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CREDIT RISK MANAGEMENT AND ITS IMPACT ON NON-PERFORMING ASSETS: A STUDY OF SELECTED COMMERCIAL BANKS

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Abstract
Credit risk management is important to ensure financial stability by keeping Non-Performing Assets (NPAs) of Indian commercial banks at the lowest level. The present study analyzes the influence of credit risk management on Non-Performing Assets (NPAs) of Indian commercial banks employing panel data regression analysis. The study concentrates on major financial ratios like Gross NPA, Net NPA, Capital Adequacy Ratio (CAR), Provision Coverage Ratio (PCR), Cost to Income Ratio (CIR), Net Interest Margin (NIM), Loan-to-Deposit Ratio (LTD), and spread. Fixed and random effects models are used in the study to identify the inter-relationships among these variables and NPAs. The results uncover that although Spread and Loan-to-Deposit Ratio have a serious impact on NPAs, others such as Provision Coverage Ratio, Capital Adequacy Ratio, Cost to Income Ratio, and Net Interest Margin do not display any significant contribution. The Hausman test affirms that this analysis is best performed using a fixed effects model. The study highlights the need for effective credit risk management strategies, particularly focusing on loan efficiency and interest rate policies, to enhance asset quality and financial stability in Indian commercial banks. The results offer valuable insights for banking institutions to develop strategies aimed at reducing NPAs and improving overall financial performance.

Key words: Credit Risk Management, Non-Performing Assets, Indian Commercial Banks, Loan-to-Deposit Ratio, Financial Stability.

1 Introduction

Bankers' oldest risk is loan default, or credit risk. Business nature makes it banks' largest risk. Credit risk is the risk that a bank borrower or counterparty would not fulfill promises. Companies borrowing for acquisitions, development, expansion, and personal usage have made credit risk ubiquitous in recent decades. By limiting credit risk, credit risk management maximizes a bank's risk-adjusted return (Brahmaiah, 2022). In evaluating credit risk and other hazards, banks must manage credit risk in their portfolio and individual loans or transactions. Comprehensive risk management includes credit risk management, which is crucial to a bank's long-term performance. Lessons from previous events should remind banks and supervisors

to identify, assess, monitor, and manage credit risk, keep appropriate capital, and be fairly paid. A borrower or counterparty failing to satisfy payment or contractual commitments on time is

credit risk, which affects 60% of banks' balance sheets. Individual or portfolio transaction risk. Banks must properly manage credit risk to prevent bankruptcy. Credit criteria, scores, analysing borrowers' creditworthiness, risk rating, collaterals, and risk-based pricing are used. Banks should assess capital efficiency and profitability using the RAROC model. They must also follow lending principles, exposure norms and ceilings, loan review and renewal methods, risk scoring, rating models, risk-based pricing, and credit portfolio exposure diversification. Individual and group credit limitations should be equal and relevant. Over the years, ineffective credit risk management has led to a rise in Non-Performing Assets (NPAs), which pose a serious threat to the banking sector. This study aims to explore the impact of credit risk management on NPAs in Indian commercial banks, emphasizing the need for robust risk assessment frameworks and policies.

Importance of Credit Risk Management

Credit risk management is essential to the survival and success of financial institutions. It is a systematic process of managing uncertainty by assessing risks, formulating strategies, and hedging through managerial means. Strategies include risk transfer to others, risk avoidance, risk reduction of the adverse impact of risk, and taking some or all of the consequences of a specific risk. Major techniques involve proper selection of counterparts and products, limitation rule, diversification approach, and credit coverage by credit derivative products (H. Kumar et al., 2023). These methods are converted to daily operations through documented processes and procedures that prescribe counterpart selection, risk profile loans, and expertise assessment requirements. Credit risk is crucial for market segmentation, but insufficient credit risk assessment and management methods can result in poor access to formal financial services and lead to chronic poverty, reduced economic growth rates, and high income and asset inequality. Poor access to formal financial services, especially credit, leads to chronic poverty, reduced economic growth rates, and high income and asset inequality.

Credit risk management has to be prioritized in an effort to stimulate innovation and enhance economic growth. CRM innovations and techniques are utilized mainly in credit expansion, enabling the utilization of credit scoring models in consumer loans, securitization of mortgages, statistical models grounded on accounting information and market value for lending to corporations and small business, and credit derivatives and swaps. But for DCs' transactional activities, these strategies may not be quite appropriate (Spuchľáková et al., 2019). It involves identification, evaluation, monitoring, and control of lending-related credit risks. Banks are able to keep their financial portfolios stable by reducing loan defaults through effective credit risk management. Globalization and rising financial integration have pushed Indian banks to use sophisticated risk management methods, such as risk rating systems, credit scoring models, and Basel III norms for regulatory needs. Poor risk management may result in banks making losses, turning unprofitable, and losing the confidence of the investors. Therefore, to ensure financial stability and avoid system risk in the banking industry, there is a requirement for an effective credit risk management system.

Understanding Non-Performing Assets (NPAs)

Non-Performing Assets (NPAs) are loans and advances that have stopped generating income for banks due to borrowers' failure to repay. The Indian banking sector has been facing a crisis

due to NPAs, which are assets that remain overdue for over ninety days. The Reserve Bank of India (RBI) categorizes NPAs into substandard, doubtful, and loss assets. Substandard assets remain NPA status for up to twelve months, doubtful assets sustain NPA designation for more than twelve months, and loss assets acknowledge the associated loss but not the exact amount. The combined inclusion of these three types of assets constitutes the entire NPA within a bank. NPAs can lead to increased operational costs and diminished interest margins, affecting banks' profitability (R. B. Agrawal & Goyal, 2021). A rising occurrence of loan defaults leads to increased operating expenditures, including increased investments in monitoring and divesting from loans. This diverts banks' attention from core business expansion efforts, resulting in reduced profits. The escalation in operating costs, including employee remuneration and branch office outlays, negatively impacts banks' cost efficiency and leads to reduced profits.

A major financial problem, non-performing assets (NPAs) are caused by a number of macroeconomic reasons. Businesses may find it challenging to fulfill their financial commitments during economic downturns due to dwindling sales, reduced earnings, and cash flow issues. Financial stress may also be experienced by industries that are highly dependent on outside variables such as changes in regulations, global demand, and technological innovations. It is difficult for sectors dealing with oversupply, policy uncertainty, or structural problems to provide enough cash flows for debt payment (D. V. Agrawal & Magar, 2023). NPAs may also result from poor corporate governance, insufficient risk assessment, poor credit evaluation procedures, and a failure to exercise due diligence while disbursing loans. Delays in the recovery process and a reduced capacity of creditors to take appropriate action against defaulting borrowers may result from ineffective legal and bankruptcy frameworks that prevent the prompt resolution of non-performing assets (NPAs). Willful default, a lack of transparency, and shocks peculiar to the economy and sector are all problems pertaining to borrowers. In India, a loan is classified as an NPA if the principal or interest payment remains overdue for more than 90 days. The rise in NPAs can severely impact a bank’s financial health by reducing its revenue, increasing provisioning requirements, and affecting overall market confidence (Raju, 2020). Several factors contribute to the accumulation of NPAs, including poor credit appraisal processes, economic downturns, policy uncertainties, and willful defaults by borrowers. The high prevalence of NPAs in Indian banks has prompted regulatory interventions by the Reserve Bank of India (RBI), which has implemented various measures such as the Asset Quality Review (AQR) and the Insolvency and Bankruptcy Code (IBC) to address the issue. Understanding the causes and consequences of NPAs is crucial for devising effective credit risk management strategies.

Development of risk management structures, Indian commercial banks also remain plagued with various issues concerning the management of credit risk and NPA management. Increasing bad loans, security and authentication issues, balance sheet management, branch banking, adequacy of capital, competition, corporate governance, customer grievances, diversity of customers, and customer expectations are some of the Indian banking sector challenges. Banks have more problematic loans, or NPAs, with the economic crisis. Because new equipment could be hacked, security and authentication are also essential. To enhance net profits and build investor confidence, banks have been unwilling to reschedule bad loans (Rathi & Bhati, 2022). To compete with world and emerging private sector banks, Indian banks need to upgrade their systems and processes to international levels and strengthen their finances. Banks require

effective corporate governance to align objectives and incentives in the face of external pressures. Being engaged in commercial and non-commercial financial services, banks also have to deal with customer complaints and diversity.

Banks and financial institutions must adapt to consumer requirements and satisfaction. Indian banks struggle to provide all communities equitable banking, handle customer complaints, and promote financial inclusion. Older staff retiring and FinTech startups rising have created a junior and intermediate vacancy, forcing banks to use technology to boost efficiency. Banks must have better and easier-to-use mobiles to compete (K. Kumar, 2021). Low efficiency results from overmanning, an unhealthy organizational culture, and weak employee commitment. Emerging rules protect the consumer, and banks need to escalate compliance costs in order to stay in tune. Business of financial enterprises like mutual fund industry, home finance companies, hire-purchase finance, investment houses, operates by competing for the deposits and advances of ordinary folks and offers greater interest than the commercial banks. Branch growth, rural and social banking, research ratios, and huge corporate and borrower repayment defaults mar profitability, the primary concern. Technical problems, qualitative banking model shifts, and rural coverage limitations pose challenges. Ineffective credit assessment and monitoring procedures are a prime concern. Most banks' appraisal models are weak, leading to adverse loan decisions (Pangrikar, 2015). Economic slow-downs, industry slowing, and governmental regimes also contribute to credit risk through the impact they have on the repayment capability of the borrowers. Compliance with banks is particularly challenging because risk management strategy would have to undergo a change. Political intervention, poor recovery practices, and an unsatisfactory debt settlement framework contribute towards rising NPA figures as well. Solution to these issues requires technological, policy, and institutional changes.

