

NPA Crisis and Its Resolution*

Focus on Management Efficiency

Nishchal Mittal[†]

February 28, 2025

Abstract

Non-Performing Assets (NPAs) have been a persistent challenge to India's banking sector, particularly to public sector banks. The rise in NPAs erodes profitability, as banks must allocate more capital to cover bad loans, leading to a credit crunch and constraining lending, thereby affecting overall economic growth. The NPA ratio for scheduled commercial banks increased from 2.4% in March 2011, rising to 4.6% in March 2015 and peaking at 11.5% in March 2018 before declining to 3.9% in March 2023. This paper investigates the factors contributing to the high NPA ratio in public sector banks for time period of FY2011 to FY2023. It employs a fixed effect panel OLS regression analysis to understand the relationship between management efficiency and NPA ratio. Additionally, the study evaluates whether relationship between management efficiency and NPA was different for private sector banks compared to public sector banks. Lastly, the study also makes efforts to analyze if the relationship between efficiency and NPA ratio changed after FY2018 as a result of the reforms undertaken. The 2008 Global Financial Crisis underscored the need for financial vigilance, a lesson reflected in India's response to its NPA crisis, where the RBI's regulatory measures played a crucial role in restoring banking stability. The study highlights the majority of reforms undertaken by the government, RBI and banks. By examining these dynamics, the paper provides insights into addressing structural challenges with focus upon management efficiency in public sector banks and assesses the effectiveness of recent policy measures.

Keywords: Non-Performing Assets (NPAs), Public Sector Banks, Private Sector Banks, Management Efficiency, Panel Data Analysis, Banking Reforms, Asset Quality, Indian Banking Sector.

JEL Classification: G21, G28, E44, C23

1 Introduction

A robust banking sector plays an indispensable role in accelerating the economic growth and development by playing the pivotal roles of ensuring economic stability, financial inclusion, and credit allocation in the country. India is a bank-based economy and therefore banks play a significant role in financial inter-mediation in the country. This dominance makes it essential that this industry maintain its financial stability.

India's bank Sector has been plagued with Non-Performing asset (NPA) problem, which has hindered its growth and been a long time concern affecting not growth of the economy especially of banks[1] as noted by Tamal Bandyopadhyay. According to the RBI Master Circular (2005), NPAs are defined as loans and advances whose principal and interest payments remain overdue for more than 90 days. Put simply, when an asset stops bringing in money for the bank, it becomes an NPA. Furthermore, if an NPA is non-performing for more than a year, it turns into substandard assets. If it continues to be subpar for a year or longer, it becomes a dubious asset. A bank classifies a doubtful asset as loss asset if auditor or RBI declares given asset as having little or no salvageable value.

***Disclaimer:** This paper has been prepared as a part of the probationary training for Indian Economic Service (IES). The content of this paper is based on research and analysis conducted by the author(s) in an academic or professional capacity and is intended for informational purposes only. The views and opinions expressed in this paper are those of the author(s) and do not reflect the official position or policy of the Government of India.

[†]Nishchal Mittal is Indian Economic Service Officer Trainee of 2024 batch, Department of Economic Affairs, Ministry of Finance, email: nishchal.mittal1@gmail.com

A NPA is considered unhealthy for a bank because it represents a loan that is not being repaid by the borrower, meaning the bank is not earning any income on that money, which significantly impacts their profitability, reduces their lending capacity, and can even lead to potential financial instability if the number of NPAs becomes too high [2]. Aggressive lending, weak credit assessment, and volatile macroeconomic conditions have been flagged as some of the major factors for a sporadic increase in NPAs. Furthermore, some studies have shown that inefficient management also results in high cost-to-income ratios often associated with poor asset quality. Tamal Bandyopadhyay[3] highlights that public sector bankers face stressful lives due to inefficiencies within the system. This includes challenges such as poor governance and the inability to manage risk effectively. To improve upon the situation, banks get involved in one time settlement with haircut¹ with borrowers and restructuring of loans² so that there can be some amount of recovery can be assured.

The trends of NPAs in Indian banking sector have been shown in figure 1. In the figure, x-axis shows the financial year³ and y-axis shows the NPA ratio⁴. It can be observed that NPAs started increasing in FY2011, with a sudden spike in FY2015 and peaked in FY2018 at 11.2 % (Figure 1 1). After that, the NPAs of the Indian banks have been on a downward trajectory, declining to 3.9 % by FY2023. For public sector banks, the trend of NPAs were the highest among foreign and private sector banks with peak of around 16% further declining to the level below FY2015 level. However, for private sector banks, trends were relatively muted and their peak (around 5%) was observed in FY2020 compared to the peak of NPAs for public sector banks in FY2018. For foreign banks, NPA trends are very different from private and public sector banks. They remained mostly muted and stable to the level below 4%. Two things can be noted from this graph. One, public banks fared worse than private sector banks and foreign banks in case of NPA. Two, there were similarity of NPA trends in public and private sector banks as for both NPAs started increasing since beginning of 2010s and peaked in late 2010s and declined to the FY2015 level by beginning of 2020s.

There are two broad factors which are likely to cause NPAs in banking sectors - external and internal. External factors amount to macroeconomic factors such as GDP growth rate, production in the economy, future prospects of the demand, inflation, geopolitical factors affecting global trade, interest rate dynamism, exchange rate stability etc. These factors are likely to remain same for every bank unless the loan portfolio of banks are significantly different i.e., if a bank's lendings are concentrated in a specific sector then despite being majority of macroeconomic factors being stable, that bank may face issues of high NPAs due to slowdown in that sector whereas other banks may not see that spike in their NPAs. Internal factors are factors which are specific to banks i.e., they mount to mostly bank's balance sheet and management efficiency such as lending practices, digital innovations, lack of corruption, political influence, credit quality assessments etc. Given pronounced NPAs in public sector banks, it is highly likely that internal factors might have played role for these especially the impact of management efficiency. It might be a possible case that public sector banks faced issue of less efficient management staff due to lack of responsibility and focus on improving profits ratio due to weak relationship between staff enumeration and banks' profits.

To improve upon NPAs of banks, reforms might have to be directed towards working on both external and internal factors. In figure 1, as observed NPAs started declining after FY2018. Here, both external and internal factors both are likely to play their role. In last few years, there are a number of reforms undertaken by government and Reserve bank of India (RBI) to improve NPAs in the banking sectors. These reforms have been depicted in Figure 2 with their corresponding timelines. The figure illustrates the impact of various regulatory and policy measures, including the post-2008 financial crisis effect, RBI's Asset Quality Review in 2015-16, the introduction of the Insolvency and bankruptcy Code (IBC) in 2017, the peak in NPAs due to the IL&FS crisis in 2018, and the subsequent decline following bank recapitalization and PSU mergers in 2019-20. This visualization highlights the role of key interventions in shaping the NPA trajectory over the years. These reforms are said to be the underlying reasons for decline in NPAs post FY2018. As NPAs were more pronounced in public

¹Haircut here refers to the amount by which the bank the value of loans to compensate borrowers and reduce his over all burden. banks do involve in this to minimize their losses from potential losses and lengthy legal processes

²Restructuring here means redefining of interest rate (mainly reduction) and changing maturity (here increasing)

³Financial year in India starts from 1st April and ends on 31st March of next calendar year

⁴NPA Ratio = $\frac{\text{Gross NPA}}{\text{Gross Advances}}$

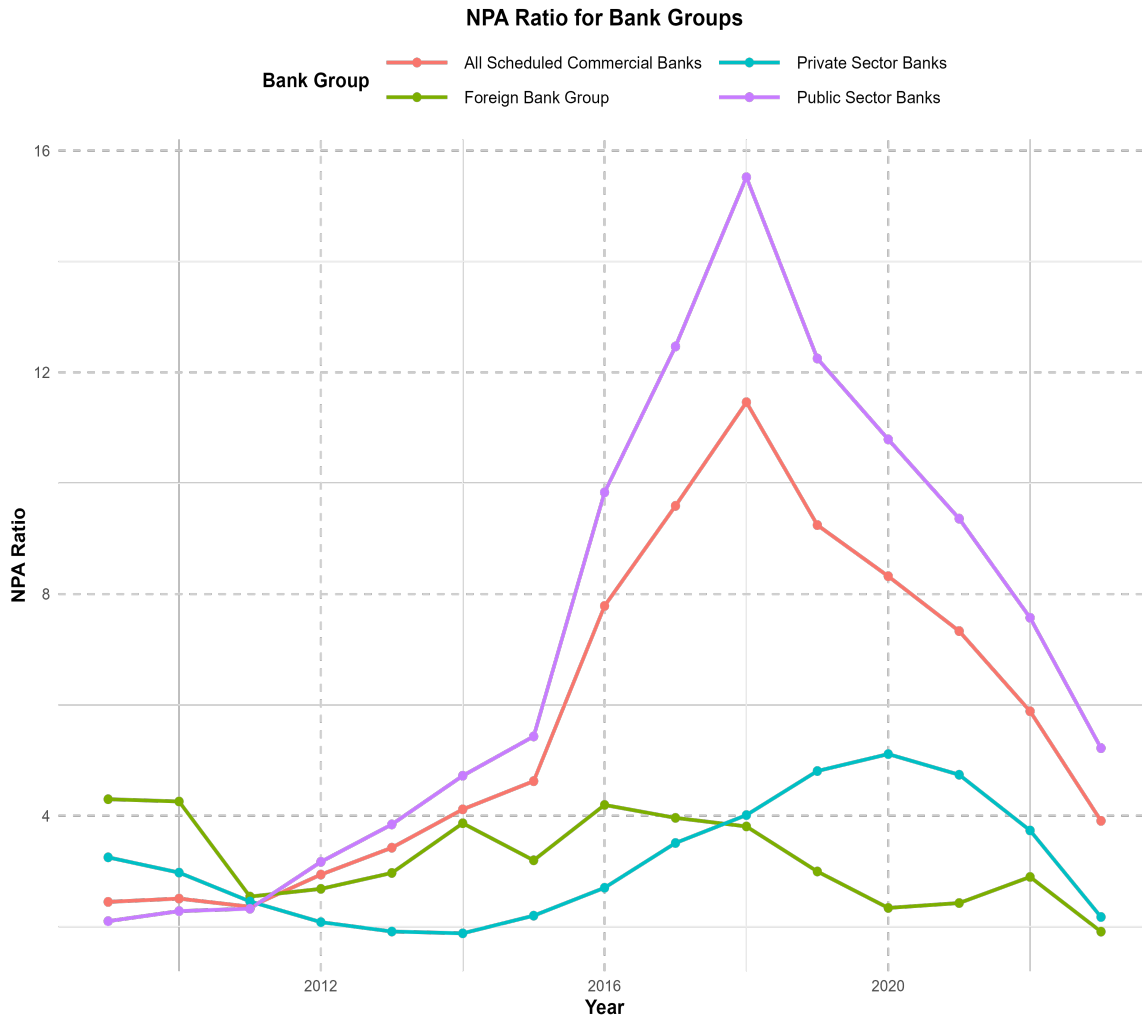


Figure 1: bank Group Wise NPA Trend

sector banks, majority of the reforms were undertaken for public sector banks to improve upon their capital status, and management practices.

