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RESEARCH ARTICLE

Bank-specific factors affecting the profitability of public sector banks in India: A dynamic panel approach

Sreemanta Sarkar[1,*], Debdas Rakshit[2]

[1] *Department of Economics, Bidhan Chandra College, Asansol, West Bengal, India. sreemanta_css29@rediffmail.com, https://orcid.org/0000-0002-0008-828X*

[2] *Department of Commerce, The University of Burdwan, West Bengal, India. drakshit@com.burnuniv.ac.in, https://orcid.org/0000-0001-9958-0145X*

*** Corresponding author:** Sreemanta Sarkar, sreemanta_css29@rediffmail.com

ABSTRACT

Profitability of commercial banks is always under spotlight because of the immensely important role it plays in affecting country's economic development as well as the life and living of the country men. Naturally, the factors which might have bearings on its performance assume great significance to banking administration and policy makers. This study desires to identify these factors in case of public sector commercial banks of India. Taking the data of all public sector commercial banks over the period 2000 to 2017, we have applied GMM estimation technique developed by Arellano and Bover, to investigate the bank-specific factors which have influential role in the profitability of Indian banks. Estimation results indicate that banking performance measured in terms of return on assets (ROA) and net interest margin (NIM) is significantly influenced by asset management, operating efficiency, loan quality and employees' performance. Capital adequacy ratio also has significant contribution on ROA while, asset size leaves no significant impact on ROA and NIM. The results arrived in this study may be used to frame appropriate policy decisions for the development of the public sector banks of India.

Keywords: Indian banking sector; bank-specific factors; performance of banks; GMM estimation; measures and drivers of performance

1. Introduction

Banking sector plays a leading role as the driver of economic growth of any nation (Schumpeter [1]). It not only promotes economic efficiency by overcoming information asymmetries in the lender-borrower relationship but also acts significantly in the allocation of financial resources in a better manner. Apart from this primary role of financial intermediation banking sector prominently contributes in achieving inclusive growth especially in developing nations (Seenaiah et.al [2]). India is no exception. Banking sector of India has been playing an important task in the economic development of this country since the middle of the twentieth

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century. With the passage of time banking sector of India has become the most important agent in keeping the wheel of growth in motion. Reserve Bank of India lies at the apex of the Indian banking structure which constitutes both scheduled and non- scheduled banks. Banks which are in the second schedule of the RBI act 1934 are called scheduled banks and the banks which are not in this list are non-scheduled banks. Scheduled banks constitute scheduled commercial banks and scheduled cooperative banks. However, scheduled commercial banks acts as the main anchor in the process of financial intermediation in India. At present, India has 94 scheduled commercial banks of which there are twelve public sector banks, twenty-one private sector banks, forty-four foreign banks, eleven small finance banks, and six payment banks (www. rbi.org.in. accessed on 27/5/24).

Indian financial sector is primarily dominated by scheduled commercial banks though the flow of finances from several other sources are increasingly gaining ground (RBI report on trend and progress of banking in India, [3]). Since nationalization of fourteen major commercial banks in 1969 there has been significant expansion of the number of branches as well as volume of credit to commercial, industrial and agricultural activities and public sector banks are the key players in this process (Rangarajan and Jadhav [4], Bhattacharyya and Chatri [5]). Public sector banks alone occupy 69.82 percent of the total assets and a little more than 74 percent of total deposits of all scheduled commercial banks in India in 2016(RBI report on trend and progress of banking in India, [3]).Though this share has declined in the subsequent years still public sector banks are the major drivers in the Indian banking industry with 57.63 percent of the total assets and 61.41 percent of the total deposits as in 2023(RBI report on trend and progress of banking in India[6]). With the passage of time Indian banking sector particularly the public sector banks have become the sine-qua-non of the development of this country (Sarkar and Rakshit [7]).

But the performance of the Indian public sector banks is not a history of success only. There is no denying the fact that banking sector under the effective supervision and control of RBI have emerged as a resilient segment and successfully defended many crises among which mention may be made of global financial crisis which jeopardized the banking segment of the global capitalist giants (Sarkar and Rakshit [8]). This catastrophe failed to hinder the progress of commercial banks in India (RBI report on trend and progress of banking in India [9]) with regards to spread, profitability and credit growth. But for the last ten years or so public sector banks of India are facing formidable challenges in relation to asset quality (Kumar et.al [10], Garg [11]) credit growth and even in respect of profitability. Growth in non-performing assets, decreasing credit demand, shrinking balance sheet and declining profitability characterizes the recent situation of the Indian public sector banks (Pramahender [12]). After a lapse of almost two and half decade since 1993-94 banking sector in India faced losses for two consecutive years in 2017-18 and 2018-19 and this occurred mainly due to huge volume of losses suffered by the public sector banks (RBI report on trend and progress of banking in India [13]). Though the performance of the public sector banks has improved marginally with respect to asset quality and profitability in recent times, areas of concern still remain with respect to demand for credit, declining trend of interest income etc. (RBI report on trend and progress of banking in India [14]).

