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# **Assessing the Relationship between Non-Performing Assets (NPAs) and Profitability of Banks in India**

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# **Assessing the Relationship between Non-Performing Assets (NPAs) and Profitability of Banks in India**

## **Introduction**

The banking sector plays a pivotal role in the economic development and stability of a country, particularly in developing nations like India, where financial systems are predominantly bank-based. Banks act as the primary financial intermediaries, converting deposits into productive investments, which is essential for facilitating economic growth (Ambarkhane et.al, 2022).<sup>1</sup>

In today's 21<sup>st</sup> century, there are many options available before savers as well as borrowers. Savers by saving their funds in other alternatives like share market, or mutual funds can earn good returns over their savings, but the risk associated with it is also very high. As we know risk and return move in tandem. The higher the returns higher the risk. This doesn't mean the savers' money is safe in banks. We have instances where banks were unable to meet the demand for funds by so many borrowers at a particular time. For instance Punjab National Bank, Yes Bank, Bank of Baroda. We have instances of the collapse of banks, and major scams. The importance of banking in economic development cannot be overstated, as it underpins financial stability, supports economic activities, and enhances growth prospects. Therefore, continuous efforts to improve the efficiency and profitability of banks are essential for sustaining economic development and stability (Ambarkhane et.al, 2022; Vasudevan, 2018; Al-Homaidi et.al, 2018; Almaqtari et.al, 2018; Gaur and Mohapatra 2021)

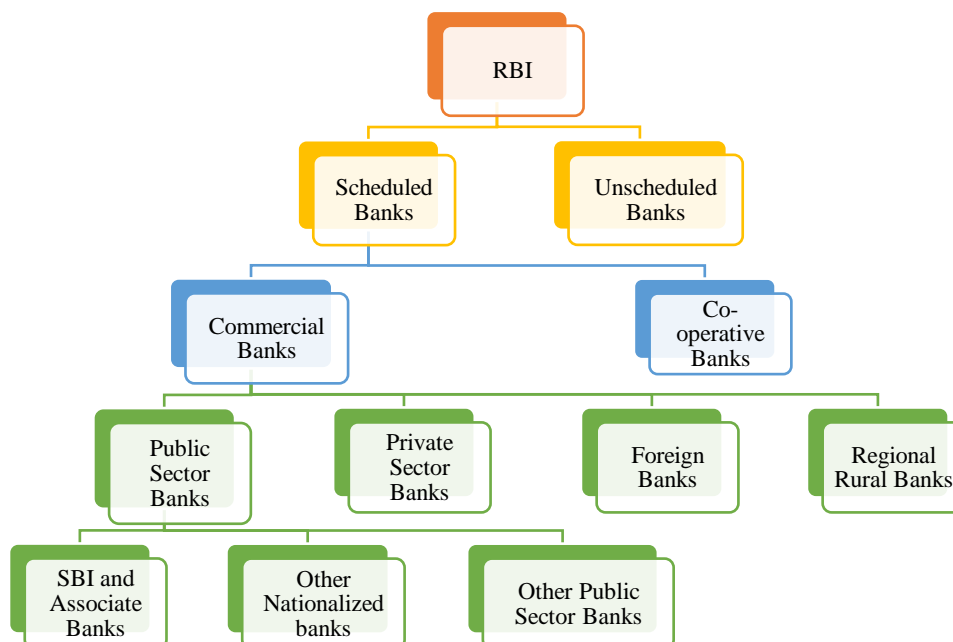
Several reforms were undertaken to strengthen the banking system in India. An efficient Banking system is the backbone of any economy. The liberalization and privatization efforts led to increased competition, compelling PSBs to compete with private and foreign banks under the same regulatory framework. (Banerjee and Velamuri, 2015). Profitability can be determined

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<sup>1</sup> I am thankful to my dissertation supervisor Prof. Swati Raju for mentoring me for this research work.

at a micro and macro level. At a micro level profit is required to keep the bank competitive, and at a macro level profitability is required to absorb external negative shocks and achieve stability (Al-Homaidi et.al; 2018). Bank profitability is influenced by a combination of internal and external factors, which can be broadly categorized into bank-specific, industry-specific, and macroeconomic determinants. Non-performing assets (NPAs) negatively affect profitability, as they represent loans that are not generating income and may require provisions for bad debts (Gaur and Mohapatra 2021; Bapat, 2017). The present study tries to analyse the trend in NPAs and its impact on profitability by considering ROA, and ROE as proxies.

As shown in the figure RBI is at the top of the banking sector. It regulates the entire banking system. RBI was established on 1<sup>st</sup> April 1935 by the Reserve Bank of India Act, of 1934. Banks can be categorized as Scheduled Banks and Unscheduled Banks. Banks listed under the second schedule of the RBI Act, of 1934 are called as scheduled banks. There are certain conditions that banks have to fulfil for including them in this schedule like the bank should have paid up capital and reserves of at least 0.5 million, and affairs are not conducted in a manner that harms the interest of depositors. Non-scheduled banks are those banks that are not included in the second schedule of the RBI Act, of 1934.



Source: Sanjiv Verma (2018), The Indian Economy

As depicted in Fig (1) Scheduled Banks are further classified into Commercial Banks and cooperative banks. Commercial banks are banks that deal with deposits and loans of business organizations. They issue bank checks, and drafts, and accept money on term deposits. A cooperative bank on the other hand belongs to its members, who are at the same time the owners and the customers of their bank. They function based on “no profit no loss”.

Commercial banks are further divided into Public Sector Banks (Here onwards, PSBs), Private Sector Banks (Here onwards, PVBs), Foreign Banks (Here onwards, FBs), and Regional Rural Banks (Here onwards, RRBs). SBI and Associate Banks, other Nationalized Banks, and Other Public Sector Banks collectively form the group of Public Sector Banks. PSBs are those banks where the majority of the stake is held by the GOI. E.g. SBI, Canara Bank, Union Bank etc. PVBs on the other hand are those banks where the majority of share capital is held by private individuals and registered as companies with limited liability. E.g. ICICI, HDFC, Axis Bank etc. FBs have their headquarters in a foreign country but have branches in our country. They are also registered as companies. E.g. HSBC, Citibank. RRBs are established to ensure sufficient institutional credit for agriculture and other rural sectors. At the end of March 2023, the Indian commercial banking space comprised 12 public sector banks (PSBs), 21 private sector banks (PVBs), 44 foreign banks (FBs), 12 SFBS, six PBs, 43 RRBs and two LABs. Of these 140 commercial banks, 136 were classified as scheduled while four banks were non-scheduled<sup>2</sup>.

