Internal and external determinants of listed commercial banks' profitability in India: dynamic GMM approach

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Abstract: This study aims to examine the impact of internal and external determinants of 37 commercial banks' profitability listed on Bombay stock exchange (BSE), India for a period from 2008 to 2017. Both static models (pooled, fixed and random effects) and generalised method of moments (GMM) are used. The results show that bank size, assets quality, liquidity, assets management, and net interest margin are important internal determinants which affect ROA. Capital adequacy, deposits, operation efficiency, gross domestic product and inflation rate are found to have a negative significant impact on ROA. Further, the results indicate that capital adequacy, bank size, operation efficiency, gross domestic product and inflation rate have a significant negative influence on ROE. However, assets quality and assets management exhibit a positive effect on ROE but liquidity, deposits, net interest margin, and non-interest income have an insignificant impact on ROE.

Keywords: internal determinants; external determinants; banks' profitability; panel data; GMM; India.

Reference to this paper should be made as follows: Al-Homaidi, E.A., Almaqtari, F.A., Yahya, A.T. and Khaled, A.S.D. (2020) 'Internal and external determinants of listed commercial banks' profitability in India: dynamic GMM approach', *Int. J. Monetary Economics and Finance*, Vol. 13, No. 1, pp.34–67.

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1 Introduction

The banking system has a significant role to play in the rapid growth of economy through planned efforts. In fact, the banking system of any country is the lifeblood of that economy. A banking institution is indispensable in modern society. The banking sector is the lifeline of the economy. It is one of the most important financial institutions in a financial system. It plays a vital role in the success or failure of an economy (Paghada, 2015). Banks play an important role in mobilisation of deposits and disbursement of credit to various sectors of the economy (Desai, 1987). The banking system is the fuel injection system which spurs economic efficiency by mobilising savings and allocating them to high return investment. Research confirms that countries with a well-developed banking system grow faster than those with the weaker one.

According to previous studies as, Chen and Wei (2017), Javaid and Alalawi (2018), Malichov and Mária (2015), Robin et al. (2018), and Yahya et al. (2017) who reported that the determinants of bank profitability are classified into two groups: external and internal determinants. The Internal determinants are sometimes called (bank-specific) and the external ones are called (micro-economic) determinants of banks' profitability. The main aim of this research is to investigate the internal (bank-specific) and external

(macro-economic) determinants of commercial banks' profitability listed on Bombay Stock Exchange (BSE) in India over the period from 2008 to 2017.

The rest of this study is organised as follows: Section 2 reviews the existing literature. Section 3 presents an overview of India banks. Section 4 provides the data and methodology of the study. Section 5 is devoted to data analysis and results. Section 6 concludes.

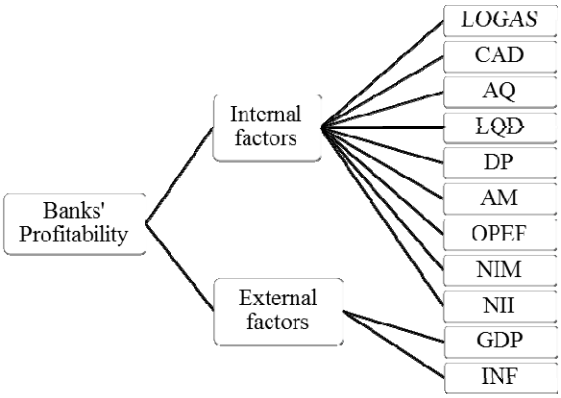
2 Literature review

There are many prior investigations that have been conducted to examine profitability determinants of banks in different countries (e.g., Malichov and Mária, 2015; Mrad, 2015; Tiberiu, 2015; Yahya et al., 2017; Mukhibad et al., 2017; Zampara et al., 2017; Bouzgarrou et al., 2017; Chen et al., 2017; Javaid and Alalawi, 2018; Robin et al., 2018; Fidanoski et al., 2018; Soedarmono et al., 2019). Most of these studies have classified profitability determinants into two categories; internal and external determinants (e.g., Yeon and Kim, 2013; Lee and Hsieh, 2013; Demirhan, 2014; Tiberiu, 2015; Bouzgarrou et al., 2017; Chen et al., 2017; Yahya et al., 2017).

Following prior studies, this study used banks' profitability as the dependent variable, while the bank-specific (internal) and macroeconomic (external) factors were considered as independent variables. Two indicators have been used for measuring banks' profitability (the dependent variable); return on assets (ROA) and return on equity (ROE). ROA is defined as the ratio of net profit after tax divided by total assets (e.g., Lee and Hsieh, 2013; Zaidirina and Lindrianasari, 2015; Yeon and Kim, 2013; Bogdan and Ihnatov, 2014; Tiberiu, 2015; Malichov and Mária, 2015; Ozili and Uadiale, 2017; Javaid and Alalawi, 2018; Al-Homaidi et al., 2019), and ROE is measured by net profit after tax to shareholders' equity (e.g., Eljelly and Elobeed, 2013; Abbas et al., 2014; Kythreotis, 2014; Jedidia, 2016). As shown in Figure 1, the independent variables are classified in this study into two categories;

- internal (bank-specific) factors
- external (Macroeconomic) determinants of commercial banks' profitability.

Figure 1 Internal and external factors



2.1 Internal factors

2.1.1 Bank size

Following prior studies, bank size measured by natural logarithm of total assets is used to define the assets size (e.g., Masood et al., 2012; Dhiensiri and Wang, 2014; Gunardi et al., 2016; Batir et al., 2017; Rjoub et al., 2017).