Department of Financial Services, Ministry of Finance organized The "Gyan Sangam" retreat for banks and financial institutions in January 2015 and March 2016 (Gyan Sangam, 2.0)⁵. As per PIB⁶, A significant aspect of the Gyan Sangam 1.0 was the sharing of best practices among banks, with sessions dedicated to learning from successful initiatives implemented by various institutions. The retreat was designed to foster an informal academic environment conducive to creative discussions among professionals and regulators. The primary objective was to achieve a common understanding of necessary reforms in public sector banks, particularly in light of current economic conditions. As per former Finance Minister Arun Jaitley, the bankers supported the idea of consolidation of banks in Gyan Sangam 2.0 which resulted in constitution of Experts' group resulting in merger plans of public sector banks further.

In 2016, the government enacted Insolvency and bankruptcy Code (IBC) as a potential solution to the lack of unified and effective insolvency regime. Before IBC, SARFAESI act was the only law in force for recovery of bad loans. However, it was argued to be less efficient and time-taking process which used to reduce value of the underlying assets. Further, there was no provision of arbitration and mediation between lenders and defaulters under SARFAESI. IBC resolved this issue by introducing the mechanism of arbitration and introducing a time limit of around 1 year for resolution so that underlying asset can retain some of their value by the end of resolution of liquidation process. As

⁵ FM Gyan Sangam 2 – banker Retreat, Department of Economic Affairs, Government of India.

⁶ Press Information Bureau, Government of India. Retrieved from pib.gov.in.

per budget 2024, since 2016, IBC resolved more than 1,000 companies, & recovered over Rs. 3.3 lakh crore to the lenders.

Raghuram Rajan[4] underscores the importance of early recognition of NPAs, arguing that delayed acknowledgment only exacerbates financial instability. He highlights how banks, under pressure to maintain profitability, engaged in "ever-greening" loans—rolling over bad debts instead of recognizing them as NPAs. To overcome this, in 2015, RBI undertook an exercise of Asset Quality Review, in which banks were asked to assess the actual levels of bad loans in their books. It is likely to be the reason of sudden spike in NPA numbers in 2015-16 for public sector banks. This exercise forced banks to identify the actual level of NPAs and reclassify the previously restructured asset as NPAs.

The 2015 AQR stands as a pivotal moment in India's banking history, fundamentally altering the way NPAs were reported. Then RBI Governor's initiative mandated banks to reassess their loan books rigorously, revealing the underlying financial stress that had been previously concealed[5]. This move, while essential for long-term stability, led to a sudden spike in reported NPAs, triggering market anxieties and increased provisioning requirements for banks.

Further, RBI pushed the banks to implement BASEL III norms which were started in 2013 and scheduled to be completely implemented by 2019, however, the deadline was extended further. The BASEL-III norms required banks to keep a larger sum of capital aside for an increase in their risk weighted assets that increased with degradation in asset quality.

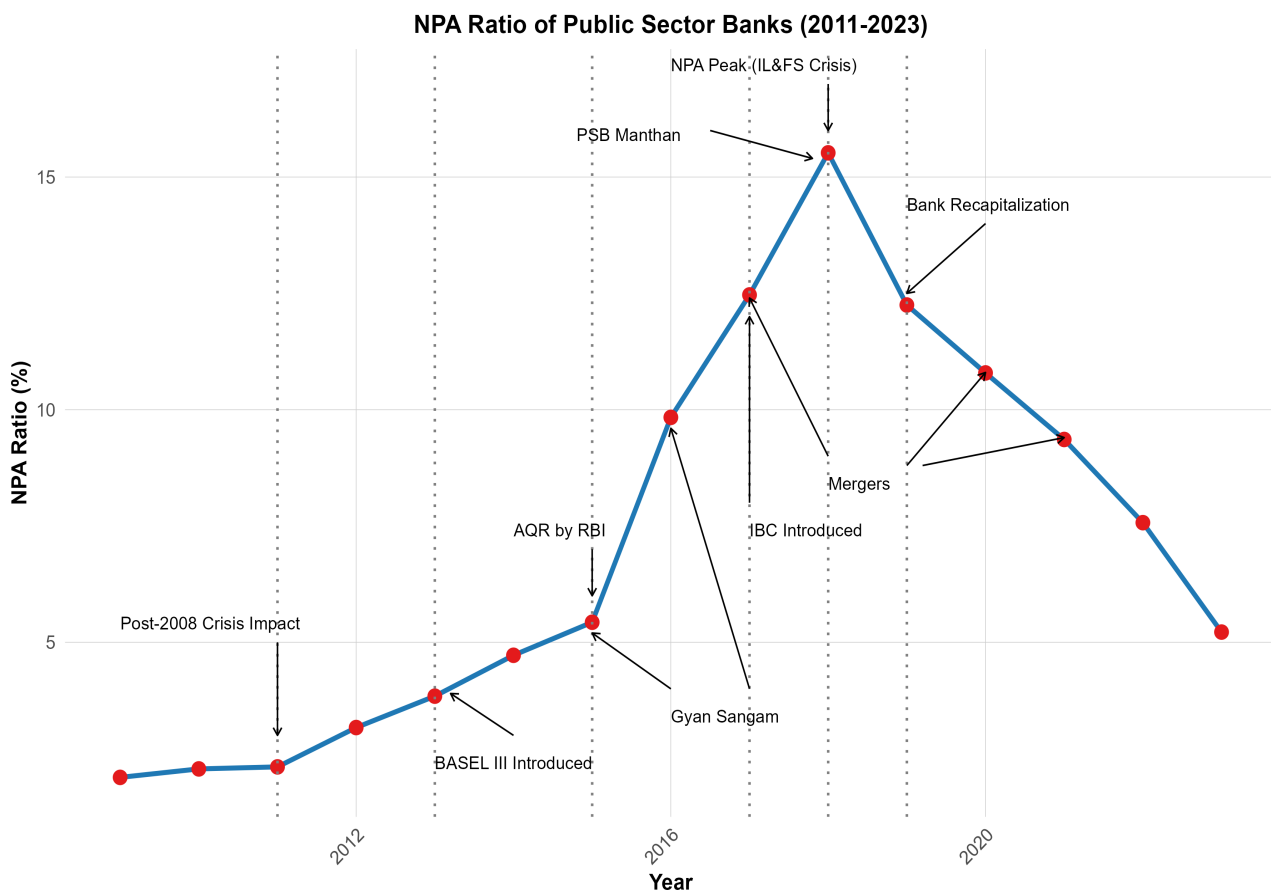


Figure 2: Public Sector Banks NPA and Key Policy Interventions

Prompt Corrective Action (PCA) comprises of structured and discretionary actions by RBI with respect to banks supposed to improve the bank management and their numbers. It was started in 2002. However, no bank came under PCA framework since its implementation in 2002 until 2014 when United bank of India coming under it. Later in April 2017, RBI revised the framework with two changes adding Common Equity Tier 1 capital ratio (CET 1 ratio) and leverage ratio as additional parameters and changing the thresholds for existing parameters. Only after 2015 did the RBI take action to apply the PCA framework strictly, and by the end of December 2017, 11 banks had already

joined the PCA.

In 2017, central government started consolidation of banks with merging of state bank and associated banks into State bank of India (see table 1). The mergers continued till March 2020 resulting into 12 public sector banks in 2020 from 27 public sector banks in March 2017. These mergers were argued to increase efficiency of banks and reducing the burden of NPAs in public sector banks. As observed in figure 1, NPAs peaked in 2017-18 in public sectors banks which resulted in lower capital available with banks and thus a large number of banks came under PCA framework by the end of December 2017. To solve this issue, Over Rs 2.5 lakh crores was infused into public Sector banks (PSBs) through recapitalization bonds over the past three years - Rs 80,000 crores in 2017-18, Rs 1 lakh crores in 2018-19 and Rs 65,000 crore in 2019-20. Followed by the issue of Zero Coupon Recap Bonds for the first time in 2020.

Bandyopadhyay views bank mergers as part of a broader strategy to enhance efficiency and reduce inefficiencies in the banking sector. He notes that consolidation can help improve the health of public sector banks by reducing the number of entities and potentially increasing their scale and competitiveness[6] Rajan, as a former RBI Governor, has emphasized the importance of addressing banking sector challenges through reforms, including improving governance and reducing non-performing assets (NPAs). He likely views mergers as a tool to strengthen the banking system by creating larger, more resilient banks, but also emphasizes the need for careful planning and execution to ensure that these mergers do not create new problems[4].

PSB Manthan – a high level meeting of senior executives and whole time directors (WTD) of PSBs – was organized in November 2017 which led to creation of Enhanced Access and Service Excellence (EASE) reform agenda. It aims to improve and redesign PSBs’ capabilities leading to fulfillment of evolving needs of the banking industry. Further, it also provisions for a shared platform of all banks to build and reinforce industry best practices leading to improved service and thus overall experience for PSB clients. Champion banks⁷ hold workshops and frequent knowledge series inducing cooperative development of all PSBs. The set reform goals are first openly shared then independently assessed and benchmarked. Then every 3 months, bank’s board evaluate them. Currently EASE 7.0 is going on which focuses on economic development, customer delight, and resilient banking.

As covered above, there were a number of reforms undertaken by RBI and the government to improve banks’ performance. These reforms were directed towards improving the capital position of the banks, management efficiency of banks and their overall performance with a focus on transparency, periodical evaluation, efficiency and capital enhancement. In this backdrop, this paper explores the direction of relationship between management efficiency of the banks and NPAs in banking sector considering period of FY2011-FY2023. It deploys panel OLS regression analysis to understand this relationship. Additionally, the study investigates if there was any difference in the direction or strength of relationship between the management efficiency and NPA ratio of private sector banks and public sector banks. Lastly, it also explores, if relationship between management efficiency and NPA ratio of banks changes post-FY2018 compared to what it was pre-FY2018.

The paper is discussed as follows: section 2 discusses literature review, section 3 discusses exploratory analysis over trends of NPA across private and public sector banks, section 4 discusses methodology used in the paper, section 5 discusses the research questions, section 6 discusses the results obtained with analysis of efficiency ratio trends, section 7 discusses the changes in management practices of banks with concluding in section 8.

2 Literature Review

NPAs are regarded as crucial prudential metrics for evaluating the banking industry’s overall financial health. Stability in the economy has been hampered by the banking system’s high NPA numbers. According to research by Lindgren et al.[7] and Caprio and Klingebiel[8], the issue facing Asia’s banking systems was the result of years of unethical lending practices that were fueled by insufficient oversight and regulators, which resulted in excessive risk-taking and rapid lending expansion. Hess et al. [9] has even shown that loan expansion leads to increased non-performing assets (NPAs).

⁷Banks that consistently perform well in the EASE reforms are considered champion banks.