This research is significant to financial institutions, regulators, scholars, and investors. Credit risk management and NPAs can assist banks in enhancing risk mitigation, loan recovery, and operational effectiveness. The RBI and regulators can utilize the findings to enhance regulatory guidelines and credit risk management guidance. The study can enable scholars to analyze credit risk processes and banking stability. Knowledge of banks loan risk-return trade- offs can also help financial market investors and stakeholders. It completes a knowledge gap in the literature and provides sustainable banking recommendations. The greatest challenge is profitability, which is affected by the opening of branches, social and rural banking, higher research ratios, and major failures in repayment from corporations and borrowers. Technological problems, qualitative banking paradigm shifts, and rural coverage limitations pose challenges. Ineffective credit assessment and monitoring processes are a primary concern. Most banks' assessment models are weak, leading to poor loan decisions. Credit risk is also heightened by economic downturns, industry stagnation, and government changes, which impact borrower repayment capacity. Banking compliance is particularly challenging because regulatory guidelines require risk management strategy adjustment. Political interference, weak recovery practices, and a poor debt settlement mechanism also contribute to NPA levels. Technology, policy, and institutional reforms are required to address these issues.

The paper is structured in the following manner. Section one gives an overview of credit risk management and its importance for Indian commercial banks. Section two gives an exhaustive review of literature that includes the analysis of past research on credit risk management, NPA

trends, and regulatory measures. Section three gives a description of the method of research, the data collection process, the analytical tools, and the empirical models employed in the paper. The fourth section shows the findings with the main trends and insights drawn from the analysis. The fifth section elaborates the findings. The last section concludes the research with an overview of main findings, implications, and proposals for enhancing credit risk management in Indian commercial banks.

2 Literature review

Credit risk management is a key function of banking operations that ensures financial soundness by keeping Non-Performing Assets (NPAs) to a minimum. NPAs have been a recurring problem for Indian commercial banks, impacting profitability and asset quality. Proper credit risk management practices such as loan evaluation, monitoring, and provisioning are essential to contain default risks. Regulatory actions from the Reserve Bank of India (RBI) and Basel requirements have also moulded risk management systems. It discusses previous studies on credit risk management, reasons behind NPAs, and performance of different measures of risk mitigations in financial performance enhancement for Indian banks.

(Banerjee, 2023) Banks play a crucial role in the development and sustainability of an economy as intermediaries in the mobilization of resources and their channeling to different sectors. Banks' health reflects the health of the economy. Credit risk, which emanates from credit, is a major issue in the banking industry. The Basel Accord 1988 focuses on credit risk and risk-weighted assets. Credit risk management is increasingly gaining prominence in Indian banks due to the regulatory requirement of BASEL II. Credit risk management is vital in an emerging economy with growing global competition, globalization, liberalization, consolidation, and deregulation, making possible effective control and management of non-performing assets. (Afriyie et al., 2018) Credit risk is the risk financial institutions can face in losing money as a result of a worsening financial condition of a borrower, resulting in diminished or destroyed asset value. The goal of this study is to gain insight into the credit risk management (CRM) systems of commercial banks in less developed economies. The research employed interviews and appropriate documents from CBs and main management officials. The research revealed that credit risk can be controlled and reduced when strategic methods are put in place and followed. The research presents a perfect case for researching how CBs in underdeveloped financial systems manage their credit risk in Ghana. (Siddique, 2021) analyzes how credit risk management and bank-specific variables affect the financial performance (FP) of commercial banks in South Asia. Their study, based on a survey of 19 Pakistani and Indian banks, identified NPLs, cost-efficiency ratio, average lending rate, and liquidity ratio as significantly negatively related to FP. In contrast, CAR and ALR were positively related to FP. They implies that policymakers in the Asian nations should adopt monetary policies that spur interest rates to minimize NPLs and be sufficiently liquid to stay afloat in high competition settings. The research is novel in its comparison of developed and developing Asia nations using income as the benchmark.

(Ravirajan & Shanmugam, 2023) examined the determinants of NPAs of Indian commercial banks between 2009-2020 with panel data analysis. The findings indicated that overgrowth of credit in the past has added to the upsurge of NPAS, and economic downturn enhances loan delinquencies. Priority sector lending leads to higher delinquencies at higher levels, whereas

big banks and profitability minimize them. They recommends counter capital buffer, dynamic provisioning, and good credit appraisal NPA can enhance financial stability and monetary policy effectiveness. The research is helpful for policymakers, bankers, and stakeholders to address the NPA problem in India. (Srikanth & Kishore, 2019) analyzed the effect of credit risk elements on credit risk management and the rise in non-performing assets (NPAs) of Indian commercial banks. Information was gathered from primary and secondary sources, while multiple linear regression was employed in estimating models. Findings indicate that credit risk identification has a significant influence on credit risk performance, with negative correlation to the annual growth of NPAs or loans. They had immediate practical use for Indian banks and implementation of new norms of Basel Accord. Their research focusesd on the vital role of a sound risk management system to handle credit risk and its implications for the Indian economy. (Kavitha & Muthukrishna, 2019) Banking is an important economic activity that decides the economic fate of a nation and plays an important role in poverty and unemployment alleviation. The banking sector is, at present, beset with the problem of mounting Non-Performing Assets (NPAs). They intends to gauge the effect of NPAs on the profitability of Indian scheduled commercial banks for the period of a decade from 2007-2008 to 2016-2017. Their study applied the use of ratio analysis, regression analysis, tests of equality of means, and cross correlograms using the EViews 10 package to determine the variables influencing the profitability of the banking industry. The findings confirm the rising trend in NPAs in India's scheduled commercial banks.

(Treesa, 2019) Non-performing assets (NPAs) are a major concern in most nations, reflecting credit risk and impacting the performance of banks. NPAs are on the rise in India because of defective lending policies and compulsory lending to priority and public sectors. It had become a buzzword in Indian banking, and NPAs need to be minimized for enhancing profitability and efficiency. The management of NPAs in Indian public and private sector commercial banks has been studied here, investigating factors influencing it. Credit is extended by public sector banks to the needy sectors, whereas private sector banks also follow various methods of loan policy and credit sanctioning. (Srivastava & Chauhan, 2018) The Indian banking sector is faced with the increasing Non-Performing Assets (NPAs), especially in Public Sector Banks (PSBs), that is posing a huge threat to the growth of the economy. But the maturity of AI technologies offers the scope for formulating new operational models and determining the lacunas in the existing financial sector operations. The technologies have the ability to deliver faultless solutions towards solving the problem of increasing NPAs, facilitating the free flow of credit, and fostering the growth of the economy. (Gudala et al., 2018) The banking industry is important for development strategies, the promotion of government policies, and social goals through lending, network of branches, and employment creation. The dominance of Non- Performing Assets (NPA) is the key issue. NPAs refer to assets which no longer generate revenue for the bank. Chief reasons are wilful default, mis-utilisation of borrowed resources, and insufficient pre-enquiry prior to disbursal of loans. Indian bank Gross NPA stood at 10.03 lakh crores as of June 2018. Public Sector Banks hold 88.74% of total NPAs, and the top five banks among them are SBI, PNB, IDBI, BOI, and BOB.

(Sharifi et al., 2019) examined the impact of credit risk factors on credit risk management and growth of non-performing assets (NPAs) of Indian commercial banks. Data was collected from both primary and secondary sources, and multiple linear regression was used for model

estimation. Results show that credit risk identification significantly impacts credit risk performance in a negative association with year-end growth in NPAs or loans. They had implications for Indian banks' operations and implementation of new Basel Accord standards. They emphasized the importance of a good risk management system to contain credit risk and its implications for the Indian economy. (Safiuddin & Khan, 2021) Effect of non-performing assets (NPAs) on Indian banks and their earnings effect. NPAs are advances or loans on which the interest or principal has not been paid for 90 days or more. According to a report by Reserve Bank of India, the Indian banking system is saddled with a large NPA, and it amounts to 8.5 of the total advances up to March 2020. Private sector banks (PrSBs) have managed their NPAs in a better way. They analyzed the effect of NPAs on bank profits, with emphasis on 20 PBS and 21 PrSBs during 2015-2019. The results indicated that PBSBs have a greater growth in NPAs than PrSBs, which has a significant impact on bank profits. (Assistant Professor, 2023) examined the credit risk management of BCCB during 2019-2023 with emphasis on the effect of these practices on the commercial performance, sustainable growth, and profitability of the bank. Secondary data from annual reports and the Altman Z score model have been applied for analysis. The results indicate that in 2020, the bank was not very far from bankruptcy, but 2019 and 2023 have witnessed improved performance. Their research also unveiled that credit risk management practices have a great influence on Non-Performing Assets (NPA) of cooperative banks.

(Goswami, 2022) examined the persistence effect of credit risk in the Indian banking industry over 19 years, focusing on bank-level data from 1998/1999 to 2016/17. They examined how bank-specific, industry-specific, macroeconomic variables, regulatory reforms, ownership changes, and financial crises affect bank asset quality in India. They finds that time lag in recovering past dues may increase bank defaults. Improving credit quality in Indian banks can be achieved through higher profitability, better managerial efficiency, diversified income from nontraditional activities, optimal bank size, proper credit screening, and regulatory adherence. (Banks et al., 2022) credit risk determinants in the banks of Jordan based on macroeconomic variables of 2008-2019. It determined that credit risk is associated with foreign direct investment (FDI) and output gap, which provide employment opportunities and enhance administrative efficiency. Output gap decreased the cash inflow of borrowers and made it difficult to repay the interest and principal of bank loans. As remittance (REMIT) grows, credit risk accelerates, as does public debt (DEBT). Tax on personal income (TAXINC) also plays a significant role in credit risk. The findings suggested that credit risk is influenced by various factors. (Sharma et al., 2019) The financial system is crucial for an economy's development, facilitating the flow of funds between savers and borrowers. It covered banks, securities, market infrastructure, central banks, and regulatory bodies. A sound, healthy banking system is required for a developed economy. The critical role of the banking system is to lend to businesses and borrowers, but it also perpetuates credit risk. The banking industry is plagued by a problem of Non-Performing Assets (NPA), which would undermine profits today, grab interest income, and impact fund recycling. Management of NPA in a proper way is crucial to prevent adverse effects on the business of banks.