Since public sector banks still occupy the dominating position in the Indian banking industry, the health and soundness of the public sector banks demands prominence in any development discourse of this country (Sarkar and Rakshit [7]) and the factors which impacts banking performance needs to be explored. Performance of commercial banks depends both on bank-specific or internal factors and the macroeconomic conditions of the economy. Internal or bank specific determinants are under the control of the banking sector whereas external or macroeconomic determinants are completely beyond their jurisdiction (Sarkar and Rakshit [7]). Almost all of the existing studies on banking sector performance determinants consider both internal and external factors and the studies which focuses on internal determinants only are really scanty. Moreover, there are almost no studies which consider only public sector banks in analysing performance determinants of commercial banks. This study attempts to fill this gap by considering bank-specific determinants only in analysing the performance determinants of public sector commercial banks in India. Taking all public sector banks which were in operation during the period from 2000 to 2017, we have attempted to determine the main bank specific performance drivers of Indian public sector commercial banks.

The rest of the work is structured as follows. Section 2 presents the survey of existing literature, followed by the objectives of the study in section 3, data and methodology in section 4, estimation results in section 5 and conclusions in section 6.

2. Literature survey

Performance of banking sector has been attracting researchers' attention for the last several decades. The pioneering attempt in this field may be attributed to Short [15], and Bourke [16]. Their works were followed by a large number of studies attempting to find out the profitability determinants of commercial banks. These studies were concentrated either on a single country or on banking sector across different countries of the world. Demigruc-Kunt & Huizinga[17], Kosmidouet.al[18],Pasiouras and Kosmidou[19], Flamini et al[20], Jara-Bertin et al[21], Căpraru & Ihnatov[22, Albulescu[23], Petria et al[24], Caporale et al[25], Le &Ngo[26], considered banking sector of several countries where as Athanasoglou et al[27], Dietrich & Wanzenried[28], Ćurak et al[29], Ongore & Kusa[30], Tan[31], Barua et.al[32], Robin et al[33],Almaqtari et al[34], Gupta and Mahakud [35] ,Sarkar &Rakshit[8], Sarkar and Rakshit[7], considered a single country in their analysis.

Bank profitability is generally viewed in terms of return on assets (ROA), return on equity (ROE) and net interest margin (NIM) (Dietrich & Wanzenried[36]). Pasiouras and Kosmidou [19], Flamini et al [20], Ćurak et al [29], Seeniah et.al [2], Hossain & Khalid [37], consider only ROA while Anbar&Alper[38], Căpraru & Ihnatov[22],Albulescu[23], Abel & Le Roux[39],Ebenezer et al[40], Almaqtari et al[34], consider both ROA and ROE as the measure of performance. ROA, ROE and NIM have been used as the measure of banks 'performance in the works of Dietrich & Wanzenried[28], Ongore & Kusa[30], Al-Homaidi et al [41], Kassem and Sakr [42], and in Sarkar &Rakshit [8].

Most studies concentrate bank specific or internal factors and macroeconomic or external factors as the performance determinants of commercial banks (Sarkar &Rakshit [7]). Bank specific determinants usually used

are asset size or size (Kosmidou et.al[18], Pasiouras and Kosmidou [19], Athanasoglou et al [27], Flamini et al [20], Căpraru & Ihnatov[22], Rashid and Jabeen[43], Caporale et al[25]),capital adequacy,(Kosmidou et.al[18], Athanasoglou et al.,2008[27],Anbar &Alper [38], Căpraru & Ihnatov[22], Dietrich & Wanzenried[28], Petria et al[24], Al-Homaidi et al[41]),operating efficiency (Rashid and Jabeen[43],Almaqtari et al[34]), asset management (Al-Homaidi et al[41], Sarkar and Rakshit[8]) etc.

Kosmidou et.al [18]), Pasiouras and Kosmidou [19],Căpraru & Ihnatov[22],Tan[31] finds a negative association between size and profitability whereas Flamini et al[20], Anbar&Alper[38],Rashid and Jabeen[43],Robin et. al [33], Sarkar &Rakshit [8], discovers a positive influence of size on performance. However, Athanasoglou et al [27], Ćurak et.al [29], do not get any impact of size on bank's performance. Capital adequacy is seen to have positive influence on performance in the works of Kosmidou et.al [18], Pasiouras and Kosmidou [19], Athanasoglou et al[27], Căpraru & Ihnatov[22],Petria et al[24],Dietrich & Wanzenried[28], while Anbar & Alper[38],finds no impact of capital adequacy on profitability of banks. Al-Homaidi et al [41], find that asset management has significant bearings on profitability for Indian commercial banks. Almaqtari et al [34], observe that operating efficiency fails to exert any significant influence on profitability, while Rashid and Jabeen (Rashid and Jabeen [43]) find that operating efficiency exerts significant negative influence on the performance of conventional and Islamic banks in Pakistan.