2.1.2 Capital adequacy

Capital adequacy is measured by the ratio of equity to total assets (e.g., Schiniotakis, 2012; Mokni and Rachdi, 2014; Rani and Zergaw, 2017; Rjoub et al., 2017). Different studies indicated that capital ratio is a significant and a positive determinant of a bank's profitability (e.g., AL-Omar and AL-Mutairi, 2008; Bougatef, 2017; Chowdhury and Rasid, 2017; Francis, 2013; Jara-Bertin et al., 2014; Menicucci and Paolucci, 2016; Salike and Ao, 2017; Saona, 2016). However, Naeem et al. (2017) concluded that capital adequacy ratio has a positive but insignificant relationship with the bank's profitability as measured by ROA and ROE. The findings of Yahya et al. (2017) revealed that capital adequacy has a negative and insignificant relationship with ROA and ROE.

2.1.3 Asset quality

Asset quality is defined by loans to total assets (e.g., Rashid and Jabeen, 2016; Salike and Ao, 2017; Ozili and Uadiale, 2017; Rani and Zergaw, 2017; Trad et al., 2017; Rjoub et al., 2017; Robin et al., 2018). Menicucci and Paolucci (2016) suggested that banks with higher loans ratio tend to be more profitable but the effects on profitability are statistically insignificant in some cases. By contrast, a low asset quality is associated with low profitability (Bougatef, 2017). However, AL-Omar and AL-Mutairi (2008) indicated that loan-assets ratio explains about 67% of the variation in ROA.

2.1.4 Liquidity

Liquidity ratio is the ratio of liquid assets to total assets (Tiberiu, 2015; Teker et al., 2016; Issn et al., 2017; Maria et al., 2017; Al-Homaidi et al., 2019). While it is found that liquidity ratio has a positive association with a bank's profitability (e.g., Bougatef, 2017; Naeem et al., 2017; Yahya et al., 2017). Tiberiu (2015) stated that the level of liquidity has a mixed influence and Marijana et al. (2012) found that the impact of liquidity ratio is negative on ROE.

2.1.5 Deposits

Deposits ratio is expressed by deposits to total assets (e.g., Tarawneh, 2006; Gul et al., 2011; Kapaya and Raphael, 2016; Rana et al., 2016; Goel and Kumar, 2016; Yahya et al., 2017). Findings from prior studies suggested that banks with higher deposits tend to be more profitable, but the effects on profitability are statistically insignificant in some cases (Menicucci and Paolucci, 2016). Consistently, Francis (2013) and Yahya et al. (2017) indicated that growth in bank deposits has a positive influence on banks' profitability.

2.1.6 Assets management

Assets management ratio is measured by operating income to total assets (Masood and Ashraf, 2012). Yahya et al. (2017) indicated that assets management is positively significant with ROE.

2.1.7 Operating efficiency

Operating efficiency ratio is defined by total operating expense to total assets (e.g., Sufian and Chong, 2008; Sen et al., 2015; Yahya et al., 2017). Prior studies indicated that operating efficiency ratio exhibited a negative association with ROA and ROE (e.g., Sufian and Chong, 2008; Alexiou and Sofoklis, 2009; Akhtar et al., 2011; Masood and Ashraf, 2012; Yahya et al., 2017). Petria et al. (2015) found contradictory results stating in their research that management efficiency ratio has an influence on banks' profitability. In the same context, Salike and Ao (2017) revealed that operating efficiency is an important determinant of banks' profitability.

2.1.8 Net interest margin

Net interest margin is measured by net interest income divided by total assets (e.g., Rani and Zergaw, 2017; Saif, 2014; Sarkar and Bhaumik, 1998; Alrawashedh et al., 2014; Yeon and Kim, 2013).

2.1.9 Non-interest income

Non-interest income is measured by non-interest income to total assets (Tan et al., 2015; Wu et al., 2007). Ahamed (2017) found that a higher share of non-interest income yields higher profits and risk-adjusted profits in particular when banks are involved in more trading activities.

2.2 External factors

2.2.1 GDP growth

GDP is considered a proxy for business cycle. It is expected that numerous factors such as deposits and loans which are related to demand and supply are affected by GDP (Masood et al., 2012; Szarowska, 2018). The impact of economic activity (GDP) in prior research is mixed. Anbar and Alper (2011), Masood and Ashraf (2012), Combey and Togbenou (2017) and Messai and Gallali (2019) concluded that GDP is negatively insignificant as far as banks' profitability is concerned. Acaravci and Çalim (2013), Jara-Bertin et al. (2014) and Yahya et al. (2017) reported that banks' performance is positively related to economic growth. Further, Marijana et al. (2012), Petria et al. (2015) and Salike and Ao (2017) concluded that GDP has an influence on banks' profitability.

2.2.2 Annual inflation rate

To measure the percentage increase in the consumer price index (CPI) for all goods and services, the annual inflation rate is used. The actual values of costs and revenues are affected by inflation (Masood et al., 2012; Nwani and Okogbue, 2017. The inflation rate

is found to have a positive insignificant relationship with ROA but a significant positive association with ROE (Bogdan and Ihnatov, 2014). Chowdhury and Rasid (2017) revealed that inflation rate is negatively and statistically significant to the performance of Islamic banks. Petrevski et al. (2012), Bogoev et al. (2012a, 2012b) used the Link between Central Bank Independence and Inflation in Central and Eastern Europe.

Although different studies have been conducted to examine profitability determinants of banks in India. For instance, Rao et al. (2009) assessed the profitability of 55 Indian banks during the period from 1998 to 2003. The study concluded that public sector banks have lower ROA than foreign banks. However, it was observed that there is a significant drop in profit margin during 2002–2003 of private banks against a significant increase for public sector banks. In their research, Narwal and Pathneja (2015) indicated that private sector banks are able to use their technology much better as compared to public sector banks. However, there exists no discernible disparity in the profit-making of these two banks.

