNPA values reflect the bank specific efficiency in terms of adequate provisioning or recovery practices and hence did not have as much impact as that of GNPA.

From the bivariate analysis it is found that GDP, construction expenditure, growth rate in per capita income, foreign exchange reserves and stock market index are significant and each of these variable explain around 35-50% of variance in the endogenous variable.

*2.4.4. Multivariate analysis.* Based on the bivariate results variables that have high influence (based on *R*-squared values) have been modelled together to assess the combined impact of macro-economic variables upon GNPA and NNPA ratios.

Panel data multiple regression analysis is conducted on repeated cross section data of macro-economic variables using panel data random effects generalized least square (GLS) model and fixed effects model. All the significant variables could not be included in one single model due to multi co linearity indicated by correlation matrix given in Table 2. Hence, alternative models with various combinations of significant macro-economic variables have been iterated to identify the suitable model.

Table 6 and 7 reports multiple regressions models estimate that have been estimated using random effects GLS model and fixed effects model respectively with the ratio of gross NPA to total advances as dependent variable. We have taken repo rate as the proxy for interest rate in regression; it reflects the short-term state of economy and was found as an influential variable in bivariate analysis.

Following alternative regression equations have been estimated:

Model 1:

$$GnpaToTotAdv_i^t = \beta_1 GDP + \beta_2 ExchRt + \beta_3 RRt + \\ + \beta_4 MktVol. \quad (5)$$

Model 2:

$$GnpaToTotAdv_i^t = \beta_1 GDP + \beta_2 ExchRt + \beta_3 RtUnEmp + \\ + \beta_4 MktVol. \quad (6)$$

Model 3:

$$GnpaToTotAdv_i^t = \beta_1 ConstrExp + \beta_2 ExchRt + \\ + \beta_3 RRt + \beta_4 MktVol. \quad (7)$$

Model 4:

$$GnpaToTotAdv_i^t = \beta_1 ConstrExp + \beta_2 ExchRt + \\ + \beta_3 RtUn\ Emp + \beta_4 MktVol. \quad (8)$$

The results of multiple regression analysis reconfirmed broadly the observations made in the bivariate analysis. Across all the above four models Mode l3 including construction expenditure, exchange rate, repo rate and market volatility had highest *R*-squared value of 0.50 inferring that these variables together explain 50 percent of variation in GNPA ratio.

The alternative model excluding construction expenditure and including GDP had *R*-square of 0.48. This infers though GDP is significant variable construction expenditure, exchange rate and interest rate have been found to be major determinants of gross NPA ratio in India. The negative relationship of GDP indicates that the slowdown in economic growth in the recent years is one of the major reasons for increasing NPAs.

Majority of housing loans are sanctioned on floating rate basis. The floating rate in turn is highly sensitive to the changes in the short term interest rate proxied by repo rate hence increase in short interest rate results in higher borrowing cost and lead to an increase in the likelihood of NPA. These results are in consensus with the observations made by Siddique (2012).

Unemployment rate is one more variable that has a significant positive impact on GNPA ratio indicating higher unemployment rate in economy results in higher NPAs. An appreciation of the exchange rate vis-à-vis the dollar, has two opposite effects: imports are more expensive (supply effects), while exports are less competitive (demand effects). In India the first effect is dominating as the Indian economy is imports driven. This supports the observations made by Bruneau (2012).

Table 6. Multiple regression using random effects GLS model between ratio of gross NPA to total advances and macro-economic variables

| Dependent variable as | *GnpaToTotAdv* | | | | | | |
|---|---|---|---|---|---|---|---|
| Model 1 | *GDP* | *ConstrExp* | *ExchRt* | *RRt* | *RtUnEmp* | *MktVol* | *R*-square |
| Coefficient | -0.00000177** | | 0.4098235** | 1.003853** | | -0.025684 | 0.4861 |
| *z*-value | -20.67 | | 7.75 | 5.5 | | -0.98 | |

