

A Study On Determinants Of Non Performing Assets

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ABSTRACT

This paper framed with aim of analyzing the sensitivity of the non-performing assets to bank specific advancing (lending) and country’s macro-economic factors. That is, an attempt is made to empirically evaluate how NPAs in banks are influenced by their advancing pattern and macro-economic factors in the country (India). This analysis is undertaken because there is a common perspective that the problem of banks’ non-performing loans is ascribed to political, economic, social, technological, legal and environmental factors across countries. With increasing pace of globalization as well as with advancement in information technology, the political, economic, social, technological, legal and environmental factors have undergone dramatic changes, primarily due to structural transformation of emerging economies, including India.

1. INTRODUCTION

The change in credit policy of the Government along with technological advancement has facilitated the bankers to create newer financial products and reduction in transaction cost in turn increasing their operational efficiency. Further, the Governments’ new credit policy has pushed the bankers to take several measures in the area of debt recovery, asset reconstruction, resolution of defaults and non-performing loans. On the whole, these developments have led to structural change in the financial sector, in turn creating an environment conducive for market mechanism, in general, and economic factors, in particular, for playing a critical role in influencing the portfolios of banks and financial institutions. Hence, in this context, it is wise to undertake an analysis for evaluating the impact of bank specific factors in terms of lending and macro economic factors on banks’ NPAs.

To find out the impact of advancing pattern on NPAs of banks, the loan variables, viz., ratio of NPAs to total advances (total loan), advances (loans) to total assets, size as natural log of total assets, change in advances (loan) at time ‘t’ relative to time ‘t-1’ as adopted by Manoj and Gaurav (2010) in their regression model for identifying the determinants of NPAs based on the empirical model employed by Jimenz and Saurina (2005) are considered as predictors. The specification of the regression model in this study is given hereunder.

$$NPATL_t = NPATL_{t-1} + LOANTA_t + SIZE_t + \Delta LOAN_t + \Delta LOAN_{t-1} \dots \dots \dots (1)$$

Where

- NPATL_t = Non Performing Assets to Total loan of Bank ‘i’ in current year (t).
- NPATL_{t-1} = Non Performing Assets to Total loan of Bank ‘i’ in previous year (t-1) (lagged one year)
- LOANTA_t = Ratio of Advances to Total Assets of Bank ‘i’ in current year (t)
- SIZE_{it} = Natural log of Total assets of Bank ‘i’ in current year (t)

- $\Delta LOAN_t$ = Change (Growth) in Advances of Bank ‘i’ in current year (t) relative to previous year
- $\Delta LOAN_{it-1}$ = Change (Growth) in Advances of Bank ‘i’ in one lagged year.

For identifying the impact of macro-economic variables on NPAs of banks, this study includes Gross Domestic Product (GDP), Money supply (Broad money), Real Effective Exchange Rate (REER), Interest rate and Inflation rate as independent variables as used by Munib and Atitya (2013). The proposed regression model for macro economic factors on NPAs is:

$$NPATL_t = \alpha + \beta_1 GDP_t + \beta_2 M2_t + \beta_3 REER_t + \beta_4 IR_t + \beta_5 CPI_t + e_t \dots\dots\dots (2)$$

Where

- $NPATL_t$ = Non Performing Assets to Total loan of Bank ‘i’ in current year (t).
- GDP_t = Current year Gross Domestic Product (India) in
- $M2_t$ = Current year Money Supply (Broad Money)
- $REER_t$ = Current year Real Effective Exchange Rate
- IR_t = Current year Interest Rate
- CPI_t = Current year Inflation rate
- α = Constant term
- $\beta_1 \dots \beta_5$ = Estimated Coefficients
- e = Error term

The effect of bank specific factors in terms of advances in the presence of macro-economic status of the country on NPAs of banks is also analyzed by including independent variables in equation (1) and (2) that have good predicting powers on NPAs captured after running the respective equations. Finally, the regression models with selected loan and macro-economic variables for NPAs of SBI and Other Selected Public Sector Banks are compared using Fisher’s Z test in order to find out whether the variables in the predictor set do equally well for both bank groups or not. The results of the analysis are tabulated and interpreted.

2. MATERIALS AND METHODS

The Study looks at all aspects of NPAs, such as trend and growth, relationship with profitability in addition to identifying the factors that contributing to the change in NPAs. The difference in NPAs between State Bank of India and Other Public Sector Banks are also focused here.

HYPOTHESES

By realizing the significance of the study, an attempt has been made to frame following null hypotheses:

- a) There is no significant difference in the non performing assets between State Bank of India and Other Selected Public Sector Banks.
- b) There is no significant relationship between NPAs and Profitability of the Selected Public Sector Banks.
- c) The factors determining the NPAs are different between State Bank of India and Other Selected Public Sector Banks.
- d) There is no impact of NPAs on financial healthiness of the banks.

3. METHODOLOGY

Designing a suitable methodology and the selection of analytical tools are important for a meaningful analysis of any research problem. In this section, the sampling design, collection of data and the tools of analysis are described.