Non-Performing Assets (NPA) are loans for which the principal or interest payment remained overdue for 90 days. Till 2003, a loan was considered non-performing if it was overdue for 180 days. This was reduced to 90 days by RBI in March 2003. NPAs can be classified into the

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<sup>2</sup> RBI (2022-23) Report on trend and progress of banking in India

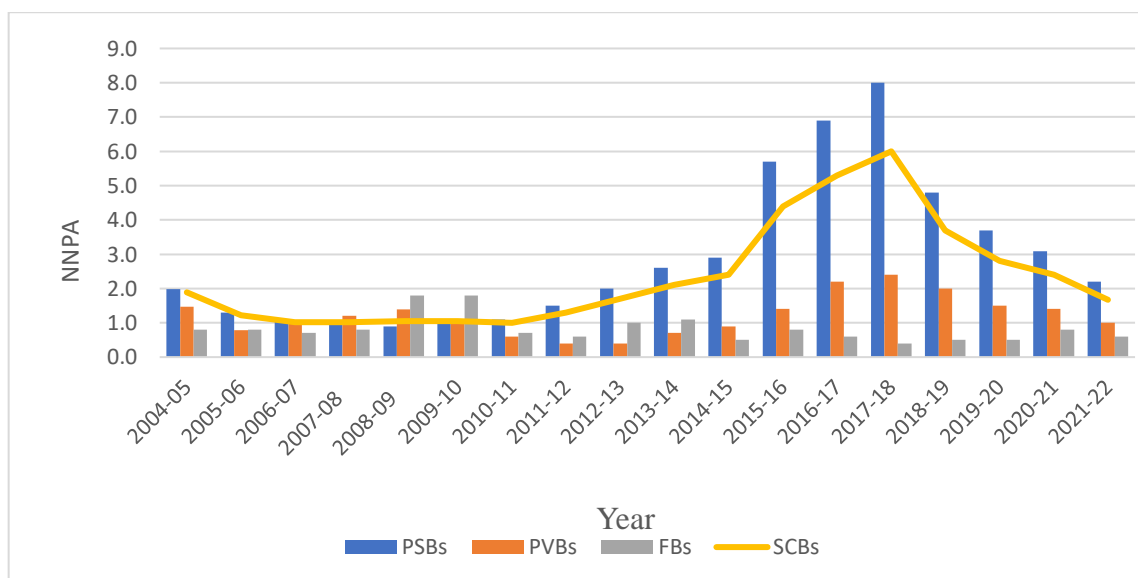
following categories. For Agriculture, if loan payments are not made for two cropping seasons loan is classified as NPA.

1. Sub-standard Assets – NPAs that have been past due for more than 12 months.
2. Doubtful Asset - NPAs that have been past due for at least 18 months.
3. Loss Asset – Loss is identified by banks but the amount is not written off wholly.

Narasimham Committee II (1998) recommended a reduction of the average NPAs of all banks from 15 to 3 percent by 2002.

To understand trends in NPAs present study takes into account entire Scheduled Commercial banks. The 3 bank groups of SCBs namely Public Sector Banks (PSBs), Private Sector Banks (PVBs), and Foreign Banks (FBs). Regional Rural Banks were excluded because of data unavailability. Let's consider the following graph

Figure 1 Bank Groupwise NNPA



Source: Author's computation

Figure one shows bank groupwise NNPA. The horizontal axis represents years and the vertical axis represents NNPA in percentage. NNPA trend for bank groups is presented from the year 2004-05 to 2021-22 i.e. for 18 years. The bar charts depict three bank groups: PSBs, PVBs,

and FBs, while the line represents SCBs. As is seen from the graph PSBs have high NNPA's compared with their counterparts here PVBs and FBs. But during the Financial Crisis of 2007-08 and some years after it, the above statement does not hold. In 2007-08 PVBs had higher NNPA's i.e. of 1.2 percent compared with PSBs of having 1.0 percent and FBs of having 0.8 percent. In 2008-09 FBs had high NNPA's i.e. 1.8 percent compared with PVBs having 1.4 percent and PSBs having 0.9 percent respectively. In 2009-10 again FBs had high NNPA's i.e. 1.8 percent compared with PSBs and PVBs having 1.1 percent each. If we consider individual bank group-wise trend then the PSBs NNPA shows a continuous decline from 2004-05 to 2008-09. After 2008-09 i.e. after the financial crisis NNPA's of PSBs started increasing continuously till 2017-18. But again after 2017-18 i.e. from 2018-19, NNPA's of PSBs started declining. NNPA's of PVBs showed a declining trend during 2004-05 and 2005-06. It started rising from 2006-07 to 2008-09. From 2008-09 and onwards it started declining up to 2012-13. From 2012-13 to 2018-19 it increases and then starts falling. Like PVBs, FBs NNPA shows a declining trend up to 2006-07. During 2007-08 to 2009-10 it increases. During 2010-11 and 2011-12, it drastically decreases and then again increases from 2012-13. From 2014-15 onwards it has shown an average declining trend. If we consider the entire SCBs class the NNPA's declined during 2004-05 and 2005-06. It remains on an average constant between 2006-07 to 2010-11. From 2010-11 to 2017-18 it increases and then starts falling. From 2010-11 to 2014-15 it steadily increased, but after 2014-15 it increased at a much more rapid rate till 2017-18 and then drastically reduced from 2018-19 onwards. In short, It is evident from the figure that PSBs have higher NPAs compared to their counterparts, with FBs having the fewest NPAs on average. When considering SCBs, which include PSBs, PVBs, FBs, and RRBs, the trend shown by the line for SCBs closely resembles that of PSBs, as PSBs constitute a major portion of SCBs.

The present study tries to understand the variation of NPAs across various bank groups namely PSBs, PVBs, and FBs. It further analyses the impact of NPAs on the profitability of banks. Here, ROA and ROE are chosen as proxies for profitability so the present study examines the variation of ROA and ROE across bank groups. Additionally, it examines how NPAs respond when the dependent variable is ROA, and when the dependent variable is ROE. By taking into account other variables study finds out whether the impact of NPAs on bank profitability is much greater compared with other variables.

### **Review of Literature:**

Bank profitability is a multifaceted issue influenced by a range of internal factors such as bank size, asset quality, and operational efficiency, as well as external factors like inflation, interest rates, and economic growth. Effective management of these determinants is crucial for enhancing the profitability of banks (Seenaiyah, Rath, and Samantaraya, 2015; Bapat, 2017; Gaur and Mohapatra, 2021; Almaqtari et.al, 2018; Al-Homaidi et.al, 2018). For instance, larger banks with better asset management and higher capital ratios tend to exhibit higher profitability, as measured by return on assets (ROA) and return on equity (ROE) (Almaqtari et.al, 2018; Gaur and Mohapatra, 2021). Operational efficiency, indicated by the cost-to-income ratio, and the management of non-performing loans (NPLs) also play crucial roles, with higher NPLs and inefficiencies negatively impacting profitability (Bapat, 2017; Gaur and Mohapatra, 2021). Additionally, the number of branches and the leverage ratio are significant determinants, with a higher number of branches and better leverage management contributing positively to profitability (Al-Homaidi et.al, 2018).

