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NPAs and profitability in Indian banks: an empirical analysis

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Abstract

As financial intermediaries, the commercial banks to a large extent depend on the performance of their lending as a critical source of earning. Due to increasing loan failures, the share of non-performing advances has increased substantially in recent years, thereby adversely impacting their profitability. The paper has examined the NPAs and profitability relationship by estimating the determinants of profitability of 39 public sector and private banks for the time period from 2005 to 2019. Using a set of bank specific and macroeconomic predictors of profitability, we found that NPA has negative impact on the rate of profit of the Indian banks. The study suggests that the banks must reduce their NPAs and operating cost to improve their profitability.

Keywords: NPAs, Bank performance, Bank profitability, Indian banks

JEL Classification: G21

Introduction

Growing incidence of non performing advances or loans can have potential adverse impact on the performance of the banks by squeezing their earnings, thereby reducing their profitability. Typically, a loan or advance becomes non-performing assets (NPAs) when a borrower defaults on the repayment of either the principal amount or unable to serve its debt. An NPA not only makes an asset unproductive, banks also fail to recover the principal capital. On the one hand, the interest earning of the bank declines; on the other side, there is a risk of recovery of principal amount. Falling interest income while directly impacts the profitability of a bank, under recovery of principal capital can result in erosion of bank's capital base. Beyond a threshold level, the combination of both can potentially affect the stability a bank.

The Reserve Bank of India (RBI) has defined the NPAs as those assets for which principal or interest payment remains overdue for a period of ninety days. The RBI has classified three types of assets within the category of NPAs—substandard assets, doubtful assets, and loss assets [24]. A substandard asset is one if it remains as an NPA for a period less than or equal to 12 months. Similarly, a doubtful asset is defined as an asset which has remained as an NPA for a period of more than 12 months. In case of loss asset, the loss has already been identified and the amount is not written off. The combination of the above three types of assets forms total NPAs in a bank. The NPAs reduce the profitability of banks due to increase in operating costs and decline in their interest margins [7, 19]. Studies have shown that a bank with high level of NPAs generally incurs 'carrying costs' on non-performing assets that reduces their profitability [4]. Also, a rise in NPA is likely to cause adverse impact on the profitability of the banks due to huge amount of provisioning requirements out of operating profits, which acts as a drain on profitability of banks. Thus, provisioning and carrying costs of NPAs act as drain on the profitability of the banks. Berger and Young [7] examined the relationship between bad loans and bank efficiency. They found that increasing incidence of loan failures forces banks to incur extra operating costs in the form of increased spending on monitoring of such assets and selling off of these loans. The banks are preoccupied with

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recovery procedures instead of concentrating on expanding their business. Higher the bank operating costs, lower will be the cost efficiency of banks and thus lower will be the profits. Operating costs include wages and salaries of employees and costs of running branch offices. These costs have an adverse impact on profitability of banks [30].

There are several factors, including non-performance of loans that can potentially affect the profitability of the banks. It can broadly be categorised into the bank specific, and macroeconomic factors. The bank-specific factors include non-performing advances [7, 19], deposits [20, 25], non-interest income [30] (Harbi 2019), interest income [5], operational efficiency [1, 17], and capital adequacy [6, 11]. The macroeconomic factor includes GDP growth [11, 30], rate of inflation [9], and interest rate [8, 11, 29].

The present paper empirically analyses the impact of NPAs on the profitability of Indian public sector and leading private banks. Accordingly, the determinants of profitability have been estimated. The paper spreads over five sections. The introduction section has provided the background of the paper. The methodology section elaborates on the empirical strategy, data, variables and estimation model. The findings of the empirical exercise have been presented in the results section. In the discussion section, the findings of the study have been discussed. The concluding remarks have been presented the conclusion section.

Literature review

Previous studies, those have examined the relationship between the non-performance of loans and profitability of banks, have overwhelmingly concluded that NPAs have adverse impact on the profitability of the banks. There are several other factors, including NPAs that affect profitability which have been discussed in the literature.