During the period of financial liberalization, Koeva, P.[10] acknowledged the significance of non-performing loans as one of the key indicators in explaining the variation in inter-mediation costs and profitability at the bank level. In actuality, banking crises brought on by an increase in non-performing assets are what caused the economic crisis. According to Khan and Bishnoi [11], a country is said to experience a banking crisis if its non-performing assets (NPA) are greater than or equal to 10% of its gross domestic product. Further, NPAs affect banks through a drop in interest spread (Brahmananda [2]) and a decline in profitability and shareholder value (Kaur and Singh [12]). Not only NPAs limit banks' ability to generate revenue but also banks must set aside money from their revenue to cover any credit losses. The economy, borrowers, creditors, industry, and other sectors are all impacted by non-performing assets (NPAs). NPAs also affect economic activity and capital formation negatively by impeding the flow of funds to potential borrowers at the macro level. Additionally, banks are forced to increase exposure towards government securities and other assets due to rise in NPAs.

Several studies have been conducted internationally, which identified a range of factors influencing NPAs of banks. The paper Pallavi et al. [13] performs a dynamic panel regression where it considers external factors such as credit growth rate, GDP growth rate, interest rate, share of assets, etc. to check their impacts on NPA ratio. Mishra et al. [14] perform panel OLS regression of gross loans and advances as dependent variables and GDP, IIP, CPI as dependent variables.

However, Aman et al. [15], take control variables related to individual bank characteristics such as asset size, liquidity situation, capital ratio, and funding ratio while estimating the impact of Micro-Prudential policy on housing credit growth and NPAs. Further, Bajaj et al. [16] performs the NPA determination analysis using dynamic panel regression technique using both external and internal factors both i.e., GDP growth, Wholesale Price Index as external factors and Non-Interest income, operating expenditure, collateral size etc. as internal factors.

Beck, Jukubik, and Piliou [17] attempt to explain how banks' asset quality varies over time and between nations. They make use of a panel dataset that was produced from the World Bank and IMF databases and covers 75 countries over a ten-year period from 2000 to 2010. They select real GDP, nominal effective exchange rate (NEER), lending interest rate, share prices, foreign claims, and stock market capitalization as their explanatory factors, with the gross non-performing loan (NPL) ratio serving as the dependent variable. Foreign currency loans is proxied by international claims (in relation to GDP). Based on dynamic panel data estimation, their study concludes that the key factors influencing NPL ratios are real GDP growth, exchange rates, share prices, and lending interest rates. In addition, Istrate et al. [18] categorizes the causes of NPA in systematic and situational cause ⁸. Mishra & Dhal et al. [19] categorizes causes of NPA into internal and external factors.

Berger, et al. [20] conclude that levels of NPLs are much higher instate-owned banks than in privately owned banks in Argentina. Haque and Shahid [21] investigate impacts of ownership structure and concentration over Indian banks' performance and risk-taking practices. They make use of GMM looking particularly at how foreign ownership and the government affect banks' risk-taking practices and profitability in developing nations. They conclude negative impact of government ownership on bank profitability and a favorable one on default risk.

There are various ratios existing in financial statements of banks through which management efficiency can be analyzed. Across the industry, Data Envelopment Analysis (DEA) is considered to be a standard method used to measure efficiency of firms. Through analyzing multiple input output, it generate a measure of efficiency to compare across different firms.

The paper by Swati[22], uses input-oriented DEA analysis over 27 public sector banks for the time period extending 2008 to 2017. It pointed out that banks' efficiency was affected by extent of sensitive lending, asset size and ownership. The paper Barr et al.[23] studies the productive efficiency of 15 US commercial banks for the period 1984-1998 using the input-oriented DEA approach. The paper concluded that the banks with higher non-interest expenses, higher salary were less efficient. It also does not find a consistent relationship between efficiency and income.

Further, principal agent problem is also suggested by Will[24] between stockholders and managers

⁸As per the paper, systematic causes can be existing government, financial, legal, and/or banking institutions and practices and situational causes are exogenous to the country's systemic problems, and it is probable to be short-term in nature. World economic recession, a depression in the business cycle, the abrupt outflow of foreign investment, currency depreciation

where the latter are more interested in short-term gains rather than long-term gains which may result in pro-cyclical risk taking response by banks and thus may result in bad quality of loans. The paper by Saleem [25] suggests that all stakeholders in a bank remain concerned with liquidity position of the bank which they establish that liquidity and profitability are closely related with each other.

Fareed Ahmed [26] examines the effectiveness of Insolvency and Bankruptcy Code of 2016 which has been brought forth to address the growing issue of Non-Performing Assets in the Indian banking sector through a systematic and time-bound resolution process. Initially, IBC caused huge disruptions in the industry, but lately, it has seen a positive turn. The recovery rates in the code are significantly improved through IBC and are 45.5%, well above the 4.1% of the DRTs, and 26.7% of the SARFAESI Act. About 61.29 percent of the overall recoveries via all channels have taken place through IBC, which brought a significant decline in Gross and Net NPAs. The gross NPAs of banks have declined due to the efficient implementation of the code and the establishment of 16 NCLT benches with over 3,100 registered insolvency professionals. However, the challenges are high haircuts for creditors and risks of future bad loans. Despite that, IBC has positively impacted NPA resolution and strengthened India's banking sector.

3 Exploratory Analysis

To check for trends and distribution of NPA ratio across public sector banks, box plot was drawn as shown in figure 3 for the years from 2014-15 to 2022-23.

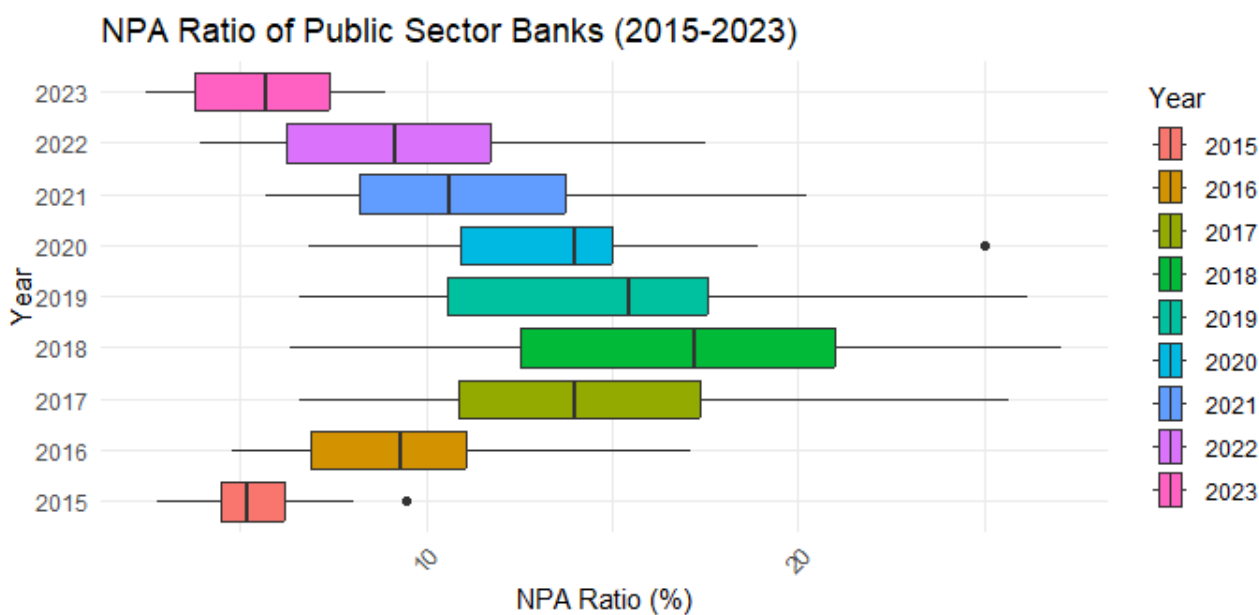


Figure 3: NPA Trend Comparison over years for PSB

Here, it can be observed that median NPA was on rising trend till FY18 after which it declined continuously. Further, it can also be noticed that 1st to 3rd quartile range (shown by the size of box) was also on increase between FY15 to FY18. After FY18, the size of box also decreased. It highlights the fact that within public sector banks, some banks were having lower NPAs then others thus higher variation within public sector banks. This suggests that there were some role of internal factors as well in high NPAs for banks as the differences within public sector banks might be raised by different management practices. However, mergers between 2017 and 2020 might also be one reason for reduction in variation of NPA ratio in public sector banks. To compare these with private sector banks, trends and distribution of NPA ratio, box plot is drawn as shown in figure 4 for the years from FY15 to FY23.

Here, not only rise median NPA ratio is comparatively lower for private sector banks but also variation across private sector banks is lower. Black dots in the right most part of the figure are those

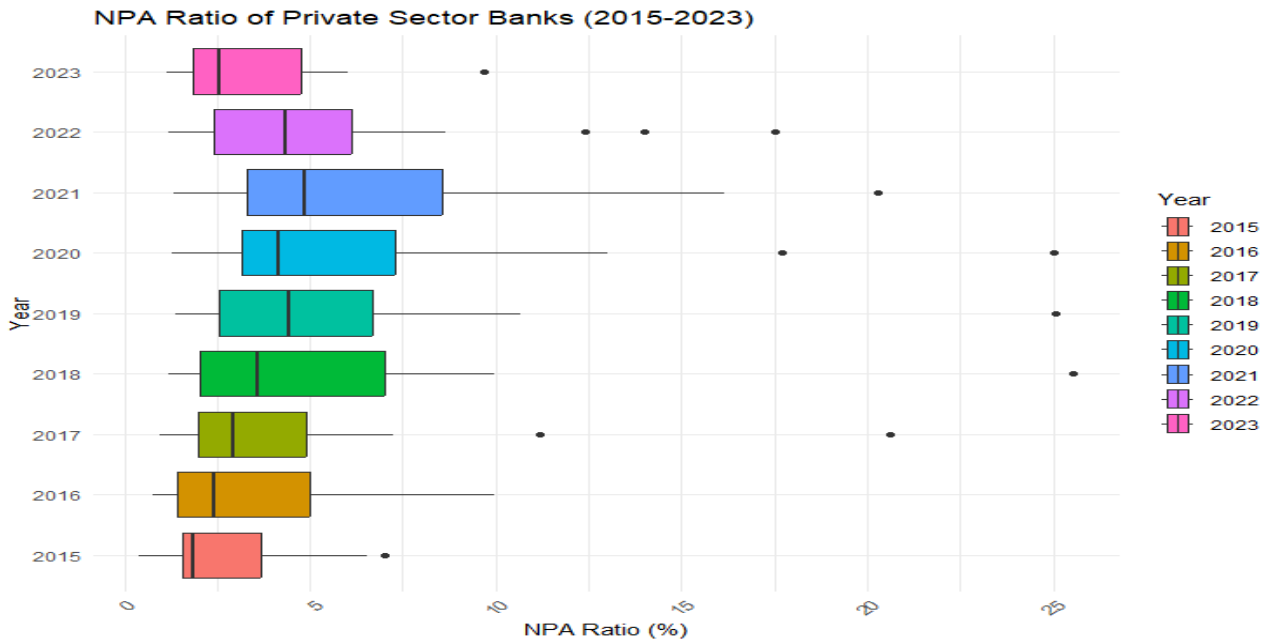


Figure 4: NPA Trend Comparison over years for PVB

values which are having NPA ratio value higher than 3rd quartile. As mentioned above, there were only 2 banks which were having NPA ratio value above 95% quintile for 4 to 5 years (see table 11). This analysis helps us to note the important learning that internal factors might be different for both group and the relationship is likely to be different across both bank group resulting in different rise of NPAs and variation within bank group.