SAMPLING DESIGN

There are 26 Public Sector Banks functioning in India (SBI - 1 & its associates - 5 and other nationalized banks -20). Out of these, 8 Public Sector Banks were randomly selected. The selected banks are: State Bank of India, Bank of Baroda, Bank of India, UCO Bank, Central Bank of India, Punjab National Bank, Union Bank of India and Canara Bank.

DATA COLLECTION

This study is based purely on secondary data. The annual financial reports such as balance sheet, profit and loss account along with schedules are the secondary data collected. Only the audited financial reports of the selected banks are collected from CMIE, PROWESS data base. The other parts of the secondary data are collected from the RBI Website, NPAs published in different journal and magazines. Some of the data relevant to the study are also gathered through internet.

STATISTICAL TECHNIQUE USED

To analyze the NPAs of the selected banks, the following statistical tools are used. They are: descriptive statistics, Linear Growth Rate, Compounded Annual Growth Rate, t-test for independent sample, Factor Analysis (as data reduction, i.e., to group the related financial ratios into one or more common factor), Multiple Regression Analysis and Discriminant Analysis. The details of the statistical techniques are given hereunder.

DESCRIPTIVE ANALYSIS

The descriptive statistics such as mean and standard deviation are used to calculate the central tendency and deviation in the time series nature of financial data for the selected banks.

The formula for Mean

$$\bar{X} = \frac{\sum X_i}{n}$$

Where, X_i is value for 'i'th year 'n' is total number of years in the sample.

The formula for Standard deviation

$$\sigma = \sqrt{\frac{\sum X_i^2}{n} - (\bar{X})^2}$$

Where, X_i is the value for 'ith' year and 'n' is number of years under study and \bar{X} is mean score for all the respondents.

COMPOUNDED ANNUAL GROWTH RATE (CAGR)

Consider the non-linear relationship between a study variable (Y) and time variable (X) as

$$Y = a b^X \dots\dots\dots (1)$$

By taking logarithms on both sides, it may be written as

$$\text{Log } Y = \log a + \log b X$$

Or simply say $Y = A + BX$

The least square estimates of A and B are given by

$$\hat{\beta} = \left(\frac{\sum xy - \frac{(\sum x)(\sum y)}{n}}{\sum x^2 - \frac{(\sum x)^2}{n}} \right)$$

$$\hat{A} = \bar{Y} - \hat{\beta} \bar{X}$$

Where, $\bar{y} = \frac{\sum y}{n}$ and $\bar{x} = \frac{\sum x}{n}$

Here, n is number of time periods (years), an estimate of 'b' is given by $\hat{b} = \text{Antilog}(\hat{\beta})$

Now, an estimate of Compounded Annualized Growth Rate (CAGR) = $[\hat{b} - 1] \times 100$

LINEAR GROWTH RATE (LGR)

Consider a linear relationship between a study variable (Y) and time variable (X) as

$$Y = a + b X$$

The Linear Growth Rate (\hat{b}) is given by

$$\hat{b} = \left(\frac{\sum xy - \frac{(\sum x)(\sum y)}{n}}{\sum x^2 - \frac{(\sum x)^2}{n}} \right)$$

The statistical significance of the growth and trend are ascertained using Student t-test.

INDEPENDENT SAMPLE T-TEST AND ONE WAY ANOVA (F TEST)

The significance of difference in mean values between two groups is checked with independent sample t-test and mean values across more than two groups is compared by F test (also called one-way ANOVA).

The formula for Independent sample t-test

$$t = \frac{(\bar{X}_1 - \bar{X}_2)}{\sqrt{\left(\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2} \right)}}$$

Where,

- \bar{X}_1 = Mean of the group 1
- \bar{X}_2 = Mean of the group 2
- σ_1^2 = Variance of the group 1
- σ_2^2 = Variance of the group 2

n_1 = Size of the Group 1

n_2 = Size of the Group 2

The formula for F test

$$F = \frac{S_B^2}{S_w^2}$$

Where,

F = Ratio of variance (F Value)

S_B^2 = Between group variance

S_w^2 = Within group variance

FACTOR ANALYSIS (PRINCIPAL COMPONENT ANALYSIS)

The principal component method of factor analysis with varimax rotation is used to classify the financial variables in order to incorporate the composite effect of group of ratios under particular category. For example, all three ratios under liquidity viz., current ratio, quick ratio and cash ratio could not be used simultaneously as predictor variables in the regression model due to multi-colinearity among them. Factor analysis are able to create new variable which has the essence of all these three ratios. The factor analysis first produces eigen value, proportion of explained variance of underlying factors (underlying dimensions). Any factor extracted by the analysis is considered to be a valid factor if its eigen value is above one based on the most commonly used criterion, which is known as Kaiser's criterion. The factor loadings (each item's correlation with valid factors) obtained from factor analysis are used for identifying actual characteristics of the underlying factors. Generally, an item belongs to one factor if its loading with that factor is 0.40 and above.

MULTIPLE REGRESSION

The multiple regression analysis is used to identify the factors determining NPAs in Banks. In the regression analysis, NPAs is treated as dependent variables and major aspects underlying financial characteristics of the banks are considered as variables in the independent set.

