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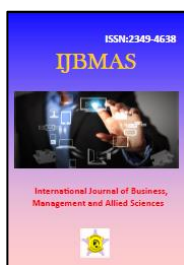
**ANALYSIS OF MICRO& MACROECONOMIC FACTORS AFFECTING  
NON-PERFORMING LOANS IN THE SELECTED INDIAN  
COMMERCIAL BANKS FROM FY 2014-15 to FY 2017-18**

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**ABSTRACT**

The lending process, one of the primary responsibilities of commercial banks, spirals out of control, negatively impacting both the banking and real sectors, with non-payment loans causing a domino effect. To diagnose the problem and make solution suggestions based on the importance of problematic loans in the country's economy, this study looked at the micro (bank-specific) and macro (economy-specific) variables that contributed to the problematic loans of 15 commercial banks that operated continuously in the Indian banking sector from 2014 to 2018. The data was analysed using balanced static panel data analysis. The analysis concluded that the macro variables that were statistically significant on the problematic loans in Indian commercial banks in the relevant period were inflation, unemployment rate, real exchange rate, and Gross national product (GNP) growth rate, and the micro variables were the real effective interest rate, capital adequacy ratio, the share of consumer loans, the conversion rate of deposits to loans, the ratio of personnel expenses to assets, and Bank Assets/Sector Assets Tot. Both public and private banks exhibit a procyclical risk-taking propensity in response to credit expansion, with private banks being more sensitive to changes in interest rates and business cycle dynamics.

Keywords: Nonperforming loans, Indian commercial banks, Macroeconomic variables, Indian banking sector from 2014 to 2018

**1. INTRODUCTION**

Banking is a commercial activity based on mutual trust. In this trust relationship, the bank is both the trusted and the trusted party. In the relationship between the depositor and the bank, the bank must protect the money entrusted to it and evaluate it in the most productive areas. In this respect, the bank is the trusted party<sup>1</sup>. In the relationship between the bank and the credit customer, the bank lends money that it holds as a trust to a person or organisation and expects the other party to repay this loan within specific terms. In this relationship, the bank trusts the other party. There is a possibility that the requirements of the trust relationship between the bank and the credit customer will not be fulfilled. In

this case, credit risk arises. Credits are the most important item that takes up a significant place in the assets of the bank's balance sheets. Credit risk arises from the failure of credit users to pay the loans' principal and/or interest on time.<sup>2</sup> The possibility of losses and financial distress caused by the realisation of credit risk and the loans becoming problematic loans brings with it the necessity of setting aside provisions for problematic loans. Setting aside resources that can be evaluated in profitable investment opportunities as provisions have positive effects on the riskiness of banks and negative effects on their profitability. The increase in problematic loans in the banking sector and the slowdown in the credit growth rate caused by this increase are, on the one hand, affected by the negative developments in the real economy<sup>3</sup>. On the other hand, they lead to a narrowing of funding opportunities and a decrease in the interest income received by banks from loans, leading to a further decrease in profitability. The negativities experienced in loan returns and profitability, which are the bank's most important cash inflow items, due to problematic loans can cause a decrease in the liquidity of banks. The deterioration in liquidity also causes negative effects on the funding structure of banks and can turn into interest risk by disrupting the maturity structure. The increase in liquidity and interest risks triggered by credit risk is a factor that will further increase the problems of banks arising from problematic loans. Another reflection of the negative effect of problematic loans on banks' profitability is the deterioration in the minimum capital adequacy ratio. The increase in problematic loans in the banking system can also negatively affect the real sector operating with loans and the country's economy in general. It is extremely important to examine and identify the factors that cause problem loans due to their destabilising effects on financial and economic stability. It is very important to know these factors and for banks to develop policies accordingly to manage the credit portfolios of banks more effectively, determine capital requirements and price similar loans and credit products that may be highly exposed to credit risk<sup>4</sup>. Based on the importance of problem loans, this study aims to determine the micro and macro factors that affect problem loans in commercial banks operating in the Indian banking sector. The concept of problem loans will be examined in the following section of the study. After the literature on the subject is presented in the third section, the data and method used in the research will be explained in the fourth section. In the conclusion section of the study, the findings obtained are discussed.