The profits made by a bank, the quality of its assets and non-interest income were assessed by Ahamed (2017) conducting research on 107 Indian banks over the time period from 1998 to 2004. The study concluded that greater non-interest income led to more profits and risk-adjustment. The research also found that banks with low assets quality are able to spread out their income benefits as compared to banks with higher asset quality. Another study was carried out by Sinha and Sharma (2016) analysing 42 banks from 2000 to 2013. The study found that capital to assets ratio, operating efficiency and diversification have led to a very important and positive impact on the profits earned by a bank. The risk of giving out credits which are calculated through the existing rules for bad debts has an adverse effect on banks' profit. The profits earned by banks is directly proportional to the increase in GDP which means that growth in the economy is good news for the banks.

Singh and Sharma (2016) studied 59 banks between 2000–2013, looking into the causes of their liquidity by analysing specific as well as macroeconomic factors. According to the study, ownership is a factor that impacts bank liquidity. Except for funding costs and except for employment, all other bank-specific and macroeconomic factors have a serious impact on liquidity of banks. Further, bank size and GDP were found to have a negative effect on bank liquidity. On the other hand, deposits, profitability, capital adequacy and inflation exhibited a positive effect on banks' liquidity. Cost of funding and unemployment indicated an insignificant effect on banks' liquidity. Further, Bapat (2017) concluded that among the bank-specific factors, non-performing loans and cost to income ratio have a negative impact on profits made by banks. However, diversion of the services is seen to have no effect on profits earned. An adverse effect is caused by banks' profits due to non-performing loans and cost to income ratio. In the same context, there is no effect caused due to diversion on profits earned by banks. Some of prior studies investigated about the banking sector in different countries such as (Sergi, 1994, 2000; Matoušek and Sergi, 2005, 2011; Barnett et al., 2018; Pellegrini et al., 2018; Naghshpour et al., 2018, 2019; Chen and Sergi, 2018; Krinichansky et al., 2019).

3 Overview of Indian banks

India has an extensive and large financial system distinguished by diversified financial institutions including both banks and non-banks (Ghosh, 2016). Since 1990s, the Indian

economy had undergone substantial liberalisation and policy shifts with the objectives of improving banks' efficiency, profitability and productivity, thus enhancing businesses to be more competitive (Agarwala, 2009; Ghosh, 2016). However, due to information asymmetry, the product markets of Indian banks are moderately competitive and less opaque (Sinha and Sharma, 2016). A salient feature of the liberalisation reforms was the concentration on enhancing the banking sector competition by expanding the financial system to include entrance of private and foreign banks (Ghosh, 2016). Currently, the Indian banking system comprises of 27 public banks, 26 private banks, 46 foreign banks, 56 regional rural banks, 1574 urban cooperative banks and 93,913 rural cooperative banks and cooperative credit institutions (Reserve bank of India (RBI)), 70–73% of the total assets of the Indian banks are reported by the public sector banks (Ghosh, 2016; Shrivastava et al., 2018). The financial system of India is dominated by commercial banks.

Increased attention during recent years has been received for Indian banking due to higher growth rates of gross domestic product (GDP). However, there are dearth of studies that examine the factors that influence banks' profitability in India. Few studies only have investigated this issue taking in consideration different measures of banks' profitability (see Table 1). With increasing pressure on net interest margin (NIM) for Indian banks, it is possible that Indian banks could reinforce revenue through diversification (Bapat, 2017). Further, in an aggressively challenging competitive and regulatory market, the Indian banks have to allocate efficiently their assets and liabilities to enhance the profitability (Viswanathan et al., 2014). Among the scheduled commercial banks, both public and private banks contributed about 93% of the deposits in the year March 2013 (Bapat, 2017).

The annual report of the Reserve Bank of India (RBI) 2016–2017 addresses that asset quality of the Indian banks reported a sharp deterioration of non-performing assets (NPAs) of public sector banks (PSBs). 12.1% of the Indian banks' advances were stressed as on 31 March 2017. Further, severe rise in NPAs provisions negatively affected the profitability of banks. Many banks have also witnessed capital position attrition, even though the capital to risk-weighted assets ratio (CRAR) for the banking system as a whole marginally increased and continued to be above the regulatory minimum under the Basel III framework. Figure 2 shows that ROE has sharply deteriorated during the period from 2008 to 2017 and ROA has also decreased during this period. Further, the net interest income is met with a rise in total operating expenses. Moreover, heavy liabilities to total assets as illustrated in Figure 2 and high liquidity levels as compared to deposits may also affect the profitability of Indian banks.

India has an emerging banking system and the disturbance in the Indian economy provides robust evidence for investigating the profitability determinants of Indian banks in detail (Sinha and Sharma, 2016). India represents a strong case among emerging and developing markets to discuss these determinants in a comprehensive approach as India is one of the largest and fastest growing emerging economies with a gamut of banks across different ownership categories (Ghosh, 2016). Further, the Financial Stability Report 2013 and 2017 by Reserve Bank of India, highlights a growing vulnerability of sustainability of the country's banking system. The report pointed out that banking sector is under severe stress, with an increasing trend of bad loans and an increase in bank fraud. Hence, this represents the necessity to examine the responsible factors that may affect banks' profitability in India in the current scenario.

Table 1 Summary of literature review in India

No.	Studies By	*Variables* IV/s	*Variables* DV/s	*Sample* Size	*Sample* Time limit	Methods	Results
1	Rao et al. (2009)	"Assets utilisation, equity multiplier, net profit margin, return on assets, and return on equity"		55	1998–2003	Descriptive analysis	Foreign banks have higher ROA than public sector banks
2	Ahamed (2017)	"Diversification, fee, trade, log of total assets, loan loss provision over assets, ratio of equity to assets, ratio of loans to assets, and asset growth"	ROA, ROE, and NII	107	1998–2014	Descriptive Regressions GMM	The higher share of non-interest income the higher profits and risk-adjusted profits
3	Narwal and Pathneja (2015)	"Return on average assets, net interest margin, diversification, market share, size, advances, investments, deposits, and physical capital"		46	2004–2014	Descriptive correlation linear regression	Private sector banks are more productive than public sector banks for their better utilisation of technology. But no significant difference exists in the profitability of two bank groups
4	Singh and Sharma (2016)	"Bank specific factors: bank size, profitability, deposits, cost of funding, capital adequacy. macroeconomic factors: GDP, inflation, and unemployment"	Liquidity	59	2000–2013	OLS, fixed effect, and random effect	Bank ownership affects liquidity of banks. Bank-specific (except cost of funding) and macroeconomic (except unemployment) factors significantly affect bank liquidity
5	Seenaiah et al. (2015)	"Operating profits, cost of deposits, ratio of wage bills to total expenditure, proportion of priority sector lending, provisioning for NPAs, and net interest margin"	ROA and ROE	72	1995–2012	Descriptive Correlations Regressions	Operating profits, wage bills, non-performing assets and net interest margin affect the profitability of Indian banks, while, the priority sector lending does not have any impact on bank profitability in India