Despite extensive research has been conducted on credit risk management and Non-Performing Assets (NPAs) of Indian commercial banks, there are still knowledge gaps in understanding the impact of some financial indicators on NPAs. Earlier studies concentrate more on NPAs in the

context of macroeconomic factors and regulatory regimes but offer less information on the effect of bank-specific factors such as Gross NPA, Net NPA, Capital Adequacy Ratio, Provision Coverage Ratio, Cost to Income Ratio, Net Interest Margin, Loan-to-Deposit Ratio, and Spread on the effectiveness of credit risk management. Also, little empirical evidence from panel data regression models is available to gauge the dynamics between these financial parameters and asset quality over time. Comparative effects of these variables on NPAs for public and private sector banks are also not thoroughly researched. Bridging these research gaps would make the role of financial metrics in shaping risk management behavior more explicit and help banks improve their asset quality and financial resilience.

3 Research Methodology

3.1 Research design

This research utilizes panel data regression analysis based on secondary time-series data to analyse the effect of credit risk management on Non-Performing Assets (NPAs) in Indian commercial banks. The major variables considered are Gross NPA, Net NPA, Capital Adequacy Ratio (CAR), Provision Coverage Ratio (PCR), Cost to Income Ratio (CIR), Net Interest Margin (NIM), Loan/Credit-to-Deposit Ratio (LTD), and Spread. The study seeks to determine the effect of these financial indicators on the volume of NPAs and overall asset quality. Using panel regression models, the study conducts an exhaustive analysis of credit risk management practices vis-à-vis NPAs and presents insights into successful risk mitigation measures to enhance financial stability in Indian banks.

3.2 Hypothesis

H0: There is no significant impact between GNPA and Capital Adequacy Ratio, Loan to Deposit Ratio, Spread, Provision Coverage Ratio, Cost to Income Ratio, Net Interest Margin.
H1: There is a significant impact between GNPA and Capital Adequacy Ratio, Loan to Deposit Ratio, Spread, Provision Coverage Ratio, Cost to Income Ratio, Net Interest Margin.
H0: There is no significant impact between NNPA and Capital Adequacy Ratio, Loan to Deposit Ratio, Spread, Provision Coverage Ratio, Cost to Income Ratio, Net Interest Margin.
H2: There is a significant impact between NNPA and Capital Adequacy Ratio, Loan to Deposit Ratio, Spread, Provision Coverage Ratio, Cost to Income Ratio, Net Interest Margin.

3.3 Data collection

This research examines credit risk management and its effect on Non-Performing Assets (NPAs) of Indian commercial banks through secondary panel data spanning a period of ten years. The dataset comprises the major financial factors like Gross NPA, Net NPA, Capital Adequacy Ratio (CAR), Provision Coverage Ratio (PCR), Cost to Income Ratio (CIR), Net Interest Margin (NIM), Loan/Credit-to-Deposit Ratio (LTD), and Spread. The information was obtained from commercial bank annual reports, Reserve Bank of India publications, and financial databases. The aim was to examine the impact of these variables on NPAs, evaluating the efficacy of risk management measures in reducing credit risk and enhancing banking sector stability in India.

Model specification:

Utilizing the GNPA, NNPA, CAR, Loan-to-Deposit Ratio, Spread, PCR, CIR, and NIM in the development of a regression model.

Model estimation:
Estimating the regression model by employing a variety of methods, including the Fixed Effects Model (FEM) and the Random Effects Model (REM).

Model selection:
A Hausman test is being carried out in order to determine which of the two models the Fixed Effects Model or the Random Effects Model is better suitable for the data.

3.4 Tools and techniques for Data analysis Tools

In this study Stata tool is utilized

Techniques Regression analysis

Regression analysis is among the statistical methods of analyzing the association between a dependent variable and either one or more independent variables. It merely states how the variation in independent variables relates to variation in the dependent variable. The idea behind this method is to find the mathematical model that would best fit into the data outlining the relationship. The most prevalent type is linear regression, with a straight line approximating the relationship. Regression analysis is increasingly popular and widely practiced in various fields such as economics, biology, and social sciences. It allows researchers to make predictions, understand patterns, and the strength and character of relationships in a dataset.

The analysis provides a regression equation in which the dependent variable value may be estimated on the basis of independent variable values. The regression provides an expression that estimates the value of the dependent variable on the basis of the contents of the independent factor.

Regression coefficients in a regression equation exhibit strength and type of relationships. A positive coefficient signifies a positive correlation, while a negative coefficient suggests a negative correlation. Scholars utilize regression procedures to quantify statistically the strength of correlations, therefore deciding whether trend occurrences are real rather than outcomes of chance. Regression analysis is a highly successful technique for describing and comprehending complex relationships among information.

Model specification.

Determine the variables: The outcome that is predicted or explained is referred to as the dependent variable (Y).

The abbreviations X1, X2,..., Xn are used to refer to the independent variables. Explanatory variables, which are often referred to as predictors. The processes involved in carrying out regression analysis. Diagnostic testing and presumptions of outcome.

Panel Data Analysis

A cross-section time-series information is another name for panel data or long-term data. Panel data or long-term data are comprised of observations on various entities or units, such as individuals, businesses, nations, and so on, at or across a number of different time periods. Accounting for variables that change or fluctuate across multiple units but remain constant over time or variables that change over time but remain constant across different units is made

possible by this form of data analysis. A comparison of the Fixed Effects Model with the Random Effects Model.

Fixed Effects Model (FEM)

The temporal uniformity attributes of the entities, as well as all the enduring distinctions between the entities, including cultural characteristics, geographic location, etc., are taken into account by the Fixed Effect Model. By including entity-specific intercepts into the regression model, this is accomplished.

Random Effects Model (REM)

The entity-specific effects, according to the Random Effects Model, are random without any connection to the independent variables. Because lower numbers of parameters are used in this model than in the Fixed Effects Model, it is more effective if all assumptions are fulfilled.

Hausman test

Model selection is done using the Hausman test. The Fixed Effects Model and the Random Effects Model are compared using the Hausman test to determine which is more suitable. The test's goal is to determine whether or not the Random Effect Model is the most commonly utilized null hypothesis.

4 Result

This research investigates the effect of Credit Risk Management on Non-Performing Assets (NPAs) in Indian Commercial Banks through panel regression analysis in Stata. Gross NPA and One of the dependent variables is net NPA, which are an indicator of overall asset quality of banks. Independent variables are key credit risk management indicators such as Capital Adequacy Ratio (CAR), Provision Coverage Ratio (PCR), Cost to Income Ratio (CIR), Net Interest Margin (NIM), Loan to Deposit Ratio (LDR), and Spread. The research aims to determine the degree to which credit risk management practices affect the levels of NPAs. The findings provide an understanding of the relationship between risk management practices and asset quality and provide useful suggestions on how to improve financial performance and stability in Indian banking institutions.

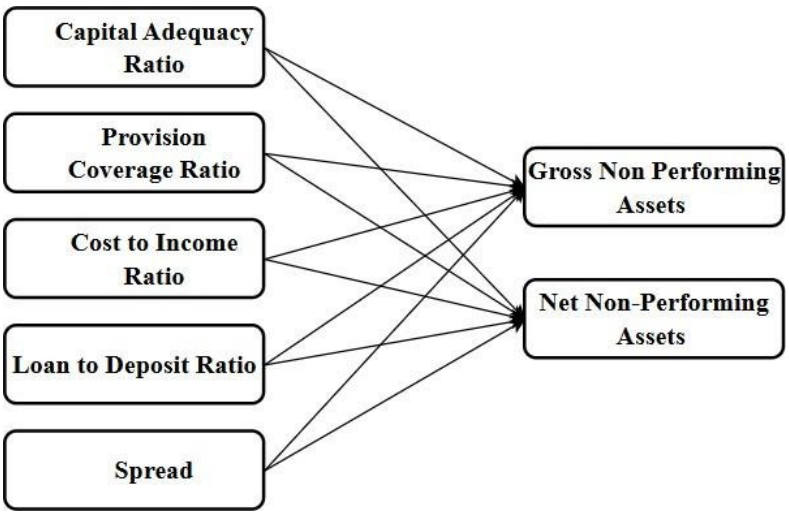

Figure 1 Conceptual Frame work Table 1 Descriptive

Variable	Mean	Std. Dev.	Min	Max
GNPA	65521.51	249865.1	1057.73	2507944
NNPA	2468043	6407648	373.27	3.50E+07
Capital Adequacy Ratio	15.377	2.901072	9.2	23.7
Loan to Deposit Ratio	56.6546	78.35469	-326.51	158.14
Spread	0.2801	0.709818	0.03	3.01
Provision Coverage Ratio	71.5716	12.72329	40.2	95.4
Cost to Income Ratio	46.7592	6.043908	32.2	58
Net Interest Margin	3.2315	0.830086	1.92	5.4

The sample data from banks shows significant variations in their gross non-performing assets (GNPA) and net non-performing assets (NNPA), which means that the loans they hold are very different. The Average Capital Adequacy Ratio that reflects the capital strength of the bank is at 15.38, and it reflects bank stability. The Loan to Deposit Ratio, with an average of 56.65, reflects banks employing different strategies in lending and taking deposits. The Spread, which is used to measure differences in profitability against interest rate spreads, has an average of 0.28, reflecting wide differences in profitability from interest rate spreads. The Provision Coverage Ratio, with an average of 71.57, shows varying amounts of inappropriate loan provisions. The Cost to Income Ratio, with an average of 46.76, shows that some banks are better in maintaining low operation costs. The Net Interest Margin, as an indicator of profitability in the lending operations of a bank, is 3.23 on average, implying modest deviations from main lending activities in terms of profitability. Overall, the information gives us some interesting facts about how banks lend money and how stable their finances.

H0) There is no significant impact between GNPA and Capital Adequacy Ratio, Loan to Deposit Ratio, Spread, Provision Coverage Ratio, Cost to Income Ratio, Net Interest Margin.

H1) There is a significant impact between GNPA and Capital Adequacy Ratio, Loan to Deposit Ratio, Spread, Provision Coverage Ratio, Cost to Income Ratio, Net Interest Margin.