DISCRIMINANT ANALYSIS

The discriminant analysis is used in this study to identify the ratios relating to performance and non-performance assets that has unique power of discriminating (differentiating) between public and private sector banks. The discriminant analysis is a multivariate technique used to identify the difference in groups relative to linear composite of variables in the independent set. That is, this technique is used to find out power of one or more variables in the independent in discriminating the groups in the dependent.

The discriminant analysis first provide the results of the Chi-square test of successive roots (functions) to show which discriminant canonical function gives better discrimination (better power of differentiating the groups). The number of successive roots tested by the analysis is the number of groups in the dependent variable minus one. In our case, there are four respondent groups (relative to four time periods) and therefore, the number of discriminant function produced and tested by the discriminant analysis is three. The standardized canonical coefficients and structure correlation matrix produced by the analysis are used to bring out the significant variables in the independent set with predicting power.

The standardized canonical coefficients are like standardized beta coefficients in the multiple regression analysis, which are comparable across variables and help to identify the degree of predicting power. On the other hand, the structure matrix, which is the correlation between discriminant function and each one of the variables in the independent set, help identifies an extent of relationship between the variable and discriminant function. That is, it helps identify the relative importance of each predictor variable in discriminating the groups.

4. RESULTS AND DISCUSSION

Table 1.1 is reported with results of regression for NPAs with lending variables for State Bank of India. In the table, there are three regression models. The first one is the ‘initial model’ with all selected variables. The next two models, first subset and second subset models are run successively after dropping least significant variables in the respective previous models in order to get the model of best fit. Such technique is advisable to overcome the problem of multi-collinearity among the variables in predictor set (of initial model / or previous models) if any. The model of best is selected based on the adjusted R² value, the explained variance which is adjusted for number of predictors in the model. The model with high adjusted R² value is considered to be the model of best fit. However, if there is only fractional difference in the adjusted R² values (< 1%) between two models, the model with minimum number of predictors is taken as the best fitted model.

Table 1.1 provides the results of regression of NPAs with loan variables for Bank of Baroda (BOB). As provided in the table, the initial model is fitted significantly with 96.42 per cent and 90.45 per cent of the explained variance before and after adjusting for degrees of freedom (adjusting for number of terms in the model). Though model is fitted significantly with high explained variance, none of the coefficients is significant due to collinearity among the variables. The first subset model is run after dropping two variables, size and previous year growth in advances, with least significant coefficients. The fit of the second model is also significantly but problem as in initial model still remains. Hence, second subset model is run after dropping of ‘previous year NPAs to Total advances’. After elimination of these variables, the coefficients of two predictors in the second model become significant. Further, fit of the overall model explaining 94.99 per cent of the variance in the dependent after adjusting for number of variables, is also fitted significantly. Therefore, the second subset model is the appropriate model for further inference in the case of BOB.

Table 1
Regression of NPAs with Loan Variables – Bank of Baroda (BOB)

Predictors	Regression Models		
	Initial Model	First Subset Model	Second Subset Model
Intercept	23.8344 (0.83)	19.7633 (1.42)	13.8167** (10.22)
Non Performing Assets to Total Advances of last year (t-1)	-0.4856 (-0.34)	-0.2905 (-0.43)	
Advances to Total Assets	-31.4990 (-0.74)	-27.8461 (-1.29)	-18.6353** (-6.89)
Size (Log of Total Assets)	-0.1091 (-0.07)		
Δ Advances (Current year)	-4.3306 (-1.08)	-4.4890 (-2.24)	-4.8880* (-2.96)

Δ Advances (Previous year)	-0.9532 -(0.18)		
R ²	0.9642	0.9638	0.9625
Adjusted R ²	0.9045	0.9421	0.9499
F Value	16.16*	44.38**	76.92**
Degrees of freedom	5..3	3..5	2..6

Figures in brackets are t-values; * Significant at 5% level; ** Significant at 1% level.

As may be seen in the second model, the coefficients of both predictors are negative in sign, in turn indicating the negative influence on NPAs of BOB. So, it is found that the BOB is likely to incur lower level of NPAs if it significantly increases the issue of fresh loans and extending the credit is higher relative to previous year.

The results of regression of NPAs of UCO bank with loan variables are given in Table 1.2 As given in the table, the initial model with all selected predictors (all loan specific factors in the independent set) is not fitted significantly despite substantial explained variance. Hence, first subset model is run after eliminating very least significant variables in the initial model. The first subset model with two predictors, viz., NPAs to Total advance in one lagged year and currency year growth in advances (change in advances in current year relative to previous year) is fitted significantly with adjusted R² value of 0.7095. However, the coefficient of growth in advances is least significant in the first model. Hence, second subset model is run after dropping this variable.

The second subset model, which is also fitted significantly, tend to explain almost same amount of variance as that of first subset model, with just one predictor. Hence, the second model is the model of best fit.

