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Factors Determining the Financial Performance of Public Sector Banks in India

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Now, an attempt is made in this paper to examine the determinants of profitability in Indian public sector banks during the period 2010-11 to 2021-22. For this purpose, a sample of 12 public sector banks listed in NSE & BSE has been taken. Multiple Linear Regression Analysis has been used to investigate the impact of independent variables such as a bank's asset size (Size), capital adequacy ratio (CAR), cost to income (CTI), net non-performing assets (NPA), credit risk (CrR), credit deposit ratio (CDR),economic growth (GDP) and consumer price index (CPI) inflation on key bank profitability indicators, i.e., return on assets (ROA), return on equity (ROE) and net interest margin (NIM)as dependent variables, separately.

The main findings show that bank asset size, cost to income, net non-performing assets, credit deposit ratio, and inflation are negatively related to ROA, ROE, and NIM. Credit risk and economic

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growth (GDP) have a positive impact on ROA, ROE, and NIM. While the capital adequacy ratio hurt ROA and NIM except for ROE. Even though overall explanatory and macroeconomic factors have a significant 5 percent effect on ROE and NIM as denoted by F-statistics value. Moreover, the banking sector has benefited weakly significantly from both economic growth and the inflationary environment. It is also suggested that if banks concentrate on these variables, they would be able to generate better profitability in the present globalized era. These findings are of value to both academicians and policymakers.

Keywords: Profitability; capital adequacy; non-performing assets.

1. INTRODUCTION

"The banking sector is the lifeline of the economy and is treated with utmost importance in the financial sector. The financial soundness of the Indian banking system can be considered one of the best banking systems in the world" (RBI-2016). During the pre-nationalization, the Indian banking sector has been dominated by public sector banks when all major banks were nationalized by the Indian government in 1969. As of result, the Indian banking industry experienced tremendous growth in the mobilization of deposits, sanctions of advances, and overall banking business. By the 1990s, the Indian banking system has undergone several changes due to the financial reforms, such as the reduction of reserve requirements, deregulation of interest rates, the introduction of prudential norms, strengthening of the banking system, upgrading of technology and human resource development, and improving the competitiveness of the system by allowing entry of private banks.

The reforms were aimed to make the Indian banking industry more competitive, productive, and efficient and to follow international accounting standards. Over the last two decades, private and foreign banks have grown faster than public sector banks by using the latest technology, providing contemporary innovations, monetary tools and techniques, and efficiency parameters.

1.1 Statement of the Problem

Today's banking sector becoming more complex due to emerging unhurt from the recent global financial crisis of the Russia and Ukraine War and COVID-19 resulting in a subsequent economic slowdown that has exerted pressure on banks' profitability and capital. There are so many factors that affect the profitability of banks. These factors are not only bank-specific, and industry-specific but also macroeconomic variables, which need to be taken care of while differentiating good banks from bad ones. As a result of this statement, efforts have been made from time to time, to measure the financial position of each bank and manage it efficiently and effectively. It is of great importance to evaluate the overall performance of banks by implementing a regulatory banking supervision framework.

Against this backdrop, the present study is necessitated to examine the financial performance of public sector banks during the period 2010-11 to 2021-22.This study is organized as follows: the next section highlights the introduction of the subject matter with relevant literature. The third section defines the objective and methodology of the present study. In the fourth section results and analysis are described, and the final section presents the main conclusions and suggestions of the study.

1.2 Review of Literature

"There is a large literature dealing with factors that influence the profitability of banks. There are some early investigations on bank profitability" [1,2]. "Some empirical studies on bank profitability are country-specific, while others have focused on a panel of countries. Examples of single-country studies are those for the US [3,4], Colombia [5], Brazil [6], Croatia [7], Greece [8-10], Tunisia [11,12], China [13], Taiwan [14,15], Philippines [16], Malaysia [17], Pakistan [18,19], Japan [20], Korea [21], Turkey [22-25], Czech Republic [26], Romania [27], Switzerland [28] and Spain [29]. Other important studies assess bank profitability by groups of countries [30-37,28]. Some of these papers investigated bank profitability determinants of European banks [30], [31], [36], [38]".

Some of the empirical studies in the Indian context are:

Ganesan [39] examined "the determinants of profitability of public sector banks in India. The

authors found that interest cost, deposits per branch, credit to total assets, the proportion of priority sector advances, and interest income are significant determinants of profitability".

Bodla and Verma [40] investigated "the determinants of Indian banks' profitability. The authors revealed that operating expenses, non-interest income, provisions, and spread have a significant relationship with net profits".