Table 6 (cont.). Multiple regression using random effects GLS model between ratio of gross NPA to total advances and macro-economic variables

| Dependent variable as | *GnpaToTotAdv* | | | | | | |
|---|---|---|---|---|---|---|---|
| Model 2 | *GDP* | *ConstrExp* | *ExchRt* | *RRt* | *RtUnEmp* | *MktVol* | *R*-square |
| Coefficient | -0.00000148** | | 0.2911693** | | 0.6533278** | -0.0757909** | 0.4293 |
| *z*-value | -15.22 | | 6.11 | | 4.08 | -3.08 | |
| Model 3 | | | | | | | |
| Coefficient | | -0.0000197** | 0.3672105** | 0.9488457** | | -0.0027043 | 0.5032 |
| *z*-value | | -21.63 | 7.19 | 5.35 | | -0.11 | |
| Model 4 | | | | | | | |
| Coefficient | | -0.0000166** | 0.2631517** | | 0.5697674** | -0.0589979* | 0.4409 |
| *z*- value | | -15.8 | 5.73 | | 3.7 | -2.4 | |

Notes: ** Indicates significance at 1% level. * Indicates significance at 5% level. *GnpaToTotAdv*: ratio of GNPA to total advances, *GDP*: gross domestic product at factor cost (in Crores), *ConstrExp*: construction expenditure (in Crores), *ExchRt*: exchange rate, *RRt*: repo rate (in %), *RtUnEmp*: rate of unemployment (in %), *MktVol*: calculated stock market annual volatility.

Table 7. Multiple regression using fixed effects model between ratio of gross NPA to total advances and macro-economic variables

| Dependent variable as | *GnpaToTotAdv* | | | | | | |
|---|---|---|---|---|---|---|---|
| Model 1 | GDP | *ConstrExp* | *ExchRt* | *RRt* | *RtUnEmp* | *MktVol* | *R*-square |
| Coefficient | -0.00000177** | | 0.4092637** | 0.9990389** | | -0.0261788 | 0.4861 |
| *t* value | -20.69 | | 7.75 | 5.48 | | -1 | |
| Model 2 | | | | | | | |
| Coefficient | -0.00000148** | | 0.2909138** | | 0.6538704** | -0.0756456** | 0.4293 |
| *t* value | -15.22 | | 6.1 | | 4.08 | -3.07 | |
| Model 3 | | | | | | | |
| Coefficient | | -0.0000197** | 0.3666947** | 0.9443131** | | -0.0031824 | 0.5032 |
| *t* value | | -21.64 | 7.19 | 5.33 | | -0.12 | |
| Model 4 | | | | | | | |
| Coefficient | | -0.0000166** | 0.2628825** | | 0.5702088** | -0.0588546* | 0.4409 |
| *t* value | | -15.8 | 5.72 | | 3.7 | -2.39 | |

Notes: ** Indicates significance at 1% level. * Indicates significance at 5% level. *GnpaToTotAdv*: ratio of GNPA to total advances, *GDP*: gross domestic product at factor cost (in Crores), *ConstrExp*: construction expenditure (in Crores), *ExchRt*: exchange rate, *RRt*: repo rate (in %), *RtUnEmp*: rate of unemployment (in %), *MktVol*: calculated stock market annual volatility.

Table 7 presents multiple regression estimates based on fixed effects model taking GNPA ratio as dependent variable. It is observed that the results of both the random effects model, presented in Table 6, and fixed effects model, presented in Table 7, are similar. However for robust check and to explore suitability of random effects model/fixed effects model.

Hausman test has been conducted, which confirms the suitability of random effects model for the data.

Overall, the results indicate that a rise in GDP, or rise in construction expenditure, while the other regressors are held constant, decrease the gross NPA ratio, which is as expected, in agreement to the theoretical argument given in section. We also found that increase in market volatility helps to reduce NPA values. Increase in market volatility indicates higher probable returns on stock market and is a lead indicator of economic growth and reflects positive sentiment in the market. These results are in contradiction with the observations made by Simons (2009). Increase in repo rate or rate of unemployment or exchange rate, while the other regressors are held constant, stimulates and increases NPA values.