In a study of banking sector of the US, for the period between 1970 and 1976, Martin [18] concluded that a rise in NPAs hurt the earnings of the banks, which reduces the profitability of banks. Masood and Ashraf [19] studied 25 Islamic banks from 12 countries from the Middle East, East Asian, African and South Asian regions for the period from 2006 to 2010. They found that non-performing loans negatively affects the bank performance and profitability. Ongore and Kusa [21] studied commercial banks in Kenya for the period from 2001 to 2010 and found a negative relationship between bank profitability and non-performing loans. Al-Jafari and Alchami [2] in their study of 17 Syrian banks, from 2004 to 2011, found a negative relationship between credit risk, as represented by loan loss provision, and bank profitability.

Cucinelli [10] using a sample of 488 listed and unlisted Italian banks over a period from 2007 to 2013 found that an increase in credit risk by either a rise in the non-performing loans ratio or a fall in credit portfolio quality as represented by a rise in loan loss provision ratio leads to banks to decrease their lending activity, which in turn can negatively impact their profitability. Higher NPAs results in lower bank profitability as higher NPAs require increased provisioning which eats into the profits of banks. Duraj and Moci [12] in their study of studied 16 Albanian banks between 1999 and 2014 found this negative relationship.

A study by Islam and Nishiyama [15], using data for 259 commercial banks in South Asian countries including India, for the period from 1997 to 2012, found that there is a negative relationship between non-performing loans and bank profitability. Similarly, Hashem [14] in his study of Egyptian banks for the period from 2004 to 2014 reported that higher loan loss provisions represent higher credit risk and hence lowers asset quality of banks which badly affects bank profitability. Bace [3] used data for 13,000 deposit taking institutions around the world for the period from 2014 to 2015 and found negative relationship between the NPAs and bank profitability. Similarly, a study by Etale et al. [13] that investigated the relationship between the non-performing loans and bank profitability for the period between 1994 and 2014, found a negative relationship between the two. Ozurumba [23], in his study of Nigerian commercial banks, concluded that the non-performing loans had an adverse impact on the profitability of banks for the period between 2000 and 2013. A study by Ozgur and Gorus [22] using data for Turkish banks for the period from 2006 to 2016 reported a negative relationship between non-performing loans and bank profitability. Previous studies have used the following dependent and explanatory variables for the empirical analysis.

Profitability

In the literature, usually the Return on Assets (ROA) is taken as a proxy for profitability, which measures the percentage of profits that a bank earns with respect to its total assets [15, 17, 27]. We have used ROA as a proxy for profitability as it reflects the average asset value during a fiscal year [15].

Bank specific determinants of profitability

Net Non-Performing Advances (NNPA): The higher the portion of income generating assets among total bank assets, the higher would be the interest income of the banks. When NPAs increase, the proportion of interest earning assets falls, which leads to a fall in interest income, and hence ROA declines. Thus, NPAs and ROA

have a negative relation; as NPA rises, return on assets (ROA) of banks falls [5]. Masood and Ashraf [19] and Berger and Young [7] have used non-performing loans to total assets as a measure of non-performing assets.

Deposits

Deposits are the principal and the cheapest source of funds for banks. Therefore, the more deposits a bank collects, higher will be the availability of funds for generating loans and for other profitable uses such as investments, higher will be the bank profitability. Thus, a positive relationship between deposits and profitability is expected [20, 25].

Non-interest income

The non-interest income is the income of banks from sources other than interest bearing assets. It is an indicator of bank's off-balance sheet business and fee income, that is non-traditional activities. Non-interest income consists of commission, service charges, and fees, guarantee fees, net profit from sale of investment securities, and foreign exchange profit. Higher the bank's non-interest income, higher will be the profits [30] (Harbi 2019). We have used the ratio of non-interest income to total income as the variable for non-interest income.

Interest Income: Net Interest Margin (NIM)

Interest income is the difference between the interest rate a bank pays to its depositors and the interest rate it charges to its borrowers. It is measured as a ratio of Net Income to Total Assets. NIM represents income of the banks from its 'core lending business'. NIM is adversely affected by NPAs, because when an asset becomes an NPA, it stops generating interest income and hence, interest earned by banks reduces, while the bank still has to pay interest on deposits [5]. The profitability of a bank increases with increase in net interest earning.