Goyal and Kaur [41] analysed "the performance of seven new private-sector banks in India. The study results indicated that there is an average debt/equity ratio at maximum levels in the case of Axis Bank, Kotak Mahindra Bank. The ratio of advances to total assets has shown an increasing trend for all the banks under study, indicating an increase in lending operations. The study concluded that there are significant differences among the mean ratios of all parameters except for liquid assets to total assets, liquid assets to total deposits, net profit to average assets, and percentage change in NPAs".

Singh and Chaudhary [42] studied "the determinants of profitability in the public sector, private sector, and foreign sector banks in India. The authors found investments had a significant impact on the operating profitability for all three-sector banks, whereas advances, deposits, and assets affected the profitability of the private sector and foreign sector banks only, and the macro-economic determinants affected the profitability significantly".

Manoj [43] studied only "the old private sector banks based in Kerala state (KOPBs). The study results showed a significant and positive relation between operating profit and non-interest income and there was a strong negative relationship between net interest margin and investment in government securities".

Bhatia et al. [44] examined "the determinants of profitability in the private sector banks in India. The authors found that spread ratio, credit deposit ratio, profit per employee, capital adequacy ratio, and net interest income are positively correlated with return on assets while non-performing assets, operating expenses, and provision and contingencies are negatively associated with return on assets. The results showed that the spread ratio, non-interest income, operating expense ratio, profit per employee, and non-performing assets are significant variables affecting the profitability of banks in the private sector".

Chavali and Kishan [45] analysed "the performance and profitability of public and private sector banks. The authors found that the public sector banks were more profitable, and the high lending rate discourages new and credit worthily borrowers from seeking loans from banks".

Sinha and Sharma [46] examined "the factors affecting the profitability of 42 Indian banks. Bank-specific variables, such as capital-to-assets ratio, operating efficiency, and diversification are significantly and positively affecting bank profits. On the other hand, risk negatively impacts the bank's profitability".

Balaji and Praveen Kumar [47] studied "the financial performance of public and private sector banks in India. The study results revealed that both public and private sector banks recorded good growth in total income and net interest income but net interest margin and operating profit for public sector banks are quantitatively higher than private sector banks".

Sahota and Dhiman [48] evaluated "the financial, operational, and managerial efficiency of the selected scheduled commercial banks in India with different ownership structures, such as public (State Bank of India), private (ICICI Bank), and foreign banks (Standard Chartered Bank). The results revealed that there was no difference among these banks in ratios of debt/equity ratio, gross non-performing assets/total assets, income interest/total assets, and liquid assets to total deposits".

Srinivasan and Britto [49] examined "the financial performance of 16 selected Indian commercial banks comprising 11 public sectors and 5 private sector banks. The authors observed that private banks had better ROA, ROE, P/E ratio, and EPS than public banks, and private banks are found to be relatively better than public sector banks concerning solvency ratio and capital adequacy ratio. The study concluded that liquidity, solvency, and turnover ratios are found to be a positive and significant impact on the profitability of the selected public sector and private sector banks in India".

Brahmaiah and Ranajee [50] examined "the factors influencing the profitability of Indian commercial banks. The study indicated that profitability is affected by both internal and

external factors. The strength of equity capital and operational efficiency ratio of banking sector deposits to the gross domestic product (GDP) had a significantly positive effect on the profitability of banks and credit risk, cost of funds, non-performing assets (NPA) ratio, and consumer price index (CPI) inflation had a significantly negative influence on banks' profitability, while bank size and the ratio of priority loans to total loans do not have any influence on the profitability. The GDP growth and inflation have a significantly negative relation with ROA and inflation has a positive influence on ROE".

Vasani (2020) examined "the financial performance of selected private-sector banks in India. The author found that there is a significant impact on the net profit of HDFC Bank, which is continuously in good condition, Yes Bank is in a deteriorating financial position, Axis Bank and ICICI Bank are slowly declining within the market, and Jammu and Kashmir Bank suffered losses".

Jeevan Basha Vand Tejesh H R [51] focused on "the determinants of bank profitability of 14 Indian commercial banks during the study period. They examined four important variables, namely, Return on Assets (ROA), Return on Equity (ROE), Net Interest Margin (, NIM), and Liquidity (LIQ) and a set of independent variables such as bank-specific factors, namely, Bank Size (SIZ), Operating Efficiency (EFF), Concentration (CON), Risk Index (RI), Capital Average Ratio or Average Capitalization Ratio (CAR), Privatization (PVT) and Quote (QUT) on the stock exchanges, and macroeconomic variables, namely, Gross Domestic Product (GDP) and inflation rate are taken into account. The authors found that the Indian commercial banks' profitability as measured by ROE, ROA, and NIM has a negative relationship with SIZ, CAR, CON, and GDP, except EFF. The fixed effect model is founded to be the best fit under ROE, ROA, and NIM".