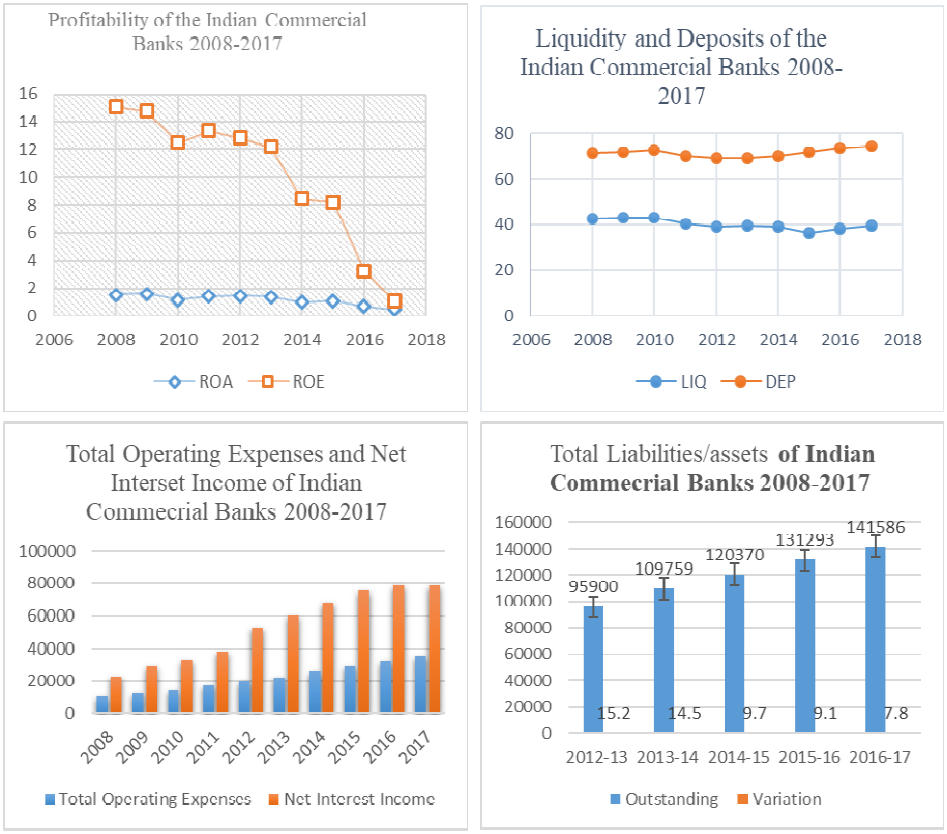
Table 1 Summary of literature review in India (continued)

No.	Studies By	*Variables*		*Sample*		Methods	Results
		IV/s	*DV/s*	*Size*	*Time limit*		
6	Al-Homaidi et al. (2018)	"Bank size, assets quality, capital adequacy, liquidity, operating efficiency, deposits, leverage, assets management and the number of branches, GDP, inflation rate, interest rate, and exchange rate"	ROA, ROE, NIM	69	2008–2017	Descriptive Correlations Regressions GMM	The results of the study show that all bank-specific factors, except the number of branches, exhibited significant impacts on profitability as measured by NIM. The findings also show that all macroeconomic determinants used in the study are found to be significant with negative impacts on Indian commercial banks profitability
7	Sinha and Sharma (2016)	"Provisions for non-performing assets to total assets, capital to assets ratio, annual growth of deposits, bank size, non-interest income, operating expenses to total assets, GDP growth, Inflation rate, and Herfindahl - Hirschman Index"	ROA and ROE	42	2000–2013	Descriptive Statistics Correlation GMM	Capital to assets ratio, operating efficiency and diversification have been found to be significantly and positively affecting the bank profits. While credit risk has a negative impact. But negatively to inflation rate. However, no evidence of crisis effect
8	Reddy (2011)	"Cost efficiency, ratio of capital to assets, ratio of non-interest income to assets, ratio of loans to assets, ratio of overhead to assets. industry-specific variables: ratio of assets to GDP, Herfindahl-Hirschman Index, market, inflation, rate of interest, and growth rate of economy"	Net interest margin and returns on assets	87	1992–2006	Regression GMM	Profitability of banks is not only determined by their own characters but also by the industry-specific and macroeconomic factors

Table 1 Summary of literature review in India (continued)