A closer look at the existing studies reveals that effects of non-performing assts on banking sector performance has been examined by Kosmidou et.al [18], Athanasoglou et al [27], Căpraru & Ihnatov[22], Albulescu[23], Petria et.al[24], Menicucci & Paolucci [44] , Gaur and Mahapatra [45]. For the commercial banks in UK, Kosmidou et.al [18], finds that impact of loan loss reserves is positively significant on NIM though it does not have any significant impact on ROA. However, Athanasoglou et al [27], observes a statistically significant negative impact of loan loss provisions on the profitability of Greek banks. This result is consistent with the findings of Căpraru & Ihnatov[22], Petria et.al[24]. In case of India Gaur and Mahapatra [45], shows that non-performing assets has significant negative impact on profitability of commercial banks.

2.1. Research gaps

The basic fact as emerges from the trends of existing works reveals that internal or bank related and external or economy related factors are considered in most of the studies concerning performance determinants of commercial banks. There is no denying the fact that the external environment plays a great deal in the performance of commercial banks but the factors which occupy the centre stage at the performance of commercial banks are the internal or bank-specific factors. (Al-Homaidi et al [41]). In spite of the overwhelming importance of the bank-specific factors in influencing banks performance there are a very limited number of studies which consider the impact of internal factors only as the performance drivers of commercial banks. Moreover, the existing studies in this field leave aside some bank -specific factors which might have some bearings on banking sector performance. Furthermore, there are almost no studies on Indian commercial banks which consider the impact of internal factors only on the profitability of public sector commercial banks. Only

Sarkar and Rakshit in a recent study (Sarkar and Rakshit [7]) consider the impact of external factors on the profitability of public sector commercial banks in India.

This study attempts to fill this void by considering bank-specific factors only to find out commercial banks' performance drivers. Moreover, we have used an exhaustive list of internal factors some of which are not considered as the explanatory variables in such type of studies. Among this mention may be made of business per employee taken as the proxy for employee's performance, net non-performing loans to net advance ratio termed as quality of loan (Sarkar et.al [46].2023).

Thus, the journey into the world of existing literatures relating to performance determinants of commercial banks signifies the necessity of considering the impact of bank-specific factors only in analysing the performance of commercial banks. This study moves into that direction and consider an exhaustive list of internal factors in finding out the crucial bank-specific performance drivers of public sector commercial banks In India.

3. Objectives of the study

This study attempts to find out the crucial bank-specific factors in influencing the performance of Indian public sector commercial banks. Keeping in tune with this broad objective, this study further attempts to answer the following questions:

a) Does size matters performance for Indian public sector commercial banks?

b) Do the public sector commercial banks need to pay attention on operating profit to asset ratio (Asset Management) and operating expenses to net interest income ratio (operating efficiency) for the improvement of their profitability?

c) How does non-performing loans affect the performance of Indian public sector commercial banks?

d) Is it necessary to maintain adequate capital strength for improved performance?

e) Is it rational for public sector banks to strive for aggressive expansion of loans?

Taking return on assets (ROA) and net interest margin (NIM) as the performance indicators and asset size (AST), asset management (ASM), operating efficiency (OPE), quality of loan (QOL), capital adequacy ratio (CAR) and employees' performance (EMP) as the bank-specific performance drivers, this study attempts to answer these questions.

4. Data and methodology

4.1. Description of variables

This work attempts to find out the crucial bank-specific performance determinants of the public sector commercial banks of India. Performance measures are considered as the explained variables and bank-specific factors are used as explanatory variables in this study. Following sections give a brief description of these variables. The measure of the variables and the acronym used in this study has been presented in **Table 1**.

4.1.1. Explained variables

Return on assets (ROA), Return on equity (ROE), and Net interest margin (NIM) are generally used in the literature to measure commercial banks performance. Return on assets (ROA), taken as net profit to total assets ratio, shows how banks manage its assets to generate profit (Dietrich and Wanzenried[36],and is considered as an important indicator of commercial banks profitability (Golin[47], Athanasoglou et al[27], Sarkar and Rakshit[48]). Return on equity (ROE), expressed as net profit to the sum of capital, reserves and surplus, indicates the return to shareholders from their equity holding (Athanasoglou et al[27]). ROE reflects the effectiveness with which a bank manages its equity capital (Robin et.al [33]). Net interest margin, can be stated as the ratio of net interest income to total assets (Sarkar and Rakshit [8]). It highlights on profit generated from interest earning activities of banks ((Dietrich and Wanzenried[36]).