Jas Bahadur and Nirmal (2022) revealed that "the credit-deposit ratio has a significant positive impact on the return on assets and net interest margin of commercial banks while gross domestic product growth has significant influence on profits. The non-performing assets weakly influence the return on assets, but it has a significant negative effect on the equity return".

Mohammad Athar Ali et al. [52] analysed "banks in India by applying a robust regression approach. The authors found that bank risk, non-performing assets measure of liquidity, and financial crises have negative and significant while capital adequacy ratio, labour productivity, and income diversification show a positive and significant correlation with the performance of public-sector banks in India during the study period. Cost inefficiency had not impacted the bank's performance".

Yuan D et al. [53] examined "the impact of specific factors and macroeconomic factors on profitability in the Bangladeshi and Indian private commercial banking sectors. The study results indicated that the banks' specific variables such as sure strength of the Bank size (BS), and Debt to Asset Ratio (DAR) had positively and significantly correlated with Return on Asset (ROA). On the other hand, the Deposit Asset Ratio (DTAR) and the L to Deposit Ratio (LDR) are negative and significant. The Equity to Asset Ratio (EAR) and Debt to Equity Ratio (DER) do not have any positive/negative impact on bank profitability. As macroeconomic variables, the inflation rate (IR) and the GDP growth rate (GDPGR) are measured and found to be positive and significant for ROA".

Sarkar, S., & Rakshit, D. [54] investigated "the determinants of commercial banks' performance in India over the period from 2000 to 2017 with special reference to the macroeconomic factors. They were ted return on assets (ROA), return on equity (ROE) and net interest margin (NIM) as the measure of bank performance and also took some external variables such as GDP, inflation, and lending interest rate as the prime explanatory variables along with some bank-specific and macroeconomic control variables. The authors applied the generalized method of moments (GMM) method for the analysis. The study results indicated that the major macroeconomic variables, bank-specific control variables like asset size have a significant positive impact, and asset management has a significant negative influence on the performance of commercial banks, but asset quality has an insignificant positive impact on banks' performance. Unemployment is not observed to have a significant impact on the measures of performance, as measured by ROA, ROE, and NIM show a significant positive influence on all measures of performance. ROE, inflation has a significant negative impact on banks' performance. Lending interest rate is observed to affect ROA positively, but it has a negative influence on ROE and NIM. They found that

overall external variables significantly affect the commercial banks' performance, and these findings remain unaltered with the sequential inclusion of all control variables".

Njoki, N. M., & Nyamute W. [55] examined "factors affecting the financial performance of commercial banks in Kenya. They selected ted return on assets (The OA) as the dependent variable and bank size, managerial effectiveness, asset quality, liquidity, and capital adequacy as independent variables. They found that asset quality and bank size have a favourable impact on return on assets while capital adequacy, liquidity, and managerial effectiveness hurt ROA".

Though, many studies have been carried out in different countries of the world to find the determinants of profitability of the banking sector, like the USA, Saudi Arabia, Greece, Malaysia, India, and many European countries as well. But a country like India, which has been recently liberalized and is facing competition not only at the global level but also within its home boundaries, needs an up-to-date examination of the financial performance of banks so that its profitability could be sustained in the present competitive environment. Hence, an attempt is made in this direction in the present study.

1.3 Objectives of the Study

The main objective of the present study is to investigate bank-specific factors, such as bank asset size, capital adequacy ratio, the cost to income, net non-performing assets, credit risk, credit deposit ratio, and macroeconomic factors viz., annual GDP and inflation rate impact on return on assets, return on equity and net interest margin as the profitability of the banks operating in the public sector in India. To achieve this objective, the following are the specific objectives of the study:

(i) To find out the determinants of the profitability of public sector banks in India.
(ii) To ascertain whether there is a significant relationship between return on assets (ROA) and its determinants.
(iii) To determine whether there is a significant relationship between return on equity (ROE) and its determinants.
(iv) To establish if there is a significant relationship between net income margin (NIM) and its determinants.
(v) To offer measures to be taken to improve the performance of the select banks of the study.

1.4 Hypotheses of the Study

The objective of the present study is to test based on earlier research studies that provide positive as well as negative relationships between bank profitability (ROA, ROE, and NIM) and different variables, so the following hypotheses have been developed according to the above-said are as:

The hypotheses of the study are:

H1: Bank size has a positive impact on profitability.
H2: The capital adequacy ratio should have a positive relationship with profitability.
H3: The cost-to-income ratio bears a negative relationship with profitability.
H4: Non-Performing Assets should have a negative relationship with profitability.
H5: Credit risk should have a negative relationship with profitability.
H6: Credit Deposit ratio bears a positive relationship with profitability.
H7: Economic growth rate (GDP) should have a positive relationship with profitability.
H8: The inflation rate has a negative relationship with profitability.