		Variables		*Sample*			
No.	*Studies By*	*IV/s*	*DV/s*	*Size*	*Time limit*	*Methods*	*Results*
9	Bapat (2017)	"Non-performing loans (NPL), income diversification (other income to operating income, credit-deposit ratio, cost to income ratio, banking industry ownership, bank size, financial crisis, GDP growth, and inflation rate"	Return on average assets and return on equity	42	2006–2007 to 2012–2013	Descriptive Statistics Correlation GMM	Among the bank-specific factors, non-performing loans and cost to income ratio negatively affect the bank profitability, and diversification measures do not affect the bank profitability
10	Bodla and Verma (2006)	"Non-interest income, credit/deposit ratio, NPA as a percentage to net advances (NPA), provision and contingencies, operating expenses, business per employee, and profit per employee"	Profit after Tax	19	1991–1992 to 2003–2004	Regression analysis	The study has brought out that the variables non-interest income, operating expenses, provision and contingencies and spread have a significant relationship with net profits of Public Sector Banks in India
11	Maiti and Jana (2017)	"Business per employee, profit per employee, net interest margin, capital to risk-weighted assets ratio, non-performing assets, advance to deposit ratio, operating expenses ratio, non-interest income ratio"	ROA and ROE	75	2008–2009 to 2012–2013	Multiple regression Descriptive statistics	The empirical results have found strong evidence that profit per employee, net interest margin, net non-performing assets ratio and non-interest income have a significant impact on the profitability for all bank groups
12	Almaqtari et al. (2018)	"Bank size, assets quality, capital adequacy, liquidity, operating efficiency, deposits, leverage, assets management, the number of branches, gross domestic product, inflation rate, interest rate, exchange rate, financial crisis, and demonetisation"	ROA and ROE	69	2008–2017	Multiple regression Descriptive Correlation	The results revealed that bank size, the number of branches, assets management ratio, operational efficiency, and leverage ratio are the most important bank-specific determinants that affect the profitability of Indian commercial banks as measured by ROA
13	El Khoury (2015)	"Stock returns, exchange rate, exports and platinum, aluminium, and unemployment rate"	Stock return	S&P 350	2003–2012	Regression	The study finds that the S&P 350 positively affects stock returns, supporting the single index model

Figure 2 Present profitability, liquidity, interest income, and commercial banks (see online version for colours)



4 Methodology of study

4.1 Study population and sample

The major concern of this study is to discuss the internal and external factors that affect the profitability of listed commercial banks in India from 2008 to 2017. For this purpose, the study has analysed 42 commercial banks which are listed in Bombay Stock Exchange. However, data were available only for 37 listed commercial banks, hence they have been chosen as a sample size for this research. The ProwessQI database was used for gathering financial data, whereas macroeconomic information was acquired from RBI publications.

Our study combined different variables such as bank internal variables and external determinants. The study includes both private sector banks and public sector banks that are listed in Bombay Stock Exchange in India. The sample size of this study represents 88% of the listed commercial banks in India.

4.2 Definition of variables

In the current study, banks' profitability is considered as the dependent variable measured by ROA and ROE which is functioned agonist internal and external determinants. While internal factors include: assets size, capital adequacy, asset quality, liquidity, deposit, asset management, operating efficiency; external factors are GDP and annual inflation rate. Following in Table 2 which summarises variables definition, the expected sign, and source of data:

4.3 Model specification

A balanced panel data of 37 listed commercial banks over the period of ten years is used in the present study. The panel used is analysed employing linear regression models with pooled, fixed and random effect models and generalised method of moments (GMM). This study uses the panel data structure model that has been used by (Chowdhury and Rasid, 2017; Masood et al., 2012) which is defined as follows:

$$\gamma_{nt} = \alpha + \beta x_{nt} + \varepsilon_{nt} \tag{1}$$

where γ_{nt} denotes the dependent variable (Profitability), α is the intercept term on the explanatory variables, β is a $k \times 1$ vector of parameter to be estimated, and vector of observations is x_{nt} which is $1 \times k$, $t = 1, \ldots, T$; $n = 1, \ldots, N$. the practical and operational form, the aforementioned model can be expressed as follows:

$$Profitability = f(Internal\ determinants;\ External\ \ factors) \tag{2}$$

The above model hypothesises that banks' profitability in India is a function of internal and external determinants. Building on this model, two models have been developed to investigate the factors that may determine banks' profitability in India which are as follows:

$$\begin{aligned} Profitability_{it} = {} & \alpha_t + \beta_1 LogAS_{it} + \beta_2 CA_{it} + \beta_3 AQ_{it} + \beta_4 LQD_{it} + \beta_5 DP_{it} + \beta_6 AM_{it} \\ & + \beta_7 OPEF_{it} + \beta_8 GDP_{it} + \beta_9 INF_{it} + \beta_{10} NIM_{it} + \beta_{11} NII_{it} + \varepsilon_{it} \end{aligned} \tag{3}$$

$$\begin{aligned} ROA_{it} = {} & \alpha_t + \beta_1 LogAS_{it} + \beta_2 CA_{it} + \beta_3 AQ_{it} + \beta_4 LQD_{it} + \beta_5 DP_{it} + \beta_6 AM_{it} \\ & + \beta_7 OPEF_{it} + \beta_8 GDP_{it} + \beta_9 INF_{it} + \beta_{10} NIM_{it} + \beta_{11} NII_{it} + \varepsilon_{it} \end{aligned} \tag{3a}$$

$$\begin{aligned} ROE_{it} = {} & \alpha_t + \beta_1 LogAS_{it} + \beta_2 CA_{it} + \beta_3 AQ_{it} + \beta_4 LQD_{it} + \beta_5 DP_{it} + \beta_6 AM_{it} \\ & + \beta_7 OPEF_{it} + \beta_8 GDP_{it} + \beta_9 INF_{it} + \beta_{10} NIM_{it} + \beta_{11} NII_{it} + \varepsilon_{it} \end{aligned} \tag{3b}$$

Where profitability = ROA and ROE; α_t is a constant term; $i = 1, \ldots, N$ and $t = 1, \ldots, T$. all other variables are as defined in Table 2. To conduct our empirical study, we address these problems by employing the GMM suggested by Arellano and Bover (1995). Following Saona (2016) these arguments suggest the application of a dynamic model of banking profitability which takes the following form:

$$Profitability_{it} = \beta_0 + \beta_1 Profitability_{it-1} + \sum_{j=1}^{9} \delta_j X_{it} \sum_{k=1}^{2} \theta_k Y_t + \eta_i + \mu_t + \varepsilon_{it} \tag{4}$$