## **2. Problem Loans/Nonperforming loans**

Different institutions have different definitions regarding the concept of problem loans. Accordingly, the International Monetary Fund (IMF) states that if a loan obligation is not fulfilled on time or is close to default, this loan can be called a non-performing loan or, in other words, a problem loan. If the delay in the principal and interest repayment of the loan exceeds 90 days, the loan is treated as a problem loan.<sup>5</sup>

According to Basel II, the situation in which loans become problem loans is when the bank assumes that it has received collateral during the loan allocation period. It is determined that the debtor has no possibility of paying the loan debt to the bank without converting the collateral into cash, and/or the debtor's loan debt to the bank is overdue by more than 90 days and the debt has not been paid. There is a point that should be taken into consideration when making a comparison between countries based on the definitions of problematic loans. There may be differences in the decisions taken by countries' central banks regarding restructured loans. For example, while restructured loans are included in the scope of "problem loans" according to the central banks of some countries, they are included in the scope of "non-problem loans" by the central banks of some countries. Studies have introduced standard criteria for resolving the differences in definition and scope between countries.

In the Indian banking sector, the applications banks can make with problematic loan ratios are limited by law. Suppose the collection of problematic loans cannot be realised, considering the maturity and collateral of the loan. In that case, the obligation to set aside provisions arises according to the "Regulation on the Determination of the Qualifications of Loans and Other Receivables for Which

Provisions Will Be Set Aside by Banks and the Principles and Procedures Regarding the Provisions to be Set Aside" (Şahbaz and İnkaya, 2014:81). According to the Provisions Decree; "Receivables that cannot be collected even though 90 days have passed since the maturity or due date of the principal and/or interest are evaluated within the scope of third, fourth or fifth group loans or other receivables and are defined as non-performing receivables. If the credit customer has more than one credit agreement with the same bank and even one of the loans used has not been repaid, the other loans are also defined as non-performing receivables. If the principal or interest of the loan referred to as non-performing receivables, is paid in full, the credit debts of the same customer can be classified under other groups if they do not create the conditions to be defined as non-performing receivables considering the credit characteristics (Sipahi, 2003:18). The factors that cause problematic loans in the banking sector can be examined by dividing into two as internal and external factors. Internal factors that cause problematic loans are expressed as situations where there is a loan repayment problem due to the economic inadequacies of both parties in the loan agreement. In this case, the process is also divided into two as reasons originating from the bank or the loan customer (Sipahi, 2003:18-19). When the banks' credit intelligence is inadequate in terms of obtaining collateral for the loan used and managing the loan, payment problems originating from the bank are experienced. When the customers using the loan are considered as business owners, it is stated that there are problems in issues such as the success of the management of the business, the soundness of its financial structure and the quality of the product or service in question for the use of the loan by the business. The external factors experienced in the repayment of the loans are stated as factors that are not originated from the bank and the loan users, but are the factors that cause the loans to become problematic loans due to reasons originating from economic, political, technological and natural changes. Problematic loans, which do not originate from banks and businesses but increase due to external factors such as economic stagnation, impose costs on banks during the solution phase. The stagnation experienced in the country's economy, the non-repayment of loans given to other countries, raw material and power constraints in the production phase within the country, price increases and events such as natural disasters are also included in the scope of external factors (Ranjan and Dhal, 2003). The rate of problematic loans in the Indian banking sector is shown in Figure 1. The most recent figure from 2018 is 9.46%, a decrease from 9.98% in 2017. The global average is 5.92%, derived from data encompassing 122 nations. The historical average for India from 2005 to 2018 is 6.09%. The minimum value of 4.35% occurred in 2014, whereas the maximum value of 9.98% was noted in 2017. The conversion rates to non-performing loans and their development should be monitored to see the formation of problem loans in the banking sector in more detail.

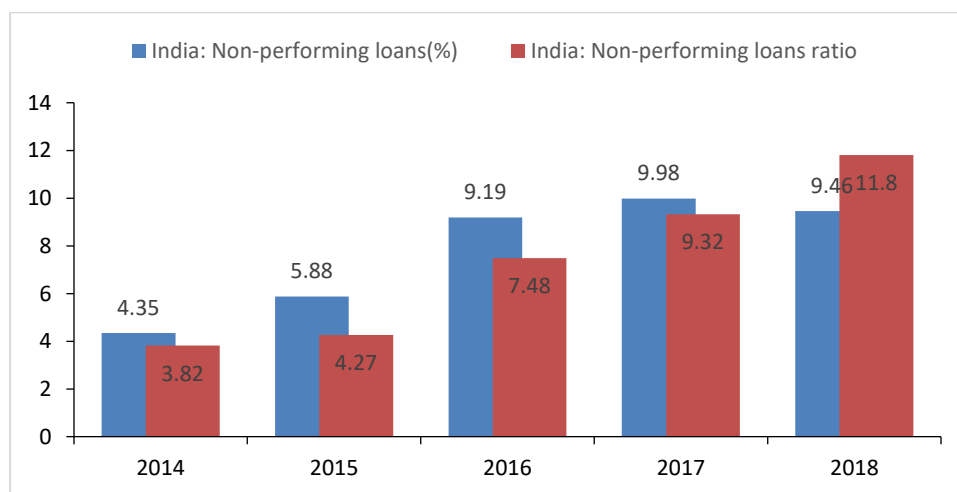


Figure 1. Non-Performing Loans/Total Loans (%) and NPL ratio (2014-2018) (Source: RBI reports, 2014-2018)