Non-performing assets (NPAs) significantly impact bank profitability, as evidenced by various studies on the Indian banking sector. NPAs, which represent loans that are in default or close to being in default, fail to generate income for banks and instead become a financial burden, leading to reduced profitability and efficiency. (Seenaiyah, Rath and Samantaraya, 2015). The

composition of NPAs has also shifted, with a significant portion now emanating from non-priority sectors, which accounted for 76.5 percent of NPAs in 2017, compared to 37 percent in 2008 (Vasudevan, 2018). This shift is linked to the discretionary powers given to bank executives and boards, leading to lax diligence in loan processing and monitoring (Vasudevan, 2018).

The impact of NPAs on profitability is profound, as higher NPAs necessitate increased provisioning, which directly reduces net earnings (Seenaiah, Rath, and Samantaraya, 2015). The relationship between NPAs and profitability is further complicated by the variations in NPA percentages across different types of banks and ownership categories. For instance, public sector banks have higher average NPAs compared to private and foreign banks, which can be attributed to differences in efficiency and prudential practices (Rajaraman, 1999). Additionally, the need for a comprehensive database on NPAs is emphasized to better manage credit risks and ensure timely recovery of loans, which is crucial for maintaining capital adequacy and preventing erosion of capital (Rao, 2018)

Non-Performing Assets (NPAs) significantly impact bank profitability in the long term by eroding the financial health and operational efficiency of banks. NPAs represent loans that are not generating income, leading to a negative spread and reducing the bank's net earnings (Seenaiah, Rath, and Samantaraya, 2015). The adverse impact of NPAs on profitability is further compounded by the high cost of provisions required to cover potential losses, which negatively affects the return on assets (ROA) and return on equity (ROE) (Seenaiah, Rath, and Samantaraya, 2015).

Studies have shown that provisions for NPAs bear a negative impact on bank performance, with no significant impact on ROA but a detrimental effect on ROE (Gaur and Mohapatra, 2021).



The Narasimham Committee-II's recommendation to reduce average NPAs from 15 to 3 percent by 2002 highlights the long-standing recognition of the detrimental impact of NPAs on bank profitability and the need for stringent measures to address this issue (Seenaiah, Rath and Samantaraya, 2015).

The profitability of Indian banks, measured by return on assets (ROA) and return on equity (ROE), is influenced by both internal factors like asset quality, liquidity, and operating efficiency, and external factors such as GDP growth and interest rates (Almaqtari et.al, 2018). Dynamic panel data analysis confirms that while diversification does not significantly affect profitability, the cost of deposits adversely impacts ROE but not ROA, suggesting a closer relationship between deposit costs and equity returns (Seenaiah, Rath, and Samantaraya, 2015, Almaqtari et.al, 2018). The profitability of Indian banks is a complex interplay of various determinants, with significant variations observed across different bank groups, including public sector banks, private sector banks, and foreign banks, each influenced by their unique operational and economic environments (Bapat, 2017; Seenaiah, Rath and Samantaraya, 2015; Gaur and Mohapatra, 2021; Gupta and Mahakud, 2020; Almaqtari et.al, 2018).

Most of the studies in the literature use the DEA framework. However, panel data offers added advantages over DEA by examining particular entities over a period of time. Many studies focus on individual banks, providing only a micro-level perspective. To gain a macro-level view of the economy, this study selects three significant bank groups: Public, Private, and Foreign. This study specifically examines the impact of NPAs on profitability proxies, namely ROA and ROE, using a panel data set. Additionally, it investigates whether profitability in the previous period affects profitability in the subsequent period.

## **Methodology**

The present study uses variables ROA, ROE, NNPA, CoD, Liquidity Management, wages, and NIM. Variables along with their formulas and definitions are given below.

### Return on Asset (ROA)

Return on Assets is one of the indicators of profitability in the banking system. It shows how much profit a bank can generate from its assets. The formula for it is

$$ROA = \frac{Net\ Income}{Average\ total\ Assets} \times 100$$

High ROA is good for banks. Higher ROA implies banks are efficiently utilizing their assets. High ROA leads to an increase in the capital of banks, which in turn improves their lending. Banks with low ROA usually have more assets involved in generating profit, while high ROA implies fewer assets involved in operating profit.

### Return of Equity (ROE)

It measures profit earned by banks by utilising shareholders' assets. Equity is nothing but shareholders' assets. It represents companies' potential to provide returns to shareholders. The formula for it is

$$ROE = \frac{Net\ Income}{Average\ total\ Equity} \times 100$$

A higher ROE indicates banks are efficiently utilizing shareholders' funds and giving good returns to them. Investors found ROE as a good metric for assessing the market value and growth of banks.

### Non-Performing Assets

Non-performing assets are those assets where principal or interest payments remain overdue for 90 days. NPAs are categorized into two gross and net. Gross NPAs are the total of all the

loans that are defaulted by individuals. Net NPAs are the amount left after the provision amount is deducted from gross NPAs. Net NPAs have an advantage over gross NPAs as it is more accurate. (Gaur and Mohapatra, 2021). In the present study, Net NPAs are considered. For convenience ratio is named NNPA. Formula is simply

$$NNPA = \frac{\text{Net Non Performing Assets}}{\text{Net Advance}} \times 100$$

Data for this variable is extracted from the RBI website. The steps are RBI website > Home > Statistics > Database on Indian Economy > Publications > Handbook of Statistics on the Indian Economy > Part 1: Annual Series > Money and Banking > Table number 54. It contains bank group-wise data related to NPAs from 1996-97 to 2021-22. As for other variables, data is not available from so long back, present study considered data from 2004-05 to 2021-22.

#### Cost of Deposits (CoD)

It shows the expenses incurred by banks while managing aggregate deposits generated by them.

The formula is as follows

$$CoD = \frac{\text{Total Interest Expense}}{\text{Total Deposits}} \times 100$$

It is used to see whether banks can manage their deposits efficiently or not. Lower CoD indicates that a bank generates more income from its deposits compared to interest expense, and vice versa.

#### Liquidity Management

We can say it is an indicator of the Liquidity management of banks. In the present study, it is coded as Liq\_Mgnt for simplicity. The formula is as follows

$$Liq_{Mgnt} = \frac{\text{Cash}}{\text{Deposits}} \times 100$$

A higher cost-to-deposit ratio indicates banks are holding a larger proportion of their deposits in cash, which affects their liquidity management severely, and vice versa.