Following the trends of the existing works, we have used ROA and NIM as the performance measures of commercial banks

4.1.2. Explanatory variables

This study tries to consider the impact of bank-specific factors on the performance of commercial banks. Details of the explanatory variable chosen for this analysis has been explained below.

Asset size or Size (AST): Natural logarithm of total assets has been considered as the asset size in this study. Asset size has been used as one of the internal determinants of profitability in the works of Kosmidou et.al [18], Pasiouras and Kosmidou [19], Flamini et al [20], Anbar&Alper[38], Căpraru & Ihnatov[22],Dietrich and Wanzenried[36],Tan[31],Rashid and Jabeen[43], Robin et. al [33]. Larger banks may enjoy the advantage of economies of scale and scope (Dietrich and Wanzenried[36], Sarkar and Rakshit[48]) and there might be a positive association between size and profitability (Pasiouras and Kosmidou[19]) however for unduly large banks it may have some dampening effect on performance due to diseconomies of scale (Dietrich and Wanzenried[36]).

Asset Management (ASM): Operating income to total assets ratio may indicate a bank's capacity in generating income from its assets and can be termed as asset management (Al-Homaidi et.al [41]). A higher asset management ratio is thus thought to be profitable for banking sector (Masood and Ashraf [49]). Following Masood and Ashraf [49], Al-Homaidi et.al [41], Almaqtari et al [34], Sarkar and Rakshit [8], we have considered asset management as one of the internal performance determinants in this analysis.

Operating Efficiency (OPE): Operating expenses to net interest income can be expressed as the operating efficiency (Rasheed and Jabeen [43]) and we have used this measure as a proxy for operating efficiency in this study. Operating expenses to income ratio has also been used as a performance determinant in the works of Pasiouras and Kosmidou [19], Dietrich and Wanzenried[28] and is assumed to have some negative relationship with profitability.

Quality of loan (QOL): Net non-performing assets to loan ratio has been used as an indicator of credit quality in Barua et.al [32], whereas Dietrich and Wanzenried[36], used the percentage of loan loss provisions in total loans as credit quality indicator of commercial banks. Increasing amount of non-performing loans may

have some negative impact on the profitability of commercial banks (Petria et.al [24], Ghosh [50]) and for this reason commercial banks always strive to maintain credit quality by minimizing the burden of stressed assets (Pramahender[12]). From this perspective we have taken net non-performing assets (Net NPA) to net advances as an indicator of the loan quality of the commercial banks in this analysis (Sarkar et al [46]).

Capital Adequacy Ratio (CAR): Capital strength of a commercial bank may be regarded as a safety net in adversities (Athanasoglou et al [27]) and is considered as an important determinant of profitability (Pasiouras and Kosmidou [19],Ongore and Kusa [30], Dietrich and Wanzenried[36]. A highly capitalized bank is considered safer (Dietrich and Wanzenried[28]) whereas thinly capitalized banks may experience 'moral hazard' leading to increased risk (Rahaman and Sur[51]). Capital strength (capital adequacy) has been proxied either by equity to asset ratio (Anbar &Alper [38], Petria et al [24]), capital to asset ratio (Ongore and Kusa [30]) or by the ratio of capital to risk weighted assets (Albulescu [23], Le and Ngo [26]). Capital adequacy in the form of capital to risk weighted assets has been used in this study.

Employees' Performance (EMP): Productivity growth of employees is an important element for the development of any organisation (Athanasoglou et al [27]) and employers always strive to fetch highest business from the workers to maximize their earnings. Like other organisations commercial banks also attempts to fetch the highest business per worker and so business per employee may be taken as a performance determinant of commercial banks. It can be expressed as the ratio of the sum of advance and deposit to no of employees (Rahaman and Sur [51]). We have considered natural logarithm of business per employee as a proxy for employees' performance (EMP) in this study.

4.2. Data

The basic objective of this work is to observe the effect of bank specific determinants of the performance of the public sector commercial banks in India over the period from 2000 to 2017. All Public sector banks (25 in total) operated during this period have been selected for our analysis. The data on these banks have been taken entirely from Reserve Bank of India (RBI) database (www.rbi.org.in). Since, data on all explanatory and explained variables are available for the entire period, we have a balanced panel data set of 25 commercial banks over the 18-year study period beginning from the year 2000. Our analysis begins from the year 2000 because most of the important reform measures for the commercial banks in India were undertaken by this period. The study ends at 2017 because from April 2017 onwards several major changes have started taking place in the Indian banking sector by means of merger of various public sector banks. These mergers have changed the scenario of different public sector commercial banks in terms of size, market share, profitability indicators, non-performing assets etc. Extension of study period after 2017 without considering these merged banks is pointless and inclusion of data of these merged banks may provide unreliable results. For these reasons we have considered the time period 2000-2017 i.e., a period of 18 years beginning from the year 2000.