4 Research Questions

After reviewing literature and exploratory analysis, it comes out that there might be a research gap on the impact of management efficiency of banks on NPAs of banks. Further, the differences in management efficiency, if any, between public sector banks and private sector banks can also be explored. Thus, research questions are mentioned below which can result in addition in literature:

1. Does management efficiency impact NPAs? If yes, what is the direction?
2. Is there any significant difference in impact of management efficiency of PSB vis-a-vis PVB?
3. Was there a change in the impact of the management efficiency over NPAs post-2016 reforms?

5 Data and Methodology

For the analysis in the paper, the dataset considered consists of 66 banks (given in table 6 in appendix). Time period is financial year 2011 to financial year 2023. This is going to be an unbalanced panel due to mergers happened between 2017 and 2020. Also, only those private and foreign banks are considered which were having data for all the years between 2011 and 2023. Thus, some new small finance and payment banks emerged after 2016 are not considered for this study. The data source for this study is RBI - Statistical tables on Indian Economy and Data Based on Indian Economy (DBIE).

After reviewing the literature, this paper considers two factors - External factors (Macroeconomic factors) and Internal factors relating to the individual bank - as determinants of NPAs. External factors considered are GDP growth rate, CPI and Index of Industrial Production (IIP). As focus of this study is management efficiency, this paper considers efficiency (cost income) ratio as a proxy to the management efficiency of banks.

Quantifying management efficiency of banks is a difficult task. Industry-wise, some ratios are generally used as proxies for management efficiency as they have correlation with management efficiency. As study by Santosuosso et al.[27] highlights that the expectations about associations between these proxies and efficiency ratios are partially confirmed. However, this study was done taking only Italian non-finance listed companies into the account so applicability of the study might be limited. However, Sherman et al.[28] pointed out that the ratio approach may not be the best approach to measure the managerial performance of banks, as a ratio tends to aggregate several aspects of the performance of banks and thus does not necessarily reflect the long-term performance of banks and may be biased because they are most likely linked to a particular benchmark. Industry-wide, efficiency score calculated using DEA is used to measure bank efficiency but this paper does not follow that approach as DEA generally considers overall bank efficiency however focus of this study is only management efficiency.

Before going into validity of efficiency ratio as proxy of management efficiency, let's look into what does efficiency ratio mean. As per the literature available⁹, efficiency (cost income) ratio is calculated as follows:

$$\text{Efficiency Ratio} = \frac{\text{Non-interest Expenses}}{\text{Net Interest Income} - \text{Provisions}}$$

Here, non-interest expenses include all the expenses incurred by banks other than interest expenses¹⁰. A non-interest expense is an expense for a bank other than those related to interest paid on customer deposits. Office rent, insurance premiums, amortization of intangible assets, employees' salaries, and several other operational expenses form a bank's non-interest expense.

Net interest income is calculated by subtracting interest expenses from interest income¹¹. Further, provisions are an expense set aside as an allowance for potential uncollected loans and loan repayments.

For this study, the efficiency ratio is considered as a proxy for management inefficiency as it depicts the percentage of the operational income spent for operation expenses. Through this, it underscores how well managers of the bank manage its assets and liabilities because of its major focus on operational activities, as explained by Maxwell[29]. A general understanding is that higher the efficiency ratio, lower is the operation efficiency thus lower management efficiency as per our assumption. However, the limitation of this approach is that rise in efficiency ratio might be caused by some expansion practices such as digital innovation, physical expansion, capacity enhancement etc. which might contribute to bank positively overall (negatively to NPA). In that case, it is expected that increase in efficiency ratio may not contribute in enhancing NPA ratio for the bank. Also, rise in efficiency ratio may also be caused by decline in net interest income despite having non-interest expenses high. However, the author checks it for banks and finds significant variation in both - net interest income and non-interest expenses.

There can be other ratios which could be considered for measuring efficiency of management such as Asset-turnover ratio, EBITDA to total asset ratios etc. However, these ratios are not considered as they are somehow directly related to the profits of the banks thus less useful in case of NPA as NPAs determine the profitability of the banks as established by Das et al.[30] in which NPA were found to have negative significant impact on profitability of the banks. Thus, a ratio which doesn't impact profitability of the banks directly might be a suitable choice for proxy of management efficiency.

Based on the study of the existing literature, this study used NPA ratio as a dependent variable. Independent variables are as follows:

- Efficiency (Cost-Income) Ratio
- Index of Industrial Production (IIP)
- Consumer Price Index (CPI)
- GDP Growth Rate of India

Moving ahead, the data, being panel data, contains the cross-sectional dimension (banks) and time dimension with annual frequency from 2011 to 2023. Here, it should be noted that there were mergers

⁹Wall Street Prep etc.

¹⁰Interest expenses for banks are the costs of borrowing money to fund their operations. This includes money borrowed from customers, bond investors, and other lenders.

¹¹Interest income for banks is the revenue they earn from interest-bearing assets, such as loans and investments. It's a primary source of income for banks.

of public sector banks which happened between the time period of 2017 to 2020. As a result of this, there were 27 public sector banks in March 2017 which reduced to only 12 by 1st April 2020. The list of mergers is given in table 1.

Year of Merger	Merged Banks
2017	State Bank of Bikaner & Jaipur, State Bank of Hyderabad, State Bank of Mysore, State Bank of Patiala, and State Bank of Travancore merged with State Bank of India
2019	Dena Bank and Vijaya Bank merged with Bank of Baroda
2020	Oriental Bank of Commerce and United Bank of India merged with Punjab National Bank
2020	Syndicate Bank merged with Canara Bank
2020	Andhra Bank and Corporation Bank merged with Union Bank of India
2020	Allahabad Bank merged with Indian Bank

Table 1: Mergers of Public Sector Banks in India

Final list of banks considered in study is given in table 6 in Appendix.

Due to the mergers given in table 1, the panel of data is unbalanced¹². Fixed effect panel regression model (as discussed by Wooldridge[31].)has been used with following regression equation:

$$NPA_{i,t} = \alpha ER_{i,t} + \beta ER_{i,t} \times I(PSB)_i + \gamma ER_{i,t} \times Post-2018_t + I(PSB)_i + IIP_t + GDP_t + Inflation_t + Constant + \epsilon \quad (1)$$

where:

$NPA_{i,t}$	=	NPA ratio of bank i at time t
$I(PSB)_i$	=	1 when the bank is a public sector bank, otherwise 0
$Post-2018_t$	=	1 for FY2019 onwards, otherwise 0*
$ER_{i,t}$	=	Efficiency (Cost-Income) ratio of bank i at time t
IIP_t	=	IIP growth rate at time t
GDP_t	=	GDP growth rate of India at time t
$Inflation_t$	=	Inflation at time t

* Though a series of reforms started in 2016, it is assumed that their impact became noticeable after FY2018.

Here, it should be noted that the author is more interested in the sign of coefficient of α, β and γ than to their magnitude as ER is a proxy of management efficiency and study looks towards understanding the direction of relationship or impact between NPA and ER.

Between the time frame of 2010-11 to 2022-23, base year for Index of Industrial Production (IIP) changed from 2004-05 to 2011-12. Thus, IIP data for year 2010-11 and 2012-13 were available for base year 2004-05 only. Besides the change in base year, respective weights of its components - Mining & Quarrying, Manufacturing and Electricity also changed as shown in table 2. To calculate the value of IIP for both of the above years for same base year of 2011-12, weights of respective components have been taken as same in 2011-12. Using new weights, value of IIP index has been calculated for both the years. Further, using splicing, the value of IIP for both years has been calculated with respect to base year 2011-12¹³.

¹²An "unbalanced panel data" refers to a dataset where different entities (individuals, firms, countries, etc.) are observed for varying numbers of time periods, meaning some entities might have data for all time points while others might have missing data for certain periods, resulting in an uneven distribution of observations across the panel; essentially, not every entity is observed at every time point.

¹³First, the conversion factor for each component was calculated as the mean of the ratio of the 2004-05 base year value to the 2011-12 base year value for the years 2012-13 to 2016-17. This conversion factor was then multiplied by the 2004-05 base year values for both years.

Component	2004-05	2011-12
Mining and Quarrying	14.16	14.37
Manufacturing	75.53	77.63
Electricity	10.32	7.99

Table 2: Weights of IIP components for base year 2004-05 and 2011-12

6 Results

The figure5 presents a boxplot comparison of the efficiency ratio (%) for private and public sector banks from FY15 to FY23. Overall, private sector banks (red) can be observed to exhibit relatively stable efficiency ratios with lower variation, whereas public sector banks (blue) show higher variation and higher median efficiency ratio. Higher median efficiency ratio of public sector banks may indicate that public sector banks had more inefficient management compared to private sector banks. Higher variation in efficiency ratios for public sector banks may suggest inconsistent performance with public sector bank group. FY18 onward, the gap between the two bank groups' median efficiency ratio narrowed, with both showing a near overlapping distributions in some years. However, post-2020, private sector banks generally maintained relatively lower and more stable efficiency ratios, compared to public sector banks who continued showing the fluctuations. Here, the presence of outliers in multiple years, particularly in 2016, 2017, and 2021, suggests that some banks had different efficiency levels compared to the others.