Table 2
Regression of NPAs with Loan Variables – UCO Bank

Predictors	Regression Models		
	Initial Model	First Subset Model	Second Subset Model
Intercept	16.0586 (0.44)	1.9541 (1.36)	0.6181 (1.23)
Non Performing Assets to Total Advances of last year (t-1)	0.5713 (0.94)	0.6873** (4.21)	0.5894** (4.54)
Advances to Total Assets	1.7552 (0.08)		
Size (Log of Total Assets)	-1.1577 -(0.45)		
Δ Advances (Current year)	-8.9874 -(0.73)	-6.7961 -(0.99)	
Δ Advances (Previous year)	-4.2636 -(0.32)		
R ²	0.7966	0.7822	0.7467
Adjusted R ²	0.4576	0.7095	0.7105
F Value	2.35 ^{NS}	10.77**	20.63**
Degrees of freedom	5..3	2..6	1..7

Figures in brackets are t-values; * Significant at 5% level; ** Significant at 1% level.

In the second subset model, the estimated coefficient of NPAs to total advances of previous year is significant with positive sign. Therefore, it is concluded that there has been a significant increase in NPAs of UCO bank due to significant increase in proportion of NPAs to total advances in the previous year.

Table 1.3 shows regression results for NPAs with loan specific factors for Central Bank of India (CBI).

Table 3
Regression of NPAs with Loan Variables – Central Bank of India (CBI)

Predictors	Regression Models		
	Initial Model	First Subset Model	Second Subset Model
Intercept	68.5424 (0.67)	55.2528** (3.87)	64.2966** (5.08)
Non Performing Assets to Total Advances of last year (t-1)	-0.0140 (-0.02)		
Advances to Total Assets	11.4455 (0.30)		
Size (Log of Total Assets)	-5.5258 (-0.60)	-3.9306* (-3.16)	-4.7473** (-4.36)
Δ Advances (Current year)	-21.1603 (-1.46)	-18.3499* (-3.28)	-22.4870** (-4.88)
Δ Advances (Previous year)	-8.4862 (-0.48)	-6.8244 (-1.22)	
R ²	0.9169	0.9141	0.8887
Adjusted R ²	0.7784	0.8626	0.8517**
F Value	6.62 ^{NS}	17.75**	23.97**
Degrees of freedom	5..3	3..5	2..6

Figures in brackets are t-values; * Significant at 5% level; ** Significant at 1% level.

As per the table, the initial model is found to be unfit for inference as this model, despite very high R² value, is not significant statistically which can be attributed to the existence of multi-collinearity among the variables in the predictor set. However, in the absence of first two predictors, the second subset model becomes significant and this model could explain 91.41 per cent and 86.26 per cent of the variance in NPAs of CBI. Yet, the estimated coefficient previous year growth in advances is found to be insignificant in the first subset model. Hence, second subset model is run after dropping these variables.

The second subset model, though fitted significantly, has resulted in adjusted R² value bit smaller than that of first subset model. But the difference between adjusted R² values between first and second subset models is very trivial (< 1%). Hence, the second subset model which explains almost same amount of variance as that of first subset model with two explanatory variables is considered as appropriate model for further inference.

In the second subset model, the estimated coefficients of both variables are significant with negative sign. This has led to conclusion that the risk of loan default is likely to go up when there has been a significant decline in overall asset levels as well as there is a significant decline

in issue of advances in the current year relative to previous year in the case of Central Bank of India (CBI).

Table 1.4 provides the estimated coefficients of the predictors and overall fit of the initial model and first model for NPAs with advancing pattern of Union Bank of India (UBI). The second subset model is not applicable as all variables in the first model are found with significant coefficient.

Table 4
Regression of NPAs with Loan Variables – Union Bank of India (UBI)

Predictors	Regression Models		
	Initial Model	First Subset Model	Second Subset Model
Intercept	-14.4391** (-5.91)	-13.9020** (-6.40)	Not Applicable
Non Performing Assets to Total Advances of last year (t-1)	0.9305** (12.10)	0.9219** (12.98)	
Advances to Total Assets	-1.9771 (-0.71)		
Size (Log of Total Assets)	1.1933** (4.43)	1.0530** (6.19)	
Δ Advances (Current year)	2.5007* (3.13)	2.4387* (3.28)	
Δ Advances (Previous year)	3.4938** (3.91)	3.1480** (4.50)	
R ²	0.9853	0.9828	
Adjusted R ²	0.9607	0.9656	
F Value	40.15**	57.24**	
Degrees of freedom	5.3	4.4	

Figures in brackets are t-values; * Significant at 5% level; ** Significant at 1% level.

From the table, it can be observed that the initial model with R² and adjusted R² value of 0.9853 and 0.9607, is fitted significantly and the estimated coefficients of all variables except that of advances to total assets are statistically significant. Though the fit of the initial model is substantial, the first subset model is run to know whether there is any increase in the explanatory power in the absence of advances to total assets. The first subset model with advances to total assets has recorded a slight increase in the adjusted R² value.

From the adjusted R² values, it is further understood that, the first subset model with advances to total assets could explain same amount of variance as that of initial model. Therefore, first subset model is taken for making final inference. In the first subset model, the estimated coefficient is positive and significant at required level between 1 per cent and 5 per cent. Hence, it is found that UBI is likely to incur higher non performing loans if it has significantly extended relatively higher level of credit in current year as well as in previous year when there has been a significant increase in current year total assets and previous year NPAs level relative to total advances.