Table 1 depicts the measure of the variables and the acronym used in this analysis. From the table it is seen that return on assets (ROA) and net interest margin (NIM) have been taken as the dependent variables which are used as a proxy for commercial banks performance. Bank specific performance determinants as used in this study are asset size, asset management, operating efficiency, quality of loan, capital adequacy and

employees' performance. **Table 2** depicts the basic relationship of the variable in terms of descriptive statistics. It shows the maximum and the minimum values, mean, and standard deviation of all variables and VIF values of the explanatory variables. The VIF (Variance-inflating factor) values of each are less than 5 with a mean VIF of 2.60(not reported in the table) clearly indicates the absence of multicollinearity among the explanatory variables (Kleinbaum et.al [52]).

Table 3 reports the unit root test of the explanatory variables as prescribed by Levin et al [53], and Im et al [54]. Levin-Lin-Chu test permits the time trends, the residual variances and higher order autocorrelation to vary across individual units without limitation while Im-Pesaran-Shin test is grounded on estimating average of individual unit root test statistics by allowing simultaneous stationary and non-stationary series, and it permits heterogenous panels with serially uncorrelated errors (Das [55]). Calculating unit root on the basis of these two tests thus give a true picture regarding stationarity of the data (Sarkar and Rakshit [8]) and this has been shown in **Table 3**. It is evident from **Table 3** that among the dependent variables. Return on assets (ROA) is stationary at level but not at first difference as per Levin-Lin-Chu test though it is stationary at first difference but not at level as per Im-Pesaran-Shin test while net interest margin (NIM) is stationary at both levels and first difference as per both the tests. Among the independent variables asset management (ASM) and capital adequacy ratio (CAR) are stationary at levels and first difference as per both Levin-Lin-Chu test and Im-Pesaran-Shin test. It is further evident from this table that asset size (AST), quality of loan (QOL) and employees' performance (EMP) are stationary only at first difference but not at levels as per both the tests. **Table 3** depicts that, operating efficiency (OPE) is stationary at both levels and first difference according to Levin-Lin-Chu test but it is stationary only at first difference according to Im-Pesaran-Shin test. Results of unit root tests thus imply that the dependent and independent variables show mixed order of integration. Some variables are stationary at first difference only while, some others are stationary at both levels and first difference according to both the tests.

Table 1. Description of variables.

Variable	Measurement	Acronym
Dependent Variables		
Return on Assets	Net profit/Total assets	ROA
Net interest Margin	Net interest income/Total assets	NIM
Independent Variables		
Asset Size	Natural Log of Total Assets	AST
Asset Management	Operating Profit/Asset	ASM
Operating Efficiency	Operating expenses/Net interest Income	OPE
Quality of loan	Net NPA/Net advance	QOL
Capital Adequacy Ratio	Capital fund /Risk weighted assets	CAR
Employees Performance	Natural Log of (Deposit +Advance/No of employees) i.e., Natural Log of BPE.	EMP

Source: *Return on Assets, Net interest Margin, Total Assets, Operating profit, Operating expenses, net interest income, net Non-performing Assets (Net NPA), Net advance, Capital Adequacy ratio, Business per employee: Reserve Bank of India Website.*

Note: ***www.rbi.org.in***

Table 2. Descriptive Statistics.

Dependent Variables	Observations	Maximum	Minimum	Mean	SD	
ROA	450	11.54	-02.80	00.73	00.77	
NIM	450	4.54	00.66	02..72	00..57	
Independent Variables	**Observations**	**Maximum**	**Minimum**	**Mean**	**SD**	**VIF**
AST	450	14.81	09.02	11.37	01.08	2.22
ASM	450	04.17	00.11	01.92	00.63	2.44
OPE	450	166.14	40.26	73.69	16.84	4.12
QOL	450	18.37	00.17	03.38	03.24	1.83
CAR	450	23.11	00.47	12.13	01.79	1.49
EMP	450	03.03	-00.20	01.70	00.87	3.53

Source: *ROA, NIM, CAR, AST, ASM, OPE, QOL and EMP: Reserve Bank of India Website.*

Note: *Calculation of AST, ASM, OPE, QOL and EMP has been done taking data of Operating profit, Operating expenses, net interest income, net Non-performing Assets (Net NPA), Net advance, and Business per employee from Reserve Bank of India website(www.rbi.org.in). Here ROA=Return on assets, NIM=net interest margin, AST=Asset Size, ASM=Asset Management, OPE=Operating efficiency, QOL= Quality of Loan, CAR= Capital Adequacy Ratio, EMP=Employees' performance.*

Table 3. Results of panel unit root tests.