Table 2 Regression

Source	SS	df	MS	Number of obs=100		
Model	2.77E+11	6	4.62E+10	F(6, 93)=0.73		
Residual	5.90E+12	93	6.35E+10	Prob > F=0.6288		
Total	6.18E+12	99	6.24E+10	R-squared=0.0448		
				Adj R-squared=-0.0168		
				Root MSE=2.5e+05		
GNPA	**Coef.**	**Std. Err.**	**t**	**P>t**	**[95% Conf.**	**Interval]**
Capital Adequacy Ratio	22214.9	15956.12	1.39	0.167	-9470.8	53900.6
Loan to Deposit Ratio	-4.412421	339.4755	-0.01	0.99	-678.54	669.719
Spread	24267.98	38923.21	0.62	0.534	-53026	101562
Provision Coverage Ratio	492.558	2219.241	0.22	0.825	-3914.4	4899.53

Cost to Income Ratio	-4458.06	4969.581	-0.9	0.372	-14327	5410.54
Net Interest Margin	-87781.95	54420.71	-1.61	0.11	-195851	20286.8
_cons	174245	317993.9	0.55	0.585	-457228	805718

The research investigates the effect of several financial parameters on Gross Non-Performing Assets (GNPA). The null hypothesis (H0) is not supported, meaning no significant effect of these variables on GNPA, whereas the alternative hypothesis (H1) is a significant effect. The independent variables explain just 4.48% of the variation in GNPA, which implies a bad fit of the model. The model as a whole is not significant, with none of the variables having any significant effect on GNPA. Capital Adequacy Ratio, Loan to Deposit Ratio, Spread, Provision Coverage Ratio, Cost to Income Ratio, and Net Interest Margin are all non-significant. Loan to Deposit Ratio also has a coefficient of -4.41, a t-value of -0.01, and a p-value of 0.99, showing no significant relationship between it and GNPA. The Spread contains a coefficient of 24,267.98, a t-value of 0.62, and a p-value of 0.534, proving to have no effect on GNPA. The Cost to Income Ratio contains a coefficient of -4,458.06, a t-value of -0.90, and a p-value of 0.372, which proves not significant in GNPA. The Net Interest Margin contains a coefficient of -87,781.95, a t-value of -1.61, and a p-value of 0.11, which proves to be statistically insignificant.

Table 3 Fixed effect model

Fixed-effects (within) regression	Number of obs=100					
Group variable: id	Number of groups=10					
R-sq:	Obs per group:					
within = 0.1201	min=10					
between = 0.0063	avg=10					
overall = 0.0096	max=10					
corr(u_i, Xb) = -0.8850	F(4,86)=1.91					
	Prob > F=0.0885					
GNPA	**Coef.**	**Std. Err.**	**t**	**P>t**	**[95% Conf.**	**Interval]**
Capital Adequacy Ratio	2.35E+04	18061.36	1.3	0.197	-1.24E+04	5.94E+04
Loan to Deposit Ratio	447.163	592.6203	0.75	0.453	-731.3275	1625.653
Spread	31795.39	207201.1	0.15	0.878	-380246.7	443837.5
Provision Coverage Ratio	4063.389	3243.278	1.25	0.214	-2386.226	10513
Cost to Income Ratio	-112.1773	7995.825	-0.01	0.989	-16012.75	15788.4
Net Interest Margin	-320476.4	100862.9	-3.18	0.002	-521053.4	-119899
_cons	420243.5	482886.6	0.87	0.387	-540029.6	1380517

The fixed-effects regression model takes a look at the correlation between Gross Non-Performing Assets (GNPA) and major financial metrics based on 100 observations across 10 groups (banks). The within R-squared measure of 0.1201 indicates that the model accounts for approximately 12% of the GNPA variations across banks over time. The between R-squared is extremely low at 0.0063, which means the model barely accounts for any variation among banks, and the overall R-squared is 0.0096, which means it accounts for less than 1% of the total variation in GNPA. The F-test statistic of 1.91 on a p-value of 0.0885 means the overall model is not significantly different from zero at the 5% level. Among the predictors, the Capital Adequacy Ratio has a statistically insignificant but positive effect on GNPA (coef. = 23,500, p

= 0.197). The Loan to Deposit Ratio also has a positive but insignificant effect (coef. = 447.16, p = 0.453). The Spread has a positive coefficient of 31,795.39 but is statistically insignificant (p = 0.878). The Provision Coverage Ratio has a significant positive impact (coef. = 4,063.39), though it is not statistically significant (p = 0.214). The Cost to Income Ratio has a negative but not significant impact (coef. = -112.18, p = 0.989). But the Net Interest Margin significantly negatively impacts GNPA (coef. = -320,476.4, p = 0.002), meaning that higher Net Interest Margin is associated with lower GNPA levels. The constant term (_cons) is not significant statistically, indicating that other unexplained variables may affect GNPA.

Table 4 Random Effect Model

Random-effects GLS regression	Number of obs=100					
Group variable: id	Number of groups=10					
R-sq:	Obs per group:					
within = 0.0655	min=10					
between = 0.0122	avg=10					
overall = 0.0448	max=10					
corr(u_i, X) = 0 (assumed)	Wald chi2(4)= 4.36					
	Prob > chi2= 0.6276					
GNPA	**Coef.**	**Std. Err.**	**z**	**P>z**	**[95% Conf.**	**Interval]**
Capital Adequacy Ratio	22214.9	15956.12	1.39	0.164	-9058.519	53488.32
Loan to Deposit Ratio	4.412421	339.4755	-0.01	0.99	-669.7722	660.9474
Spread	24267.98	38923.21	0.62	0.533	-52020.12	100556.1
Provision Coverage Ratio	492.558	2219.241	0.22	0.824	-3857.075	4842.191
Cost to Income Ratio	4458.06	4969.581	-0.9	0.37	-14198.26	5282.14
Net Interest Margin	87781.95	54420.71	-1.61	0.107	-194444.6	18880.67
_cons	174245	317993.9	0.55	0.584	-449011.5	797501.6

The Random Effects Model analyzes the variables that determine Gross Non-Performing Assets (GNPA) in a sample of 100 observations that have been split into 10 groups with a mean of 10 observations in a group. The within-group R-squared of 0.0655 is a measure showing that 6.55% of GNPA variation is determined by group variations. The R-squared between groups of 0.0122 indicates that the model accounts for just 1.22% of the group variation, whereas the overall R-squared of 0.0448 indicates that the model explains approximately 4.48% of the total GNPA variation.

The Capital Adequacy Ratio has a positive coefficient of 22,214.9 and a p-value of 0.164, which means that it is not statistically significant to GNPA. Loan to Deposit Ratio has a coefficient of 4.41 and a p-value of 0.99 with no significant impact on GNPA. Spread has a positive coefficient of 24,267.98 but a p-value of 0.533 and hence is statistically insignificant. Provision Coverage Ratio and Cost to Income Ratio also have high p-values (0.824 and 0.37, respectively) with no significant impact. The Net Interest Margin coefficient is 87,781.95 and p-value of 0.107 and it reflects a moderate negative and statistically not significant effect. The constant term is 174,245 with the p-value 0.584 and it has no significant effect when other independent variables are held constant. Wald chi-square 4.36 and p-value of 0.6276 indicate that overall the model is statistically not significant.

Table 5 hausman Test

	(b)	(B)	(b-B)	sqrt(diag(V_bV_B))	Chi-square
	fixed	random	Difference	S.E.	
Capital Adequacy Ratio	22214.9	22214.9	0	0	
Loan to Deposit Ratio	-4.412421	-4.41242	0	0	
Spread	24267.98	24267.98	0	0	0.00
Provision Coverage Ratio	492.558	492.558	0	0	
Cost to Income Ratio	-4458.06	-4458.06	0	0	
Net Interest Margin	-87781.95	-87782	0	0	

Hausman test verifies if it is more appropriate to use the fixed effects or random effects model in this study. The Chi-square value is 0, indicating that the coefficients of both the fixed and random effects models are identical. Coefficients of Capital Adequacy Ratio, Loan to Deposit Ratio, Spread, Provision Coverage Ratio, Cost to Income Ratio, and Net Interest Margin are the same for the two models without any variation in the standard errors. Since the value of Chi-square is very small, we do not reject the null hypothesis. This means that the fixed effects model is preferable for the analysis, as individual effects are not correlated with the independent variables.

H0) There is no significant impact between NNPA and Capital Adequacy Ratio, Loan to Deposit Ratio, Spread, Provision Coverage Ratio, Cost to Income Ratio, Net Interest Margin.

H2) There is a significant impact between NNPA and Capital Adequacy Ratio, Loan to Deposit Ratio, Spread, Provision Coverage Ratio, Cost to Income Ratio, Net Interest Margin.

Table 6 Regression

Source	**SS**	**df**	**MS**	Number of obs=100		
Model	2.72E+15	6	4.54E+14	F(6, 93)=31.46		
Residual	1.34E+15	93	1.44E+13	Prob > F=0		
Total	4.06E+15	99	4.11E+13	R-squared=0.67		
				Adj R-squared=-0.6487		
				Root MSE=3.80e+06		
NNPA	**Coef.**	**Std. Err.**	**t**	**P>t**	**[95% Conf.**	**Interval]**
Capital Adequacy Ratio	157187.1	240522.5	0.65	0.515	-320443	634817
Loan to Deposit Ratio	-13797.42	5117.253	-2.7	0.008	-23959.3	-3635.57
Spread	6726285	586728.3	11.46	0	5561159	7891411
Provision Coverage Ratio	11208.67	33452.83	-0.34	0.738	-77639.4	55222.03
Cost to Income Ratio	53544.56	74911.44	0.71	0.477	-95214.7	202303.8
Net Interest Margin	-1472150	820337.5	-1.79	0.076	-3101178	156877.3
_cons	2004409	4793438	0.42	0.677	-7514410	1.15E+07

This research compares NNPA with Capital Adequacy, Loan to Deposit, Spread, Provision Coverage, Cost to Income, and Net Interest Margin. The goal is to test the null hypothesis (H0) that these factors do not significantly affect NNPA, against the alternative hypothesis (H1). Independent variables of the model explain 67% of NNPA variation, F-statistic of 31.46 and p-value of 0.00. Capital Adequacy Ratio coefficient is 157187.1, and it has no effect on NNPA. Loan to Deposit Ratio has a negative and statistically significant effect on NNPA at 1%, whereas Spread has a positive effect. Provision Coverage Ratio and Cost to Income Ratio have

no effect on NNPA. Net Interest Margin has a negative correlation with NNPA, but not significant at 5%. The regression shows that the Capital Adequacy Ratio, Provision Coverage Ratio, Cost to Income Ratio, and Net Interest Margin do not affect NNPA while Loan to Deposit Ratio and Spread have significant. The study results prove the alternative hypothesis (H1) is suitable.