Table 2 Definitions of the variables

Determinants	*Variable*	*Notation*	*Measure*	*Expect effect*	*Data source*
Dependent variables	Profitability	ROA	$ROA_{it} = \frac{Net\ prof_{it}}{Total\ assets_{it}}$	NA	Prowess QI database
		ROE	$ROE_{it} = \frac{Net\ prof_{it}}{Total\ equity_{it}}$	NA	Prowess QI database
Bank-specific independent variables Asset	Bank size	LogAs	Natural logarithm of total assets	±	Prowess QI database
	Capital adequacy	CA	$ROA_{it} = \frac{Equity_{it}}{Total\ assets_{it}}$	±	Prowess QI database
	Asset quality	AQ	$AQ_{it} = \frac{Loan_{it}}{Total\ assets_{it}}$	±	Prowess QI database
	Liquidity	LQD	$LIQ_{it} = \frac{Liquid\ assets_{it}}{Total\ assets_{it}}$	±	Prowess QI database
	Deposit	DP	$DEP_{it} = \frac{Deposits_{it}}{Total\ assets_{it}}$	+	Prowess QI database

Table 2 Definitions of the variables (continued)

Determinants	*Variable*	*Notation*	*Measure*	*Expect effect*	*Data source*
Bank-specific independent variables Asset	Asset management	AM	$AM_{it} = \frac{Operating\ income_{it}}{Total\ assets_{it}}$	+	Prowess QI database
	Operating efficiency	OPEF	$OPEF_{it} = \frac{Total\ operating\ expense_{it}}{Total\ assets_{it}}$	–	Prowess QI database
	Income-expenditure structure	NIM	$NIM_{it} = \frac{Net\ interest\ income_{it}}{Total\ assets_{it}}$	±	Prowess QI database
	Macroeconomic	NII	$NII_{it} = \frac{Non-interest\ income_{it}}{Total\ assets_{it}}$	–	Bank-scope
Macroeconomic independent variables	Economic activity GDP	GDP	*Annual real GDP growth rate*	+	World bank
	Inflation rate	IFR	*Annual inflation rate (IFR).*	±	World bank

where X_{it} represents the vector of the intra-bank determinants of profitability, Y_t is the vector of the extra-bank determinants and i, t and ε_{it} measure the individual effect, the temporal effect, and the stochastic error, respectively.

$$\sum_{j=1}^{9} \delta_j X_{it} = \delta_1 LOGAS_{it} + \delta_2 CA_{it} + \delta_3 AQ_{it} + \delta_4 LQD_{it} + \delta_5 DP_{it} + \delta_6 AM_{it} + \delta_7 OPEF_{it} + \delta_8 NIM_{it} + \delta_9 NII_{it} + \varepsilon_{it} \quad (5)$$

And

$$\sum_{j=1}^{2} \theta_k Y_t = \theta_1 GDP_{it} + \theta_2 INF_{it} \quad (6)$$

The study uses Hausman test to choose the appropriate estimation method -fixed effects or random effects. The fixed effect regression model is more appropriate than the random effect model the value of Hausman test is less than 0.05% (p-value < 0.05%) in model 1 (ROA). In model 2 (ROE) the random effect regression model is more appropriate than the fixed effect regression model as the value of Hausman test is less than 0.05% (p-value > 0.05).

5 Results and discussion

5.1 Descriptive statistics

Table 3 presents descriptive statistics analysis for the selected sample over the period from 2008 to 2016. The variables have considerable dispersion as represented by the average, the standard deviation, maximum and minimum scores. The average values of ROA and ROE are 0.82 and 10.93 respectively. It reveals that the percentages of ROA and ROE are very small, whereas, S.D is 0.70 for ROA and 12.09 for ROE. The minimum and maximum values are –2.04 and 2.02 for ROA, and –38.6 and 31.56 for ROE respectively. With regard to the internal factors, the results also show that the mean assets size is 13.89 with a minimum value of 9.60, maximum value of 17.12 and S.D of 1.28. Further, the average assets quality is 0.61 with a minimum value of 0.40 and the maximum value of 0.70. In the same context, the mean of capital adequacy is approximately very small (0.00) with minimum and a maximum value of 0.00 and 0.07 respectively and S.D of 0.01.

The average value of deposits is 0.82 which is the second largest after bank size (Min. = 0.52 and Max. = 0.92). Both liquidity and operating efficiency have a mean of 0.08 but liquidity varies between a minimum value of 0.00 and the maximum value of 0.33 with S.D of 0.03. The operating efficiency has a small variance of 0.01 (min. = 0.06 and max. = 0.14). AM has a mean of 0.07 with a minimum value of 0.05 and a maximum value of 0.11. NII and NIM each have mean values of 0.04 and 2.97 with a minimum value of 0.00 both and the maximum value of 1.16 and 6.30 and S.D of 0.11 and 0.86 respectively. On the other hand, the mean value of the growth rate of GDP is approximately 7.16, the minimum value is 3.89 in 2007 and the maximum value is 10.26 in 2016. The average value of the inflation rate is 8.39, whereas the minimum value is 4.90 and the maximum value is 12.00.

Overall, the average values of the dependent and independent variables are positive. The largest average value among internal determinants is for bank size (13.89) followed by deposits (0.820).