The NPAs of CANB is regressed with loan specific factors of the bank and the results of the regression analysis are presented in Table 4.8. From the observation of the table, it is understood that initial model, first subset and second subset models are all fitted significantly. Between first and second subset models, the Adjusted R² value of 0.8944 is found to be higher

by more than 1 per cent in the first compared to that of (0.8811) second subset model. Therefore, the first subset model is considered as the appropriate model for further inference.

The results of regression of NPAs with loan specific factors for all other Selected Public Sector banks are provided in Table 1.5.

Table 5
Regression of NPAs with Loan Variables –All Other Selected Public Sector Banks

Predictors	Regression Models		
	Initial Model	First Subset Model	Second Subset Model
Intercept	-10.3400 (-0.91)	-4.1194 (-0.77)	2.6090** (5.01)
Non Performing Assets to Total Advances of last year (t-1)	0.8071* (2.39)	0.6175** (5.33)	0.4867** (9.01)
Advances to Total Assets	-1.9672 (-0.11)		
Size (Log of Total Assets)	0.8440 (0.74)	0.4351 (1.26)	
Δ Advances (Current year)	-4.8266 (-1.11)	-6.8869* (-3.06)	-8.5851** (-4.53)
Δ Advances (Previous year)	3.7182 (0.61)		
R ²	0.9839	0.9814	0.9755
Adjusted R ²	0.9571	0.9702	0.9673
F Value	36.69**	87.86**	119.24**
Degrees of freedom	5..3	3..5	2..6

Figures in brackets are t-values; * Significant at 5% level; ** Significant at 1% level.

According to the table, initial model is fitted significantly but the estimated coefficients of most of the predictors are insignificant. Though, the fit of the first subset model with three selected predictors is better than the initial model (Adjusted R² value is higher compared to that of initial model), the coefficient of size is insignificant here. The second subset model, which is also fitted significantly, could explain almost same amount of variance as that of first subset model without size variables. In this model, the estimated coefficient of Non Performing Assets to total advances in one year lag (previous year) is significant with positive sign and that of current year growth in advances is significant with negative sign. So, from the above inferences, it is deduced that the non performing loans of all selected public sector banks in current year tend to increase significantly with significant increase in proportion of NPAs in total advances in the last year despite the public sector banks has significantly reduced the extend of issuing credit relative to previous year.

Table 6
Regression of NPAs with Loan Variables – State Bank of India and All Other Selected Public Sector Banks Combined

Predictors	Regression Models		
	Initial Model	First Subset Model	Second Subset Model
Intercept	1.7655 (0.36)	3.1910 (2.03)	1.5891** (3.93)
Non Performing Assets to Total Advances of last year (t-1)	0.4847* (3.24)	0.4702** (4.71)	0.5596** (10.60)
Advances to Total Assets	-2.6089 (-1.01)	-2.1607 (-1.05)	
Size (Log of Total Assets)	0.1183 (0.34)		
Δ Advances (Current year)	-4.6827* (-2.55)	-4.9726* (-3.21)	-4.4038* (-3.02)
Δ Advances (Previous year)	-0.1434 (-0.07)		
R ²	0.9338	0.9323	0.9269
Adjusted R ²	0.9055	0.9178	0.9172
F Value	33.57**	64.25**	95.12**
Degrees of freedom	5..12	3..14	2..15

Figures in brackets are t-values; * Significant at 5% level; ** Significant at 1% level.

From this picture, it is evident that the current year non performing loans in Indian banks tend to increase significantly if there is a significant increase in proportion of non- performing loans in total advances during previous year even though there has been a significant reduction in extending fresh loans in current year compared to previous year in the banks

In order to find out whether a particular set of loan variables (predictors) are equally effective in predicting NPAs for SBI and Other Selected Public Sector Banks, Fisher’s Z test is carried out to compare the R² values of the two models. The beta coefficient of individual predictors is also compared between two bank groups by Z value. For comparing the regressions between two groups, the explanatory variables in the models should be the same. Here, the explanatory variables in the model are selected based on the predictors in the best fitted regression model which is run combining SBI and Other Selected Public Sector Banks. The explanatory variables in the first subset model as reported in Table 1.5 are considered for the present regression models. Table 1.6 presents the results of comparative analysis.

From the observation of the table, it is understood that the regression for SBI as well as Other Selected Public Sector Banks is fitted significantly. The variance explained (with taking number of terms into consideration) in current year NPAs (dependent) is 96.71 per cent and 98.74 per cent for in the models for SBI and Other Selected Public Sector Banks respectively. After adjusting for number of terms in the models, the explained variance by the model for Public sector banks is higher compared to explained variance by the model for SBI. This

implies as if the power of loan variables in predicting the NPAs is higher for Other Selected Public Sector Banks.