Figure 1. NPL Conversion Rate in the Indian Banking Sector (%) due to the adverse impacts of the global crisis. In 2015, this ratio rose to 7.48% due to the problematic receivables balance and increased credit volume. During this period, there was a notable rise in the creation of non-performing loans (NPLs) within the banking sector. There was an escalation in the receivables about follow-up items during 2016-2018. Over the years, the increase in this item is attributed to the ageing analysis of the loans, which revealed a significant rise in 2017 and 2018 (RBI, 2018)<sup>6</sup>. The follow-up conversion rate remained stable at 9.32% in 2017 and 11.8% in 2018 but subsequently increased due to economic developments in 2018. Upon analysing the conversion rates to follow-up on a credit basis across the banking sector, it is evident that the conversion rate for commercial loans, which significantly contributes to the overall growth of problematic loans over the years, is inferior to the conversion rates of other consumer loans, credit cards, and SME loans. The non-performing loan (NPL) ratios of banks exhibit sensitivity to the prevailing interest rate environment and the general economic growth. Despite variations in management and governance frameworks, both public and private banks exhibit a procyclical propensity for risk-taking in response to credit expansion, with private banks demonstrating greater sensitivity to fluctuations in interest rates and business cycle dynamics.

### 3. Literature

The development of problematic loans in the banking sector over the years is generally explained in the literature as depending on two factors. The first is external factors that include all macroeconomic conditions affecting the repayment capacity of individuals or institutions, and the second is bank-specific factors. Using bank-specific data to analyse problematic loans can identify bank asset quality deterioration. Examples of bank-specific data include the bank's size, efficiency and credit periods. In addition, market power and risk profile are among the important factors. Among the macroeconomic variables that include external factors, variables such as real interest rate, GNP growth rate, credit increase rate, real exchange rate, and unemployment rate generally give significant results as factors affecting problematic loans in the analysis. The results from the literature review regarding the variables used in the studies examining the factors affecting problem loans are given in Table 1.

Table 1. Variables Used in the Literature

Work	Variables	
	Dependent	Independent
<b>Panel A: Studies Incorporating Bank-Specific Factors in the Analysis</b>		
Ranjan, Rajiv & Dhal, Sarat. (2003). <sup>7</sup>	Non-Performing Loans	Credit quality, cost-effectiveness, and the amount of capital banks have at their disposal.
Dhal, Sarat. (2003). <sup>8</sup>	Non-Performing Loans	Income variables before loan loss provision
Pillai, Rajasekharan. (2017). <sup>9</sup>	Non-Performing Loans	Bank size, sources of income, ownership structure of banks
Jayakkodi, D.. (2016) <sup>10</sup> .	Non-Performing Loans Ratio	Bank size, Rate of return on assets
Sengupta, Rajeswari & Vardhan, Harsa. (2017) <sup>11</sup> .	Non-Performing Loans Ratio	Capital adequacy, Bank recapitalisation, Balance-sheet crisis
Rashmi Kumari, et al (2017) <sup>12</sup>	Non-Performing Assets	impact of GNPA, ROA, and NNPA on financial performance of Indian banking sectors

Bodla, Bhag. (2015). <sup>13</sup>	Non-Performing Assets	Average interest rate, inflation
<b>Panel B: Studies Incorporating Macroeconomic Factors in the Analysis</b>		
Swamy, Vighneswara. (2012). <sup>14</sup>	Non-Performing Loans	Macroeconomic conditions
Nikolopoulos, Konstantinos & Tsalas, Andreas. (2017) <sup>15</sup> .	Non-Performing Loans	It is classified as Growth Rate of Loans, Secured Loans, Loan Portfolio. Real interest rate and real GNP growth rate.
Rajaraman, I., S.Bhaumik and N.Bhatia (1999) <sup>16</sup> :	Credit losses net Value	Change in GNP and real interest rates, lagged value of the dependent variable,
Kotha, Kiran & Sahu, Bhawna. (2016) <sup>17</sup> .	Non-Performing Loans	Macroeconomic Factors (Industrial Production Index, Interest Rate and Producer Price Index)
<b>Panel C: Studies Incorporating Macroeconomic Factors into the Analysis with Bank-Specific Factors</b>		
Gopalakrishnan, K. & Mehta, S.. (2017) <sup>18</sup> .	Non-Performing Loans	GNP growth rate, banking regulation regime, credit growth, growth rate of branches of banks, bank size over assets, secured loans, net interest margin, capital-to-asset ratio, market power of defaulting firms, firms' debt-equity ratio
Srivastava, Ankita. (2012) <sup>19</sup> .	Non-Performing Loans	GNP growth rate, indebtedness of firms and individuals, inefficiency, wallet Elections (Portfolio Composition), bank size, net interest margin, capital ratio and market power
Ranjan, R. and Dhal, S.C. (2003) <sup>20</sup>	Non-Performing Loans	GNP Growth Rate, Bank Loan Term, Interest Rate, Bank Size, Bank Deposit Rate
Khemraj, T. ve Pasha, S. (2009) <sup>21</sup>	Non-Performing Loans	Real Effective exchange rate, interest rates, loan growth, GNP and bank size.