Variables	LLC (Levin-Lin-Chu) Test (Adjusted t statistic value)		IPS(Im-Pesaran-Shin) Test (z-t-tilde-bar statistic value)	
	Level	**1st difference**	**Level**	**1st difference**
ROA	-01.36*	-00.47	01.06	-08.70***
NIM	-04.99***	-03.78***	-04.22***	-08.96***
AST	05.90	-02.60***	07.96	-04.45***
ASM	-12.44***	-05.42***	-04.52***	-08.74***
OPE	-02.49***	-05.17***	00.43	-09.93***
QOL	03.83	-04.27***	10.17	-07.84***
CAR	-06.39***	-05.44***	-04.99***	-10.48***
EMP	05.70	-02.26***	09.56	-07.13***

Source: *ROA, NIM, CAR, AST, ASM, OPE, QOL and EMP: Reserve Bank of India Website.*

Note: *Unit root tests has been calculated using STATA. Adjusted t* statistic has been given in case of Levin-Lin Chu (LLC) test and z-t-tilde-bar statistic has been given in case of Im-Pesaran-Shin (IPS) test. *, ** and *** denote 10%, 5% and 1% level of significance respectively. Here ROA=Return on assets, NIM=net interest margin, AST=Asset Size, ASM=Asset Management, OPE=Operating efficiency, QOL= Quality of Loan, CAR= Capital Adequacy Ratio, EMP=Employees' performance.*

4.3. Methodology

We have applied a system GMM estimation technique developed by Arellano and Bover [56] in this study. The following section elaborately presents the justification for the choice of this methodological framework.

4.3.1. Justification for the choice of methodology

The works relating to profitability determinants of banking sector mostly use panel regression analysis. These works generally confront two basic challenges, one relating to issues of endogeneity and other is associated with the problem of profit persistence (Sarkar and Rakshit [8]). To overcome these challenges a dynamic panel estimation (GMM estimation) framework has been used in the works of Athansoglou et al [27], Dietrich and Wanzenried[36], Le &Ngo[26]. Roodman [57], advocates for the use of GMM estimation in the situations where the relationship is dynamic in nature i.e., the present values of the explained variables get affected by previous values, some of the explanatory variables are endogenous and number of time series observations is less than the number of cross section units. Present study may conform to almost all these conditions suggested by Roodman [57]. Firstly, bank profitability in one period may get affected by the profits of the previous periods because a profitable bank may become capable of increasing equity by retaining profit (Garcia-Herrero et.al [58]). Profitable bank may also be capable of influencing its future profit through business expansion by increased advertisement expenditure etc. Thus, bank profit in one period may get affected by past profit and may also influence profits of the coming year. This implies that there is a dynamic relationship as the present values of the explained variables get influenced by previous values. Secondly, there are sufficient reasons to believe that some of the explanatory variables may be endogenous. A profitable bank may influence its size, and operating efficiency (Dietrich and Wanzenried[36]) and may also have some impact on non-performing loans (Sarkar and Rakshit[48]). Thirdly, in the present study the number of time series observations (18) is less than the number of cross section units (25). Thus, our study conforms to all conditions to apply GMM estimation technique as suggested by Roodman [57]. Moreover, according to Delis and Kouretas [59], GMM estimation has two additional advantages. Firstly, GMM offers efficient estimation even in the presence of unit roots and secondly, it accommodates the problem of endogeneity in an efficient manner. Besides, GMM estimation may be efficiently used in the situations where some variables are stationary at levels and some are stationary at first difference, that is there are mixed order of integration. **Table 3** reports a mixed order of integration because some of the variables are stationary at levels and some are stationary at first difference. Thus, there are ample reasons for the use of GMM estimation procedure for this study and that is why so we have applied a system GMM estimation technique developed by Arellano and Bover (Arellano and Bover [56], 1995).

4.3.2. System GMM model

We have applied system GMM model for this study. Ullah [60] suggests that in case of balanced panel system GMM estimator provides a more efficient estimates for the coefficients involved in the model. Moreover, system GMM estimator controls for unobserved heterogeneity and profit persistence (Dietrich and Wanzenried[36]). According to Roodman [61] both one step and two step variants are used in the system GMM model. However, a two-step variant is asymptotically efficient than one step- variant (Roodman [61]). That is why, we have applied a two-step system GMM model for this study.