2. METHODOLOGY OF THE STUDY

2.1 Sources of Data

The present study is based on secondary data about the dependent and independent variables that have been collected from the statistics available at the websites of Moneycontrol.com, Reports of the Reserve Bank of India, Indian Banking Association Publications, Magazines, and Journals, working papers, and newspapers are also accessed for the relevant [56-58].

2.2 Period of Study

To find out valid findings and draw conclusions, a minimum period of ten years is required for this type of study. Hence, this research study covers a period of 12 years, i.e., from the financial year 2010-2011 to 2021-2022.

2.3 Selection of Organizations

A sample of twelve public sector banks in India has been selected and the criteria are based on the highest market capitalization generated by the banks during 2021-2022.

2.4 Determinants of Variables

The determinants of banks' profitability are usually divided into internal and external factors. Internal factors include such bank-specific factors as bank size, capital adequacy, management efficiency (cost to income), non-performing assets, credit risk, and credit deposits while external factors consist of such macroeconomic variables as economic growth (GDP) and inflation. Our objective is to test the effect of internal and external factors on the bank's profitability.

The description of variables is described (Appendix 1) as follows:

(A) Dependent Variables:

Profitability is measured by Return on Assets (ROA), Return on Equity (ROE), and Net Interest Margin (NIM).

(i) **Return on Assets (ROA):** ROA reflects the ability of a bank's management to generate profits from the bank's assets. It is calculated as Net Income/Total Assets.
(ii) **Return on Equity (ROE):** ROE measures the rate of return on the ownership interest (shareholders' equity) of the common stock. It measures the firm's efficiency in generating profits from every unit of shareholders' equity. It is calculated as Net Income to Shareholders' Equity.
(iii) **Net Interest Margin (NIM**): It represents the profit earned by banks on interest activities. It is a measure of the difference between the interest income generated by banks and the interest amount paid on deposits to their lenders relative to the interest amount received from their advances. It is calculated as Net Interest Income divided by the Total Assets.

(B) Independent Variables or Explanatory Variables:

The determinants of banks' profitability are usually divided into internal and external factors.

(a) Internal or Bank Specific Factors:

This study uses the following internal or bank-specific factors:

(i) **Bank Size (Size):** The higher size may generate economies of scale, thus an increase in profitability. On the other hand, the smaller size may lead to diseconomies due to some reasons such as rigidities, inertia, and the bureaucracy that may decrease profitability [11,36,37,9]. Hence, there is no prior expectation of the impact of this variable on bank profitability. This factor is proxied by the natural logarithm of total bank assets.
(ii) **Capital Adequacy Ratio (CAR):**A higher capital adequacy ratio may have a positive effect on profitability as it reduces the risks taken by the bank [3,37]. On the other hand, a higher capital adequacy ratio will reduce the leverage effect, thus it may increase the financing costs [11] (Akbas, 2012). However, and the general theoretical framework suggests that reduced expenses and overheads lead to more profitability [17]. It is calculated as equity capital / total assets.
(iii) **Cost-to-Income Ratio (CTI):** The cost-to-income ratio as a proxy for management efficiency. Based on the poor management assumption, cost efficiency has an impact on impaired loans due to the lack of precise supervision of loans. The higher the operating costs relative to bank incomes, the lower the bank's profitability. Hence, a negative relationship is expected (Akbas, 2012) and it is calculated as the total cost to total income.
(iv) **Non-Performing Asset Ratio (NPA):** NPAs as a proxy for asset quality. Credit creation accompanies with it the risk of non-payment by the customers. Hence, a huge amount of unpaid loans (non-performing assets) would hurt the profitability of the banking business [40]. It is calculated as net non-performing assets to total assets.
(v) **Credit Risk (CrR):** According to insolvency theory, if banks' liabilities exceed their assets exhibits a loss probability cause of the failure of the debtor to fulfill its obligations to the bank. In many cases, non-performing loans lead to falling in asset values. These represent a portion of profits kept for contingent situations and expenditures and thus it expects a negative effect on the performance of the potential losses from bad

quality loans (Mansur et al. 1993).It is calculated as loan loss provisions to total assets.