#### 4. Data and Method

In this study, which was conducted to determine the factors affecting the problem loans of commercial banks operating in India, static panel data analysis was used. The scope of the study consists of the problem loans of commercial banks that continued their activities in the banking sector without interruption between 2014 and 2018. Data on banks and macroeconomic factors were obtained from the official websites of respective banks and the Banking Regulation and Supervision Agency, i.e. Reserve Bank of India (RBI).

##### 4.1. Data

In this study, 15 commercial banks that continued their activities in the Indian banking sector without interruption between 2014 and 2018 were included in the scope of the study, and these banks are indicated in Table 2. The problem loan ratio was used as the dependent variable in the study. This variable was calculated by the ratio of loans under follow-up to total loans and receivables.

Table 2. Commercial Banks Included in the Analysis

Name of the Commercial Bank	type of the bank
1. Bank of India	Public
2. Bank of Maharashtra	Public
3. Canara Bank	Public
4. Central Bank of India	Public
5. Federal Bank	private
6. IDBI Bank	private
7. Indian Bank	Public
8. Indian Overseas Bank	Public
9. IndusInd Bank	Private
10. Karur Vysya Bank	Private
11. Kotak Mahindra Bank	Private
12. Punjab and Sind Bank	Public
13. Punjab National Bank	Public
14. Union Bank of India	Public
15. YES bank	Private

The dependent variable in the study is the problem loan ratio. The problem loan ratio (NPL) is directly related to the financial performance of banks. Although it directly reflects the credit risk in the banking sector, the increase in problem loans on a bank basis is considered a factor that increases the probability of large-scale credit defaults. In this case, it can be said that the net values of banks are negatively affected because their assets are damaged.

The problem loan ratio is calculated as follows:

$$rSK = \frac{TK}{TK + KA}$$

' $rSK$ ' in the equation is the problem loans ratio, TK is the follow-up loans, KA is the loans and receivables.

In the study, both bank-specific independent variables and macroeconomic independent variables were used. Bank-specific variables, loan growth rate, return on assets, bank size, bank competition index (BCI), capital adequacy ratio, share of Indian loans, conversion rate of deposits to loans and the ratio of personnel expenses to assets were obtained from RBI and included in the analysis. In addition, other bank-specific independent variables, return on equity, real effective interest rate, and share of consumer loans, were obtained from individual Bank's FY year statements. This study obtained macroeconomic independent variables such as the inflation rate, GNP rates, and real exchange rates from RBI. Detailed information on the calculations of both bank-specific and macroeconomic independent variables is available in Torun (2017)<sup>22</sup>, Dimitrios et al(2012)<sup>23</sup>.

#### 4.2. Analysis Method and Models

In the first stage of the research, all variables specific to banks and macroeconomics thought to have explanatory power on the problem loan ratio were included in the analysis. Model 1, expressed as the starting point in the modelling, was created as shown below.

$$rSK_{i,t} = c + \beta_1 LIR_{i,t} + \beta_2 REIR_{i,t} + \beta_3 CGR_{i,t} + \beta_4 GNPI_{i,t} + \beta_6 ER_{i,t} + \beta_7 RER_{i,t} + \beta_8 UR_{i,t} \\ + \beta_9 IRI_{i,t} + \beta_{11} CAR_{i,t} + \beta_{12} CAR2_{i,t} + \beta_{13} ROAI_{i,t} + \beta_{14} ROEI_{i,t} + \beta_{15} CTCI_{i,t} \\ + \beta_{16} ATAI_{i,t} + \beta_{17} BSEI_{i,t} + \beta_{18} RBI_{i,t} + \beta_{19} SICLI_{i,t} + \beta_{20} DLCRI_{i,t} + \beta_{21} SCLI_{i,t} \\ + \beta_{22} PEARI_{i,t} + \epsilon_{i,t} \text{ (Model)}$$

The final model was tried to be reached by providing the criteria determined as statistical significance in the inclusion of variables in the model, the expected effect direction on the dependent variable and the inclusion of the variables with the highest power to affect the dependent variable together with other variables in the model. The model that best represents the problem of the problem loan ratio among the many models established with the independent variables affecting the problem loan ratio was determined as Model 2.