Table 7 Fixed Effect Model

Fixed-effects (within) regression	Number of obs=100					
Group variable: id	Number of groups=10					
R-sq:	Obs per group:					
within = 0.2249	min=10					
between = 0.8136	avg=10					
overall = 0.5324	max=10					
corr(u_i, Xb) = -0.9568	F(4,86)=4.06					
	Prob > F=0.0013					
NNPA	**Coef.**	**Std. Err.**	**t**	**P>t**	**[95% Conf.**	**Interval]**
Capital Adequacy Ratio	147764.3	214676.6	-0.69	0.493	-574672.4	279143.7
Loan to Deposit Ratio	999.5066	7043.863	0.14	0.888	-13007.99	15007
Spread	1.01E+07	2462785	-4.12	0	-1.50E+07	-5244676
Provision Coverage Ratio	16222.81	38549.49	0.42	0.675	-60437.08	92882.69
Cost to Income Ratio	90422.09	95038.09	0.95	0.344	-98571.57	279415.8
Net Interest Margin	-1449069	1198853	-1.21	0.23	-3833120	934982.1
_cons	6817926	5739573	1.19	0.238	-4595844	1.82E+07

Fixed-effects regression model analyzes the relationship between Net Non-Performing Assets (NNPA) and various financial variables with 100 observations for 10 groups. Within R-squared measure of 0.2249 suggests that about 22.49% of NNPA variation within groups is explained by the independent variables. The overall R-squared measure of 0.5324 implies that the model accounts for nearly 53.24% of the total NNPA variation. The model is significant statistically, as the F-statistic is 4.06 and the p-value is 0.0013. The findings reveal that the Capital Adequacy Ratio has a positive coefficient of 147764.3 but is statistically insignificant (p = 0.493), reflecting no significant relationship with NNPA. The Loan to Deposit Ratio has a minor positive impact (999.51) but is statistically insignificant (p = 0.888). Spread has a very strong negative impact on NNPA, with a coefficient of -1.01E+07 (p = 0.000), meaning that increased spreads are linked to decreased NNPA. The Provision Coverage Ratio and Cost to Income Ratio both have positive coefficients (16222.81 and 90422.09, respectively) but are not statistically significant (p = 0.675 and p = 0.344). The Net Interest Margin has a negative but statistically insignificant impact on NNPA, with a coefficient of -1449069 (p = 0.23). The constant term (_cons) is positive but statistically insignificant, and it implies other unobserved variables affect NNPA.

Table 8 Random Effect Model

Random-effects GLS regression	Number of obs=100
Group variable: id	Number of groups=10
R-sq:	Obs per group:
within = 0.0414	min=10
between = 0.9582	avg=10
overall = 0.6700	max=10

corr(u_i, X) = 0 (assumed)	Wald chi2(6)= 188.79					
	Prob > chi2= 0					
NNPA	**Coef.**	**Std. Err.**	**z**	**P>z**	**[95% Conf.**	**Interval]**
Capital Adequacy Ratio	157187.1	240522.5	0.65	0.513	-314228.3	628602.4
Loan to Deposit Ratio	-13797.42	5117.253	-2.7	0.007	-23827.05	-3767.793
Spread	6726285	586728.3	11.46	0	5576319	7876252
Provision Coverage Ratio	-11208.67	33452.83	-0.34	0.738	-76775.02	54357.68
Cost to Income Ratio	53544.56	74911.44	0.71	0.475	-93279.16	200368.3
Net Interest Margin	-1472150	820337.5	-1.79	0.073	-3079982	135681.6
_cons	2004409	4793438	0.42	0.676	-7390558	1.14E+07

The Random Effects Model is an analysis of the determinants of the Net Non-Performing Assets (NNPA) based on 100 observations in 10 groups. On average, 10 observations are in each group. The within-group R-squared of the model is 0.0414, meaning that a mere 4.14% of NNPA variation is explained by differences within groups. The between-group R-squared of 0.9582 indicates that 95.82% of NNPA variation is explained by group differences. The R-squared value of the model, 0.6700, shows that the model is able to explain 67% of the variation in NNPA. The coefficient for the Capital Adequacy Ratio is 157187.1 and p-value is 0.513, which implies that it does not have a significant impact on NNPA. Loan to Deposit Ratio has a strong negative impact on NNPA, with a coefficient of -13797.42 and a p-value of 0.007, which shows that an increase in Loan to Deposit Ratio decreases NNPA. Spread has a very strong positive and significant association with NNPA, with a coefficient of 6726285 and a p- value of 0.00. Provision Coverage Ratio, Cost to Income Ratio, and Net Interest Margin have p-values greater than 0.05 and thus do not have any statistically significant influence on NNPA. The constant term (_cons) is 2004409 with a p-value of 0.676, which shows that the baseline

NNPA is not statistically significant. The Wald chi-square value of 188.79 with a p-value of 0.00 proves that the model is statistically significant in general.

Table 9 Hausman Test

	(b)	(B)	(b-B)	sqrt(diag(V_bV_B))	Chi-square
	Fixed	random	Difference	S.E.	
Capital Adequacy Ratio	157187.1	157187.1	0	0	
Loan to Deposit Ratio	-13797.42	-13797.42	0	0	
Spread	6726285	6726285	0	0	0.00
Provision Coverage Ratio	-11208.67	-11208.67	0	0	
Cost to Income Ratio	53544.56	53544.56	0	0	
Net Interest Margin	-1472150	-1472150	0	0	

The Hausman test checks whether it is more suitable to use the fixed effects or random effects model for this research. The Chi-square value is 0, which means that there is no difference between the fixed and random effects models' coefficients. Coefficients of Capital Adequacy Ratio, Loan to Deposit Ratio, Spread, Provision Coverage Ratio, Cost to Income Ratio, and Net Interest Margin are the same for both the models with no difference in the standard errors. Because the value of Chi-square is very small, we do not reject the null hypothesis. This implies

that the model of fixed effects model is preferable for the analysis, since individual effects are not correlated with the independent variables.

Comparison plots Gross NPA

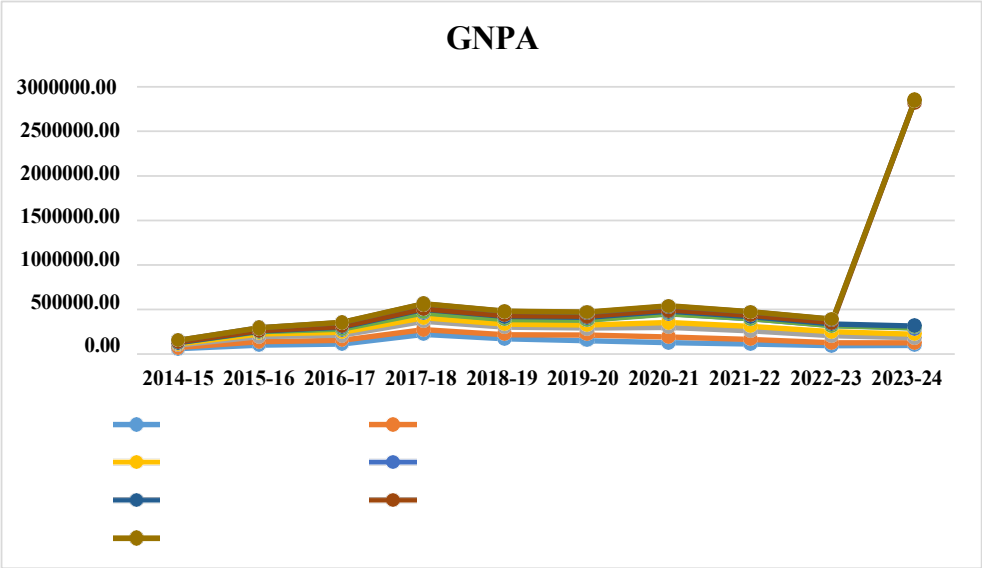

Figure 2 Gross NPA (crores) from 2014-2024

The figure is a comparison of the Gross Non-Performing Assets (GNPA) of selected Indian commercial banks between 2014-15 and 2023-24. The State Bank of India (SBI) recorded the highest GNPA, which was ₹2,23,427.46 crore in 2017-18 before reducing step by step. Punjab National Bank (PNB) and Bank of Baroda also experienced fluctuations, with PNB reaching a high of ₹1,04,423.42 crore in 2020-21. Canara Bank and Bank of India recorded sharp leaps, with the latter reaching the highest at ₹89,788.20 crore in 2020-21. Private banks such as HDFC Bank, ICICI Bank, Kotak Bank, and Axis Bank were comparatively lower with GNPA rates. But that of HDFC Bank in 2023-24 shot up unexpectedly to ₹25,07,944.28 crore and may be the result of an inconsistency in the data. Federal Bank was consistently comparatively lower for the period. Overall, the information indicates fluctuating trends in asset quality of public and private sector banks.