(vi) **Credit Deposit Ratio (CDR):** Credit deposit ratio as a proxy for liquidity risk. The ratio highlights the effective utilization of deposits. From this perspective, a comfortable ratio decreases the risks of failure which may reduce the financing costs and enhance profitability [10] Singh and Chaudhary, [42]). On the other hand, a lower ratio may indicate that the advances bring low returns, which lowers profitability. It is calculated as total advances/total deposits.

(b) External or Macroeconomic Factors:

Many other determinants affect a bank's performance, such as taxes, quality of service, and so on, that can be considered an additional function. In our view, there are macroeconomic factors that have been studied. For the study of a single country, such as this one, it would be irrelevant to include these factors in our test models. However, the model includes external variables as the control variables.

This study uses the following external or macroeconomic factors:

(i) GDP Growth Rate (GDP): Gross domestic product as a proxy for the country's economic growth. The well-developed financial system accelerates economic growth by balancing between income, savings, and consumption in an economy resulting that a positive impact on bank profitability because the demand for lending increases during cyclical upswings. When economic activity decreases, the demand for loans and deposits decreases and negatively affects the profit margins [42]. This factor is proxied as the annual GDP growth rate (%).

(ii) **Inflation (Infl):** Inflation effects on bank performance depend on the bank's anticipations, operating expenses, and revenue. Hence, if banks expect general inflation to be higher in the future, they may believe that they can increase their prices without experiencing a decline in demand for their output. It is associated with the bank's interest rate and profitability [59-61,17,36]. It is proxied as the average annual growth rate of the consumer price index (CPI).

2.5 Statistical Tools

An evaluation of factors determining the profitability of public sector banks in India based on the following statistical tools was used: descriptive statistics, multi-co-linearity have been diagnosed and applied multiple linear regressions analysis, "t" test, "f" test, and Analysis of Variance (ANOVA) and SSPS-28version of the software is used for the analysis.

2.6 Regression Model

The following Regression model has been established:

$$PRO = \beta0 + \beta1\ (Size) + \beta2(CAR) + \beta3(CTI) + \beta4(NPA) + \beta5(CrR) + \beta6(CDR) + \beta7(GDP) + \beta8(Infl) + \varepsilon$$

Where, β0 = Constant's Coefficient, β1- β8 = Regression Coefficients for independents variables PRO = ROA/ROE/NIM, Size= Bank Size, CAR= Capital Adequacy Ratio, CTI= Cost to Income Ratio, NPA= Non-performing Assets, CrR= Credit Risk, CDR= Credit Deposit Ratio, GDP= Economic Growth, Infl= Inflation, ε= Error Term

3. RESULTS AND DISCUSSION

This section provides summary statistics and correlation, regression coefficients, and ANOVA results (depicted in Appendix 1) of the selected variables used in the analysis.

Table 1 shows the data on the descriptive statistics for the banks' performance measures during the period of study. Of the selected, the first one is the return on assets, whose mean value is 1.16 percent; the standard deviation is 8.59 percent; the maximum value is 12.19percent,andthe minimum value is -11.19 percent. The second one is the return on equity variable, and its mean is -5.49 percent; the standard deviation of 158.93percent; the maximum value is 212.68percent, and the minimum value is -257.02 percent. The third variable is net interest margin, the mean is 16.74 percent; the standard deviation is 29.47 percent; the maximum value is 57.05percent, and the minimum value is -33.64 percent. The fourth variable represents bank size, the mean is 153.67percent; the standard deviation is 3.24 percent, the maximum value is 159.11 percent, and the minimum value is 147.95 percent.

Table 1. Descriptive statistics of selected variables of public sector banks in India

Variable	Minimum	Maximum	Mean	Std. Deviation	Covariance
ROA	-11.19	12.19	1.16	8.59	73.72
ROE	-257.02	212.68	-5.49	158.93	25258.28
NIM	-33.64	57.05	16.74	29.47	868.33
Size	147.95	159.11	153.67	3.24	10.49
CAR	135.54	174.85	148.06	12.22	149.24
CTI	335.40	629.00	447.50	104.67	10956.67
NPA	11.83	108.13	53.40	32.14	1033.23
CrR	1.36	4.30	3.67	0.84	7.14
CDR	730.62	919.77	842.53	66.45	4415.21
GDP	-7.25	8.26	4.63	4.56	20.79
Info	2.49	10.91	6.52	2.44	5.95