The BCI Index was used to measure banks' competition in Model 1, and the Securities and Exchange Board of India (SEBI) index, NIFTY and real interest rate, which also reflect the economic developments within the country, were excluded from the model due to the multicollinearity problem in the model. The bank size, inflation rate, capital adequacy ratio and loan interest rate variables were calculated in two different ways and included in the model. When the real effective and loan interest rates were simultaneously included in the model, they were excluded due to multicollinearity. Although the independent variables that remained in the first model after being calculated in two different ways gave statistically significant results, in the model testing phase, these variables were removed from the model in models that gave statistically and theoretically insignificant results. In the testing phase of the models, the statistical significance and theoretical suitability of the remaining variables were examined. The inappropriate variables were removed from the model in order, and the previously removed ones were added back. The most appropriate model was sought by adding one lagged value of the variables to the model. The reason for using lagged variables in the models is that 90 days must pass for problematic loans to be provisioned by definition; problematic loans that occurred in the last quarter of the previous year may appear to have occurred in the following year. The model 2 obtained in this way is as shown below.

$$rSK_{i,t} = c + \beta_2 REFI_{i,t} + \beta_4 GNPI_{i,t} + \beta_7 RER_{i,t} + \beta_{11} CAR_{i,t} + \beta_{13} ROAI_{i,t} + \beta_{14} ROEI_{i,t} \\ + \beta_{16} ATAI_{i,t} + \beta_{18} RBI_{i,t} + \beta_{19} SICLI_{i,t} + \beta_{20} DLCRI_{i,t} + \beta_{21} SCLI_{i,t} + \beta_{22} PEARI_{i,t} \\ + \beta_{24} UR(-1)_{i,t} + \epsilon_{i,t} \text{ (Model - 2)}$$

parameter estimates for Model 1 and Model 2 are given in Table 3.

Table 3: Parameter Estimation Results for Models Created to Explain the Problematic Loans Ratio

		Model 1		Model 2	
		Coefficients	p-value	Coefficients	p-value
<b>c</b>	Fixed Term	0.598	0.014	-0.043	0.047
<b>LIR</b>	Loan Interest Rate	0.594	0.00		
<b>REIR</b>	Real Effective Interest Rate	*		0.534	0.000
<b>REIR (-1)</b>	1 Period Delayed Real Interest Rate			a	
<b>LGR</b>	Loan Growth Rate	0.008	0.375		
<b>GNP</b>	Gross National Product	-2.732	0.009	-0.895	0.019
<b>ER</b>	Exchange rate	-0.4271	0.08		
<b>RER</b>	Real Exchange Rate	0.144	0.296	-0.553	0.024

<i>RER (-1)</i>	1 Period Delayed Real Exchange Rate	a			
<i>I</i>	Unemployment Rate	-0.695	0.086	c	
<i>I(-1)</i>	1 Period Lagged Unemployment Rate	b		1.960	0.021
<i>INFLR</i>	Inflation Rate	-5.887	0.008	4.284	0.017
<i>INFLR2</i>	Inflation Rate	-0.948	0.057	d	0.000
<i>CAR</i>	Capital Adequacy Ratio	0.569	0.000	1.394	0.000
<i>CAR2</i>	Capital Adequacy Ratio	0.327	0.000	d	0.000
<i>ROA</i>	Return on Assets	-0.914	0.000	-0.077	0.019
<i>ROE</i>	Return on Equity	0.103	0.005	-0.128	0.013
<i>KTK</i>	Credits /Total Credits	0.788	0.045	d	0.000
<i>ATA</i>	Assets / Total Assets	-0.859	0.030	-1.376	0.015
<i>BCI</i>	bank competition index	*			
<i>SEBI</i>	SEBI	*		-0.149	0.037
<i>SICL</i>	Share of Indian Currency Loans	0.015	0.615	-0.090	0.067
<i>DLCR</i>	Deposit to Loan Conversion Rate	-0.056	0.000	-0.043	0.000
<i>SCL</i>	Share of Consumer Loans	0.081	0.007	0.262	0.001
<i>PEAR</i>	Personnel Expenses to Assets Ratio	-0.156	0.868	-7.400	0.000
<i>R<sup>2</sup></i>		0.8789		0.8011	

NOTE: \* These variables were not included in the model due to multicollinearity problems.

- *a* – They were not included in Models 1 and 2, but were used in Model 3.
- *b* – They were not included in Model 1, but were used in Model 2.
- *c* – The level values of the variables whose lagged values were taken in Model 2 were not taken.
- *d* – The variables that defined the same variable in two different ways in the model were not included in Model 2, which was before the final model.