Table 7
Comparison of Regression Models for NPAs with Best Predicting Loan Variables between State Bank of India and All Other Selected Public Sector Banks Combined

Predictors	Regression Model with Best Predictable Loan Variables		Z value for the difference in Beta Coefficients
	State Bank of India	Other Selected Public Sector Banks	
Intercept	3.5751 (1.33)	-9.8105* (-2.42)	
Non Performing Assets to Total Advances of last year (t-1)	0.4200 (1.92)	1.0059** (6.70)	-2.22*
Advances to Total Assets	-3.1125 (-0.95)	17.9542* (3.11)	-3.17*
Δ Advances (Current year)	-3.2735 (-1.71)	-6.4224* (-2.89)	1.07
R ²	0.9671	0.9874	
Adjusted R ²	0.9506	0.9811	
F Value	58.78**	157.16**	
Degrees of freedom	3..6	3..6	

From the comparison of coefficient of individual variables, it is apparent that unique power of previous year NPAs proportionate to total advances and current year proportion of advances to total advances in determining the NPAs of Other Selected Public Sector Banks is significantly higher when compared to that of SBI.

Table 8
Results of Fisher’s Z test Comparing R² values of the Regression Models for NPAs with Loan Variables between Two Banking Groups

N	R ²	R	Zr	SE	Z value
12	0.9671	0.9834	2.3920	0.4714	-1.03 ^{NS}
12	0.9874	0.9937	2.8770		

NS – Not significant

However, from Fisher’s Z value of 1.03 as shown in Table 1.8, obtained from comparing the R² values between SBI and Other Selected Public Sector Banks model, which is insignificant, it becomes apparent that the selected loan variables together are equally effective for both bank groups in explaining NPAs. In sum, it is found that unique power of previous year NPAs proportionate to total advances and current year proportion of advances to total advances in determining the NPAs of Other Selected Public Sector Banks is significantly higher when compared to that of SBI but combined effect of all loan variables on NPAs does not differ between SBI and Other Selected Public Sector Banks.

NPAs AND MACRO ECONOMIC VARIABLES

The loan default in banks and financial institution is likely to occur when economic scenario is in strange situation. As the economic scenario of a country is judged by various components, the Gross Domestic Product (GDP), Money Supply, Real Effective Exchange Rate (REER),

Interest rate (lending rate) and Inflation rate are the important components for weighing the economic condition. Hence, here an attempt is made to know what extend these economic indicators have affected the default loan in banks.

Table 1.9 presents regression results identifying the influence of selected macro economic variables on NPAs of SBI. From the table, it can be observed that the initial model with all selected variables in the predictor set is not significant. Hence, first subset model is run after dropping two least significant variables. This model is fitted significantly with adjusted R² value of 0.7654.

Table 9
Regression of NPAs with Macro Economic Variables – State Bank of India (SBI)

Predictors	Regression Models		
	Initial Mode	First Subset Model	Second Subset Model
Intercept	35.5105** (4.19)	30.3720** (5.91)	27.2336** (5.52)
GDP	-0.3273 (-0.84)	-0.3403* (-2.56)	-0.2651 (-2.04)
Money Supply	-2.4264 (-1.83)	-2.2013** (-5.63)	-2.1434** (-5.16)
Real Effective Exchange Rate (REER)	-0.0270 (-0.17)		
Interest Rate	-0.2047 (-1.23)	-0.1675 (-1.41)	
Inflation Rate	0.0391 (0.18)		
R ²	0.8667	0.8436	0.7920
Adjusted R ²	0.6999	0.7654	0.7356
F Value	5.20 ^{NS}	10.79**	13.33**
Degrees of freedom	5..4	3..6	2..7

In order to know whether there is any further improvement in the model fit if interest rate, whose coefficient is insignificant in the first model, is dropped in the absence of interest rate, the second subset model is also fitted significantly but with less adjusted R² value compared to first model. Hence, the first model is the best fitted model for further inference. In this model, coefficient is negative for all three predictors but significant at required only for GDP and Money supply. Based on the entire above results, it is found that a significant decline in GDP and Money supply tend increase the risk of loan default in SBI despite there is a marginal decline in rate of interest on loan.

Table 10
Regression of NPAs with Macro Economic Variables – Bank of Baroda (BOB)

Predictors	Regression Models		
	Initial Mode	First Subset Model	Second Subset Model
Intercept	56.6146** (7.10)	55.9178** (12.25)	51.5995** (10.13)
GDP	-0.6823 (-1.86)	-0.5423** (-4.59)	-0.4388* (-3.28)
Money Supply	-4.9246** (-3.94)	-4.4121** (-12.69)	-4.3325** (-10.12)
Real Effective Exchange Rate (REER)	0.0561 (0.39)		
Interest Rate	-0.2700 (-1.72)	-0.2305 (-2.18)	
Inflation Rate	0.0882		

	(0.44)		
R ²	0.9661	0.9645	0.9365
Adjusted R ²	0.9238	0.9468	0.9184
F Value	22.83**	54.40**	51.63**
Degrees of freedom	5..4	3..6	2..7

Figures in brackets are t-values; * Significant at 5% level; ** Significant at 1% level.