Source: Author's calculation Compiled from Moneycontrol.com

The next variable is the capital adequacy ratio whose mean value is 148.06 percent; the standard deviation is 12.22 percent; the maximum value is 174.85 percent, and the minimum value is 135.54 percent. The sixth variable is the risk cost to income ratio, the mean is 447.50 percent; the standard deviation is 104.67 percent; the maximum value is 629.00percent, and the minimum value is 335.40 percent. The next one is the non-performing assets, whose mean value is 53.40 percent; the standard deviation is 32.14 percent; the maximum value is 108.13 percent, and the minimum value is 11.83 percent. The eighth one is credit risk has a mean value of 3.67 percent; a standard deviation is 0.84 percent; a maximum value is 4.30 percent, and a minimum value is 1.36 percent. The ninth one is the credit deposit ratio, whose mean value is 842.53; the standard deviation is 66.45 percent; the maximum value is 919.77percent, and the minimum value is 730.62 percent. Furthermore, the economic growth (GDP) rate has a mean value of 4.63 percent while the standard deviation is 4.56 percent; the maximum value is 8.56 percent, and the minimum value is -7.25 percent. Finally, the mean inflation rate is 6.52 percent; the standard deviation is 2.44 percent. The maximum and minimum values of the inflation rate are represented as 10.91 percent and 6.52 percent respectively.

It can be seen from the Table 1 that the covariance of all the selected variables (i.e., independent as well as dependent) of the public sector banks in India having a high coefficient of variation (CV>1) indicates less consist of and hence more risk during the period for study.

Table 2 displays the statistical results of the estimated correlation between the selected variables of the public sector banks in India, the bank size, the cost-to-income ratio, and non-performing asset ratio variables are negative correlation with ROA coefficient values are -0.73, -0.68, and -0.83, ROE coefficient values of -0.83, -0.77 and -0.89 and for NIM the coefficient values are -0.82, -0.76 and -0.88 respectively which are also significant. Whereas the capital adequacy ratio, credit risk, credit deposit ratio, economic growth (GDP) rate, and Inflation rate variable showed a positive correlation with its ROA coefficient values are 0.42, 0.56, 0.67, 0.20, and 0.54, ROE coefficient values of 0.56, 0.60, 0.73, 0.20 and 0.54 and for NIM the coefficient values are 0.55, 0.63, 0.72, 0.10 and 0.59 respectively and hence, it statically insignificant except credit deposit ratio. Therefore, it can be said that all the selected variables, except bank size, credit risk, and inflation based on their correlation analysis are more consistent with the earlier studies.

Table 3 depicts the data on the overall regression results relating to the public sector banks in India during the period of study. The overall Multiple Regression results of ROA exhibit that it is statistically unfit and registers the fitness value of Prob >F=0.221. The 'R' square shows that the 93.9 percent variant in ROA is elucidated byall independent variables jointlysuch as bank size, capital adequacy ratio, the cost-to-income ratio, non-performing assets, credit risk, credit deposit ratio, economic growth (GDP) rate, and inflation although the remaining 6.1 percent is expounded by unobserved factors. The adjusted 'R' square is 24.2 percent lower than the 'R' square and is specified as 69.2 percent.

The ROE overall regression results showed that it is statistically fit and is statistically significant at

Table 2. Correlation matrix for all the dependent and independent variables of public sector banks in India

Variable	ROA	ROE	NIM	Size	CAR	CTI	NPA	CrR	CDR	GDP	Info
ROA	1										
ROE	0.90**	1									
NIM	0.94**	0.99**	1								
Size	-0.73*	-0.83**	-0.82**	1							
CAR	0.42	0.56	0.55	-0.12	1						
CTI	-0.68*	-0.77**	-0.76**	0.84**	-0.03	1					
NPA	-0.83**	-0.89**	-0.88**	0.72*	-0.63*	0.63*	1				
CrR	0.56	0.60	0.63*	-0.46	0.25	-0.62*	-0.39	1			
CDR	0.67*	0.73*	0.72*	-0.90**	-0.05	-0.94**	-0.62*	0.57	1		
GDP	0.20	0.09	0.10	-0.37	-0.68*	-0.45	0.19	0.32	0.51	1	
Info	0.54	0.6	0.59	-0.67*	0.32	-0.56	-0.83**	0.27	0.66*	-0.18	1

**. Correlation is significant at the 0.05 level (2-tailed).*

***. Correlation is significant at the 0.01 level (2-tailed).*

Source: Author calculation Compiled from the Moneycontrol.com

Table 3. Model summary & ANOVA summary of public sector banks in India

Dependent Variable	Regression Summary			ANOVA	
	R	R-Square	Adjusted R-Square	F-Value	P-Value
ROA	0.969	0.939	0.697	3.881	0.221
ROE	0.994	0.987	0.936	19.306	0.05
NIM	0.995	0.99	0.952	25.648	0.038

Source: Author's calculation Compiled from moneycontrol.com

a five percent level with the fitness value as (prob > F) 0.05. The 'R' square presents a 98.7 percent variation in ROE and is explained by all independent variables jointly and the remaining 1.3 percent is demonstrated by unobserved factors. The adjusted 'R' square is 5.1 percent less than the 'R' square which is specified as 93.6 percent.