Two alternative regression models have been estimated using NNPA ratio as dependent variable. The cross section random effects estimates are reported in Table 8 and fixed effects estimates are reported in Table 9. The following regression equations have been estimated:

Model 5:

$$NnpaToTotAdv_i^t = \beta_1 GDP + \beta_2 ExchRt + \beta_3 RtUn\ Emp + \\ + \beta_4 MktVol + \beta_4 LndRt. \quad (9)$$

Model 6:

$$NnpaToTotAdv_i^t = \beta_1 ConstrExp + \beta_2 ExchRt + \\ + \beta_3 RtUn\ Emp + \beta_4 MktVol. \quad (10)$$

Table 8. Multiple regression using random effects GLS model between ratio of net NPA to total advances and macro-economic variables

| Dependent variable | *NnpaToTotAdv* | | | | | | |
|---|---|---|---|---|---|---|---|
| Model 5 | *GDP* | *ConstrExp* | *ExchRt* | *RtUnEmp* | *MktVol* | *LndRt* | *R*-square |
| Coefficient | -0.000000616** | | 0.1867332** | 0.3353174** | -0.0527848** | 0.1524679 | 0.3456 |
| *z* value | -10.51 | | 6.45 | 3.01 | -3.29 | 1.15 | |
| Model 6 | | | | | | | |
| Coefficient | | -0.00000701** | 0.1759231** | 0.3007034** | -0.0436587** | 0.1336084 | 0.3601 |
| *z* value | | -11.07 | 6.28 | 2.78 | -2.72 | 1.03 | |

Notes: ** Indicates significance at 1% level. * Indicates significance at 5% level. *NnpaToTotAdv*: ratio of NNPA to total advances, GDP: gross domestic product at factor cost (in Crores), *ConstrExp*: construction expenditure (in Crores), *ExchRt*: exchange rate, *RtUnEmp*: rate of unemployment (in %), *MktVol*: calculated stock market annual volatility, *LndRt*: long-term lending rate (in %).

Table 9. Multiple regression using fixed effects GLS model between ratio of net NPA to total advances and macro-economic variables

| Dependent variable | *NnpaToTotAdv* | | | | | | |
|---|---|---|---|---|---|---|---|
| Model 5 | *GDPCurr* | *ConstrExpCurr* | *ExchRt* | *RtUnEmp* | *MktVol* | *LndRt* | *R*-square |
| Coefficient | -0.000000619** | | 0.1872441** | 0.3365265** | -0.052888** | 0.1529164 | 0.3456 |
| *t* value | -10.56 | | 6.48 | 3.02 | -3.3 | 1.16 | |
| Model 6 | | | | | | | |
| Coefficient | | -0.00000704** | 0.1763849** | 0.3017775** | -0.0437178 | 0.1339526 | 0.3601 |
| *t* value | | -11.12 | 6.3 | 2.79 | -2.72 | 1.03 | |

Notes: ** Indicates significance at 1% level. * Indicates significance at 5% level. *NnpaToTotAdv*: ratio of NNPA to total advances, GDP: gross domestic product at factor cost (in Crores), *ConstrExp*: construction expenditure (in Crores), *ExchRt*: exchange rate, *RtUnEmp*: rate of unemployment (in %), *MktVol*: calculated stock market annual volatility, *LndRt*: long-term lending rate (in %).

Finding of this regression analysis reconfirms the observations made in the bivariate analysis that the impact of macro-economic variables was much higher in GNPA ratio compare to that of NNPA ratio. Model 6 including construction expenditure, exchange rate, rate of unemployment and market volatility had highest *R*-squared value of 0.36 inferring that these variables together explain 36 percent of variation in NNPA ratio. The alternative model (Model 5) excluding construction expenditure and including GDP had *R*-square of 0.34. This infers though GDP is significant variable construction expenditure, exchange rate, rate of unemployment and stock market volatility have been found to be major determinants of NNPA ratio in India.

In contrast to the literature, our result indicates that the interest rate is not an influential factor that determines the ratio of net NPA to total advances, in Indian banking system. The reason may be the provisions value, which is subtracted from gross NPA values, has compensated this impact. It is also observed that the results of both the random effects model, presented in Table 6, and fixed effects model presented in Table 7 are similar.

The Hausman specification test is used to compare the fixed and random effect models. The null hypothesis tests whether the individual effects are uncorrelated with any regressor in the model (Hausman, 1978). If the null hypothesis of no correlation is not violated, fixed and random effect model are consistent, but fixed effect model is inefficient; otherwise, fixed effect model is consistent but random effect model is inconsistent and biased (Greene, 2008, p. 208). Results of Hausman test are summarized in Table 10.