### WAGE

It is the sum of the wages paid to the employees by the bank management usually biannually.

The formula for it is

$$WAGE = \frac{Wage\ Bills}{Total\ Expenditure} \times 100$$

### Net Interest Margin (NIM)

NIM measures the difference between the interest income generated by assets of banks like loans and the interest expense paid out on banks' liabilities, like deposits. Higher NIM indicates banks are earning more from their interest-giving assets compared with the interest they pay on liabilities. Formula is

$$NIM = \frac{Net\ Interest\ Income}{Average\ interest\ earning\ assets} \times 100$$

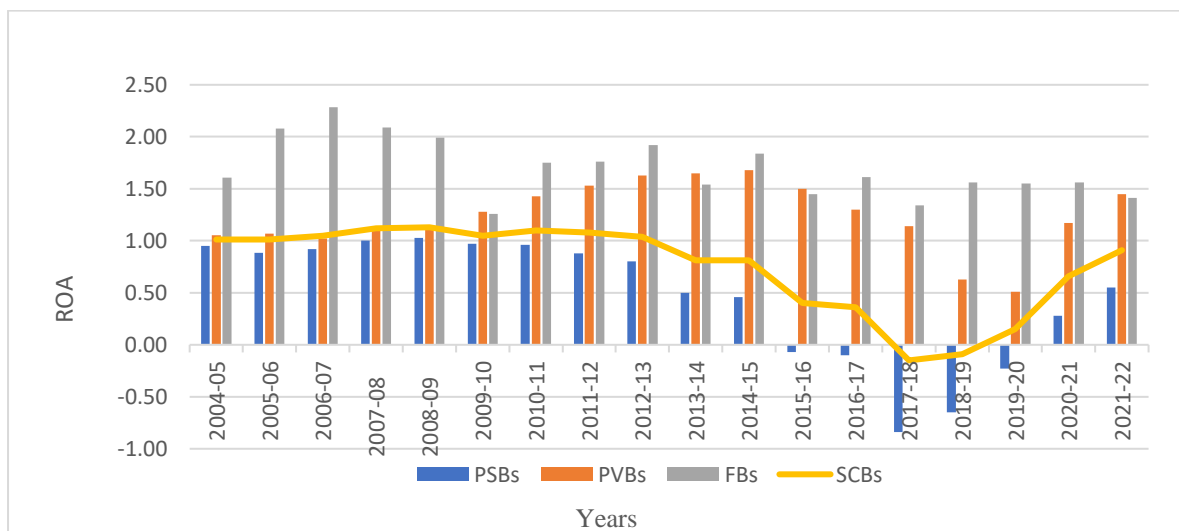
Variables ROA, ROE, CoD, Liq\_Mgnt, WAGE, and NIM used in the present study are extracted from the RBI website. Steps undertaken are RBI website Home > Statistics > Database on Indian Economy > Publications > Statistical tables relating to banks in India > Tables based on annual accounts > Table Number 10 Bank group-wise select Ratio of Scheduled Commercial Banks.

### Trends in ROA

To understand trends in ROA present study takes into account entire Scheduled Commercial banks, and 3 bank groups of SCBs namely Public Sector Banks (PSBs), Private Sector Banks (PVBs), and Foreign Banks (FBs). Regional Rural Banks were excluded because of data unavailability. As depicted in the graph FBs ROA compared with its counterparts, remains on an average high from 2004-05 to 2021-22 except for years 2009-10, 2013-14, 2015-16 and

2021-22. In 2009-10, 2021-22 PVBs ROA is slightly greater than FBs. Not a drastic but somewhat visible decrease in ROA of FBs compared to PVBs occurred in 2013-14 and 2015-16. PSBs ROA is always less compared with FBs. If we compare PSBs with PVBs then PSBs ROA is always less compared with PVBs. Now if we consider individual bank group-wise trend of ROA then we find that PSBs ROA started increasing from 2006-07, but the trend has not sustained for a longer period. From 2009-10 i.e. after the Financial Crisis ROA of PSBs continuously declined till 2019-20. It is slightly improved in 2021-22 compared to the 2020-21 level. We can see that demonetisation, GST, and the COVID-19 pandemic affect the banking system. Profit generated by banking especially PSBs by taking ROA as a proxy for profitability is negative.

Figure 2: Bank Group-wise ROA



Source: Author’s computation

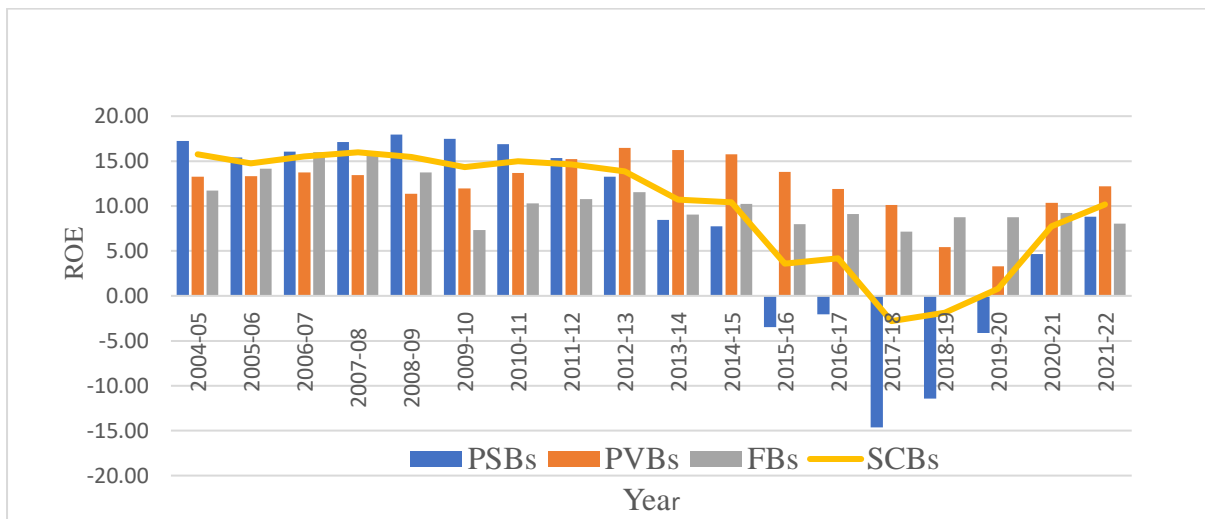
If we consider PVBs ROA then between 2004-05 to 2008-09 it remains constant on average. Suppose started increasing thereafter till 20014-15. From 2015-16 to 2019-20 it falls continuously and again increases in 2020-21 to 2021-22. FBs ROA increased till 2006-07. From 2007-08 it started falling till 2009-10. Again, increased from 2010-11 till 2012-13. Fall in 2013-14. Slightly increased in 2014-15. Falls in 2015-16. Slightly increase in 2016-17. Falls

in 2017-18 and then increases for 3 years i.e. from 2018-19 to 2020-21 and then again falls in 2021-22. So basically, FBs do not show any consistently increasing or decreasing trend but we can say in the initial period i.e. from 2004-05 to 2006-07 ROA of FBs increased and then fell till 2009-10 and again increased in later periods but increased in later periods is not as much as that of initial periods. If we consider all SCBs then ROA is constant on an average till 2012-13, thereafter falls till 2019-20, and again increases in 2020-21, 2021-22.