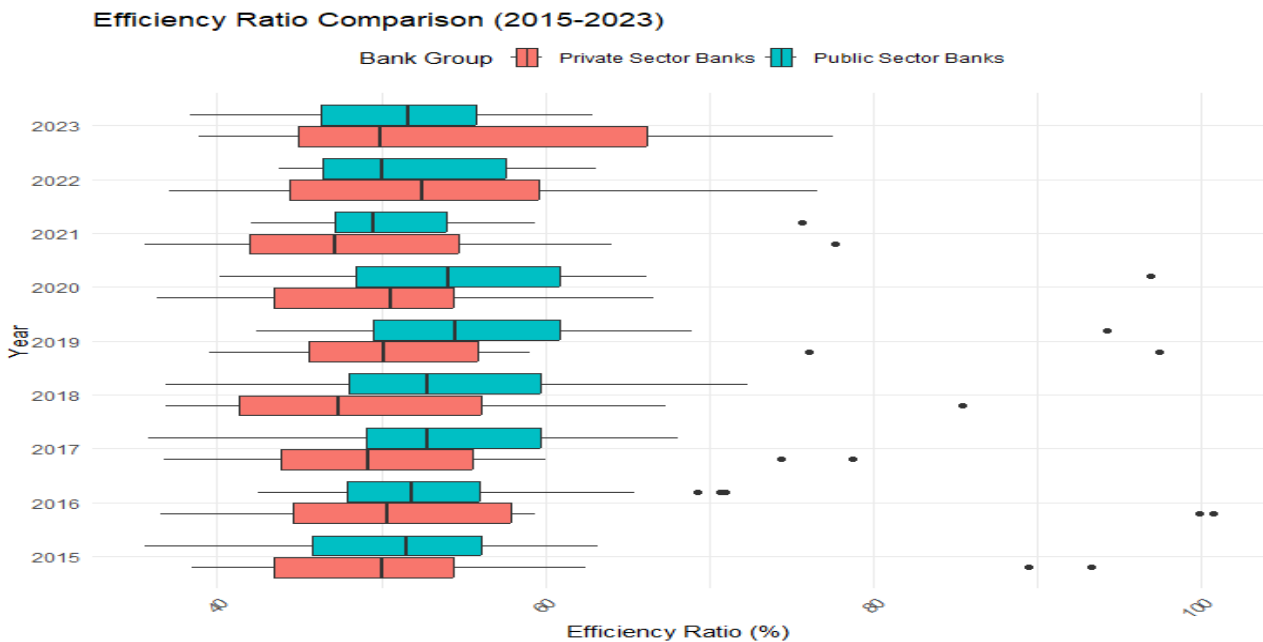


Figure 5: Efficiency Ratio Comparison between PVB and PSB

In the figure 6, the standardized Non-Performing Asset (NPA) ratio and efficiency ratio from 2015 to 2023 across three banking categories: All Scheduled Commercial banks, Private sector banks, and public sector banks have been compared. These two variables were standardized to facilitate a meaningful graphical comparison, as the NPA ratio ranged between 5% and 25% in the data, while the Efficiency Ratio (ER) fell within the 50% to 80% range. Here, standardization ensured that both variables are presented on a comparable scale, allowing for a clearer visual interpretation of their relationship¹⁴. The standardized NPA ratio (blue) and standardized efficiency ratio (red) can be observed moving in same directions often. This indicates a potential positive correlation between NPA ratio and efficiency ratio which is as expected as efficiency ratio is seemed to have inverse relationship

¹⁴The standardized value is computed as: $Standardized\ value = \frac{Value - Mean}{Standard\ Deviation}$

with management efficiency of bank. For all scheduled commercial banks and public sector banks, lagged impact is not that much strong. However, for private sector banks, it seems that there is lagged response in NPA ratio of change in efficiency ratio. Private sector banks demonstrate relatively smoother fluctuations with a less pronounced link between the two metrics. Public sector banks exhibit the highest volatility in both NPA and efficiency ratios which may reflect inconsistent financial performance. The synchronized peaks and troughs in some periods suggest that worsening asset quality (higher NPA ratio) may coincide with higher efficiency ratio i.e., lower management efficiency, especially for public sector banks.

Comparison of Standardized NPA and Efficiency Ratios (2015-2023)

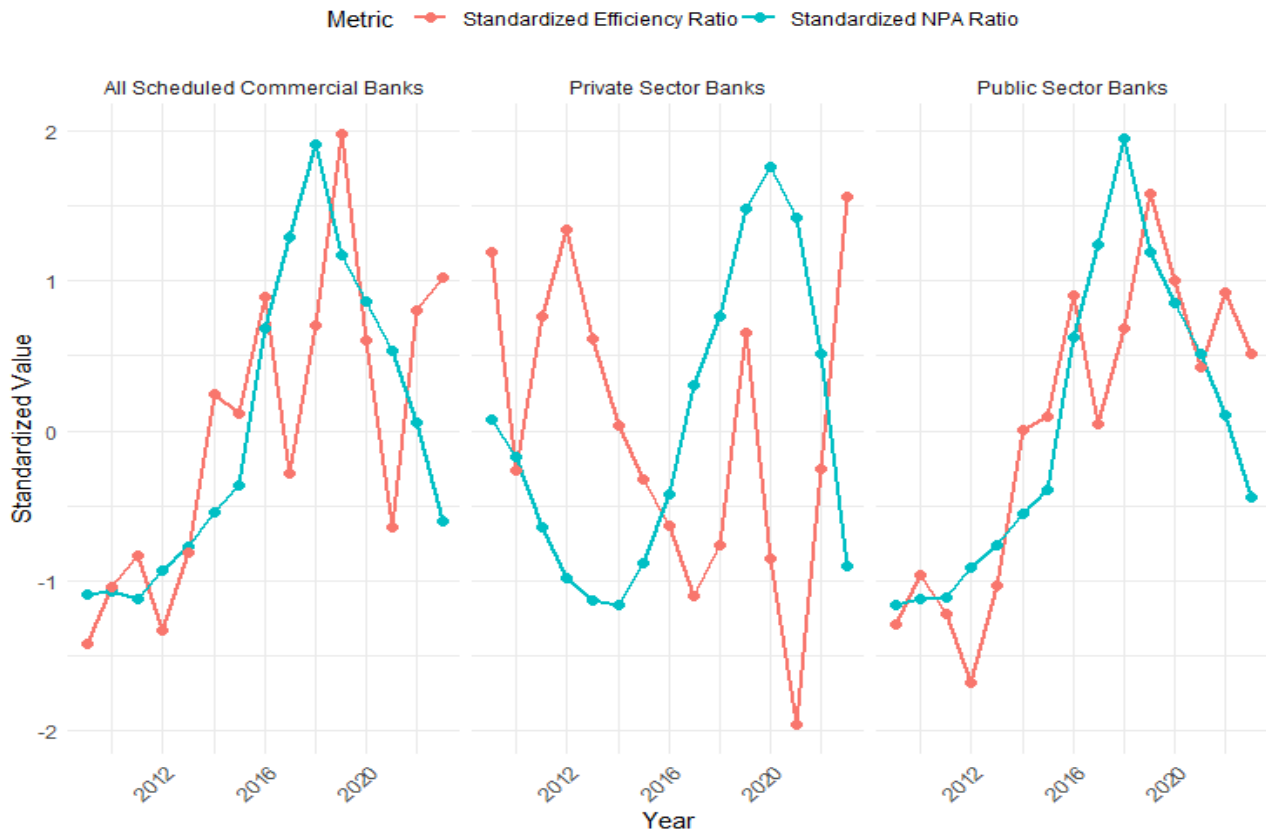


Figure 6: Comparison of Standardized NPA and Efficiency Ratios (2015-2023)

Summary statistics of the variables are given in table 3:

Table 3: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Efficiency Cost Income Ratio	802	49.54	15.89	13.49	131.64
NPA Ratio	802	5.18	5.37	0.00	27.10
IIP Growth Rate in India	802	3.62	4.23	-8.47	11.40
Inflation Rate in India	802	6.20	2.15	3.33	10.02
GDP Growth Rate in India	802	5.91	3.59	-5.78	9.69

Here, efficiency cost income ratio (ER) is found to have a significantly long range which may pose risk of outliers. After carefully analyzing the data, it is found out that there was no outlier in public sector banks¹⁵. However, three private sector banks in table 11 were found to have outlier values but not for all years. Therefore, these 3 banks haven't been dropped to not lose data information and values. However, Foreign bank American Express was having outlier value for all 13 years. However,

¹⁵Criteria for outlier considered is 95 percentile.

to check specification, regression has also been run on the panel after removing American Express bank in table 9. For rest of the variables considered, no outlier values were found.

Initially, a panel OLS regression using equation 1 has been run. For the mentioned regression, both fixed effect (FE) and random effect (RE) models are considered. Fixed effect model is useful in the cases where errors are arbitrarily correlated with the included variables. On the other hand, random effect model assumes that errors in the model are random thus not correlated arbitrarily with included variables. FE model is preferred over RE in the case when it is considered to be unbiased under strict exogeneity assumption. In our case, the internal factor i.e., efficiency ratio has been considered to account for bank's management. However, there might be other individual characteristics of banks which may influence the regressor especially efficiency ratio considered in the regression equation. For example, if a bank is committed to develop digital services or expanding bank branches then its operational expenditure will be higher in this higher efficiency ratio. Thus, there can be correlation of an unaccounted variable with included variables. However, there is a possibility of having random errors as well such as global geopolitical factors which can induce higher NPA to a bank if it has higher exposure of its loan profile to that particular industry worst impacted but have a very low correlation with IIP, GDP Growth etc.

The case for fixed effects (FE) appears stronger than random effects (RE), as the likelihood of an unaccounted variable being correlated with the included variables is relatively high. To validate this, a Hausman test¹⁶ was conducted. After running Hausman test, it is found out that null hypothesis is rejected i.e., there are systemic differences between FE and RE models. Thus, FE model has been considered a better fit.

The results of the regression with various specifications are given in table 3. It should be noted that all regression results are panel OLS with fixed effect and robust clustered errors. Here, all regression specifications are run without year fixed effects except for those in column 1 and 2. Further, regression is run by taking all 66 banks into the consideration for columns 1, 2, 3 and 5. However, in columns 4 and 6, foreign banks are excluded to compare public sector banks with private sector banks. In columns 5 and 6, lagged term of ER and interaction terms have also been considered as lagged impact was highlighted in figure 6 for private sector banks. Complete regression results are given in table 7 in Appendices¹⁷.

Here, in the results, not all specifications give positive and significant coefficient of ER. However, in column 4 and 6, this coefficient turns out to be significant and positive as opposed to column 5. It may suggest that the private and public sector domestic banks have significant positive relationship between efficiency ratio and NPA ratio. This difference in relationship of efficiency ratio and NPAs between domestic and foreign banks is likely to be caused by global management, technology, and risk management practices adopted by foreign banks which domestic banks might not be practicing.

Across all the regression specifications, positive and significant coefficient of interaction term of ER and PSB dummy is obtained suggesting that relationship between ER and NPAs is stronger for public sector banks which underlines that operational expenditure of public sector banks might not be carried out in areas like strengthening underwriting and lending practices, training of employees and digital innovation etc. such that it contributed comparatively higher towards increase in NPA ratio relative to all other banks. However, in column 4 and 6 (where foreign banks have been excluded) the coefficient has a smaller magnitude compared to the value of coefficient in other columns. This may underscore that foreign banks' management practices are comparatively more efficient than private and public sector banks both and there is a smaller difference in impact of ER on NPA between public and private sector banks.

Furthermore, coefficient of interaction term of ER and post-2018 dummy is negative but insignificant for all specifications considered. It highlights that post-2018 reforms were unable to significantly alter the quality of operational expenditure made by banks in the direction of reducing NPA. However, it should be noted that the insignificant coefficient also points out the fact that in post-2018 period, operational expenditure was not made in those areas which contribute towards NPAs further. Thus,

¹⁶In Hausman test, the null hypothesis is that the preferred model is random effects vs. the alternative the fixed effects. It basically tests whether the unique errors are correlated with the regressor, the null hypothesis is they are not.

¹⁷It should be noted that author doesn't check for exogeneity of independent variables considered thus causality of the results can not be established.