Finally, the overall regression results of the net interest margin indicated thatit is statistically fit and is statistically significant at a five percent level with the fitness value as (prob>F) 0.038. The 'R' square presents a 99 percent variation in the NIMand is explained by all independent variables jointly and the remaining 1 percent is demonstrated by unobserved factors. The adjusted 'R' square is 3.8 percent less than the 'R'square which is specified as 95.2 percent.

Table 4 presents the outcomes of the regression analysis of the model that exploits the profitability determinants of the public sector banks in India. Our results explain that bank size has an inverse relationship with the bank profitability as ROA, ROE, and the NIMwith beta and p-values as (-0.285, p-0.69), (-0.186, p-0.581) and (-0.119, p-0.348) percent respectively and it is statistically insignificant. Thus, it rejects the first assumption.

The capital adequacy ratio is found to be negatively correlated with ROA and NIM and it registers beta and P-value of (-0.742, p-0.723);(-0.119, p-0.885) respectively while it is positively related to ROE with beta and P-value of (0.328, p-0.733) but all variables are not statistically significant. Hence, rejects the 2nd hypothesis.

The cost-to-income ratio has negatively associated with ROA and ROE registered with the beta and P-values as (-0.087, p-0.892), (-0.05, p-0.866) respectively. On the other hand, it has positively related with NIM register the beta and P-value as (0.019, p-0.94) but all variables is statistically insignificant. Thus, it rejects the third hypothesis.

The non-performing assets ratio is negatively correlated with all dependent variables such as ROA, ROE, and NIM and it registers with beta and P-values of (-1.493, p-0.436), (-0.575, p-0.503), and (-0.941, p-0.267) respectively. These results are supported by earlier studies but are not significant. Hence, it rejects the fourth hypothesis.

The credit risk is directly correlated with ROA, ROE, and the net interest margin register the coefficient and P-values as (0.521, p-0.664), (0.128, p-0.813), (0.448, p-0.392) respectively and is insignificant. Thus, it rejects the fifth hypothesis.

The credit deposit ratio has inversely related to ROA and the net interest margin with the beta and P-values of (-0.998, p-0.738), (-0.351, p-0.767) respectively, whereas positively correlated with ROE register a beta and P-value as (0.327, p-0.81) but the estimated coefficient has a week statistical significance. Hence, it rejects the sixth hypothesis.

The results further explain that there is a positive association between GDP growth rate and profitability measures of the selected public sector banks in India with beta and P-values as (0.227, p-0.609), (0.056, p-0.777), (0.094, p-0.597) respectively, and estimated coefficient statistically insignificant. Hence, it denied the seventh hypothesis.

Table 4. Regression results of bank profitability on the 8 predicted variables

Variable	ROA		ROE		NIM	
	Coefficients	t-Stat	Coefficients	t-Stat	Coefficients	t-Stat
(Constant)	307.939	0.468	326.268	0.058	606.727	0.673
Size	-0.285	-0.461	-0.186	-0.653	-0.3	-1.215
CAR	-0.742	-0.408	0.328	0.392	-0.119	-0.163
CTI	-0.087	-0.154	-0.05	-0.192	0.019	0.085
NPA	-1.493	-0.966	-0.575	-0.809	-0.941	-1.523
CrR	0.521	0.504	0.128	0.269	0.448	1.084
CDR	-0.998	-0.384	0.327	0.274	-0.351	-0.338
GDP	0.227	0.601	0.056	0.323	0.094	0.623
Info	-0.072	-0.111	-0.313	-1.053	-0.164	-0.635

**. Correlation is significant at the 0.05 level (2-tailed)*

***. Correlation is significant at the 0.01 level (2-tailed)*

Source: Author's calculation Compiled from moneycontrol.com

Table 5. A snapshot of results (comparison of expected relationship with actual results)

Independent Variables	Expected Relation with Profitability	Results of the present study			Significance level
		ROA	ROE	NIM	
Bank Size	Positive / Negative	Negative	Negative	Negative	Insignificant
Capital Adequacy Ratio	Positive	Negative	Positive	Negative	Insignificant
Cost to Income Ratio	Negative	Negative	Negative	Positive	Insignificant
Non-performing Assets Ratio	Negative	Negative	Negative	Negative	Insignificant
Credit Risk Ratio	Negative	Positive	Positive	Positive	Insignificant
Credit Deposit Ratio	Positive	Negative	Positive	Negative	Insignificant
Economic Growth (GDP) rate	Positive	Positive	Positive	Positive	Insignificant
Inflation rate	Negative	Negative	Negative	Negative	Insignificant

Source: Compiled by authors, based on a literature survey

Finally, the annual inflation rate has negatively correlated with ROA, ROE, and NIM indicating the coefficient and P-values as (-0.072, p-0.922), (-0.313, p-0.403), (-0.164, 0.59) respectively but the expected coefficient is not statistically significant. Thus, it discards the eight hypotheses.