### Trends in ROE

To understand trends in ROE present study takes into account entire Scheduled Commercial banks, and 3 bank groups of SCBs namely Public Sector Banks (PSBs), Private Sector Banks (PVBs), and Foreign Banks (FBs).

Figure 3: Bank Group-wise ROE



Source: Author's computation

If we compare the ROE of PSBs with its counterparts then PSBs ROE is always high till 2011-12. From 2012-13 to 2021-22 PSBs ROE remained continuously low compared with PVBs. In 2012-13 PSBs ROE was greater compared with FBs but smaller compared with PVBs. From

2013-14 onwards PSBs ROE continuously remained low compared with FBs and PVBs till 2020-21. Again in 2021-22, PSBs ROE is greater than FBs but slightly lower than PVBs.

Comparing PVBs and FBs except for 2005-06 to 2008-09, 2018-19 to 2019-20, PVBs ROE is higher than FBs. If we consider individual bank groups then PSBs ROA declined in 2005-06. From 2006-07 it increases till 2008-09. From 2009-10 it continuously declines and even becomes negative between till 2019-20. It rises from 2020-21 again. PVBs ROE increases from 2004-05 to 2006-07. It declined in 2007-08 and 2008-09. It started increasing from 2009-10 till 2012-13. From 2013-14 it continuously declines till 2019-20 and rises very rapidly in 2020-21 and 2021-22.

FBs ROE started increasing from 2005-06 and trend continuous till 2007-08. It declines drastically in 2008-09 and 2009-10. It increases from 2010-11 till 2012-13. It falls in 2013-14. Increases in 2014-15. Decreases in 2015-16. Increases in 2016-17. Decreases in 2017-18, increases from 2018-19 till 2020-21 and again falls in 2021-22.

If we consider all SCBs then on average ROE lies between 14 percent to 15 percent range till 2012-13. It drastically fell thereafter for several consecutive periods, even became negative in between and started showing an increasing trend in the last 3 years.

Table 1 Descriptive Statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
<i>ROA</i>	54	1.20	0.52	0.07	2.28
<i>ROE</i>	54	11.55	4.08	2.05	17.94
<i>NNPA</i>	54	1.64	1.56	0.40	8.00
<i>CoD</i>	54	4.89	1.16	2.13	6.72
<i>Liq_Mgnt</i>	54	7.21	2.20	4.83	16.95
<i>WAGE</i>	54	15.54	3.76	8.73	23.79
<i>NIM</i>	54	3.11	0.60	2.08	4.36

Source: Authors calculations based on RBI Database.

Table 1 provides information related to the mean, standard deviation, minimum and maximum values of variables. As shown in Table 1 mean ROA for all bank groups is 1.20 whereas the mean ROE is 11.55. Among the explanatory variables, NIM shows a low standard deviation. A more detailed analysis of the same variable by considering 3 bank groups PSBs, PVBs, and FBs is given in Table 2.

Table 2: Bank Group-wise Descriptive Statistics

Bank Groups	<i>ROA</i>	<i>ROE</i>	<i>NNPA</i>	<i>CoD</i>	<i>Liq_Mgnt</i>	<i>WAGE</i>	<i>NIM</i>
PSBs							
Mean	0.67	11.79	2.88	5.44	6.22	16.35	2.49
Standard Deviation	0.33	5.52	2.15	0.86	1.21	3.60	0.30
PVBs							
Mean	1.24	12.31	1.21	5.46	6.92	12.11	3.13
Standard Deviation	0.33	3.43	0.57	0.94	1.44	1.51	0.34
FBs							
Mean	1.70	10.55	0.82	3.78	8.50	18.16	3.71
Standard Deviation	0.28	2.79	0.40	0.78	2.94	2.88	0.38

Source: Author's estimation

The mean ROA for PSBs is less compared with PVBs and FBs. As ROA is considered a proxy for profitability, low ROA implies that the public sector bank group is unable to utilise its assets to generate profits. PVBs have the highest average ROE i.e. 12.30 compared with PSBs and FBs. This means that PVBs are better at utilizing their shareholders' equity to generate profit compared with their counterparts. Mean NNPA is higher for PSBs than PVBs and FBs. It indicates that PSBs have large non-performing assets. If we see the CoD variable then FBs have low CoD. Low CoD is beneficial for banks because it means that FBs pay less interest on the funds they gathered from depositors. The Liq\_Mgnt variable is higher for FBs, which



indicates that a larger proportion of their deposits are in cash which may not be a very good sign. The average WAGE is higher for FBs than its counterpart. Average NIM is also higher for FBs which indicates that banks are earning more interest income from their assets e.g. loans compared with its interest expense. Overall, this table tells us that if we rank the bank groups based on the above-given variables then FBs have performed well followed by PVBs and then followed by PSBs.

Table 3 (1) Correlation Matrix of Variables (ROA)

Variables	<i>ROA</i>	<i>NNPA</i>	<i>CoD</i>	<i>Liq_Mgnt</i>	<i>WAGE</i>	<i>NIM</i>
<i>ROA</i>	1.00					
<i>NNPA</i>	-0.66	1.00				
<i>CoD</i>	-0.37	0.22	1.00			
<i>Liq_Mgnt</i>	0.37	-0.34	-0.48	1.00		
<i>WAGE</i>	0.16	-0.05	-0.67	0.27	1.00	
<i>NIM</i>	0.82	-0.55	-0.50	0.29	0.35	1.00

Source: Author's estimation

The correlation matrix helps us to see whether there exists a problem of multicollinearity. As it is seen from Table 3 (1) none of the explanatory variables is strongly correlated with each other. Generally, when the correlation is greater than 0.80 there exists a problem of multicollinearity, but here there is no problem of multicollinearity.