Table 10. Hausman test results for all models designed

| Dependent | *GnpaToTotAdv* | | | *NnpaToTotAdv* | | |
|---|---|---|---|---|---|---|
| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 |
| Chi square value | 0.33 | 0.04 | 0.32 | -0.05 | 0.41 | 0.26 |
| Prob > Chi square | 0.9537 | 0.9975 | 0.9558 | 0.9973 | 0.982 | 0.992 |

Notes: ** Indicates significance at 1 % and * indicates significance at 5%. *GnpaToTotAdv*: ratio of GNPA to total advances, *NnpaToTotAdv*: ratio of NNPA to total advances. If the model is significant at 1% or at 5% then we need to use fixed effects.

All chi-squares scores ($p > 0.05$ or .01, so insignificant) are small enough to reject the null hypothesis. Hence random effect model is found better suited for analysis for all the models.

## 3. Panel data bivariate analysis with bank specific variables, GNPA and NNPA

In the previous section, the determinants of NPA are analyzed at macro-level, using macro-economic

variables. However, firm level data may provide a much richer insight of credit risk drivers. In this section we will explore the fundamental relationship between bank specific characteristics and credit risk proxies using bivariate panel data regression.

**3.1. Bank specific characteristics.** The search for the determinants of NPAs should not be restricted among macro-economic variables only. The distinctive features of the bank and the strategy and policy choices by each bank are also expected to influence the NPA values. Based on past research following are the bank specific characteristics that are included for the analysis of Indian banking system.

- Bank size (*MktCap*): Market capitalization is used as proxy for firm size. It reflects the value of the bank and represents worth of the company as perceived by investors. Khemraj and Pasha (2009) noted empirical evidence relating to the effect of bank size on the NPA ratio. A negative relationship between the NPA ratio and bank size signify that the larger the bank is, the better risk management strategies it is able to employ, and hence has lower level of NPA compared to smaller banks. However, few studies reported contradictory expectation that larger banks take more risk, increasing the magnitude of non-performing advances. These studies noted a positive relationship between the size of banking institution and the level of NPAs.
- Inefficiency ratio (*InEffRatio*): Inefficiency ratio is calculated as the ratio of operating expenses to operating income. Berger and DeYoung (1997) found that higher inefficiency ratio is positively associated with increase in NPA values. There were reported results to contradict this expectation. Higher expenses incurred when the ratio is high may include debt collection and recovery costs that reduce NPAs. Higher inefficiency is also linked with poor skills in credit appraisal of borrower, pledged collaterals and deficiency in monitoring borrowers.
- Diversification (*Div*): It is measured using the non-interest income as a share of total income. It is expected to have a negative relation between diversification and NPA values, since diversification lowers credit risk on the grounds of other source of income.
- Return on equity (*ROE*): ROE is calculated as a ratio of profit after tax to total equity. It measures return on money invested by shareholders. It is expected to have negative relation with NPA values.
- Return on assets (*ROA*): ROA is an indicator of how profitable a company is relative to its total assets. It reflects efficiency of management in using its assets to generate earnings. ROA is calculated by dividing a profit after tax by its total assets. It is expected to have negative relationship with NPA values.
- Liquidity ratio (*LiqRatio*): Liquidity ratio determines a company's ability to pay off its short-term debts obligations. It is the ratio of current assets to current liabilities. In general, the higher the value of the ratio, the larger the margin of safety that company possesses to cover short-term debts.

**3.2. Analysis of bank specific variables.** Firm level data, for 30 banks, is collected from CMIE database Prowess for the period of 2001-2011. The average *ROE* is 15% while *ROA* is around 10%. The descriptive statistics presented in Table 11 reveals that cross sectional variation in between the firms is higher than the variation within the bank over the time period.