Following the works of Athansoglou et al [27], Dietrich and Wanzenried[36], we can apply a system GMM model as given by the equation 1.

$$PR_{it} = d + \delta PR_{i,t-1} + \sum_{k=1}^{k} \beta_J Y_{it}{}^{k} + \varepsilon_{it} \quad (1)$$

PR_{it} is the profitability(performance) of bank i at time t (ROA and NIM), where $i = 1, 2, .., N, t = 1, \ldots\ldots, T$. d denotes the constant term, Y_{it} is the bank specific independent variables, ε_{it} is the disturbance term comprising unobserved bank specific effect bi and u_{it}, the idiosyncratic error term. The value of δ(0< δ <1) signifies profit persistence, which ultimately returns to their normal level. A value of δ near to zero implies a competitive structure of the banking industry where as a value nearing to 1 implies that the industry is not much competitive (Dietrich & Wanzenried[28]).

Given the nature of our study we estimate the model separately for all performance measures ROA, and NIM taking all bank specific independent variables as mentioned in **Table 1**. Appropriate post estimation tests have been conducted to examine the statistical validity of the findings.

5. Estimation results

Table 4 presents the estimation results of two step system GMM Estimation. Lagged dependent variables are seen to be highly significant which ensures the use of a dynamic model. The positive coefficients of the profitability measures signify the persistence of profit. Since the coefficients values are small it implies the existence of competition in the banking industry (Dietrich and Wanzenried[36]). The relevant post estimation tests confirm the statistical validity of the results arrived in the study. Wald test probability values ensure the goodness of fit of the estimated model. Result **Table 4** suggests that Arellano-Bond 2nd order auto correlation is far higher than 0.10. This implies the absence of no serial correlation in the model. Probability value of the Sargan test statistic implies the absence of over-identifying restrictions in the model. These post estimation tests confirm that the results are statistically valid and provide an efficient estimate of the parameters.

It is seen from estimation table that asset size does not significantly affect the profitability measures ROA and NIM. However, the coefficient values suggest a mixed finding. There is an insignificant positive association between ROA and asset size where as in case of NIM the association is negative. These mixed findings suggest that increase in asset size may result increased returns for the public sector banks of India though it may not always result higher net interest margin. This insignificant association between size and profitability suggests that size hardly matters for the performance of public sector commercial banks in India. Existing studies also supports the assertion that size matters little for bank performance. For a panel of Greek banks. Athanasoglou et al [27], finds no significant association between size and profitability. Ćurak et.al [29], find the same result for Macedonian banking sector.

Asset management affects all profitability measures in a significant manner. This result hints that an increase in operating income per unit of asset leads to significant expansion of profitability of the commercial banks. Al-Hoimadi et.al [41], Almaqtari et.al [34], find the same result on their study on profitability of banks

operating in India. The significant positive association between asset management and banks 'performance indicate that public sector banks should pay adequate attention to increase operating profit to asset ratio for better performance.

An increase in operating cost leads to a decline in profitability (Dietrich and Wanzenried[28]) and this negative association is found in case of profitability of Indian commercial banks too. **Table 4** suggests that operating efficiency, measured as the ratio of operating expenses to net interest income, exerts highly significant negative association on ROA, and NIM. This result is in tune with the findings of Athansoglou et.al[27], Dietrich and Wanzenried[36], and specifies that Indian public sector banks are needed to be cost efficient to increase their profitability.

An increase in the volume of stressed asset is always considered a threat for the commercial banks (Petria et.al [24]) and commercial banks always strive to minimise the burden of this non-performing asset. An increase in the burden of non-performing loans deteriorates the quality of credit and leads to a negative impact on commercial banks performance. Result **Table 4** indicates that an increase in the burden of stressed asset significantly reduces profitability. The significant negative association between quality of loan (QOL) and profitability measures signify that public sector banks are needed to be cautious about the burden of unpaid debts and should not indulge into indiscriminate expansion of credit. Credit quality, expressed as net nonperforming loans to advance in Barua et.al [32], is also seen to have significant negative impact on profitability.

A higher capital ratio is presumed to reduce the need for external funding and may lead to higher profitability (Dietrich and Wanzenried[28]). Besides it may provide more flexibility to seize opportunities in business and also to tackle events resulting from unprecedented situations (Athansoglou et.al [27]). Thus, the banks with higher capital adequacy ratio may be more profitable (Pasiouras and Kosmidou [19]). Estimation results obtained in this work strongly supports this conjecture as capital adequacy ratio is seen to have strongly significant positive impact on profitability measure ROA. This significant positive association between capital adequacy and return on assets (ROA) signifies that maintaining adequate capital strength is necessary for improved profitability of public sector banks. The experience of Indian banking sector shows that a higher capital adequacy has yielded positive results for Indian public sector commercial banks. From 1992-93 onwards Government of India has infused capital into public sector banks in different times and these measures resulted increased profitability for these banks. (RBI report on trend and progress of banking in India [6]). The findings arrived here is in tune with the works of Athansoglou et.al [27], Flamini et.al [20], Capraru and Ihnatov[22].