Table 3 (2) Correlation Matrix of Variables (ROE)

Variables	<i>ROE</i>	<i>NNPA</i>	<i>CoD</i>	<i>Liq_Mgnt</i>	<i>WAGE</i>	<i>NIM</i>
<i>ROE</i>	1.00					
<i>NNPA</i>	-0.37	1.00				
<i>CoD</i>	0.24	0.22	1.00			
<i>Liq_Mgnt</i>	0.07	-0.34	-0.48	1.00		
<i>WAGE</i>	-0.06	-0.05	-0.67	0.27	1.00	
<i>NIM</i>	0.07	-0.55	-0.50	0.29	0.35	1.00

Source: Author's estimation

Table 3 (2) also shows that there is no problem of multicollinearity as none of the explanatory variables is highly correlated with each other.

Besides this multicollinearity is also checked by using VIF.

Table No. 4: Multicollinearity

Variable	VIF	1/VIF
<i>dWAGE</i>	1.68	0.60
<i>dCoD</i>	1.67	0.60
<i>dLiq_Mgnt</i>	1.15	0.87
<i>dNIM</i>	1.13	0.88
<i>NNPA</i>	1.11	0.90
<i>Mean VIF</i>	1.35	

Source: Author's estimation

None of the explanatory variables have VIF above 10, and the problem of multicollinearity no longer holds.

### Model Specification

Panel data are repeated observations on the same cross-section, observed for several periods. Short panel, meaning a large cross-section of individuals observed for a few periods, whereas long panel meaning a small cross-section of countries observed for many periods.<sup>3</sup> (Cameron and Trivedi, 2005). In other words, we can say that a short panel is one in which N is infinite and T is finite, whereas a long panel is one in which T is infinite and N is finite. 2<sup>nd</sup> case of T being infinite and N being finite applies to the current study.

The present study uses Static Panel Data models. The present study considers ROA, and ROE as dependent variables, and NNPA, CoD, Liq\_Mgnt, WAGE, and NIM as explanatory variables. 3 bank groups namely PSBs, PVBs, and FBs are considered. As the time component

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<sup>3</sup> Cameron A. and Trivedi P. Microeconometrics Methods and Applications (2005)

dominates stationarity is checked. To check for stationarity, the Levin Lin Chu unit root test was performed, whose Null hypothesis is that Panels contain unit roots and an alternate hypothesis is that panels are stationary. In the stationarity test  $p$ -values obtained for ROA, ROE, and NNPA were less than 0.05. The rule says that when  $p < 0.05$ , reject the Null hypothesis, here panel contains a unit root. So, here we will accept the alternate hypothesis and say that ROA, RoE, and NNPA are stationary at their level forms. The rest of the variables are stationary at their first difference. The results obtained from performing the Levin Lin Chu unit root test for all the variables considered in this study are in the appendix section. The model is formed by considering  $ROA, ROE, NNPA, dCoD, dLiq_{Mgnt}, dWAGE$  and  $dNIM$  variables. Note that  $d$  indicates that the variables are the first difference.

Fixed effect models used in the study are as follows

1.  $ROA_{it} = \alpha_{it} + \beta_1 NNPA_{it} + \beta_2 dCoD_{it} + \beta_3 dLiq_{Mgnt_{it}} + \beta_4 dWAGE_{it} + \beta_5 dNIM_{it} + u_{it}$
2.  $ROE_{it} = \alpha_{it} + \beta_1 NNPA_{it} + \beta_2 dCoD_{it} + \beta_3 dLiq_{Mgnt_{it}} + \beta_4 dWAGE_{it} + \beta_5 dNIM_{it} + u_{it}$

Where  $i = 1, 2, 3$  and  $t = 1, 2, 3, \dots, 18$

In the above equations, ROA and ROE are considered as dependent variables. Notice that the intercept term has  $i$  subscripts which suggest that intercept may differ across bank groups but it does vary over time, i.e. it is time invariant. On the other hand, the slope coefficient of the regressors does not vary across individuals or over time.

Random Effect model used in the present study are as follows

- I.  $ROA_{it} = \alpha + \beta_1 NNPA_{it} + \beta_2 dCoD_{it} + \beta_3 dLiq_{Mgnt_{it}} + \beta_4 dWAGE_{it} + \beta_5 dNIM_{it} + \eta_{it}$

$$\text{II. } ROE_{it} = \alpha + \beta_1 NNPA_{it} + \beta_2 dCoD_{it} + \beta_3 dLiqMgnt_{it} + \beta_4 dWAGE_{it} + \beta_5 dNIM_{it} + \eta_{it}$$

Where  $\alpha_i = \alpha + \varepsilon_i$

and  $\eta_{it} = \varepsilon_i + u_{it}$

In this random effect models instead of treating  $\alpha_i$  as fixed, it is assumed as a random variable with the mean value  $\alpha$ . The intercept of an individual bank group can be expressed

as  $\alpha_i = \alpha + \varepsilon_i$

where  $\varepsilon_i \sim [0, \sigma^2]$

Disturbance term consists  $\eta_{it}$  which consists of two components:  $\varepsilon_i$  which individual specific error component and error component  $u_{it}$  which varies over the cross-sections as well as time.

The random effect model assumes that individual component is not correlated across both cross-section and time series units.  $\eta_{it}$  is not correlated with any of the explanatory variables.<sup>4</sup>

### **Empirical Evidence:**

All the above models were estimated by using STATA. The results are attached in the appendix. Hausman test was performed to choose between random effect and fixed effect. Hausman favoured a fixed effect for ROA being a dependent variable and a random effect for ROE being the dependent variable which seems unrealistic. Individual specific effects i.e. intercept terms vary across different bank groups or are specific to each bank group. So, they affect bank performance but in random effect, we are saying that individual specific effect term has a constant mean ( $\alpha$ ) that is all the bank groups will have the same individual-specific effect which may not hold. So, even if Hausman is favouring random effect in the case of ROE, the present study considers fixed effect models.