Table 3 Descriptive statistics

Variables	*Obs.*	*Minimum*	*Maximum*	*Mean*	*Std. dev.*
Panel A: Dependent variables (profitability)					
ROA	370	–2.04	2.02	0.82	0.70
ROE	370	–38.60	31.56	10.93	12.09
Panel B: Independent variables (internal variables)					
AQ	370	0.40	0.70	0.61	0.04
CA	370	0.00	0.07	0.01	0.01
DEP	370	0.52	0.92	0.82	0.08
LOGAS	370	9.60	17.12	13.89	1.28
LQD	370	0.00	0.33	0.08	0.03
NII	370	0.00	1.16	0.04	0.11
NIM	370	0.00	6.30	2.97	0.86
OPEF	370	0.06	0.14	0.08	0.01
AM	370	0.05	0.11	0.07	0.01
Panel C: Independent variables (external variables)					
GDP	370	3.89	10.26	7.33	1.81
IFR	370	4.90	12.00	8.39	2.31

ROA is the ratio of bank net profit to total assets (%), ROE is net profit divided by shareholder equity (%), LOGAS is the natural logarithm of total assets (%), AQ is the asset quality (%), CA is the capital adequacy ratio (%), DEP is the deposits of the total assets (%), GDP is gross domestic product growth rate (%), LQD is the liquidity ratio (%), NII is the non-interest income ratio, NIM is the net interest margin ratio (%), AM is the asset management ratio (%), OPEF is the operating efficiency ratio(%) and INF is the annual inflation rate (IFR) (%).

5.2 Unit root analysis

The variables of the study have been analysed by the Unit Root method and their results are mentioned in Table 4. Stationarity of the data as an essential step for panel data analysis is confirmed using unit root test. Levin, Lin and Chu t, I'm, Pesaran and Shin W-stat, ADF – Fisher Chi-square and PP – Fisher Chi-square tests are applied to test the stationarity of the variables. As shown in Table 4, all variables used in the models are found to be stationary at the first difference in all the applied tests. This leads to rejecting the null hypothesis of a unit root.

5.3 Correlation matrix and multicollinearity diagnostics

With regard to internal determinants, Table 5 (Panel A), shows that ROA has a positive relationship with AQ, NII, NIM and it has a negative association with CA, DP, LOGAS,

LQD, AM, and OPEF. ROE has a negative relationship with all variables except AQ, and OPEF. On the other hand, the correlation matrix results indicate that the external factors are positively associated with both ROA and ROE.

The outcome of variance inflation factor (VIF) shows that there is no multicollinearity problem among the independent variables. All values of the VIF are below 10 which indicate that multicollinearity problem among the independent variables is not present in this study (see Table 5 panel C).

Table 4 Unit root analysis

	1st difference				
Variables	*Levin, Lin and Chu t**	*I'm, Pesaran and Shin W-stat*	*ADF – Fisher Chi-square*	*PP – Fisher Chi-square*	*Result*
Panel A: Dependent variables (profitability)					
ROA	0.00	0.18	0.00	0.00	Reject null hypothesis
ROE	0.00	0.00	0.00	0.00	Reject null hypothesis
Panel B: Independent variables (internal variables)					
AQ	0.00	0.04	0.01	0.00	Reject null hypothesis
CA	0.00	0.05	0.01	0.00	Reject null hypothesis
DEP	0.00	0.10	0.07	0.00	Reject null hypothesis
LOGAS	0.00	0.00	0.00	0.00	Reject null hypothesis
LQD	0.00	0.13	0.09	0.00	Reject null hypothesis
NII	0.00	0.00	0.00	0.00	Reject null hypothesis
NIM	0.00	0.00	0.00	0.00	Reject null hypothesis
OPEF	0.00	0.00	0.00	0.00	Reject null hypothesis
AM	0.00	0.00	0.00	0.01	Reject null hypothesis
Panel C: Independent variables (external variables)					
GDP	0.00	0.00	0.00	0.00	Reject null hypothesis
IFR	0.00	0.00	0.00	0.00	Reject null hypothesis

5.4 Multiple regression analysis

With regard to ROA, Table 6 presents the results of multiple regressions between dependent and independent variables. The Adjusted R-squared of pooled, fixed and random effects models are 25%, 38%, and 18% respectively. This suggests that independent variables contribute to about 25%, 38% and 18% of the variation in ROA.

The findings with respect to ROA show that CA ratio, DP ratio, and LOGAS have a statistically significant negative impact on ROA. While AQ ratio, IFR, LQD ratio and AM ratio have a statistically significant positive impact on ROA. AQ ratio exhibits a significant positive impact at the level of 5% only in case of pooled model.

Similarly, AM ratio shows a positive relationship with ROA at the level of 5% only in case of fixed model. In the same context, CA ratio has statistically significant negative impact on ROA on the level of 1% (p-value < 0.01) in the case of both pooled and random effect models, but it is statistically significant at the level of 10% (p-value < 0.10) in the case of fixed effect model, the CA results show how equity of a bank influences the banks' profitability. These results are supported by AL-Omar and AL-Mutairi (2008). Likewise, the results of LOGAS is statistically significant at the level of 1% in pooled and random effect models and at the level of 5% in the fixed effect model which indicate that the large size of the banks is expected to achieve higher profitability ratios than small banks. The findings of LOGAS are constant with Chowdhury Rasid (2017), Masood and Ashraf (2012) and Yahya et al. (2017). On the other hand, all the other factors, Economic activity GDP which exposes the state of the economic cycle in a country, Income-expenditure structure macroeconomic (NII, NIM, and OPEF) which refer to wages and salaries and other facilities of the banks have statistically no significant association with ROA.

With regard to ROE, Table 6 show the results of Adjusted R-squared of pooled, fixed and random effect models which are 35%, 58% and 48% respectively. This suggests that independent variables contribute about 35%, 58% and 48% of the variation in ROE.

The results reveal that CA ratio, GDP and OPEF ratio have a statistically significant negative impact on ROE at the level of 1% (p-value < 0.01). Further, LOGAS has a negative association with ROE which indicates by a negative coefficient. It is statistically significant at the level of 5% in case of fixed model but at the level 10% in both pooled and random effect models. Differently, AM ratio indicating a positively significant impact on ROE at the level of 1% (p-value < 0.01). However, AQ ratio, DEP ratio, LQD ratio, NII and NIM show statistically no significant impact on ROE.