Net NPA

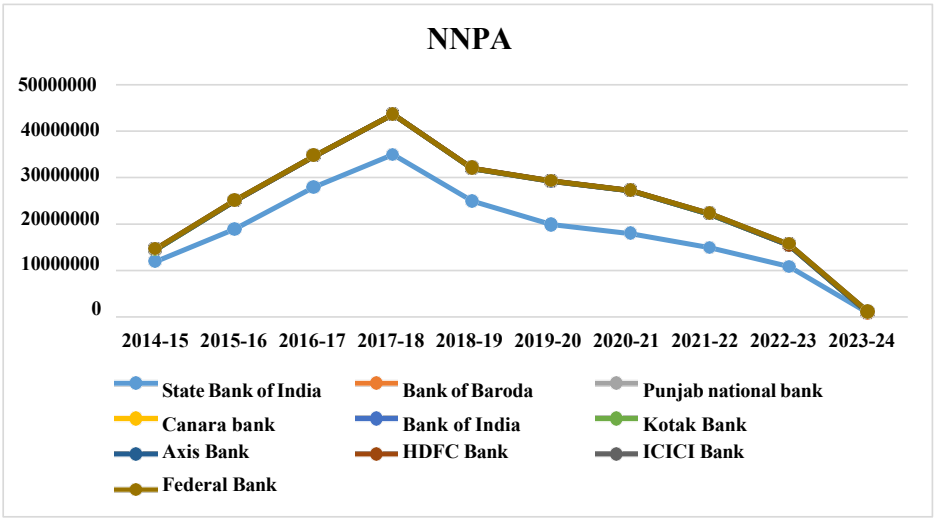

Figure 3 Net NPA (crores) from 2014-2024

The below figure illustrates the Net Non-Performing Assets (NNPA) of certain Indian commercial banks during 2014-15 to 2023-24. The State Bank of India (SBI) possessed the highest NNPA, which increased to a high of ₹35,000 crore in 2017-18 and decreased steadily to ₹10,00.28 crore in 2023-24. Bank of Baroda and Punjab National Bank (PNB) also experienced fluctuations with PNB's NNPA dropping to ₹22,585 crore in 2023-24. Canara Bank and Bank of India both saw a fall, while Kotak Bank had persistently lower NNPA values. Axis Bank and HDFC Bank had a moderate trend, while that of ICICI Bank saw a steep rise to ₹75,961.16 crore in 2023-24. That of the Federal Bank was relatively stable, with only small changes from year to year.

Capital Adequacy Ratio

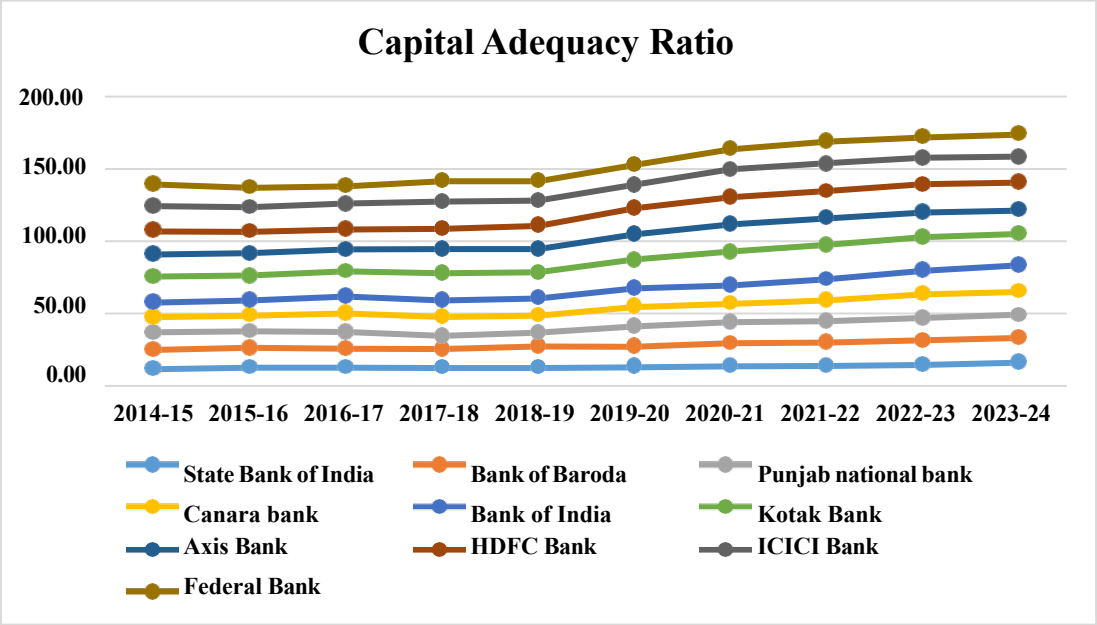

Figure 4 Capital Adequacy Ratio (%) from 2014-2024

The Capital Adequacy Ratio (CAR) of Indian banks has also risen over the years, showing better financial safety and risk control. State Bank of India (SBI) started off at 12.00% in 2014-15 and increased steadily to 16.31% in 2023-24. Bank of Baroda and Punjab National Bank (PNB) also recorded better figures, with PNB bouncing strongly from a reduction in 2017-18. Kotak Bank maintained a consistently high CAR, which was highest at 23.7% in 2021-22, whereas Axis Bank, HDFC Bank, and ICICI Bank maintained stable ratios but with negligible changes. Federal Bank recorded a moderate rise to 16.13% in 2023-24. Overall, the data suggests that all the banks have enhanced their capitals over the years.

Loan-to-Deposit Ratio

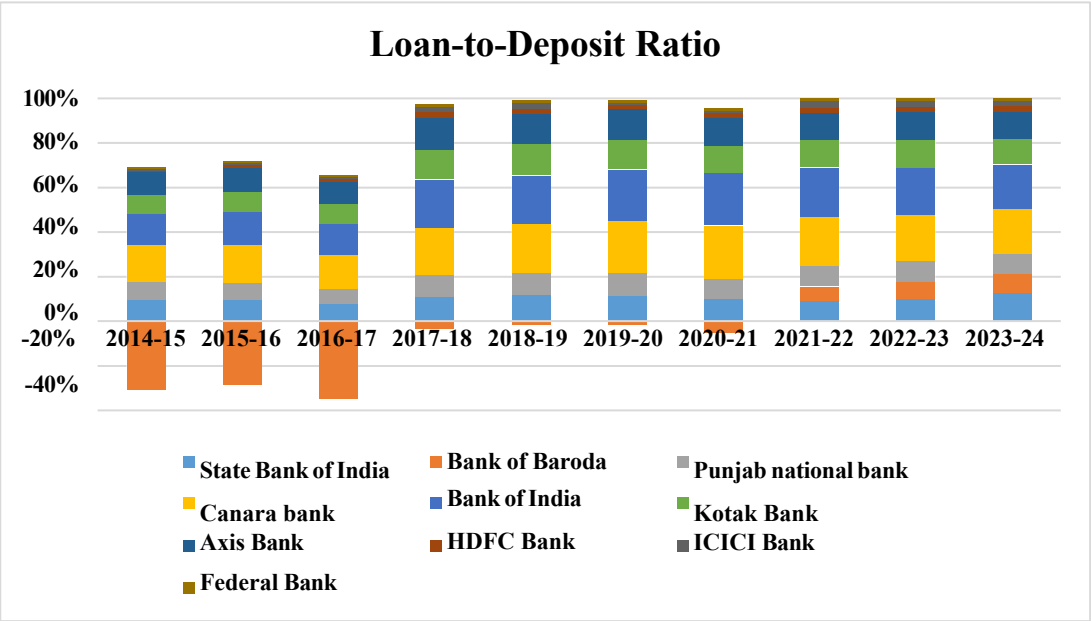

Figure 5 Loan-to-Deposit Ratio (%) from 2014-2024

The Loan-to-Deposit Ratio (LTD) of Indian banks during 2014-15 to 2023-24 indicates different trends. State Bank of India (SBI) had a consistent LTD, varying between 67.50% and 95.7%, with a significant rise in 2023-24. Bank of Baroda recorded negative figures up to 2020-21, then consistently improved to 61.21% in 2023-24. Punjab National Bank (PNB) was quite consistent between 62.78% and 75.9%. Canara Bank and Bank of India recorded consistently high LTD ratios, over 140%, reflecting aggressive lending. Kotak Bank and Axis Bank recorded moderate levels between 78.2% and 94.64%. HDFC Bank, ICICI Bank, and Federal Bank recorded much lower LTD ratios, below 21%, showing that lenders are being cautious.

Spread

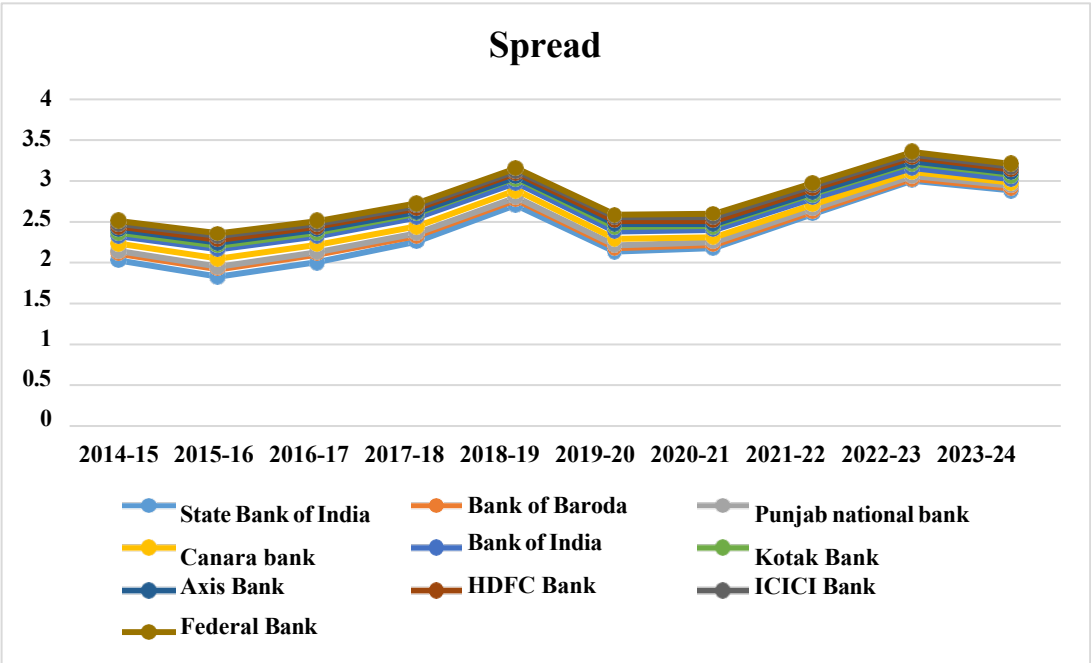

Figure 6 Spread (%) from 2014-2024

The figure shows the Spread of different Indian commercial banks from 2014-15 to 2023-24. State Bank of India (SBI) has the widest spread, rising from 2.03 in 2014-15 to 3.01 in 2022-23, before declining slightly to 2.89 in 2023-24. Bank of Baroda, Punjab National Bank (PNB), Canara Bank, and Bank of India have all lower, though consistent, spreads, with Bank of Baroda falling from 0.09 in 2014-15 to 0.03 in 2023-24. Private sector banks like Kotak Bank, Axis Bank, HDFC Bank, ICICI Bank, and Federal Bank have relatively stable spreads, mostly between 0.03 and 0.04. SBI dominates in terms of spread overall, and public sector banks follow a declining trend, while the private banks have similar figures.