Assumption tests must be performed before deciding whether Model 2 is the final model. As a result of subjecting Model 2 to assumption tests, it was observed that there were deviations from the assumptions. As a result of the tests performed to ensure the assumptions, some independent variables became insignificant, so these variables were removed from Model 2, and as a result of performing assumption tests on the newly established model and correcting deviations from the assumptions according to the obtained test results, Model 3, which will be evaluated as the final model, was reached. Model 3 is given below:

$$rSKI_{i,t} = c + \beta_4GNP_{i,t} + \beta_9ENF_{i,t} + \beta_{11}CAR_{i,t} + \beta_{16}ATA_{i,t} + \beta_{18}RBI_{i,t} + \beta_{20}DLCR_{i,t} + \beta_{21}SCL_{i,t} + \beta_{22}PEAR_{i,t} + \beta_{24}UR(-1)_{i,t} + \beta_{25}PLRER(-1)_{i,t} + \beta_{26}REF(-1)_{i,t} + \varepsilon_{i,t} \text{ (model - 3)}$$

Based on Model 3, before parameter estimation, the panel data analysis model must be determined. For this purpose, a choice must be made between the fixed effects model and the random effects model by using the Hausman test statistic to determine the model. The *F* – test, which is also the test of the Classical model, is included in the testing phase of the fixed effects model. As seen in Table 4, it was concluded that the model was unsuitable for the Classical model, also known as the Pooled Model.



According to the Hausman test result, it was concluded that the model should be estimated using the fixed effects model.

Table 4. Results of F and Hausman Tests

F-Tests	Hausman Test
$F(25.61) = 3.694$	$\chi^2$ Test Statistic= 39.62
$Prob > F = 0$	$Prob > \chi^2 = 0$

In panel data models, as in time series models, some assumptions must be made regarding model reliability. These assumptions are that the model has no heteroscedasticity, autocorrelation and inter-unit correlation. Each model has different assumption tests, and different methods are used for corrections in case of deviations from the assumption.

Table 5. Test Results Regarding the Reliability of the Model

HYPOSISTANCE TEST	Autocorrelation Test	Inter-unit correlation tests	
Modified Wald Test	Durbin-Watson & Baltagi-Wu Test		
$\chi^2$ Test Statistics: 13686.9	Durbin-Watson: 1.324	p-value : 2.69	Friedman CSI: 3.68
$Prob > \chi^2 = 0$	Baltagi-Wu LBI: 1.367	Probability = 0.618	Probability = 0.496

The result was reached. As a result of the tests performed, since heteroscedasticity and autocorrelation were detected in the model created to determine the factors affecting problem loans, it was decided to make the fixed effects model estimate with clustered standard errors. When modelling is done with clustered standard errors, it is seen that the parameter estimates remain the same, but there is a difference between the standard errors and the model where the correction is not made. It is known that estimation is made with robust standard errors in calculating clustered standard errors in panel regressions. According to the t statistics recalculated in the constant effects model with clustered standard errors, the effect of the variables of return on assets, return on equity and the share of Indian Rupees loans on problem loans has become insignificant. The F test is significant, and  $R^2$  is at 80% level (Tatoğlu, 2013: 245-248). The panel regression model was re-estimated by removing the variables that lost their statistical significance from the data set. At this stage, when some variables that were statistically significant at the current value in Model 2 lost their significance, the lagged values of these variables were also included in the models in the estimation stage. For example; The 1-period lagged values of the real interest rate and the real exchange rate are also included in the final model. The lagged values of the GNP and unemployment rate of the India are also included in the model in Model 2. The display of the final model (Model 3) is as follows:

The testing phase of Model 3, which was determined as the final model, has begun. The Hausman test result will determine whether the final model should be estimated with a fixed effects or random effects model. Table 6 shows the Hausman test results.

Table 6. Hausman Test Results

HAUSMAN TEST RESULT	HAUSMAN TEST RESULT (With robust estimator)
$\chi^2$ Test Statistic= 43.15	$\chi^2$ Test Statistic= 31.28
$Prob > \chi^2 = 0$	$Prob > \chi^2 = 0.000$

According to the Hausman Test results, continuing with the fixed effects model in the estimation phase is necessary. When the Hausman test is repeated with a robust estimation, the test result shows that the estimation should be done with the fixed effects model, as seen in Table 7. Since the assumptions should be provided regarding the model's reliability, the assumptions were tested in the fixed effects model. The first assumption was the existence of heteroscedasticity tested with the Modified Wald Test. Then, the second assumption was the existence of autocorrelation, which was tested with the Durbin-Watson & Baltagi-Wu Test. The last assumption before estimating the model is that the units have no correlation. The test results are given in Table 7.