Table 11. Bank-specific variables: descriptive statistics

| Variable | | Mean | Std. dev. | Min | Max | Observations |
|---|---|---|---|---|---|---|
| *InEffRatio* | Overall | 0.228 | 0.083 | 0.020 | 0.590 | *N* = 330 |
| | Between | | 0.066 | 0.086 | 0.473 | *n* = 30 |
| | Within | | 0.051 | 0.055 | 0.460 | *T* = 11 |
| *Div* | Overall | 0.027 | 0.018 | 0.000 | 0.107 | *N* = 330 |
| | Between | | 0.014 | 0.009 | 0.059 | *n* = 30 |
| | Within | | 0.012 | 0.002 | 0.092 | *T* = 11 |
| *ROE* | Overall | 0.152 | 0.102 | 0.082 | 0.361 | *N* = 330 |
| | Between | | 0.064 | 0.010 | 0.225 | *n* = 30 |
| | Within | | 0.080 | 0.005 | 0.395 | *T* = 11 |
| *ROA* | Overall | 0.010 | 0.012 | 0.003 | 0.090 | *N* = 330 |
| | Between | | 0.012 | 0.005 | 0.068 | *n* = 30 |
| | Within | | 0.005 | 0.002 | 0.032 | *T* = 11 |
| *LiqRatio* | Overall | 2.891 | 1.132 | 0.675 | 7.793 | *N* = 330 |
| | Between | | 0.841 | 1.359 | 4.253 | *n* = 30 |
| | Within | | 0.772 | 1.027 | 6.480 | *T* = 11 |

Table 11 (cont.). Bank-specific variables: descriptive statistics

| Variable | | Mean | Std. dev. | Min | Max | Observations |
|---|---|---|---|---|---|---|
| *MktCap* | Overall | 8459.183 | 20118.830 | 55.62 | 175761.700 | *N* = 244 |
| | Between | | 16640.240 | 370.607 | 83292.100 | *n* = 24 |
| | Within | | 11324.260 | 606.80 | 100928.700 | *T* = 11 |

Notes: The overall standard deviation (SD) shows the total standard deviation in the variables. The "between" standard deviation shows the deviation across the companies, while the "within" deviation shows the deviation over time. *InEffRatio*: inefficiency ratio, div: diversification, *ROE*: return on equity, *ROA*: return on assets, *LiqRati*o: liquidity ratio, *MktCap*: market capitalization.

**3.3. Panel data regression.** Panel data regression taking gross NPA ratio and net NPA ratio to total advances (*GnpaToTotAdv* and *NnpaToTotAdv*) as alternate dependent variables and one by one bank specific independent variables has been estimated. Using Hausman test, the independent variables are partitioned into two sets. One set required random effect analysis while another set required fixed effect analysis. RE model was found suitable for inefficiency ratio (*InEffRatio*), and return on equity (*ROE*). FE model was noted to be better fit as per Hausman test for return on asset (*ROA*), liquidity ratio (*LiqRatio*), market capitalization (*MktCap*) and diversification (*Div*).

The results of the bivariate random effect model are tabulated in Table 12. Empirical evidence presented in Table 12 shows that the coefficient of the inefficiency ratio is positive and statistically significant. This result supports the hypothesis of poor skills management that banks with higher expenses to income ratio demonstrate inefficiency and incur higher NPA. This observation is in consensus with the findings of Berger and DeYoung (1997). This result support observations made by Louzis (2012). ROE indicator is statistically significant and negatively related to NPA ratio values, which suggests superior bank performance indicates efficiency in the management of lending activities.

Table 12. Bivariate analysis results of random effect model with bank specific variables

| GNPA ratio as dependent variable | Coefficient | *z*-value | *R*-square |
|---|---|---|---|
| *InEffRatio* | 18.153** | 5.17 | 0.0837 |
| *ROE* | -8.253** | -3.12 | 0.0407 |
| NNPA ratio as dependent variable | Coefficient | *z* value | *R*-square |
| *InEffRatio* | 4.204* | 2.2 | 0.018 |
| *ROE* | -4.468** | -3.13 | 0.034 |

Notes: ** Indicates significance at 1% level. * Indicates significance at 5% level. *GnpaToTotAdv*: ratio of GNNPA and total advances, *NnpaToTotAdv*: ratio of NNPA and total advances, *InEffRatio*: inefficiency ratio, *ROE*: return on equity.

Fixed effect bivariate results are reported in Table 12. The results show that diversification hypothesis (Div) is strongly accepted, in contrast with Louzis (2012). This observation confirms that, higher diversification in banking activities and higher noninterest income reduces concentration risk and limits substantial losses on account of NPAs in banks' loan portfolio.

Negative and significant relationship of liquidity ratio (*LiqRatio*) suggests banks to have larger margin of safety to cover short-term debts. Return on equity variable (*ROA*) had expected significant inverse relationship with NNPA ratio, indicating that efficient management of banks while using its assets well to generate earnings will also reduce NPAs.