Provision Coverage Ratio

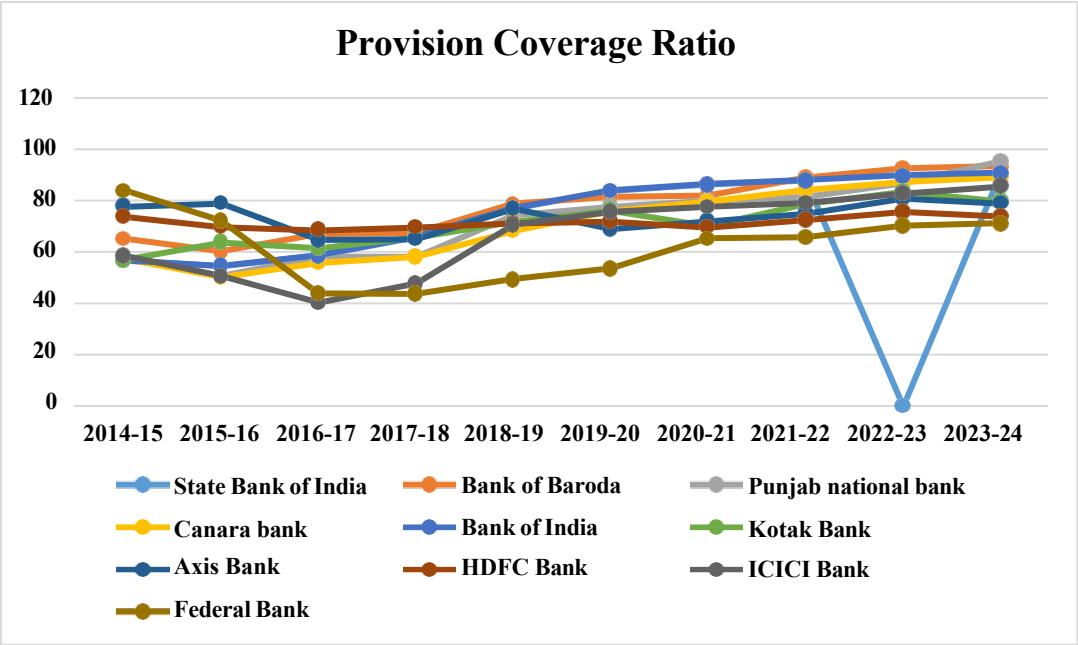

Figure 7 Provision Coverage Ratio (%) from 2014-2024

Provision Coverage Ratio (PCR) of Indian PSU banks has exhibited an overall rising trend between 2014-15 and 2023-24, reflecting better risk management and provisioning against bad loans. State Bank of India (SBI), Bank of Baroda, and Bank of India have notably enhanced their PCR to more than 90% by 2023-24. Punjab National Bank (PNB) also registered a consistent rise, touching 95.4% in 2023-24. Canara Bank and ICICI Bank exhibited steady improvement, whereas Kotak Bank and Axis Bank fluctuated in their PCR levels. HDFC Bank and Federal Bank had relatively stable ratios, where the growth was gradual in nature over time. These trends reflect increased provisioning, lowering credit risk, and the enhancement of financial solidity in the banking industry.

Cost to Income Ratio

The Cost to Income Ratio of some Indian banks between 2014-15 and 2023-24 shows changes in these banks. State Bank of India (SBI) experienced fluctuating trends, reaching a high of 56.93% in 2018-19 before reducing. Bank of Baroda had a relatively consistent ratio of 45-50%, whereas Punjab National Bank (PNB) experienced a steady rise, reaching 53.37% in 2023-24. The peak ratio was noticed by Canara Bank in the year 2019-20 (55.3%) which decreased later on. Axis Bank and Kotak Bank were consistently less than 50% while they fluctuated. HDFC Bank and ICICI Bank had the lowest points maintained throughout and

ICICI reduced to 32.2% in some of the years. Federal Bank maintained a fluctuating trend, peaking at 54.5% in the year 2023-24. These trends show fluctuations in the efficiency in managing costs for banks.

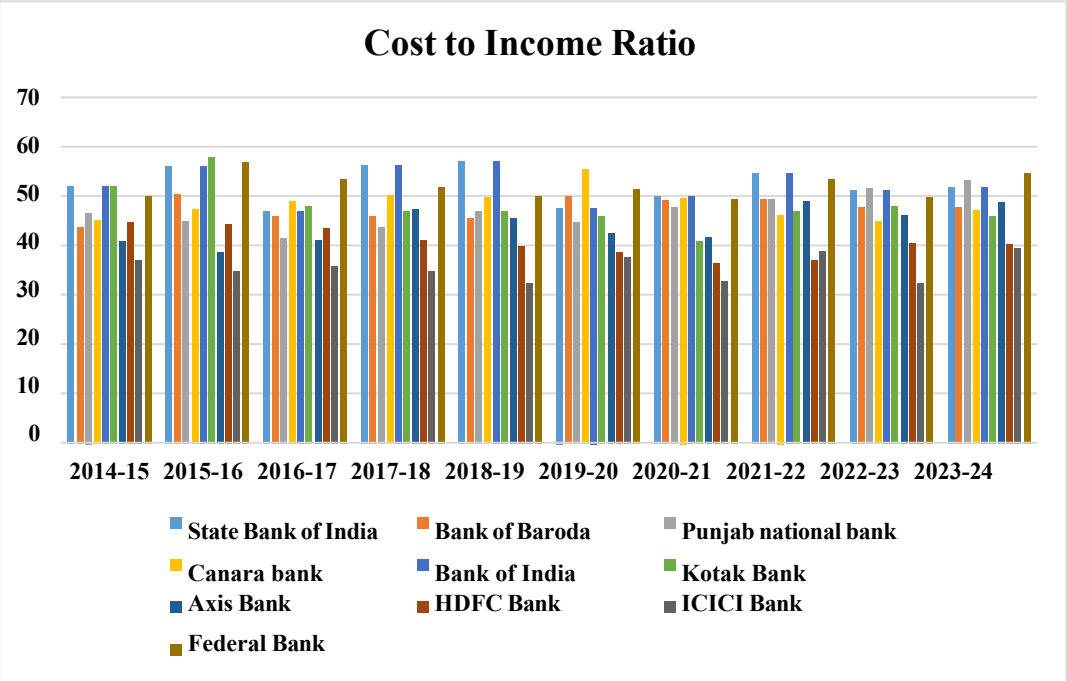

Figure 8 Cost to Income Ratio (%) from 2014-2024

Net Interest Margin

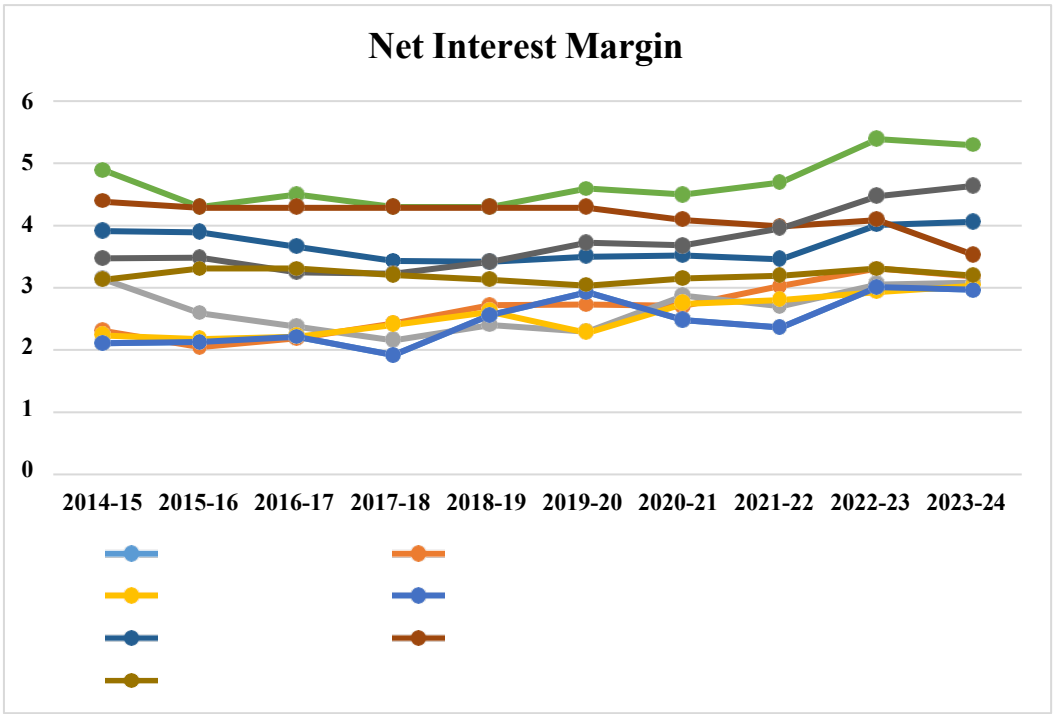

Figure 9 Net Interest Margin (%) from 2014-2024

Net Interest Margin (NIM) of some Indian commercial banks varied over the period of years from 2014-15 to 2023-24. Kotak Bank was always at the top with the highest NIM, reaching

its peak of 5.4% in 2022-23. HDFC Bank and ICICI Bank also reflected consistent margins, of which HDFC Bank reduced gradually in recent times, to 3.53% in 2023-24. Axis Bank and Federal Bank had moderate NIM levels, whereas ICICI Bank had a consistent increase to 4.65% in 2023-24. For public sector banks, State Bank of India, Bank of Baroda, Punjab National Bank, Canara Bank, and Bank of India fluctuated, with an uptrend in recent years. Private banks generally had higher and consistent NIMs, whereas public banks were variable, reflecting variations in interest income efficiency.