From Table 1.10, in which the results of regression for NPAs of BOB with macro economic variables are reported, it can be observed that the first subset model with high adjusted R² value, which is fitted significantly, is the best fitted model compared to initial and second subset models. In the first subset model, the estimated coefficient of GDP and Money supply is significant with negative sign. However, the coefficient of interest rate, which is also negative, is insignificant. From the above inferences, it is found that the proportion of non-performing assets in total advances of BOB tend to increase significantly with notable decline GDP and Money supply irrespective of marginal decline in interest rate.

The impact of macroeconomic variables on NPAs of UCO bank is analyzed by regression method. Table 1.11 presents the results of the analysis. According to the results presented in the table, all five selected macro economic factors together could significantly explain 74.89 per cent of the variance in the dependent when adjusted for number of variables in the independent set, but none of the coefficients is significant in the initial model. Hence, first and second subset models are considered for further inference. Between two subset models, the first subset model with adjusted R² value of 0.8308, which is higher compared to that of second subset model (Adjusted R² = 0.8138) is found to be appropriate one for ascertaining the impact of macro- economic factors on NPAs of UCO Bank.

Table 11
Regression of NPAs with Macro Economic Variables – UCO Bank

Predictors	Regression Models		
	Initial Model	First Subset Model	Second Subset Model
Intercept	64.6660** (3.93)	64.2973** (6.94)	59.0470** (6.75)
GDP	-1.0286 (-1.36)	-0.8856** (-3.70)	-0.7598* (-3.31)
Money Supply	-5.3014 (-2.06)	-4.7960** (-6.80)	-4.6992** (-6.39)
Real Effective Exchange Rate (REER)	0.0588 (0.20)		
Interest Rate	-0.3179 (-0.98)	-0.2802 (-1.30)	
Inflation Rate	0.0870 (0.21)		
R ²	0.8884	0.8872	0.8552
Adjusted R ²	0.7489	0.8308	0.8138
F Value	6.37*	15.73**	20.67**
Degrees of freedom	5..4	3..6	2..7

Figures in brackets are t-values; * Significant at 5% level; ** Significant at 1% level.

In the selected model, the estimated coefficient of GDP and Money supply is significant with negative sign whereas that of interest rate is insignificant with negative sign. That is, GDP and

Money supply are the important determinants of NPAs of UCO Bank when interest rate on advances plays a marginal role on it. In sum, it is found that the NPAs level of UCO Bank has increased significantly when there has been a significant decline in GDP and Money supply irrespective of a marginal decline in interest rate.

The impact of macroeconomic variables on NPAs of CBI is analyzed by regression method and the results of the analysis are exhibited in Table 1.12.

Table 12
Regression of NPAs with Macro Economic Variables – Central Bank of India (CBI)

Predictors	Regression Models		
	Initial Model	First Subset Model	Second Subset Model
Intercept	138.2480** (4.05)	125.6552** (6.37)	113.7596** (6.02)
GDP	-1.6455 (-1.05)	-1.4996* (-2.94)	-1.2146* (-2.45)
Money Supply	-10.7250 (-2.01)	-9.5693** (-6.37)	-9.3500** (-5.88)
Real Effective Exchange Rate (REER)	0.0087 (0.01)		
Interest Rate	-0.7692 (-1.15)	-0.6349 (-1.39)	
Inflation Rate	0.1997 (0.23)		
R ²	0.8807	0.8726	0.8317
Adjusted R ²	0.7315	0.8089	0.7836
F Value	5.90 ^{NS}	13.70**	17.30**
Degrees of freedom	5..4	3..6	2..7

Figures in brackets are t-values; * Significant at 5% level; ** Significant at 1% level.

Table 1.12 provides the regression results for NPAs of UBI with selected five macro economic variables. As provided in the table, initial model with all selected macro economic variables is not fitted significantly. That is, all five macro economic variables together could not explain the level of credit risk of UBI. However, the fit of first and second subset models are significant at 5 per cent and 1 per cent levels respectively. There is no much difference in the adjusted R² values (0.6097 for first and 0.6164 for second and difference in fractional, i.e., < 1%) between two subset models. However, based on the number of predictors, the second subset model is considered for final inference (the amount of variance explained by second model with two predictors is almost same compared to that of first model with three predictors).

Table 13
Regression of NPAs with Macro Economic Variables – Union Bank of India (UBI)

Predictors	Regression Models		
	Initial Model	First Subset Model	Second Subset Model
Intercept	30.8932 (2.22)	29.7108* (2.94)	24.5439* (2.92)
GDP	0.1409 (0.22)	0.2130 (0.94)	
Money Supply	-0.2295 (-0.11)		
Real Effective Exchange Rate (REER)	-0.2449 (-0.97)	-0.2663* (-2.49)	-0.2003* (-2.52)

Interest Rate	-0.0537 -(0.20)		
Inflation Rate	-0.3553 -(1.01)	-0.3931** -(4.11)	-0.3662** -(4.05)
R ²	0.7423	0.7398	0.7017
Adjusted R ²	0.4201	0.6097	0.6164
F Value	2.30NS	5.69*	8.23**
Degrees of freedom	5..4	3..6	2..7

Figures in brackets are t-values; * Significant at 5% level; ** Significant at 1% level.