Capital adequacy

High capital reserve requirement leads to higher profitability for banks because of lower costs of financial risk for banks. Lower financial risks attract higher deposits and boost the banking busies, thereby leading to higher rate of profit. Several studies have found a positive relation between capital and profitability of banks [1, 6, 11, 19] (Harbi 2019). We have used Tier 1 capital ratio as prescribed by the Basel Committee as the variable for capital adequacy.

Operating costs

It is the total amount of wages and salaries of bank employees and the cost of running branch office facilities. Higher the operating costs, lower will be the profits. Sufian and Habibullah [30] used the ratio of overhead expenses to total assets as a measure of overhead expenses. Al-Homaidi et al. [1] used ratio of operating expenses to interest income as a measure of operating efficiency and argued that lower the ratio, higher will be the management efficiency and higher will be the profits of banks, whereas Kohlscheen et al. [17] took the ratio of operational expenses to gross revenues as the measure of operating efficiency.

Macroeconomic determinants of profitability

GDP growth rate

It is the value of all final goods and services produced in a country in a given period of time. During higher economic growth, profitability of banks would be higher because it encourages banks to lend more and charge higher interests [11, 30].

Inflation

It is the rate at which general price level of goods and services rises and the purchasing power of currency falls. Studies have found that profitability of banks will be higher with inflation. It has been used by prior studies on banks' profitability [1, 9, 11, 19].

Interest rate

There has been mixed evidence with respect to the relationship between interest rate and profitability. Low interest rates along with stiff competition among banks put pressure on interest margins of banks and hence negatively affect bank profitability (Trujillo-Ponce 2013). Studies such as Demirguç-Kunt and Huizinga [11, 29], Bourke [8] have found a positive relationship between interest rates and bank profitability. The repo rate has been used as it reflects the lending rate of banks.

There are very few studies that cover current phase of NPAs with the revised definition while analysing the NPAs and profitability in Indian banks. The present study not only covers the recent phase of NPAs crisis, but also covers the time period with revised or new definition of NPAs. The definition of NPAs in the present study follows uniformity.

Method

Data

In this study, we have drawn a sample of 39 scheduled commercial banks, out of which 20 are Public sector Banks (PSBs) and 19 are domestic private banks. As per the recent data, these 39 banks constitute more than 90 percent of the banking operation in terms of assets, and close to 95 percent in terms of deposits and credit disbursement in India. In case of Public Sector Banks (PSBs), the overall management

responsibility lies with the Government, as it remains the majority stakeholder. The PSBs are governed by specific acts (banking acts) passed by the parliament. On the other side, the private banks are registered under the Companies Act and governed as per that act. Their management lies with the majority promoters or shareholders. In terms of NPA volume, it is largely the PSBs and some private banks that have been badly affected by the NPA crisis. Few small private banks were dropped from the analysis due to unavailability of data. The time period of the study is from 2005 to 2019. The period of the study has been chosen as the definition of NPA underwent a change in 2004, and the NPA data from 2005 onward follow uniformity with the new definition. Annual data for the sample of 39 banks was collected from a Reserve Bank of India (RBI) publication—Statistical Tables Relating to Banks in India. The bank specific determinates or factors that potentially explain the profitability of banks were obtained the above report. The data for macroeconomic variables were collected from the Handbook of Statistics on Indian Economy—a publication of the RBI.

Variables

In this study, we have estimated the determinants of profitability of Indian Scheduled Commercial Banks. The dependent variable is profitability, which is determined by a set of bank specific and macroeconomic factors (Table 1). In the study, the Return on Assets (ROA) has been used as the variable for profitability. In literature, the ROA is widely used as indicator or proxy for bank profitability. It is an appropriate indicator of profitability, as it measures the earnings of a bank in relative to its total assets. Therefore, it has been used as the dependent variable. We have used the following bank specific explanatory variables like Net NPA, total deposit, interest income, non-interest income, operational efficiency and capital adequacy. The study has used the following macroeconomic predictors of bank profitability—economic growth, inflation and interest rate to estimate the determinants of profitability.