Table 4: Panel Data Regression FE

	(1)	(2)	(3)	(4)	(5)	(6)
	NPA Ratio	NPA Ratio	NPA Ratio	NPA Ratio	NPA Ratio	NPA Ratio
Efficiency Ratio	0.06** (0.028)	0.02 (0.021)	0.02 (0.022)	0.15*** (0.043)	0.02 (0.018)	0.14*** (0.041)
Efficiency X Post 2018		-0.02 (0.024)	-0.02 (0.023)	-0.05 (0.046)	-0.01 (0.021)	-0.07 (0.047)
Efficiency X PSB		0.33*** (0.050)	0.31*** (0.051)	0.13** (0.061)	0.22*** (0.044)	0.09* (0.049)
L1.Efficiency Ratio					-0.01 (0.024)	0.01 (0.033)
L1.Efficiency X Post 2018					-0.02 (0.025)	0.03 (0.042)
L1.Efficiency X PSB					0.21*** (0.048)	0.12** (0.053)
Constant	8.82*** (1.625)	4.11** (1.624)	-35.12*** (6.980)	-55.84*** (9.969)	-13.74 (15.776)	13.27 (28.141)
R-squared	0.26	0.35	0.40	0.63	0.42	0.64
Observations	802.00	802.00	802.00	516.00	802.00	516.00

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Note: In all columns, the dependent variable is the NPA ratio. Columns (1) and (2) are regressed using the All banks sample without fixed effects. Columns (3), (4), (5), and (6) are regressed using year fixed effects. Columns (3) and (5) use the All banks sample, while columns (4) and (6) exclude foreign banks. Coefficient of ER in column 6 is 0.14 which is significant at 1% level of significance. It signifies the positive relationship between ER and NPA ratio and quantifies the impact that increasing ER by 1 percentage point will lead to increase in NPA ratio by 0.14 percentage points on average ceteris paribus. However, the significant (at 10% level) coefficient of interaction of ER and PSB underlines that for public sector banks, efficiency ratio was contributing more towards NPA ratio compared to private sector banks. Coefficient of first lag is also positive significant at 10% level of significance. Further, interaction term of ER and Post-2018 dummy is coming to be insignificant which may highlight the chances of expenditure made by banks in those areas which may not contribute to NPA building further. However, the sign of this coefficient came negative which aligns with expectation.

Table 5: Panel Data Regression FE Including merger dummies

	(1)	(2)	(3)	(4)	(5)	(6)
	NPA Ratio	NPA Ratio	NPA Ratio	NPA Ratio	NPA Ratio	NPA Ratio
Efficiency Ratio	0.06** (0.028)	0.02 (0.021)	0.02 (0.022)	0.15*** (0.044)	0.02 (0.018)	0.14*** (0.041)
Efficiency X Post 2018		-0.02 (0.024)	-0.02 (0.023)	-0.05 (0.046)	-0.01 (0.022)	-0.07 (0.047)
Efficiency X PSB		0.33*** (0.050)	0.32*** (0.051)	0.14** (0.062)	0.22*** (0.044)	0.09* (0.049)
L1. Efficiency Ratio					-0.01 (0.024)	0.01 (0.033)
L1. Efficiency X Post 2018					-0.02 (0.025)	0.04 (0.044)
L1. Efficiency X PSB					0.22*** (0.048)	0.13** (0.054)
Constant	8.78*** (1.631)	4.08** (1.638)	-34.22*** (7.093)	-55.25*** (10.285)	-11.92 (15.997)	16.85 (29.232)
R-squared	0.27	0.35	0.41	0.63	0.43	0.64
Observations	802.00	802.00	802.00	516.00	802.00	516.00

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Note: All coefficients having (.) are representing omitted variables due to multicollinearity issue. In all columns, the dependent variable is the NPA ratio. Columns (1) and (2) are regressed using the All banks sample without fixed effects. Columns (3), (4), (5), and (6) are regressed using year fixed effects. Columns (3) and (5) use the All banks sample, while columns (4) and (6) exclude foreign banks.

it also suggests need to check the composition of expenditure made by public sector banks and private sector banks.

For further robustness check, author includes merger dummies as well in regression to account for the impact of merger into public sector banks. As given in 1, there are 6 parents banks into whom other banks merged between 2017 to 2020. As a result of it, there would have been change in the numbers for these parent banks. To account for this, author considers dummy bank_name which takes value 1 if bank is parent bank and year is the financial year just next to the merger year otherwise it takes value 0. For example, dummy SBI Merger will take value 1 if bank name is State bank of India and Year is 2017-18. Following this, 6 merger dummies have been created. With these, regression is run and results are presented in table 5. These results are in same direction as above results in table 3. Even after including these dummies, interaction term between ER and Post-2018 dummy remain insignificant.

Further, as mentioned, Asset Quality Review (AQR) in 2015-16 exercise which was asked to be conducted in the banks as directed by RBI, brought an already existing NPA into the books of banks. In other words, a large parts of the loans were already of bad quality and present in the system however they were not recognized or identified by banks. AQR helped the banks to bring these assets in the books of the banks thus got recorded. Because of it, the results may not be fully representative as the regression accounts for the time period of 2010-11 to 2022-23 and under identification of bad quality of assets may underestimate the NPA numbers. To account for this, author also considers running regression with same specifications as conducted in table 3 and table 5. The regression results are presented in Appendix in table 8 and table 10. The results achieved through this align with overall results conducted above. In this result, coefficient of interaction term of ER and post-2018 dummy becomes negative and significant for 5th and 6th columns. However, this might be because of lack of representative data as only 3 data points would be there before 2018-19. Further, loss of degree of freedom may also be another issue arising in these results.

Lastly, an additional regression has been run by keeping only interaction between ER and post-2018 and removing another interaction between ER and PSB to check if it consumes some of the impact of former interaction term. In other words, this regression is run to check if interaction between ER and post-2018 becomes significant. The result of this regression is presented in table 12. Here, the regression is run for only domestic banks. The results obtained are along the lines of our main specification run using equation 1. In other words, after removing the interaction between ER and PSB, coefficient of interaction between ER and post-2018 remains negative but insignificant.

The positive relationship between banks' NPAs and management inefficiencies was also expected by Bandyopadhyay who underlined the role of governance challenges behind this[32]. Whereas Raghuram Rajan's emphasis on robust governance and risk management underscores the importance of improving management efficiency to mitigate NPAs[4]. These perspectives corroborate our findings, which suggest a positive correlation between managerial inefficiencies and NPAs, particularly in public sector banks.

Thus, results are suggestive of the fact that the public sector banks' management was less efficient than private sector banks and foreign banks in terms of operational expenditure. Further, post-2017-18, public sector banks' expenditure was not found to contribute towards NPAs significantly compared to pre-2017-18 period. The explanation of this include that banks may have allocated their operational expenditure in areas which did not contribute towards NPA enhancement. Expenditure made in areas such that digital innovation (e.g., checking repayment capability), capacity enhancement (e.g., staff training and reduction in vacancy), technology upgradation (e.g., automated data capture etc.) and others may not contribute further towards enhancement of NPA. Thus, exploration of changes made in management practices of banks becomes inevitable.

7 Overview of Changes in Management Practices of Banks

Given the above results, it is essential to review the changes made by management after 2017, especially in public sector banks, to analyze the potential reason behind insignificant coefficient of interaction between post-2018 and efficiency ratio. To achieve this, author reviews paper written by Ravindra [33]

which analyze the change in management of State Bank of India after 2006. He concludes that though the efforts of the bank to change its culture and technology are intermittent and leader driven, but it covered large number of employees at each cadre and made a difference to banks performance. The bank started its change efforts in response to loss of market share due to meteoric rise in new dynamic private sector banks. Some of the management practice changes after 2016 have been mentioned below.

- **Digital Transformation and Innovation:**

- Implementation of digital tools for HR and performance management, automated data capture and monthly performance scoring.
- Introduction of P.A.C.E. Tool for SME credit underwriting using cash flow-based lending.¹⁸
- Strengthened corporate lending by making credit risk and review independent of appraisal and sanction.
- Project IMPACT and best PSB in EASE Index.¹⁹

- **Personnel Management**

- Development of a transfer optimization tool using 200+ parameters to find the "right person for the right job"
- Implementation of an automated grievance redressal system with escalation mechanisms
- Focus on employee engagement through integrated career path planning and digital recognition programs

- **Customer-Centric Approach**

- Rollout of revised customer satisfaction measures
- Introduction of the "Nayi Disha-Phase 2" training program emphasizing customer service
- Enhanced focus on digitizing customer journeys for improved service delivery²⁰

It should be noted that this expenditure gets accounted in efficiency ratio calculation under the header of non-interest expenses, so the direction of relationship between efficiency ratio and NPA ratio may change as observed in table 3. Thus, spending money in digital innovation, personnel management and other approaches might be expected to contribute to reduce NPA ratio because of technology-driven lending practices, use of credit history and better professional practices etc.

To further explore the management change in private sector banks, in a contemporary paper, Ravindra [34] analyzes the strategic management changes at HDFC Bank in response to technological advancements, competitive pressures, and leadership transitions. Some of these are as below:

- **Technological Innovation and Digitization**

- Adoption of a comprehensive digitization strategy, termed as Digitization 2.0, which emphasized developing advanced digital services such as PayZapp (a comprehensive mobile payment solution), DigiPOS terminals, and Smart Merchant Hubs.
- Streamlining of service delivery for both retail customers and merchants to foster greater operational efficiency.
- Introduction of the Virtual Relationship Management model for redefining customer engagement. The integration of digital processes facilitated frictionless customer journeys, with features such as instant credit card issuance and consumer loans on demand.

- **Human Resource Development**

¹⁸Post 2017 - under Arundhati Bhattacharya

¹⁹Post - 2018, Under Rajnish Kumar period

²⁰Post - 2018, Under Rajnish Kumar period

- Continuous employee training, and adoption of the Kaizen approach to inculcate a culture of incremental improvements.
- Implementation of an automated grievance redressal system with escalation mechanisms
- Focus on employee engagement through integrated career path planning and digital recognition programs

By analyzing the management changes in two biggest banks of India, it can be understood that expenditure in SBI were more directed towards creating infrastructure which can lead to better and informed lending practices. However, for HDFC bank, the management change was more looking as continuation of previous reforms i.e., employing technology in areas to enhance consumer experience thus towards improving business. Thus, SBI targeted for reforming those management practices which were contributing towards NPAs building.

8 Conclusion

The Wall Street crisis in 2008 underscored the need for financial regulators to maintain vigilance. Similarly, the NPA crisis in India built up over time but was first accurately measured due to AQR, an exercise conducted by RBI, in 2015, followed by peak in 2018 with 11.2% NPA ratio. The resolution of this crisis involved a series of careful measures implemented by the Reserve Bank of India (RBI) and Government of India, including BASEL norms implementation, IBC introduction, mergers of public sector banks, Gyan Sangam 1.0 and 2.0 and PSB Manthan, recapitalization, Prompt Corrective Action etc. Given its scale and impact, the NPA crisis serves as a critical case study in financial regulation and economic stability.