Empirical studies do not provide clear evidence about the impact of bank size up on NPAs. Boyd and Gertker (1994) argued that in 1980s it is believed in the US that large banks are less risky and are likely to have fewer loan defaults. On the other hand, Ennis and Malek (2005) concluded that the argument of Boyd and Gertker (1994) was not found valid for the period of 1983-2003. Our analysis shows that market capitalization, proxy for bank size is negatively related with NPA ratios and supports the too-big-too-fail argument of Louzis (2012). This confirms the expectation that large banks will tend to have lower gross NPAs.

Table 13. Bivariate analysis results of fixed effect model with bank specific variables

| GNPA ratio as dependent variable | Coefficient | *t* value | *R*-square |
|---|---|---|---|
| *Div* | -138.6** | -7.54 | 0.053 |
| *ROA* | -79.409 | -1.55 | 0.0085 |
| *LiqRatio* | -0.9115** | -2.97 | 0.0028 |
| *MktCap* | -0.0000542** | -2.62 | 0.001 |
| NNPA ratio as dependent variable | Coefficient | *t* value | *R*-square |
| *Div* | -87.303** | -8.69 | 0.0314 |

Table 13 (cont.). Bivariate analysis results of fixed effect model with bank specific variables

| GNPA ratio as dependent variable | Coefficient | *t* value | *R*-square |
|---|---|---|---|
| *ROA* | -107.442** | -3.7 | 0.0167 |
| *LiqRatio* | -0.441* | -2.56 | 0.0017 |
| *MktCap* | -0.000019 | -1.58 | 0.0012 |

Notes: ** Indicates significance at 1% level. * Indicates significance at 5% level. *GnpaToTotAdv*: ratio of GNPA and total advances, *NnpaToTotAdv*: ratio of net NPA and total advances, *Div*: diversification, *ROA*: return on assets, *LiqRatio*: liquidity ratio, *MktCap*: market capitalization.

Broadly both GNPA ratio and NNPA ratio demonstrate similar relationship with bank specific characteristics. Higher inefficiency ratio indicates that banks also suffer from higher NPAs. Large banks are likely to have smaller NPAs. Higher diversification in banking activities increase noninterest income of the bank and reduce NPAs. Banks with higher performance ratios of *ROA* and *ROE* have lower NPAs.

## Conclusion

The study examined the impact of macroeconomic variables and bank specific characteristics upon the non-performing advances of the banks. Macroeconomic variables had greater impact on gross NPA ratio compared to NNPA ratio. This is because NNPA depends upon the NPA provisions made by the bank. Among macro-economic variables GDP, construction expenditure, growth rate in per capita income, foreign exchange reserves, stock market index and volatility have statistically significant inverse relationship with NPA ratios. This infers that economic growth coupled with positive stock market and foreign exchange market performance will indicate the reduction in non-performing advances and the banks can go forward with credit growth expansion plans. Exchange rate and repo interest rate had significant positive impact on NPAs. Higher interest rate and exchange rates result in higher non-performing advances for the banks. Inflation that was found significant variable in the reviewed literature had expected positive relationship with NPA but the relationship was not statistically significant. Interest rate had significant positive relationship with NPA. Further, multiple regression analysis confirms that GDP, Construction expenditure, repo interest rate and exchange rate together explain 50% of variance in NPAs.

Among bank specific variables inefficiency ratio had significant positive impact on the non-performing advances. Bank size and performance indicators had significant negative impact indicating efficient operational management at bank level helps to reduce non-performing advances.