It is the objective of every business to fetch higher business per employee. Commercial banks are not exception. Banks also desire to increase business per employee to achieve higher profitability. But mere increase in business may not always converted to increased profitability the estimation result suggests. It is seen that business per employee proxied as employees' performance exerts significant negative influence on ROA and NIM of the Indian public sector banks. This implies that the race of the workers to increase business

without giving due consideration on the probability of loan loss may lead to an increase in non-performing loans and reduce profitability of the banking sector. Thus, the estimation result signifies that Indian public sector banks should not vie for aggressive expansion of loans without making proper judgement on repayment prospect.

Table 4. System GMM estimation.

Dependent Variables (Return on Assets and Net Interest Margin)		
Variables	**ROA**	**NIM**
$L_{1.}$ dependent variable	0.037***	0.359***
	(0.002)	(0.018)
AST	0.171	-0.120
	(0.008)	(0.020)
ASM	0.289***	0.169***
	(0.026)	(0.026)
OPE	-0.005***	-0.015***(0.001)
	(0.002)	
QOL	-0.109***	-0.035***
	(0.007)	(0.005)
CAR	0.034***	0.006
	(0.008)	(0.004)
EMP	-0.399***	-0.252**
	(0.106)	(0.107)
Number of Observations	425	425
Arellano-Bond Test for AR (2)	0.380	0.189
Sargan Test P value	0.520	0.503
Wald test p- value	0.000	0.000

Source: *Authors' calculation. Standard errors are in brackets.*

Note: **, ** and *** denote level of significance at 10%, 5% and 1% level respectively. N.B. Two Step Estimation.*

6. Conclusions

This work desires to find out the role of bank-specific factors affecting the performance of public sector commercial banks in India. The estimation results show that asset management, operating efficiency, quality of loan and employees' performance have highly significant impact on all the measures of performance ROA and NIM. Capital adequacy ratio strongly affects return on assets (ROA) but it has an insignificant positive association with NIM. Asset size leaves no significant impact on the profitability of public sector commercial banks in India. The estimation results thus provide an answer to the questions set in section 3. These results show that size hardly matters for the performance of public sector commercial banks. Increasing asset size may not improve performance of public sector banks in India. The results obtained in this study further

suggests that banks should pay adequate attention to maintain a proper balance between operating profit and asset and should strive for reducing operating expenses. Burden of unpaid loans severely impacts banks' profitability and adequate capital strength improves performance of commercial banks the results suggest. Thus, public sector banks should try to put a tap on stressed assets and should try to increase capital base. Aggressive business expansion may not be a solution for improved performance for the public sector commercial banks in India.

From the above analysis it can be concluded that, asset management, operating efficiency, quality of loan and employees' performance may be regarded as the crucial performance drivers of the public sector commercial banks in India. Capital adequacy ratio may also be regarded as the significant determinant of Indian commercial banks performance. These results suggest that public sector banks should manage their assets in a better way, be cautious about increase in operating expenses, follow a prudent attitude in the matters of credit expansion and be vigilant about timely repayment by the debtors. These results also indicate that maintaining adequate capital strength should also be a priority of public sector banks.

It has been already mentioned that the last decade was not at all great for the Indian public sector banks. Declining profitability, mounting volume of non-performing loans, deterioration of asset quality characterized the public sector banks of India during this decade. Besides, anaemic credit growth, lower level of credit GDP ratio compared to international average, decline in interest income are still haunting the banking sector of this country (RBI report on trend and progress of banking in India [14]). However, strict adherence to IBC (Insolvency and Bankruptcy Code) as the dominant mode of recovery, policy of capital infusion to the public sector banks has yielded some positive results with respect to the performance of banking sector especially of public sector banks in current times (RBI report on trend and progress of banking in India [7]). Areas of concern are till there with respect to non-performing loans, declining credit demand and interest income. On the policy front the decision to merge public sector banks has already taken place (Sarkar and Rakshit [8]) and there is a high speculation for second round of merger to reduce the number of public sector banks. Views of privatising all public sector banks except SBI, are also gaining ground in the corridors of power.

In view of this situation the results arrived in this study have profound implications in framing appropriate policy decisions for the growth and development of banking sector of India.

Authors' contribution

Sreemanta Sarkar: Conceptualisation, Data Collection, Selection of Methodology, Calculation, Preparation of initial draft.

Debdas Rakshit: Review, editing and refinement of initial draft.

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The authors do not have any conflicts of intertest

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