Table 7. Tests of Assumptions in the Fixed Effects Model

Hyposistance Test Result	Autocorrelation Test Result	Inter-Unit Correlation Test Result	
Chi-Square Test Statistic = 25216.40	Durbin-Watson = 1.53	P-Value = 4.632	Friedman CSI = 5.69
Prob> $\chi^2=0.000$	Baltagi-Wu LBI = 1.69	Pr = 0.467	Pr = 0.631

As a result of the tests, it was determined that there was heteroscedasticity, autocorrelation and no correlation between units. Since heteroscedasticity and autocorrelation problems were detected in the new model created after the statistically insignificant values were removed, the fixed effects model and parameter coefficients were estimated using clustered standard errors. Accordingly, the parameters and test statistics of the final model, Model 3, are given in Table 8.

Table 8. Parameter Estimation Results for Models Created to Explain the Problematic Loans Ratio

		Model 3	
		Coefficients	P – Value
<b>c</b>	Fixed Term	-0.233	0.010
<b>PDRIR (-1)</b>	1 Period Delayed Real Interest Rate	0.955	0.021
<b>GNP</b>	Gross National Product	-0.778	0.013
<b>PDRER(-1)</b>	1 Period Delayed Real Exchange Rate	0.325	0.008
<b>I(-1)</b>	1 Period Lagged Unemployment Rate	1.693	0.035
<b>INFLR</b>	Inflation Rate	1.876	0.046
<b>CAR</b>	Capital Adequacy Ratio	1.203	0.000
<b>ATA</b>	Assets / Total Assets	-1.496	0.016
<b>SEBI</b>	SEBI Index	-0.306	0.027
<b>DLCR</b>	Conversion Rate of Deposits to Loans	-0.043	0.000
<b>SCL</b>	Share of Consumer Loans	0.262	0.001
<b>PEAR</b>	The ratio of Personnel Expenses to Assets	-8.096	0.002
<b>R<sup>2</sup></b>		0.7980	

## 5. RESULTS AND DISCUSSION

When the findings are examined, it is concluded that the relationship between the first *lag* of the real effective interest rate and problem loans is positive. Accordingly, the effect of the increase in real effective loan interest rates, which increases the cost of credit, can cause difficulties in repaying loans. The findings of this study are consistent with the results obtained in the studies included in the literature<sup>24</sup>.

According to the study results, there is a negative relationship between GNP and problem loans. Khemraj and Pasha (2009) emphasised that the growth in GNP reduces banks' problem loans by increasing individuals' income and thus the credit repayment capacity of credit users. Most studies in the literature have concluded a negative relationship between problem loans and GNP growth.

It has been concluded that the relationship between the first-lagged value of the GNP of India and problem loans is negative. It can be concluded that since a significant portion of Indian trade is carried during this specific period, changes in income in this region may also indirectly affect the quality of credits in our country. The decrease in the income level in the region causes a decreasing effect on incomes through exports and may cause those with credit debts to have difficulty paying.

In addition, a positive relationship has been found between the first-lagged value of the real effective exchange rate and problem loans. The fact that the increase in exchange rates negatively affects the payment capacity of all economic units and creates problems in the repayment of the loans they use, with its cost-increasing effect on a wide range from the raw materials of the products produced within the country to the prices of the imported products, is an expected result that is compatible with the developments in the country during the analysis period. Khemraj and Pasha (2009) have similarly reached findings in their studies regarding a positive relationship between problem loans and real effective exchange rates. The appreciation of the real exchange rate can hinder growth, especially in export-based economies, due to the narrowing effect on banks' profit margins. As a result, it can directly affect the contraction in the economy and credit performances.

When the relationship between the first lag value of the unemployment rate and problem loans is examined, it is concluded that this relationship is positive. An increase/decrease in the unemployment rate can be expected to cause a similar increase/decrease in the problem loans rate at the end of the one-year period. With an increase in the unemployment rate, the credit user who becomes unemployed or loses his/her income has difficulty paying his/her loan and problems begin to arise in the repayment of the loans. In the studies of Bofondi and Ropele (2011)<sup>25</sup>, it was concluded that the unemployment rate affects the credit risk in the banking system. Chaibi, Hasna. (2016)<sup>26</sup> study found a positive relationship between the unemployment rate and problem loans. It was concluded that the relationship between the inflation rate and problem loans is positive. In unexpected cases, hyperinflation can damage bank assets and capital and weaken banks' financial structures through the interest rate channel. As stated in most studies, the fact that inflation has the same effect on problem loans is an expected result consistent with the country's developments during the analysis period. The study results show a positive relationship between the capital adequacy ratio value and problem loans. In the studies in the literature, there is generally no definite conclusion about the direction of the relationship between problem loans and capital adequacy ratio. On the other hand, Boudriga et al. (2009)<sup>27</sup> found a negative relationship between problem loans and capital adequacy ratio. Bank size is represented by Bank Credit/Sector Credit Total and Bank Active/Sector Active Total. As a result of the model tests, in the model with the highest representation ability (Model 3), since there was a high correlation between the two variables, the Bank Active/Sector Total Active ratio, which gave statistically significant results, remained in the analysis. In contrast, the Bank Credit/Sector Total Credit ratio, which did not give statistically significant results, was excluded from the analysis. It was concluded that the relationship between the bank size value represented by the Bank Active/Sector Total Active ratio and problem loans is negative.