Model

To understand how NPAs impact the profitability, we have estimated the determinants of profitability of Indian scheduled commercial banks. We have employed the panel data estimation procedure to estimate the factors that have affected the profitability of banks in India. The following functional relationship has been employed to analyse the determinants of profitability.

$$\begin{aligned}\text{profitability}_{i,t} = {} & \beta_0 + \beta_1 \text{Non-performing advances}_{i,t} \\ & + \beta_2 \text{deposits}_{i,t} \\ & + \beta_3 \text{non-interest income}_{i,t} \\ & + \beta_4 \text{interest income}_{i,t} \\ & + \beta_5 \text{operational efficiency}_{i,t} \\ & + \beta_6 \text{capital adequacy}_{i,t} \\ & + \beta_7 \text{economic growth}_{t} \\ & + \beta_8 \text{inflation rate}_{t} \\ & + \beta_9 \text{interest rate}_{t} + \varepsilon_{i,t}\end{aligned} \tag{1}$$

where i = bank, 1,....0.39, and t = time, 1,....,15. $\varepsilon_{i,t}$ is the error term.

In the above equation, six bank specific factors and three macro-economic factors combined determine the profitability of a bank. In the paper, we have employed both the fixed and random effect approach to estimate the determinants of bank profitability. By using fixed effect (FE) model, the impact of variables those are time variant can be analysed. The FE estimation also controls for all time invariant heterogeneity among the sample banks. It therefore is likely to produce unbiased

Table 1 Description of variables used in the study

Notation	Variable	Description	Expected effect
Dependent variable ROA	Profitability	Ratio of Net Income to Total Assets (%)	
NNPA	Net Non-Performing Assets	Ratio of Net NPA to Net Advances (%)	Negative
*ln*TD	Total deposit	Natural Logarithm of Total Deposit	Positive
NII	Non-Interest Income	Ratio of Net Interest Income to Total Income (%)	Positive
II	Interest Income	Net Interest Margin (%)	Positive
OCTII	Operating Cost	Ratio of Operating Cost to Total Interest Income (%)	Negative
CapT1	Capital Adequacy	Tier 1 capital as per Basel norm (%)	Positive
GDPGr	GDP growth rate	Annual Economic Growth rate (%)	Positive
INF	Inflation	Annual rate of Inflation (%)	Positive
IR	Interest rate	Annual Average Repo Rate (%)	Positive

coefficient estimates due to omitted time invariant characteristics [31]. The general form of the fixed effects model can be expressed in the following equation [32].

$$P_{i,t} = C + \beta X_{i,t} + \mu_i + u_{i,t} \quad (2)$$

In Eq. (2), the dependent variable 'profitability' is $P_{i,t}$ for i-th bank and t-th year. The dependent variable $P_{i,t}$ is determined by a set of exogenous regressor that includes both the bank specific and macroeconomic variables, $X_{i,t}$, for i-th bank and t-th year; and βs are model parameters. Beta value in regression is the estimated coefficients of the independent or explanatory variables. It indicates a change in the dependent variable as a result of a unit change in explanatory variables keeping other independent or explanatory variables constant. The unobserved individual bank effect is μ_i, and the random error is, $u_{i,t}$.

Unlike the fixed effects model, in the random effects (RE) model, it is assumed that the error term is uncorrelated with the explanatory variables. It allows the time invariant variables to act as similar to the predictors in the model. The benefit of RE is that the inferences can be generalised, beyond the sample drawn in a model [31].

Table 2 Summary statistics of the dependent and explanatory variables

Variable	Obs	Mean	SD	Min	Max
ROA	585	0.65	0.96	− 5.49	2.13
NNPA	585	2.41	2.72	0.01	16.69
*ln*TD	585	4.84	0.62	2.82	6.46
NII	585	1.17	0.46	0.16	3.57
II	585	2.70	0.71	0.23	5.61
CAPT1	585	10.27	4.12	4.88	55.93
OCTII	585	0.24	0.08	0.11	1.33
GDPGr	585	6.80	1.49	3.09	8.50
INF	585	6.01	2.57	2.28	10.53
IR	585	6.82	0.93	5.08	8.00

The general form of the RE model can be expressed in the following equation [32].

$$P_{i,t} = C + \beta X_{i,t} + \mu + u_{i,t} + \varepsilon_{i,t} \quad (3)$$

In Eq. (3), the random error, $\varepsilon_{i,t}$ is with in entity error term and $u_{i,t}$ is between entity error term. μ is the bank specific random effect. Random effect model assumes that the unobservable individual-specific effects (unobserved heterogeneity) are distributed independently of the explanatory variables or independent variables. More clearly, it assumes that the unobserved heterogeneity is uncorrelated with each explanatory variable across in all time period. Then, if the random effect model is significant, it indicates that the unobserved individual (cross-sectional) effects are uncorrelated with all the explanatory variables across all time-period.