5 Discussion

The findings of this study provide valuable insights into the relationship between financial performance indicators and NNPA in Indian commercial banks. The significant negative relationship between the Loan to Deposit Ratio and NNPA suggests that improving loan-to-deposit ratios through better loan management and increased deposit organizing can effectively reduce non-performing assets. Previous study has shown that banks with higher loan-to-deposit rates tend to have better asset quality because they are better at allocating credit and handling cash flow. The positive and statistically significant impact of Spread on NNPA underscores the role of interest rate spreads in influencing asset quality. Higher spreads may indicate higher lending rates, which could increase the repayment burden on borrowers, leading to higher default rates and increased NNPA. Therefore, banks need to strike a balance between profitability from interest rate spreads and maintaining asset quality to prevent a rise in NNPA. Interestingly, Capital Adequacy Ratio, Provision Coverage Ratio, Cost to Income Ratio, and Net Interest Margin do not show a significant impact on NNPA. This suggests that while these indicators reflect the overall financial health and operational efficiency of banks, they may not directly influence the level of non-performing assets. The lack of significance for Provision Coverage Ratio implies that higher provisioning may not necessarily reduce NNPA levels, possibly due to the quality of loan recovery processes. The fixed-effects and random-effects models produce consistent results, reinforcing the significance of Loan to Deposit Ratio and Spread. The Hausman test validates the suggesting fixed effects model as the more suitable approach for this study, indicating that variations across banks are better explained by group differences rather than individual characteristics. The findings emphasize the need for targeted credit risk management strategies, particularly focusing on loan disbursement efficiency and interest rate policies, to improve asset quality and financial performance in Indian commercial banks.

6 Conclusion

This research examines the influence of significant financial metrics on Net Non-Performing Assets (NNPA) of Indian commercial banks. The study finds that the model is successful in explaining most of the variance in NNPA, which shows that credit risk management practices have an important bearing on asset quality. The financial metrics, loan-to-deposit ratio and spread are found to be key determinants of NNPA. Increased loan-to-deposit ratio is related to a decrease in NNPA, implying that better lending efficiency and effective management of deposits help in the improvement of asset quality. Likewise, spread has a positive significant effect on NNPA, and it implies that increased profitability from lending operations can possibly lead to increased risk of asset decline. Meanwhile, capital adequacy ratio, provision coverage ratio, cost-to-income ratio, and net interest margin do not display any statistically significant

correlation with NNPA. This indicates that although these variables are crucial for general financial stability, they can possibly not affect asset quality directly in non-performing assets context. The fixed-effects model offers more insights by also pointing out the significant effect of spread, adding credence to the fact that increased profitability margins can result in asset quality problems. The random-effects model agrees with the critical effect of loan-to-deposit ratio and spread, stressing their persistent effect in all banks.

The Hausman test reveals that the fixed effects model is more appropriate in this analysis, and differences among banks are best explained by fixed differences instead of random variables. To minimize non-performing assets, lending activities and profitability have to be enhanced. Better credit risk evaluation, loan-to-deposit ratio, and balanced spreads can enhance asset quality and stability of banks. The analysis revel that, certain risk management practices can reduce non-performing assets and enhance banking performance. Findings indicate that Indian commercial banks need to increase capital buffers, enhance operational efficiency, and ensure a balanced lending procedures to manage credit risk. For enhancing asset quality, NPAs reduction, and ensuring financial stability, these measures are essential. Focusing on loan-to-deposit management and spread optimization is crucial for minimizing credit risk and improving asset performance in the Indian banking sector.

Reference

Afriyie, S. O., Yusheng, K., Kaodui, L., Caesar, A. E., & Akomeah, M. O. (2018). Credit Risk Management System of Commercial Banks: an Analysis of the Process. European Journal of Accounting, Auditing and Finance Research, 6(6), 2. www.eajournals.org

Agrawal, D. V., & Magar, D. A. (2023). Non-Performing Assets (NPA) in Indian Banking: Causes, consequences, and remedial measures. International Journal of Research in Management, 5(2), 62–65. https://doi.org/10.33545/26648792.2023.v5.i2a.95

Agrawal, R. B., & Goyal, M. (2021). Non-Performing Assets of Banks: A Literature Review. PalArch's Journalof Archaeology of …, 18(August). https://archives.palarch.nl/index.php/jae/article/view/9777%0Ahttps://archives.palarch.nl/index.php/jae/article/download/9777/8991

Assistant Professor, L. (2023). Credit Risk Management with reference to Non-Performing Assets of Bangalore City Co-Operative Bank (BCCB). International Journal of Commerce and Management Studies (IJCAMS) Peer Reviewed, Indexed Journal, 8(4). www.ijcams.com

Banerjee, K. (2023). Credit risk management in Indian banking sector: Issues and challenges. Anthrology the Research, 52(12), 1–7. https://www.researchgate.net/publication/376650715

Banks, C., Alrfai, M. M., Salleh, D. B., & Waemustafa, W. (2022). Empirical Examination of Credit Risk Determinant of.

Brahmaiah, B. (2022). Credit Risk Management Practices of Indian Banking Industry: An Empirical Study. International Journal of Economics and Financial Issues, 12(2), 67–71. https://doi.org/10.32479/ijefi.12968

Goswami, A. (2022). Does credit risk persist in the Indian banking industry? Recent evidence. Asian Journal of Economics and Banking, 6(2), 178–197. https://doi.org/10.1108/ajeb- 01-2021-0006

Gudala, Rao, S., Kamireddy, Chand, Prem, Purushotham, & J. (2018). Causes and Effects of Non-Performing Assets in the Banking Sector. Internationalnternational Journal of Management, Technology And Engineering, 8(XII), 4001–4009. https://www.researchgate.net/publication/346445809_Causes_and_Effects_of_Non-Performing_Assets_in_the_Banking_Sector

Kavitha, N., & Muthukrishna, V. (2019). Impact of non-performing assets on the profitability in Indian scheduled commercial banks. African Journal of Business Management, 13(4), 128–137. https://doi.org/10.5897/ajbm2018.8683

Kumar, H., Sunil Angane, S., & Balanaga Gurunathan, K. (2023). A Study On Credit Risk Management In Commercial Bank In India. International Journal of Creative Research Thoughts, 11(5), 2320–2882. www.ijcrt.org

Kumar, K. (2021). Challenges of Banking Industry in India. International Journal of Business and Management Invention (IJBMI) ISSN, 10(4), 42–44. https://doi.org/10.35629/8028-1004024244

Pangrikar, M. (2015). Challenges and Opportunities of Retailing Sector in India. Vidyabharati International Interdisciplinary Research Journal, 4(1), 95–99. https://doi.org/10.25215/2455/0701009

Raju, S. (2020). Non-Performing Assets of Banks in India : Efficiency in Management. 1–62. http://iibf.org.in/documents/reseach-report/Swati-Raju-Final-Report.pdf

Rathi, A., & Bhati, S. (2022). Issues and Challenges in the Indian Banking Sector. Indian Journal of Business Administration (IJBA) (A National Peer Reviewed Refereed Journal) ISSN, 15(2), 9–12.

Ravirajan, K., & Shanmugam, K. R. (2023). WORKING PAPER 251 / 2023 DETERMINANTS OF NON - PERFORMING ASSETS OF COMMERCIAL BANKS IN INDIA Determinants

of Non-Performing Assets of Commercial Banks in India. November.

Safiuddin, S. K., & Khan, M. M. (2021). Managing Non-Performing Assets In The Indian Banking Sector : A Call For Strengthening Credit Appraisal And Risk Management. 17(4), 724–735.

Sharifi, S., Haldar, A., & Rao, S. V. D. N. (2019). The relationship between credit risk management and non-performing assets of commercial banks in India. Managerial Finance, 45(3), 399–412. https://doi.org/10.1108/MF-06-2018-0259

Sharma, S., Rathore, D. S., & Prasad, J. (2019). Empirical assessment of management of non-performing asset (NPA) in the public and private sector banks. Journal of Statistics and Management Systems, 22(3), 587–601. https://doi.org/10.1080/09720510.2019.1575601

Siddique, A. (2021). The effect of credit risk management and bank-specific factors on the financial performance of the South Asian commercial banks. https://doi.org/10.1108/AJAR-08-2020-0071

Spuchľáková, E., Valašková, K., & Adamko, P. (2019). The Credit Risk and its Measurement, Hedging and Monitoring. Procedia Economics and Finance, 24(July), 675–681. https://doi.org/10.1016/s2212-5671(15)00671-1

Srikanth, M., & Kishore, B. (2019). Credit Risk Management in Indian Banks. The Indian Economic Journal, 62(1), 751–767. https://doi.org/10.1177/0019466220140104

Srivastava, S., & Chauhan, P. (2018). Institutional Factors influencing Non-Performing Assets (NPA) in Indian Banking Sector and use of Artificial Intelligence as a remedial tool. Indore Management Journal, 10(1), 46–56.
Treesa, J. (2019). Factors Affecting the Non-Performing Assets of the Banks: a Comparison Between the Public Sector and Private Sector Banks. Journal of Emerging Technologies and Innovative Research, 6(1), 137–144. https://www.researchgate.net/publication/349494960_FACTORS_AFFECTING_THE_NON-PERFORMING_ASSETS_OF_THE_BANKS_A_COMPARISON_BETWEEN_THE_PUBLIC_SECTOR_AND_PRIVATE_SECTOR_BANKS