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<sup>4</sup> Gujarati D., Porter D. Basic Econometrics, McGraw-Hill (2009)

The results of the fixed effect model by considering equation (1) are as follows

Fixed-effects (within) regression      Number of obs = 51

Group variable: bank\_groups            Number of groups = 3

$R^2$

within = 0.2650

between = 0.8079

overall = 0.3758

Obs per group:

min = 17

avg = 17.0

max = 17

$F(5, 43) = 3.10$

Prob = 0.0178

Corr( $u_i, Xb$ ) = 0.4057

<i>ROA</i>	Coef.	Std. Err.	<i>t</i>	<i>P&gt;t</i>	[95 percent Conf. Interval]
<i>NNPA</i>	-0.09	0.03	-2.61	0.01	-0.15 -0.02
<i>dCoD</i>	0.03	0.08	0.40	0.70	-0.14 0.20
<i>dLiqMgnt</i>	-0.01	0.02	-0.25	0.80	-0.05 0.04
<i>dWAGE</i>	-0.02	0.02	-1.08	0.29	-0.07 0.02
<i>dNIM</i>	0.41	0.24	1.68	0.10	-0.08 0.90
Cons	1.35	0.07	20.02	0.00	1.21 1.48
$\sigma_u$	0.43				
$\sigma_e$	0.29				

$\rho = 0.695673$  (fraction of variance due to  $u_i$ )

$F$  test that all:  $u_i = 0$   $F(2, 43) = 26.72$        $Prob > F = 0.0000$

Source: Author's estimation

Here, we have considered *ROA* as a dependent variable. And *NNPA*, *dCoD*, *dLiq\_Mgnt*, *d\_WAGE*, *dNIM* as explanatory variable. As  $Prob > F = 0.0178$  which is less than 0.05, it means that the model formed is correct. This is an  $F$  test whose Null hypothesis is that coefficients are not statistically significant. As the value is less than 0.05, we failed to accept the null hypothesis, which means that coefficients in the model are jointly different from zero.

Generally, the  $\beta$  coefficient indicates the change in ROA when the explanatory variables change by 1 unit over time. The present study considered ROA, and NNPA at their level forms because they were stationary at their level forms. Other variables become stationary at their first difference. So, the interpretation is that a 1-unit increase in NNPA leads to a -0.08 decrease in ROA. We can say that the NNPA reduces the profitability of banks. 1 unit change in Cost of deposits ( $dCoD$ ) leads to a 0.03 increase in ROA and so on.  $P > t$  is the two-tailed p-value test hypothesis which tells us that each coefficient is different from 0. If the value is lower than 0.05, we will reject the null and conclude that the explanatory variable has a significant effect on the outcome variable. Notice that for the constant term and NNPA, we are getting  $P > t$  less than 0.05 or it is easily noticeable that the  $t$  value is lying outside the confidence interval. When Calculated value  $>$  Critical value we reject the null hypothesis of coefficients equal to zero. So here net non-performing assets significantly reduce the profitability of bank groups. The constant term which comprises individual specific, unobserved factors that are specific to each bank group which we are unable to capture is also significantly impacting the profitability of banks.

The results of the fixed effect model by considering equation (2) are as follows

Fixed-effects (within) regression	Number of obs = 51
Group variable: bank_groups	Number of groups = 3
$\mathcal{R}^2$ :	Obs per group:
within = 0.3270	min = 17
between = 0.0176	avg = 17.0
overall = 0.2283	max = 17
	$F(5, 43) = 4.18$
$\text{Corr}(u_i, Xb) = -0.4390$	$\text{Prob} > F = 0.0035$

<i>ROE</i>	Coef.	Std. Err.	<i>t</i>	<i>P&gt;t</i>	[95 percent Conf. Interval]	
<i>NNPA</i>	-1.31	0.41	-3.22	0.00	-2.14	-0.49
<i>dCoD</i>	1.18	1.05	1.12	0.27	-0.94	3.30
<i>dLiqMgnt</i>	0.05	0.30	0.15	0.88	-0.56	0.65
<i>dWAGE</i>	-0.19	0.27	-0.68	0.50	-0.74	0.36
<i>dNIM</i>	3.70	3.03	1.22	0.23	-2.41	9.82
Cons	13.62	0.84	16.26	0.00	11.93	15.31
$\sigma_u$	1.92					
$\sigma_e$	3.58					

$\rho = 0.22$  (fraction of variance due to  $u_i$ )

*F* test that all  $u_i = 0$  :  $F(2, 43) = 3.36$  *Prob* > *F* = 0.04

Source: Author's estimation

As earlier this model is also specified correctly. In this model, also constant and non-performing assets are affecting profitability measured by ROE. The coefficient of NNPA is much higher here than the fixed effect model. To see whether last year's profitability is affecting the current profit of the banks. The present study introduces lags of dependent variables i.e. ROA and ROE.

Models (1) and (2) specified above will then look like as follows

$$A. ROA_{it} = \alpha + \beta_1 ROA_{it-1} + \beta_2 ROA_{it-2} + \beta_3 NNPA_{it} + \beta_4 dCoD_{it} + \beta_5 dLiqMgnt_{it} + \beta_6 dWAGE_{it} + \beta_6 dNIM_{it} + \eta_{it}$$

$$B. ROE_{it} = \alpha + \beta_1 ROE_{it-1} + \beta_2 ROE_{it-2} + \beta_3 NNPA_{it} + \beta_4 dCoD_{it} + \beta_5 dLiqMgnt_{it} + \beta_6 dWAGE_{it} + \beta_6 dNIM_{it} + \eta_{it}$$

The above models (A) and (B) are estimated by using STATA software. The results are as follows:

### Estimation of Model (A)

Fixed-effects (within) regression      Number of obs    =    48  
 Group variable: bank\_groups            Number of groups =    3

$\mathcal{R}^2$ :    Obs per group:  
 within = 0.5030                              min = 16  
 between = 0.9991                            avg = 16.0  
 overall = 0.7806                            max = 16

Corr( $u_i, Xb$ ) = 0.7514                       $F(7, 38) = 5.49$   
      $Prob > F = 0.0002$

ROA	Coef.	Std. Err.	t	P>t	[95 percent Conf. Interval]
$ROA_{t-1}$	0.61	0.16	3.89	0.00	0.29    0.93
$ROA_{t-2}$	-0.11	0.16	-0.72	0.48	-0.43   0.20
NNPA	-0.04	0.03	-1.18	0.24	-0.10   0.03
dCoD	-0.02	0.07	-0.32	0.75	-0.17   0.13
dLiq_Mgmt	0.00	0.02	0.04	0.97	-0.04   0.04
dWAGE	-0.03	0.02	-1.74	0.09	-0.07   0.01
dNIM	0.33	0.24	1.36	0.18	-0.16   0.82
_cons	0.66	0.21	3.20	0.00	0.24    1.08
$\sigma_u$	0.22				
$\sigma_e$	0.25				

$\rho = 0.438682$  (fraction of variance due to  $u_i$ )  
 F test that all  $u_i = 0$ :  $F(2, 38) = 3.50$   $Prob > F = 0.0403$

Source: Author's estimation

It is found that last year's profitability does affect the current profitability of banks.  $t$ -value got for 1 period lag of ROA is 3.89 which lies beyond the confidence interval of 95 percent. A 1 percent increase in the last period's profitability (considering ROA as a proxy) increases current profitability by 0.61. The constant is also significant here which means that individual-specific



effects that are unobservable do impact profitability. This is the same as the above models. The second lag of ROA is not significant which implies that previous 2 years profitability will not have any impact on current profitability.