This paper provides a comprehensive analysis of the factors influencing Non-Performing Assets (NPAs) in the Indian banking sector, with a particular emphasis on management efficiency. By employing panel data regression, it establishes a link between operational inefficiency, as measured by the efficiency ratio, and the rise in NPAs, particularly in public sector banks (PSBs).

A key insight that can be drawn from this analysis is that while PSBs exhibit higher inefficiencies compared to their private sector counterparts, post-2018 reforms have reshaped operational expenditure patterns in ways that may reduce future NPA accumulation. Strategic investments in digital transformation, enhanced risk management practices, and personnel training have shown promise in mitigating the inefficiencies that contributed to asset quality deterioration. Despite these efforts, the findings indicate that the reforms did not immediately translate into lower NPA ratios, highlighting the need for sustained efforts toward strengthening managerial practices and governance frameworks. The study underscores the importance of targeted operational improvements, such as digital innovation, capacity enhancement, and technology upgrades, as key enablers to foster long-term resilience. Moreover, the divergence in efficiency trends between PSBs and private banks suggests that public sector institutions need to adopt more aggressive managerial reforms. Optimizing operational expenses, strengthening credit evaluation processes, and fostering a culture of accountability are critical steps for reducing NPAs and ensuring financial stability.

On an ending note, this study provides room for further research and granular study of banks' profile, balance sheets and their annual reports to understand the specific changes made by the respective banks and their management to improve upon management practices enhancing efficiencies to tackle the issue of high NPAs. Study of bank loan profiles or expenditure profile on various operational components may complement it. Additionally, a quantitative analysis of the specific impact of digital transformation (such as automated credit scoring and fraud detection systems) on NPA reduction could be another area of exploration. Further, the treatment of mergers and impact of other simultaneous regulatory reforms such as PCA may also be looked to figure out impact of the management efficiency on NPAs.

Acknowledgment

I would like to express my sincere gratitude to my mentor Dr. Girish Bahal, Dr. Vikram Dayal, Dr. Saudamini Das and Dr. Oindrila De, for their valuable guidance and support throughout this research. I extend my gratitude to library and computer section of Institute of Economic Growth as well for making data sources and literature available. I also extend my appreciation to my colleagues at Institute of Economic Growth for their insightful discussions and feedback. Special thanks to the Indian Economic Service and the Department of Economic Affairs, Ministry of Finance, for providing the resources and platform for conducting this study. Finally, I am grateful to my family and friends for their unwavering encouragement.

References

- [1] Tamal Bandyopadhyay. Banking, npa crisis, rbi: Tamal bandyopadhyay — arth niti. YouTube Interview by Shekhar Tomar, 2021. [Accessed: May 7, 2021].
- [2] P.R. Brahmananda. Rbi report on trend and progress in banking interest income as a measure of viability. *The Hindu Business Line*, p. 4, 1999.
- [3] Tamal Bandyopadhyay. Tamal bandyopadhyay on the stressful lives of public sector bankers, n.d. Accessed: 2025-02-27.
- [4] Raghuram Rajan. *I Do What I Do: On Reform, Rhetoric & Resolve*. HarperCollins India, 2017.
- [5] Economic Times. Rbi's gradual shift from transparency to forbearance towards stressed sectors, February 26 2020. Accessed: 2025-02-27.
- [6] Tamal Bandyopadhyay. Cricket, culture & psu bank merger, September 2019. LinkedIn. Accessed: 2025-02-27.
- [7] Gillian García Mathew I. Saal Lindgren, Carl-Johan. Bank soundness and macroeconomic policy. *Washington: International Monetary Fund*, 1996.
- [8] Klingebiel D. Caprio Jr, G. Bank insolvency: Bad luck, bad policy, or bad banking? *Annual World Bank Conference on Development Economics (Policy Research Working Paper, 1620)*, 1996.
- [9] Grimes A. Holmes M. Hess, K. Credit losses in australasian banking. *Economic Record*, 85(270), 331–343., 2009.
- [10] P. Koeva. The performance of indian banks during financial liberalization. *IMF Working Paper, W/03/150*, 2003.
- [11] M.Y. Khan and T.R. Bishnoi. Banking crisis and financial reforms: Lessons for india. *Chartered Secretary: 44 - 48*, 2001.
- [12] K. Kaur and B. Singh. Non performing assets of public and private sector banks (a comparative study). *South Asian Journal of Marketing and Management Research*, 1(3), 54-72, 2011.
- [13] Pallavi Chavan and Leonardo Gambacorta. Bank lending and loan quality: The case of india. *RBI WORKING PAPER SERIES, WPS (DEPR): 09 / 2016*, 2016.
- [14] Mohammad Abid Manogna R L Aswini Kumar Mishra, Shikhar Jain. Macro-economic determinants of non-performing assets in the indian banking system: A panel data analysis. *Int J Fin Econ. 2021;26:3819–3834.*, 2020.
- [15] Alok Kumar Chakrawal Amar Nath Yadav, Vivek Kumar and Jyoti Kumari. Assessing the impact of macroprudential policies on housing credit dynamics: Evidence from india. *RBI WORKING PAPER SERIES, WPS (DEPR): 04 / 2024*, 2024.
- [16] Gargi Sanati Richa Verma Bajaj and Chetan Lodha. Impact assessment study of npas and rate of recovery: Are private sector banks in india better off? *Global Business Review 25(3) 724–749*, 2024.
- [17] Jukubik P. Piloiu A. Beck, R. Key determinants of nonperforming loans: New evidence from a global sample. *Open Economies Review*, 26(3), 525–550, 2015.
- [18] D.D. Gupta E. Istrate. and P. Weissburg. Towards developing a structured approach to the diagnosis and resolution of nonperforming loans: The case of china and india. *Review of Policy Research 24(4), pages 345–365*, 2007.

- [19] B.M. Misra and S. Dhal. Pro-cyclical management of banks' non-performing loans by the indian public sector banks. *Available Online* : <http://www.bis.org/repofficpubl/arpresearch201003.08.pdf>, 2011.
- [20] Clarke G. R. G. Cull R. Klapper L. Udell G. F. (Berger, A. N. Corporate governance and bankperformance: a joint analysis of the static, selection, and dynamic effects of domestic, foreign, and stateownership. *Journal of Banking and Finance*, 29(8–9), 2005.
- [21] Shahid R. Haque, F. Ownership, risk-taking and performance of banks in emerging economies: Evidence from india. *Journal of Financial Economic Policy*, 8(3), 282–297, 2016.
- [22] Swati Raju. Non-performing assets of banks in india: Efficiency in management. *Mumbai School of Economics Public Policy (Autonomous), University of Mumbai*.
- [23] K A Killgo T F Siems Barr, R S and S Zimmel. Evaluating the productive efficiency and performance of us commercial banks. *“Managerial Finance”*, vol. 28, no. 8, pp. 3-25, 2000.
- [24] Oliver E. Williamson. Managerial discretion and business behavior. *The American Economic Review*, Vol. 53, No. 5 (Dec., 1963), pp. 1032-1057, 1963.
- [25] Rehman R. U. Saleem, Q. Impacts of liquidity ratios on profitability. *Interdisciplinary Journal of Research in Business*, 1(7), 95-98, 2011.
- [26] Dr. Fareed Ahmed. Assessing the effectiveness of insolvency and bankruptcy code. *International Journal of Research in Engineering, IT and Social Sciences*, ISSN 2250-0588, Volume 11 Issue 01, Page 1-13, 2021.
- [27] Pierluigi Santosuosso. Do efficiency ratios help investors to explore firm performances? evidence from italian listed firms. *International Business Research*, 7:111–111, 12 2024.
- [28] Gold F. Sherman, H.D. Bank branch operating efficiency. *Journal of Banking and Finance*, vol.9, no.2, pp. 297-315, 1985.
- [29] Dr. Maxwell Ampong. Efficiency ratios explained, and how to use them. *LinkedIn blog* <https://www.linkedin.com/pulse/efficiency-ratios-explained-how-use-them-dr-maxwell-ampong-dba-jpqve/>, June 7, 2024.
- [30] Khushboo Uppal Santosh Kumar Das. Npas and profitability in indian banks: an empirical analysis. *Future Business Journal* 7, Article number: 53, 2021.
- [31] J. M. Wooldridge. Introductory econometrics: A modern approach (5th ed.). *Mason, OH: South-Western, Cengage Learning*, 2013.
- [32] Tamal Bandyopadhyay. Banks' npas never went away, they were only hidden, May 26 2022. Accessed: 2025-02-27.
- [33] Ravindra Sangvai. Change management profile of state bank of india-developing change core capacity. *IOSR Journal of Business and Management (IOSR-JBM) e-ISSN: 2278-487X, p-ISSN: 2319-7668. Volume 22, Issue 7. Ser. IV (July 2020), PP 34-48, July 2020.*
- [34] Ravindra Sangvai. Change management profile of hdfc bank ltd. creating comfort in customer journeys. *IOSR Journal of Business and Management (IOSR-JBM) e-ISSN: 2278-487X, p-ISSN: 2319-7668. Volume 22, Issue 7. Ser. IV (July 2020), PP 09-18, July 2020.*

A Appendices

Table 6: List of Public and Private Sector Banks Considered for the Study

1. AB Bank Limited	2. American Express Banking Corp.
3. Andhra Bank	4. Axis Bank Limited
5. Bank of America, National Association	6. Bank of Bahrain & Kuwait B.S.C.
7. Bank of Baroda	8. Bank of Ceylon
9. Bank of India	10. Bank of Maharashtra
11. Bank of Nova Scotia	12. Barclays Bank PLC
13. BNP Paribas	14. Canara Bank
15. Central Bank of India	16. Citibank N.A
17. City Union Bank Limited	18. Corporation Bank
19. Credit Agricole Corporate and Investment Bank	20. CSB Bank Limited
21. CTBC Bank Co., Ltd.	22. DBS Bank India Limited
23. DCB Bank Limited	24. Dena Bank
25. Deutsche Bank AG	26. Dhanlaxmi Bank Limited
27. Federal Bank Ltd	28. HDFC Bank Ltd.
29. ICICI Bank Limited	30. IDBI Bank Limited
31. Indian Bank	32. Indian Overseas Bank
33. IndusInd Bank Ltd	34. Jammu & Kashmir Bank Ltd
35. JPMorgan Chase Bank National Association	36. Karnataka Bank Ltd
37. Karur Vysya Bank Ltd	38. Kotak Mahindra Bank Ltd.
39. Mashreq Bank PSC	40. Mizuho Bank Ltd
41. MUFG Bank, Ltd.	42. Nainital Bank Ltd
43. Oriental Bank of Commerce	44. Punjab and Sind Bank
45. Punjab National Bank	46. RBL Bank Ltd
47. SBM Bank (India) Limited	48. Shinhan Bank
49. Societe Generale	50. Sonali Bank
51. South Indian Bank Ltd	52. Standard Chartered Bank
53. State Bank of Bikaner and Jaipur	54. State Bank of Hyderabad
55. State Bank of India	56. State Bank of Mysore
57. State Bank of Patiala	58. State Bank of Travancore
59. Syndicate Bank	60. Tamilnad Mercantile Bank Ltd
61. UCO Bank	62. Union Bank of India
63. United Bank of India	64. Vijaya Bank
65. Yes Bank Ltd.	66. Allahabad Bank