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## References

1. Berge, T.O., Boye, K.G. (2007). An Analysis of Bank's Problem Loans, *Norges Bank Economic Bulletin*, 78, pp. 65-76.
2. Berger, A., DeYoung, R. (1997). Problem Loans and Cost Efficiency in Commercial Banks, *Journal of Banking and Finance*, 21, pp. 849-870.
3. Bofondi, Marcello, Ropele, Tiziano (2011). Macroeconomic Determinants of Bad Loans: Evidence from Italian Banks, Occasional Papers.
4. Boyd, J., Gertler, M. (1994). The Role of Large Banks in the Recent US Banking Crisis, *Federal Reserve Bank of Minneapolis Quarterly Review*, 18, pp. 1-21.
5. Bruneau C., Bandl O. de Amri, W.El. (2012). Macroeconomic fluctuations and corporate financial fragility, *Journal of Financial Stability*, 8, pp. 219-235.
6. Ennis, H., Malek, H. (2005). Bank risk of failure and the too-big-too-fail policy, *Federal Reserve Bank of Richmond Economic Quarterly*, (91/2), pp. 21-44.
7. Festic, Mejra, Beko, Jani (2008). The Banking Sector and Macroeconomic Performance in Central European Economies, *Czech Journal of Economics and Finance*, 58, No. 3-4.
8. Fofack, Hippolyte (2005). Nonperforming Loans in Sub-Saharan Africa: Causal Analysis and Macro-Economic Implications, World Bank Policy Research Working Paper 3769.
9. Gavin, M., Haumann, R. (1995). The Roots of Banking Crises: The Macroeconomic Context, Interamerican Development Bank, Washington, D.C.
10. Graham, David R., David Burras Humphrey (1978). Banks Examination Data as Predictors of Bank Net Loans Losses, *Journal of Money, Credit and Banking*, November, 10 (4), pp. 491-504.
11. Greene, William H. (2008). Econometric Analysis, 6th ed., Upper Saddle River, NJ: Prentice Hall.
12. Greenidge, Kevin, Grosvenor, Tiffany (2010). Forecasting Nonperforming Loans in Barbados Business, *Finance & Economics in Emerging Economies*, 5 (1).
13. Hausman, J.A. (1978). Specification Tests in Econometrics, *Econometrica*, 46 (6), pp. 1252-1271.

14. Keeton, William R., Morris, Charles S. (1987). Why Do Banks Loan Losses Differ? *Economic Review – Federal Reserve Bank of Kansas City*, May, 72 (5).
15. Khemraj, Tarron, Sukrishnalall Pasha (2009). The Determinants of Non-performing Loans: An Econometric Case Study of Guyana, Presented at the Caribbean Centre for Banking and Finance Bi-annual Conference on Banking and Finance, St. Augustine, Trinidad.
16. Louzis, P. Dimitrios, Vouldis, T. Angelos, Metaxas, L. Vasilios (2012). Macroeconomic and Bank Specific Determinants of Nonperforming Loans in Greece: A Comparative Study of Mortgage Business and Consumer Loan Portfolios, *Journal of Banking & Finance*, 36, pp. 1012-1027.
17. Nkusu, Mwanza (2011). Nonperforming Loans and Macrofinancial Vulnerabilities in Advanced Economies, *IMF Working paper*, WP/11/161.
18. Qu, Yiping (2008). Macro economic Factors and Probability of Default, *European Journal of economics*, Finance and Administrative Sciences, ISSN 1450-2275, Issue 13.
19. Ranjan, Rajiv, Dhal, Sarat Chandra (2003). Non-Performing Loans and Term of Credit of Public Sector Banks in India: An Empirical Assessment, Reserve Bank of India Occasional Papers, 24 (3).
20. Rinaldi, L., Sanchis-Arellano, A. (2006). Household Debt Sustainability: What Explains Household Non-performing Loans? An Empirical Analysis, ECB Working Paper.
21. Siddiqui, S., Malik, K., S., Shah, S.Z.A. (2012). Impact of Interest Rate Volatility on Non-Performing Loans in Pakistan, *International Research Journal of Finance and Economics*, 84.
22. Simons, Dietske, Rowles, Ferdinand (2009). Macroeconomic Default Modelling and Stress Testing, *International Journal of Central Banking*.
23. Swamy, Vigneswara (2012). Impact of Macroeconomic and Endogenous Factors on Non-Performing Banks Assets, *International Journal of Banking and Finance*, 9 (1), Article 2.
24. Tracey, Marlon (2007). A VAR Analysis of the Effects of Macroeconomic Shocks on Banking Sector Loan Quality in Jamaica, Draft.
25. Vogiazas, D., Sofoklis, Nikolaidou, Eftychia (2011). Investigating the Determinants of Nonperforming Loans in the Romanian Banking System: An Empirical Study with Reference to the Greek Crisis, Economics Research International, Vol. 2011, Article ID 214689.