The following fixed effects (FE) model has been estimated to analyse the determinants of profitability.

$$\mathrm{ROA}_{i,t} = C+\beta_1\mathrm{NNPA}_{i,t}+\beta_2\mathrm{TD}_{i,t}+\beta_3\mathrm{NII}_{i,t} + \beta_4\mathrm{II}_{i,t} + \beta_5\mathrm{OCTII}_{i,t} + \beta_6\mathrm{CapT1}_{i,t} + \beta_7\mathrm{GDPGr}_{i,t} + \beta_8\mathrm{INF}_{i,t} + \beta_9\mathrm{IR}_{i,t} + \mu_i + u_{i,t} \quad (4)$$

where i = bank, 1,….0.39, and t = time, 1,….,15.

In Eq. (4), the dependent variable is $\mathrm{ROA}_{i,t}$. It is determined by a set of exogenous regressors that includes both the bank specific and macroeconomic variables. The unobserved individual bank effect is μ_i, and random error is $u_{i,t}$. It is assumed that the set of explanatory variables is uncorrelated with the error term $u_{i,t}$, and the error term is normally distributed, $u_{i,t} \sim N(0,\sigma_u^2)$, where σ_u^2 is > 0.

We have estimated the following random effect (RE) model to analyse the determinants of profitability in Indian scheduled commercial banks.

$$\mathrm{ROA}_{i,t} = C+\beta_1\mathrm{NNPA}_{i,t}+\beta_2\mathrm{TD}_{i,t}+\beta_3\mathrm{NII}_{i,t} + \beta_4\mathrm{II}_{i,t} + \beta_5\mathrm{OCTII}_{i,t} + \beta_6\mathrm{CapT1}_{i,t} + \beta_7\mathrm{GDPGr}_{i,t} + \beta_8\mathrm{INF}_{i,t} + \beta_9\mathrm{IR}_{i,t} + \mu + u_{i,t}+\varepsilon_{i,t} \quad (5)$$

Results

The descriptive statistics of the variables that has been used in the estimation of determinants of profitability is presented in Table 2. The descriptive statistics of both the dependent and explanatory variables for the time period between 2005 and 2019 is presented in the form of mean, standard deviation, minimum and maximum. The results show that the return on profitability (ROA) ranges from − 5.49 to 2.13, with a mean ROA value of 0.65. Similarly, the minimum and maximum values of the explanatory variables range low to high. The mean and standard deviation values of the variables suggest that there is variation between the two.

The correlation matrix with correlation coefficients of the variables used is presented in Table 3. The results suggest that there is no multicollinearity problem in the data. The results show a negative association of ROA with NNPA and CapT1. The rest of the explanatory variables exhibit positive association with ROA.

We have estimated both the fixed effect (Eq. 4) and random effect (Eq. 5) models to analyse the determinants of profitability in Indian scheduled commercial banks. The estimation result of the FE model shows

Table 3 Correlation matrix

	ROA	NNPA	*ln*TD	NII	CapT1	OCTII	GDPGr	INF	IR	II
ROA	1.000									
NNPA	− 0.770	1.000								
*ln*TD	− 0.099	0.264	1.000							
NII	0.373	− 0.195	− 0.019	1.000						
CapT1	0.277	− 0.205	− 0.250	0.162	1.000					
OCTII	− 0.093	− 0.025	− 0.350	0.388	0.178	1.000				
GDPGr	0.050	0.015	− 0.075	0.021	− 0.074	0.064	1.000			
INF	0.357	− 0.458	− 0.307	0.083	0.003	0.050	− 0.169	1.000		
IR	0.215	− 0.265	− 0.031	− 0.146	− 0.033	− 0.130	− 0.388	0.128	1.000	
II	0.516	− 0.399	− 0.206	0.327	0.411	0.319	0.018	0.089	0.072	1.000

Table 4 Determinants of bank profitability: panel regression, time period: 2005–2019