3.1 Results of the Regression Model

Equation-1: ROA= 307.939 + -0.285 (Size) + -0.742 (CAR) + -0.087 (CTI) + -1.493 (NPA) + 0.521 (CrR) + -0.998 (CDR) + 0.227 (GDP) + -0.072 (Infl) [R^2 0.939, F-value 3.881, f_t0.221]

Equation-2: ROE= 326.27 + -0.186 (Size) + 0.328 (CAR) + -0.05 (CTI) + -0.575 (NPA) + 0.128 (CrR) + 0.327 (CDR) + 0.056 (GDP) + -0.313 (Infl) [R^2 0.987, F-value 19.306, f_t0.05]

Equation-3: NIM= 606.73 + -0.30 (Size) + -0.113 (CAR) +0.019 (CTI) + -0.941 (NPA) + 0.448 (CrR) + -0.351 (CDR) + 0.094 (GDP) + -0.164 (Infl) [R^2 0.99, F-value 24.65, f_t0.038]

The study revealed profitability metrics for India's public sector banks. It is considered that the bank-specific elements, which constitute the internal efficiency of each bank, should be examined and addressed first, before dealing with macro and external concerns. Table 5 analyzes the expected connection of independent factors with profitability in terms of ROA, ROE, and net interest margin outcomes from the current study.

It can be seen from Table 5, the actual results strongly coincide with the expected results in terms of the variables bank size, non-performing assets, economic growth (GDP) rate, and Inflation rate with profitability measured in terms of ROA, ROE, and the NIM. Similarly, other independent variables, such as capital adequacy ratio have a positive relationship with ROE as

expected while the cost-to-income ratio has a negative association with ROA and ROE as expected. Further, the credit deposit ratio has a positive association with ROA only as expected and lastly, the credit risk ratio has a completely reverse association with expected results in the case of ROA, ROE, and the NIM.

It is perhaps the Indian economy was passing through a phase of global recessionary pressures where the bank's investments could not prove very fruitful. However, public sector banks need to be cautious with respect to their advances as the credit risk, and credit deposit ratio has a strong bearing on a bank's asset-liability management in the long run. Similarly, other independent variables such as the capital adequacy ratio, and the cost-to-income ratio indicated the failure of the bank's assets to regenerate. Provisions and contingencies are a reduction in profits and the lesser the operating expenses, the more the profitability, and vice versa. Hence, banks should take measures to reduce NPAs and operating expenses to have enhanced profitability.

4. CONCLUSION

It can be concluded from the foregoing discussion that the financial system has expanded from national to international boundaries. There has been a paradigm change in marketing thinking away from the growing emphasis on customer service excellence. From traditional functions of accepting deposits and granting loans and advances banks have diversified into allied businesses. There is a growing emphasis on enhancing operational efficiency rather than solely focusing on profits.

SUGGESTIVE MEASURES

A policy suggestion to the authorities is better supervision of credit and liquidity risk of banks and the encouragement of banking competition. For banks' decision-makers, it also recommends monitoring the credit and liquidity risk indicators, to diversify the sources of revenues and to optimize costs. As a future direction of research, it intends to deepen the analysis by extending the period and by splitting the sample into groups of countries.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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APPENDIX

Appendix 1. Variable description

Category	Variable	Description
Dependent Variable	ROA	Return on Assets = Net Income / Total Assets
	ROE	Return on Equity = Net Income / Total Equity
	NIM	Net Interest Margin = Net Interest Income / Total Assets
Independent Variables: Internal or Bank Specific Factors	Size	Bank Size = Natural Logarithm of Total Assets
	CAR	Capital Adequacy Ratio = Total Equity / Total Assets
	CTI	Cost to Income Ratio = Total Cost / Total Income
	NPA	Non-performing Assets Ratio = Net NPA's / Advances
	CrR	Credit Risk Ratio = Loan loss provision / Total Assets
	CDR	Credit Deposit Ratio = Total Advances / Total Deposits
Independent Variables: External or macroeconomic Factors	GDP	Economic Growth (GDP) = Annual GDP growth rate (%).
	Infl	Inflation = Average annual growth rate of a consumer price index (CPI).

Source: Compiled by authors, based on a literature survey

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