Estimation of Model (B)

Fixed-effects (within) regression                      Number of obs = 48  
 Group variable: bank\_groups                              Number of groups = 3

$\mathcal{R}^2$ :    Obs per group:  
 within = 0.5673    min = 16  
 between = 0.3025    avg = 16.0  
 overall = 0.5567    max = 16

$F(7, 38) = 7.12$   
 $Corr(u_i, Xb) = -0.0358$                                        $Prob > F = 0.0000$

<i>ROE</i>	Coef.	Std. Err.	<i>t</i>	<i>P&gt;t</i>	[95 percent Conf. Interval]
<i>ROE</i>					
<i>ROE</i> <sub><i>t</i>-1</sub>	0.73	0.17	4.33	0.00	0.39 1.07
<i>ROE</i> <sub><i>t</i>-2</sub>	-0.20	0.17	-1.21	0.23	-0.53 0.13
<i>NNPA</i>	-0.46	0.41	-1.13	0.27	-1.29 0.37
<i>dCoD</i>	-0.05	0.93	-0.06	0.95	-1.93 1.83
<i>dLiq_Mgnt</i>	0.09	0.25	0.37	0.72	-0.42 0.61
<i>dWAGE</i>	-0.31	0.23	-1.34	0.19	-0.78 0.16
<i>dNIM</i>	1.89	2.95	0.64	0.53	-4.08 7.86
<i>_cons</i>	5.98	2.19	2.73	0.01	1.54 10.42
$\sigma_u$	0.82				
$\sigma_e$	2.99				

$\rho = 0.7029634$  (fraction of variance due to  $u_i$ )  
 $F$  test that all  $u_i=0$ :  $F(2,38) = 0.71$   $Prob F = 0.4976$

Source: Author's estimation

It is found that last year's profitability does affect the current profitability of banks.  $t$ -value got for 1 period *lag* of *ROE* is 4.33. A 1 percent increase in the last period's profitability (considering *ROE* as a proxy) increases current profitability by 0.73. The second *lag* of *ROE* is not significant which implies that previous 2 years profitability will not have any impact on current profitability.

As there is no heteroskedasticity and autocorrelation problem therefore robust standard errors are not reported. Heteroskedasticity and autocorrelation results are attached in the appendix. Breusch Pagan's LM test is performed to check for heteroskedasticity. The first test is performed for Model (1) given above where the dependent variable is *ROA*, where  $\chi^2(3) = 0.468$ ,  $Pr = 0.9259$  is found. It implies an absence of heteroskedasticity. The test is performed for Model (2) given above where the dependent variable is *ROE*, where  $\chi^2(3) = 1.184$ ,  $Pr = 0.7569$  which implies an absence of heteroskedasticity. The test is performed for models where lags are introduced. In both of these models, Model (A) and Model (B),  $\chi^2(3) = 0.901$   $Prob = 0.825$ ,  $\chi^2(3) = 1.336$   $Prob = 0.7207$  respectively which implies there is no problem of heteroskedasticity. The results of this test are attached in the appendix. Serial correlation is also checked as a time component dominant in the present study. Wooldridge test for autocorrelation in panel data gives,  $F(1,2) = 2.104$ ,  $Prob > F = 0.2840$  as  $p$  is greater than 0.05 we will accept the null of no first-order correlation.

### **Conclusion:**

The present study analyses trends in non-performing assets and profitability proxies i.e. *ROA*, and *ROE* over 18-year periods for 3 bank groups namely *PSBs*, *PVBs*, and *FBs*. Non-performing assets of *PSBs* are somewhat higher compared with their counterparts. For seeing the relationship between *NPAs* and Profitability fixed effect models of panel data sets are used in the study. Models confirm that *NPAs* affect the profitability of banking groups in India. To

see whether last year's profitability affected the current profitability of bank groups lags of dependent variables were introduced on the right-hand side which is the lag of the dependent variable and is considered as the explanatory variable. 2 lags were introduced to see the significance. Results stated that last year's profitability affect current profitability. Several tests like the Levin-Lin-Chu test for stationarity, Breusch Pagan's test for heteroskedasticity, and Wooldridge test to check for autocorrelation, were performed.

As the huge accumulation of NPAs affects profitability and people's trust in banks also gets affected banks must keep watch on its NPAs. NPAs have shown a decreasing trend in the last few years. Banks are undertaking huge write-offs, which is not bad. All the banks do this to clean up their balance sheets and maintain their good image in the minds of customers. PVBs are involved greatly in such write-offs than PSBs. Instead of doing Larger write off banks should focus on reducing or preventing NPAs. There are several ways to do this. Building as many business models as credit segment and customer segments, Loans given to big corporate funds need to be monitored, Diversification of funds, developing underwriting and turnaround skills.<sup>5</sup>

Limitations of the present study are that it considers just 3 bank groups and the period is just 18 years. The sample size for the panel data set is not much larger. To have a more detailed analysis of selected banks one can perform a study by considering individual banks with more explanatory variables.

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<sup>5</sup> Rangarajan C, Sambamurthy B., (2023) "NPAs, write off and recoveries, The Business Line, 11<sup>th</sup> July)

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## Appendix

### Stationarity test Results

Test: Levin - Lin - Chu - Unit Root Test

Variables	$I(0)$		$I(1)$	
	statistics	<i>p</i> -value	statistics	<i>p</i> -value
<i>ROA</i>	-2.05**	0.02		
<i>ROE</i>	-2.02**	0.02		
<i>NNPA</i>	-2.17**	0.02		
<i>CoD</i>	0.66	0.74	- 4.83***	0.00
<i>Liq_Mgnt</i>	0.00	0.50	-3.60***	0.00
<i>Wage</i>	-1.31	0.10*	-4.45***	0.00
<i>NIM</i>	-1.11	0.13	-3.51***	0.00

(\*denotes 10 percent significance, \*\* denotes 5 percent significance, \*\*\* denotes 1 percent significance.)

### Model Selection

Hausman Test Results

For Model (1) and (I)	
chi-square statistics	P -Value
42.31	0.00

Hausman Test Results

For Model (2) and (II)	
chi-square statistics	P - Value
5.25	0.39

### Test for Heteroskedasticity

BP-LM Test

Models	Dependent Variables	Statistics	<i>P</i> - Value
1	<i>ROA</i>	0.47	0.93
2	<i>ROE</i>	1.18	0.76
A	<i>ROA</i>	901.00	0.83
B	<i>ROE</i>	1.34	0.72

### Test for Autocorrelations

Wooldridge test for autocorrelation

Statistics	2.10
<i>P</i> - Value	0.28