Variables	Fixed effect model		Random effect model	
Dependent variable: ROA	**Coefficient**	**SE**	**Coefficient**	**SE**
Explanatory variables				
NNPA	− 0.2136***	0.0258	− 0.2083***	0.0207
lnTD	0.0978	0.3103	0.1640***	0.0505
NII	0.4911***	0.1051	0.5266***	0.0740
II	0.2687***	0.0866	0.3097***	0.0635
CAPT1	0.0282***	0.0092	0.0291***	0.0097
OCTII	− 2.9788**	1.2694	− 3.3055***	1.1504
GDPGr	0.5507***	0.1737	0.5126***	0.1629
INF	− 0.4228	0.4191	− 0.3160	0.2167
IR	1.3884	1.2767	1.0733	0.7345
C	− 10.5673	5.8362	− 9.2618	4.5848
Number of observations	585		585	
Number of Banks	39		39	
R-Square	0.735		0.734	
Prob [*F* Statistics]	0		0	

***$p < 0.001$; **$p < 0.05$; *$p < 0.01$

Table 5 Hausman test

Chi-Sq. statistics	Chi-Sq. d.f	Prob
23.7	20	0.255

that there is an inverse relationship between the rate of profit (ROA) and non-performing loans (NNPA), and the association is statistically significant (Table 4). Non-interest income (NII), interest income (II), capital adequacy (CAPT1) and GDP growth (GDPGr) are found to be positively associated with the rate of profit (ROA). The estimates are found to be statically significant. Ratio of operating cost to interest income (OCTII) shows negative relationship with profitability (ROA). The other macroeconomic variables like rate of inflation and interest rate show negative and positive associations, respectively. However, their association is not statistically significant.

The regression estimates of the RE model also give a similar result (Table 3). NPAs and operating cost (OCTII) are negatively associated with the rate of profit (ROA). Their relationship is statistically significant. On the other side, deposit (lnTD), non-interest income (NII), interest income (II), capital adequacy (CAPT1) and GDP growth (GDPGr) exhibit positive association with profitability (ROA). Their association is statistically significant. The other two macroeconomic explanatory variables, the rate of inflation and interest rate exhibit negative and positive associations, respectively. While total deposit was found to be significant in RE, it is found to be insignificant in FE model. In order to arrive at an appropriate test between FE and RE, the Hausman test was conducted. The results of Hausman test suggest that the RE estimate will be appropriate for the sample as the '*p*' value is greater than 0.05 (Table 5).

Discussion

In this paper, we have examined the impact of NPAs on the profitability of Indian banks. Using set of bank specific and macroeconomic variables, we have estimated the determinants of profitability of 39 commercial banks in India. The estimation result suggests that growing incidence of NPA is likely to reduce the profitability of the banks considerably. Results also suggest that increase in operating cost has negative impact on the profitability in Indian banks. The negative association between profitability (ROA) and NPA (NNPA); and profitability (ROA) and operating cost (OCTII) is statistically significant. The results show that there is a positive relationship between profitability (ROA), and interest earning (II) and non-interest earnings (NII). Their association is found to be statistically significant. The results further show that the volume of deposit (lnTD) is positively associated with the profitability (ROA). As financial intermediaries, commercial banks largely relay on interest earnings as their major source of income. In order to boost up their interest earnings, the banks must reduce their NPA volumes. The result suggests that Indian banks must reduce NPAs and operating cost in order to enhance their profitability.

The findings of the empirical estimation are similar to the findings of the studies by Kannan et al. [16], Sensarma and Ghosh [26], and Sinha and Sakshi [28]. A study by Kannan et al. [16], using data for 86 Indian banks, for the period from 1995–96 to 1999–2000 found that banks with higher NPAs have relatively lower profit margins. A study by Sensarma and Ghosh [26] of Indian commercial banks, for the period from 1997–98 to 2000–01, reported that a rise in NPA adversely affects the interest margins for banks and hence reduces bank profitability. Similarly, Sinha and Sakshi [28], in their study of 42 Indian commercial banks for the period from 2000 to 2013, found that higher credit risk, as measured by provision non-performing assets, negatively impacts bank profitability. Analysing NPAs in 46 Indian commercial banks from 2007 to 2014, Bawa et al. [5] found a negative relationship between NPAs and return on assets.