In the selected second subset model, the coefficients of macroeconomic variables, viz., REER and Inflation rate, are significant with negative sign. Hence, it is deduced that the level of Non Performing loans in UBI is likely to increase when there has been a significant decline in REER (i.e., significant decline in international competitiveness of domestic economy) despite there is a notable decline in inflation rate.

Table 14
Comparison of Regression Models for NPAs with Best Predicting Macro Economic Variables between State Bank of India and All Other Selected Public Sector Banks Combined

Predictors	Regression Model with Best Predictable Macro Economic Variables		Z value for the difference in Beta Coefficients
	State Bank of India	Other Selected Public Sector Banks	
Intercept	30.3720** (5.91)	48.6936** (6.30)	-1.97 ^{NS}
GDP	-0.3403* -(2.56)	-0.6098* -(3.05)	1.12 ^{NS}
Money Supply	-2.2013** -(5.63)	-3.6510** -(6.20)	2.05 ^{NS}
Interest Rate	-0.1675 -(1.41)	-0.2494 -(1.39)	0.38 ^{NS}
R ²	0.8436	0.8669	
Adjusted R ²	0.7354	0.8003	
F Value	10.79**	13.03**	
Degrees of freedom	3..6	3..6	

Table 1.14 provides comparison of regression analysis results between SBI and All Other Selected Public Sector Banks with best predicting macro economic variables captured from regression model for combined data of SBI and All Other Selected Public Sector Banks (see Table 4.23, first subset model). It can be seen from the table that the macro economic variables, GDP, Money supply and Interest rate together could significantly explain the NPAs of SBI and All Other Selected Public Sector Banks. The estimated coefficients of GDP, Money supply and Interest rate does not differ significantly between two models (Z values for the difference in beta coefficients are insignificant). However, the combined effect of these three macro economic variables on NPAs is found to be high for All Other Selected Public Sector Banks are compared to that of SBI (Adjusted R² in regression model for Other Selected Public Sector Banks is higher than adjusted R² in regression model for SBI). But from Fisher's Z value obtained from comparing the R² values of regression models between SBI and All Other Selected Public Sector Banks is very trivial and insignificant.

Table 15
Results of Fisher’s Z test Comparing R² values of the Regression Models for NPAs with Macro Economic Variables between Banking Groups

N	R ²	R	Zr	SE	Z value
12	0.8436	0.9185	1.5792	0.4714	-0.18 ^{NS}
12	0.8669	0.9311	1.6664		

Therefore, it is concluded that the predicting power of GDP, Money supply and Interest rate on NPAs does not differ between SBI and Other Selected Public Sector Banks in India.

5. CONCLUSION

In this paper, it is attempted to identify the bank specific factors in terms of advances and macro-economic variables of the country that could determine the level of NPAs in SBI and All Other Selected Public Sector Banks and also in the banks on the whole. The regression approach is used for identifying the determinants. From the inferences of the results, it is concluded that non performing loans of all Other Selected Public Sector Banks in current year tend to increase significantly with significant increase in proportion of NPAs in total advances in the last year despite the Other Selected Public Sector banks has significantly reduced the extend of issuing credit relative to previous year.

When the data of SBI and All Other Selected Public Sector Banks are pooled together, it becomes evident that the current year non performing loans in Indian banks tend to increase significantly if there is a significant increase in proportion of nonperforming loans in total advances during previous year even though there has been a significant reduction in extending fresh loans in current year compared to previous year in the banks.

From the comparison of unique influence of loan variables between SBI and All Other Selected Public Sector Banks, it is concluded that unique power of previous year NPAs proportionate to total advances and current year proportion of advances to total advances in determining the NPAs of All Other Selected Public Sector Banks is significantly higher when compared to that of SBI. However, combined effect of all loan variables on NPAs does not differ between SBI and All Other Selected Public Sector Banks.

Regarding role of macro-economic variables in determining NPAs, it is understood that the credit risk (level of NPAs) level of Selected Other Public Sector banks tend to increase significantly if there is a significant decline in country’s GDP and Money supply regardless of marginal decline in interest rate.

From the analysis of combined data, it is concluded that the credit risk level of SBI and All Other Selected Public sector Banks is likely to go up when there has been a notable decline in country’s GDP and Money supply levels even if there is a marginal decline in interest rate.

From the comparison of predicting power of selected macro-economic variables between SBI and All Other Selected Public Sector Banks using Fisher’s Z test, it becomes evident that the predicting power of GDP, Money supply and Interest rate on NPAs is same for SBI and All Other Selected Public Sector Banks in India.

Regarding role of both advancing pattern of banks and macro-economic variables of the country on NPAs of banks, it is identified that an increase in the level of NPAs in All Other Selected Public Sector Banks is unrelated to the macro economic status if there has been a notable increase in NPAs to total advance in previous year and substantial decline in current year credit growth.

The level of NPAs in banks in India is likely to go up when there has been a significant increase in NPAs in previous year despite there is a notable increase in country's money supply. From the comparison of predicting power of loan and macro economic variables between SBI and All Other Selected Public Sector Banks, it is understood that power of NPAs to total assets in previous year and Money supply in the country is equally effective in determining the level of NPAs for SBI and All Other Selected Public Sector Banks.

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