Table 7: Full regression results of table 3

	(1)	(2)	(3)	(4)	(5)	(6)
	NPA Ratio	NPA Ratio	NPA Ratio	NPA Ratio	NPA Ratio	NPA Ratio
Efficiency Ratio	0.06** (0.028)	0.02 (0.021)	0.02 (0.022)	0.15*** (0.043)	0.02 (0.018)	0.14*** (0.041)
IIP Growth Rate	-0.05*** (0.018)	-0.03** (0.016)	-0.30*** (0.062)	-0.49*** (0.086)	-2.79 (2.116)	0.83 (3.738)
Inflation in India	-0.85*** (0.119)	-0.71*** (0.115)	3.71*** (0.779)	5.63*** (1.100)	0.54 (1.260)	-2.11 (2.286)
India GDP growth rate	-0.19*** (0.040)	-0.14*** (0.041)	0.20*** (0.052)	0.29*** (0.063)	0.61 (0.593)	-0.52 (1.047)
Efficiency X Post 2018		-0.02 (0.024)	-0.02 (0.023)	-0.05 (0.046)	-0.01 (0.021)	-0.07 (0.047)
Efficiency X PSB		0.33*** (0.050)	0.31*** (0.051)	0.13** (0.061)	0.22*** (0.044)	0.09* (0.049)
Post 2018		1.34 (1.187)	12.80*** (2.547)	20.45*** (4.035)	0.38 (1.508)	0.37 (2.825)
Year=2012			-3.65*** (0.823)	-5.72*** (1.169)	-4.43 (4.253)	3.44 (7.596)
Year=2013			-5.04*** (1.295)	-8.48*** (1.719)	-7.19 (6.876)	4.85 (12.382)
Year=2014			7.54*** (1.422)	10.13*** (1.982)	-8.69 (5.612)	-0.52 (10.035)
Year=2015			14.09*** (2.810)	20.69*** (3.939)	-9.76* (4.910)	-3.21 (8.578)
Year=2016			15.56*** (2.829)	22.26*** (3.934)	-11.56 (7.919)	0.54 (13.908)
Year=2017			24.51*** (4.349)	36.03*** (6.065)	-5.45 (3.317)	-1.08 (5.651)
Year=2018			22.51*** (3.976)	33.71*** (5.580)	0.00 (.)	0.00 (.)
Year=2019			10.75*** (2.041)	16.18*** (2.880)	0.00 (.)	0.00 (.)
L1.Efficiency Ratio					-0.01 (0.024)	0.01 (0.033)
L1.IIP growth					-0.50* (0.271)	-0.11 (0.483)
L1.India GDP growth					3.34 (2.565)	-1.11 (4.518)
L1.Efficiency X Post 2018					-0.02 (0.025)	0.03 (0.042)
L1.Efficiency X PSB					0.21*** (0.048)	0.12** (0.053)
Constant	8.82*** (1.625)	4.11** (1.624)	-35.12*** (6.980)	-55.84*** (9.969)	-13.74 (15.776)	13.27 (28.141)
R-squared	0.26	0.35	0.40	0.63	0.42	0.64
Observations	802.00	802.00	802.00	516.00	802.00	516.00

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Note: Coefficients of PSB, Year of 2011, 2020, 2021, 2022 and 2023 are omitted due to multicollinearity issue. In all columns, the dependent variable is the NPA ratio. Columns (1) and (2) are regressed using the All banks sample without fixed effects. Columns (3), (4), (5), and (6) are regressed using year fixed effects. Columns (3) and (5) use the All banks sample, while columns (4) and (6) exclude foreign banks.

Table 8: Panel Data Regression FE (2015-16 to 2022-23)

	(1) NPA Ratio	(2) NPA Ratio	(3) NPA Ratio	(4) NPA Ratio	(5) NPA Ratio	(6) NPA Ratio
Efficiency Ratio	0.04 (0.028)	0.01 (0.021)	0.04 (0.029)	0.15*** (0.043)	0.06* (0.028)	0.21*** (0.046)
Efficiency X Post 2018		-0.01 (0.009)	-0.04 (0.030)	-0.07 (0.048)	-0.04* (0.024)	-0.10** (0.042)
Efficiency X PSB		0.22*** (0.066)	0.21*** (0.065)	0.10 (0.071)	0.17** (0.066)	0.03 (0.068)
L.Efficiency Ratio					-0.05* (0.028)	-0.08* (0.049)
L.Efficiency X Post 2018					-0.01 (0.030)	0.05 (0.047)
L.Efficiency X PSB					0.17** (0.071)	0.18** (0.076)
Constant	9.19*** (1.873)	6.65*** (1.662)	5.62 (39.080)	-28.23 (63.886)	11.17*** (3.685)	20.87*** (6.563)
R-squared	0.09	0.13	0.20	0.39	0.22	0.41
Observations	472.00	472.00	472.00	296.00	472.00	296.00

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Note: In all columns, the dependent variable is the NPA ratio. Columns (1) and (2) are regressed using the All banks sample without fixed effects. Columns (3), (4), (5), and (6) are regressed using year fixed effects. Columns (3) and (5) use the All banks sample, while columns (4) and (6) exclude foreign banks.

Table 9: Panel Data Regression FE After Dropping American Express

	(1) NPA Ratio	(2) NPA Ratio	(3) NPA Ratio	(4) NPA Ratio	(5) NPA Ratio	(6) NPA Ratio
Efficiency Ratio	0.06** (0.028)	0.02 (0.022)	0.02 (0.023)	0.15*** (0.043)	0.02 (0.019)	0.14*** (0.041)
Efficiency X Post 2018		-0.03 (0.026)	-0.03 (0.025)	-0.05 (0.046)	-0.01 (0.024)	-0.07 (0.047)
Efficiency X PSB		0.33*** (0.049)	0.31*** (0.050)	0.13** (0.061)	0.22*** (0.043)	0.09* (0.049)
L1.Efficiency Ratio					-0.01 (0.023)	0.01 (0.033)
L1.Efficiency X Post 2018					-0.03 (0.022)	0.03 (0.042)
L1.Efficiency X PSB					0.21*** (0.048)	0.12** (0.053)
Constant	9.07*** (1.638)	4.00** (1.675)	-35.77*** (7.031)	-55.84*** (9.969)	-21.98 (14.212)	13.27 (28.141)
R-squared	0.27	0.35	0.41	0.63	0.43	0.64
Observations	789.00	789.00	789.00	516.00	789.00	516.00

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Note: All coefficients having (.) are representing omitted variables due to multicollinearity issue. In all columns, the dependent variable is the NPA ratio. Columns (1) and (2) are regressed using the All banks sample without fixed effects. Columns (3), (4), (5), and (6) are regressed using year fixed effects. Columns (3) and (5) use the All banks sample, while columns (4) and (6) exclude foreign banks.

Table 10: Panel Data Regression FE for 2015-16 to 2022-23 (With merger dummies)

	(1)	(2)	(3)	(4)	(5)	(6)
	NPA Ratio	NPA Ratio	NPA Ratio	NPA Ratio	NPA Ratio	NPA Ratio
Efficiency Ratio	0.04 (0.028)	0.03 (0.029)	0.04 (0.029)	0.15*** (0.044)	0.06* (0.028)	0.21*** (0.046)
SBI Merger	5.44*** (0.295)	5.89*** (0.459)	4.90*** (0.605)	3.89*** (0.723)	5.46*** (0.671)	4.35*** (0.743)
BOB Merger	0.07 (0.404)	0.31 (0.399)	0.41 (0.384)	-0.50 (0.523)	0.52 (0.410)	-0.21 (0.587)
PNB Merger	0.75** (0.359)	0.80* (0.409)	0.01 (0.454)	-0.92 (0.623)	0.11 (0.469)	-0.60 (0.720)
Canara Bank Merger	0.47 (0.361)	0.56 (0.421)	-0.24 (0.462)	-1.12* (0.621)	-1.07** (0.532)	-1.98*** (0.540)
UBI Merger	2.22*** (0.355)	2.55*** (0.434)	1.76*** (0.475)	0.83 (0.643)	2.07*** (0.558)	1.33* (0.782)
Indian Bank Merger	3.12*** (0.380)	2.72*** (0.425)	1.94*** (0.468)	1.09* (0.611)	2.71*** (0.684)	2.21** (0.957)
Efficiency X Post 2018		-0.05 (0.031)	-0.04 (0.030)	-0.07 (0.048)	-0.04* (0.024)	-0.11** (0.043)
Efficiency X PSB		0.23*** (0.064)	0.22*** (0.066)	0.10 (0.072)	0.16** (0.067)	0.03 (0.069)
L1. Efficiency Ratio					-0.05* (0.028)	-0.09* (0.050)
L1. Efficiency X Post 2018					-0.01 (0.030)	0.05 (0.049)
L1. Efficiency X PSB					0.19** (0.071)	0.19** (0.077)
_cons	9.16*** (1.892)	5.52*** (1.849)	-18.87*** (4.557)	-32.98*** (6.752)	9.81*** (3.570)	14.97*** (4.849)
R-squared	0.09	0.15	0.20	0.39	0.23	0.41
Observations	472.00	472.00	472.00	296.00	472.00	296.00

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Note: All coefficients having (.) are representing omitted variables due to multicollinearity issue. In all columns, the dependent variable is the NPA ratio. Columns (1) and (2) are regressed using the All banks sample without fixed effects. Columns (3), (4), (5), and (6) are regressed using year fixed effects. Columns (3) and (5) use the All banks sample, while columns (4) and (6) exclude foreign banks.

Table 11: Bank Name Frequency

Bank	Number of Outliers
DHANLAXMI BANK LIMITED	7
CSB BANK LIMITED	6
RBL BANK LTD	1

Table 12: Panel Data Regression FE (Iteration)

	(1)	(2)	(3)	(4)
	NPA Ratio	NPA Ratio	NPA Ratio	NPA Ratio
Efficiency Ratio	0.15*** (0.043)	0.20*** (0.038)	0.14*** (0.041)	0.18*** (0.035)
Efficiency X Post 2018	-0.05 (0.046)	-0.03 (0.050)	-0.07 (0.047)	-0.04 (0.052)
Efficiency X PSB	0.13** (0.061)		0.09* (0.049)	
L.Efficiency Ratio			0.01 (0.033)	0.05* (0.027)
L1.Efficiency X Post 2018			0.03 (0.042)	0.03 (0.043)
L1.Efficiency X PSB			0.12** (0.053)	
Constant	-55.84*** (9.969)	-56.73*** (9.907)	13.27 (28.141)	12.61 (28.030)
R-squared	0.63	0.62	0.64	0.63
Observations	516.00	516.00	516.00	516.00

Note: Standard errors are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. All the columns consist of year fixed effects. Also, foreign banks have not been included in all the columns.