It has been concluded that the relationship between RBI value and problematic loans is negative. According to the analysis results, an increase/decrease in NIFTY (National Stock Exchange Fifty) causes a decrease/increase in the problematic loans ratio. As a result of the increase in GNP, which is the symbol of economic growth in the country, and the upward developments in the stock market, where positive and negative developments in the country are reflected very quickly, the decrease in the problematic loans ratio in the banking sector is an expected result. It has been concluded that the relationship between the Deposit to Credit Conversion Ratio value and problematic loans is negative<sup>28</sup>. The deposit-to-credit conversion ratio should be evaluated as the second indicator that shows the growth rate of loans. Since a high correlation occurs between the two variables due to the inclusion of two representative values in the analysis, it has been determined that the growth rate of loans does not give statistically significant results. In contrast, the deposit-to-credit conversion ratio gives statistically significant results. When the literature is examined, it is seen that there are studies that find negative and significant results between bank size and problematic loans. Other studies that bank size hurts the problem loan ratio also found a negative relationship between bank size and problem loans<sup>29</sup>. Hu et al. (2004)<sup>30</sup> observed a negative relationship between banks and problem loans when the size of the banks is considered.

It was concluded that the relationship between the share value of consumer loans and problem loans is positive. According to the findings of the analysis, an increase/decrease in the share of consumer loans in total loans will also cause an increase/decrease in the problem loan ratio. This is an expected result and is compatible with the developments in the country during the analysis period. It was observed that consumer loans increased the most among the increases in individual loans over the years. The problems experienced by consumer loan users in their payment capacity due to economic developments in the country have an increasing effect on problem loans.

It was concluded that the relationship between the ratio of personnel expenses to assets variable and problem loans is negative. According to the findings of the analysis, an increase/decrease in the ratio of personnel expenses to assets will cause a decrease/increase in the ratio of problem loans. It has been determined as a result of the analysis that the increase in the ratio of personnel expenses to assets in banks and the increase in the size of banks, which is also expressed as the share of banks in the sector, have similar results on problem loans in the Indian banking sector. It can be said that the higher efficiency of the specialists in the credit allocation departments of banks and the employees who perform risk analysis and the fact that the management staff can make more accurate decisions about the loans and risks compared to the size of the banks and that the loans can be managed better have a reducing effect on problem loans. It can be evaluated as an expected result and in line with the developments in the country during the analysis period.

## 6. Conclusion

Problematic loans in the banking sector reflect both the financial system and the economic cycle of a country. When economic conditions worsen, individuals and businesses face decreased income, leading to an inability to repay debts and an increase in non-performing loans (NPLs). This creates a domino effect, negatively impacting the real sector, which relies on loans for investment and growth, and can even lead to a broader economic crisis if left unaddressed.

Problematic loans degrade bank balance sheets, reduce profitability, and limit capital, making it harder for banks to issue new loans. If unresolved, these loans can cause significant financial distress and systemic crises. Banks also face added costs from unpaid loans, while credit users lose collateral and access to new loans.

This study investigates the micro and macro factors influencing the problematic loan ratio in India's banking sector between 2008 and 2015, using panel data analysis with 25 commercial banks in continuous operation. It found that factors such as inflation, unemployment, exchange rates, interest

rates, capital adequacy ratio, consumer loans share, GDP growth, NIFTY, deposit-to-loan ratio, bank size, and personnel expenses significantly affect the problem loan ratio. Although some variables, like profitability and loan shares, showed statistical significance, their effects were less pronounced in later stages of analysis.

To mitigate the impact of problem loans, banks, regulators, and policymakers must develop new strategies. Strengthening supervisory mechanisms, enhancing risk management systems, and enforcing effective credit risk criteria are essential. Policymakers should also remove barriers to help banks build healthier portfolios. This study provides valuable insights for banking sector managers, regulators, and researchers, and can be expanded by exploring other periods or techniques in future research.

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