Conclusion

The paper has empirically estimated the factors that determine the profitability of Indian scheduled commercial banks, in order to understand the relationship between increasing non-performing advances and the rate of profit. The determinants of profitability have been estimated by taking a set of bank specific and macroeconomic explanatory variables. From the panel data estimation of 39 Public Sector and private banks, we found that the increase in non-performing advances has negative impact on the rate of profit. Operating cost is also found to be negatively associated with profitability. The estimates of both the FE and RE model suggest that non-interest income, interest income, capital adequacy and GDP growth rate have positively contributed to the rate of profit of the Indian banks. Given that, banks to a large extent depend on the performance of their loan assets as a critical source of income and profit, the rising NPAs is a cause of concern. It on the one hand reduces their interest earning and on the other side also affects their future deposits and increases their operating cost as the cost of recovery of NPAs will go up. The study suggests that the banks must reduce their NPAs and operating cost to improve their profitability.

Limitation of the study and future research avenues

The findings of the study are based on a sample of banks that mostly covers the PSBs and the private banks, covering the time period from 2005 to 2019. Though data for the year 2020 are available, it could not be incorporated due to recent bank mergers in India. Between 2020 and 2021, several mergers took place within the Public Sector Banks (PSBs). Post-merger, the number of PSBs has declined from 20 to 12. While it would be interesting to include the mergers into the empirical analysis, however one year is a too short time period to make any meaningful conclusion. The effect of merger in the analysis of NAPs and profitability of banks can be studied in future, with the availability of data for a longer time period.

Appendix

See Table 6.

Table 6 List of banks studied

S. no.	Name of bank	Category	S. no.	Name of Bank	Category
1	ALLAHABAD BANK	PSB	21	AXIS BANK	Private
2	ANDHRA BANK	PSB	22	CATHOLIC SYRIAN BANK LTD	Private
3	BANK OF BARODA	PSB	23	CITY UNION BANK LIMITED	Private
4	BANK OF INDIA	PSB	24	DCB BANK LIMITED	Private
5	BANK OF MAHARASHTRA	PSB	25	THE DHANALAKSHMI BANK LTD	Private
6	CANARA BANK	PSB	26	FEDERAL BANK	Private
7	CENTRAL BANK OF INDIA	PSB	27	HDFC BANK	Private
8	CORPORATION BANK	PSB	28	ICICI BANK	Private
9	DENA BANK	PSB	29	IDBI BANK LIMITED	Private
10	INDIAN BANK	PSB	30	INDUSIND BANK	Private
11	INDIAN OVERSEAS BANK	PSB	31	JAMMU & KASHMIR BANK LTD	Private
12	ORIENTAL BANK OF COMMERCE	PSB	32	KARNATAKA BANK LTD	Private
13	PUNJAB AND SIND BANK	PSB	33	KARUR VYSYA BANK	Private
14	PUNJAB NATIONAL BANK	PSB	34	KOTAK MAHINDRA BANK LTD	Private
15	SYNDICATE BANK	PSB	35	LAKSHMI VILAS BANK	Private
16	UCO BANK	PSB	36	RBL	Private
17	UNION BANK OF INDIA	PSB	37	SOUTH INDIAN BANK	Private
18	UNITED BANK OF INDIA	PSB	38	TAMILNAD MERCANTILE BANK LTD	Private
19	VIJAYA BANK	PSB	39	YES BANK LTD	Private
20	STATE BANK OF INDIA & ITS ASSOCIATES	PSB			

Abbreviations
NPAs: Non-Performing Assets; GDP: Gross Domestic Product; FE: Fixed Effects; RE: Random Effects; RBI: Reserve Bank of India.

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Authors' contributions
Both the authors have contributed in completing the research paper/study. The paper was conceptualised by SKD. The structure of the paper was prepared by SKD in consultation with KU. KU largely contributed to the literature section and data collection. Estimation and analysis were done by SKD. Both the authors have contributed to the methodology section. Both the authors have read and approved the final manuscript.

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Availability of data and materials
The data that support the findings of this study are collected from public domain resources. It is available at https://dbie.rbi.org.in/DBIE/dbie.rbi?site=publications [RBI publications/database on Indian economy].

Declarations

Competing interests
We (both authors) do not have any competing interest.

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