Hausman test is applied to select the appropriate estimation method; fixed or random effect models. The results of Hausman test suggest that the fixed effect model is more appropriate than the random effects model because the p-value is less than 5% (p-value < 0.05%). However, the results of the Hausman test show that the random effect model is preferred more than the fixed effect model as the p-value is more than 5% (p-value = 0.83 > 0.05).

5.5 Robust regression

The results of robust regression are similarity to ordinary least squares (OLS) regression model. Table 7 demonstrates that coefficient estimates in case of robust regression are not highly deviated from the OLS regression. This shows a proper estimation of the regression assumptions. The results of robust regression also indicate that data is not contaminated with outliers. Further there are no influential observations that affect the estimated results.

Table 5 Correlation matrix and multicollinearity diagnostics test

Variables	*AQ*	*CA*	*DP*	*GDP*	*LOGAS*	*LQD*	*NII*	*NIM*	*AM*	*ROA*	*ROE*	*OPEF*	*IFR*
						Correlation matrix (Panel A)							
AQ	1												
CA	–0.36	1											
DP	0.25	–0.19	1										
GDP	–0.05	0.03	0.01	1									
LOGAS	0.22	–0.61	–0.13	–0.06	1								
LQD	–0.39	0.29	0.08	0.09	–0.05	1							
NII	–0.15	0.33	–0.16	0.08	–0.3	0.09	1						
NIM	–0.23	0.7	–0.02	0.02	–0.54	0.33	0.43	1					
AM	0.06	0.1	0.04	–0.35	–0.36	–0.4	0.05	0.05	1				
ROA	0.05	–0.07	–0.34	0.02	–0.08	–0.01	0.07	0.01	–0.3	1			
ROE	0.22	–0.16	–0.04	0.04	–0.06	–0.04	–0.01	–0.07	–0.35	0.75	1		
OPEF	0.02	0.05	–0.01	–0.31	–0.18	–0.33	0.02	0.01	0.77	–0.45	–0.59	1	
IFR	0.04	0.03	–0.01	0.11	–0.11	–0.07	0.06	–0.03	–0.19	0.24	0.38	–0.32	1
						Multicollinearity test (Panel B)							
VIF	1.55	1.66	1.13	1.62	6.09	1.67	2.97	7.37	5.09			4.57	1.15

Table 6 Determinants of ROA and ROE

	ROA			*ROE*		
Variables	*Pooled*	*Fixed*	*Random*	*Pooled*	*Fixed*	*Random*
C	5.36	4.60	4.96	0.39	1.28	0.39
	(5.05)***	(1.83)*	(4.17)***	(1.81)*	(2.31)**	(1.76)*
			Internal factors:			
AQ	1.32	0.43	0.95	–0.29	–0.10	–0.29
	(1.91)**	(0.66)	1.49)	(–0.97)	(–0.23)	(–0.94)
CA	–36.67	–17.93	–26.87	–12.45	–11.72	–12.45
	(–5.07)***	(–1.73)*	(–3.38)***	(–3.22)***	(–2.73)***	(–3.14)***
DEP	–3.89	–1.04	–3.45	–0.12	0.09	–0.12
	(–8.85)***	(–0.80)	(–6.12)***	(–0.24)	(0.15)	(–0.23)
LOGAS	–0.20	–0.29	–0.20	–0.02	–0.09	–0.02
	(–5.16)***	(–2.28)**	(–4.12)***	(–1.82)*	(–2.24)**	(–1.77)*
LQD	4.38	4.24	4.79	–0.32	–0.01	–0.32
	(3.68)***	(2.93)***	(3.92)***	(–0.56)	(–0.01)	(–0.54)
NII	–948.3	–1125	–1155.2	–0.03	–0.03	–0.03
	(–0.42)	–0.52)	(–0.55)	(–1.41)	(–1.24)	(–1.38)
NIM	175.5	–1277.8	–437.99	0.08	0.05	0.08
	(0.22)	(–1.46)	(–0.55)	(0.74)	(0.37)	(0.72)
OPEF	–4.03	–5.31	–4.61	–31.25	–30.85	–31.25
	(–1.04)	(–1.24)	(–1.20)	(–9.58)***	(–8.99)***	(–9.33)***
AM	4.79	11.16	7.17	17.03	17.17	17.03
	(0.84)	(1.99)**	(1.34)	(4.27)***	(4.14)***	(4.16)***
			External variables:			
GDP	–0.01	0.00	–0.01	–0.03	–0.02	–0.03
	(–0.64)	(0.26)	(–0.39)	(–5.01)***	–(4.06)***	(–4.87)***
IFR	0.30	0.18	0.28	–0.01	–0.01	–0.01
	(2.11)**	(1.05)	(2.09)**	(–1.29)	(–2.02)**	(–1.26)
R-squared	0.27	0.47	0.21	0.37	0.64	0.50
Adjusted R-squared	0.25	0.38	0.18	0.35	0.58	0.48
Durbin-Watson	1.37	1.84	1.58	2.19	1.54	1.31
Observations no.	333	333	333	333	333	333
F-statistic	11.04	5.38	7.55	17.16	10.63	29.40
Prob(F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000
Hausman test		0.0234			0.8328	

*, ** and *** indicate at 10%, 5% and 1% level of significance respectively.

Table 7 Robust regression

	ROA		*ROE*	
Variables	*Robust*	*OLS*	*Robust*	*OLS*
C	5.351	5.359	0.407	0.390
	(0.928)***	(1.062)***	(0.149)***	(0.216)*
		Internal variables:		
AQ	0.923	1.315	–0.234	–0.289
	(0.600)	(0.687)**	(0.206)	0.298
CA	–36.91	–36.67	–14.65	–12.44
	(6.319)***	(7.232)***	(2.670)***	3.862)***
DP	–3.591	–3.887	–0.353	–0.124
	(0.384)***	(0.439)***	(0.362)	(0.523)
LOGAS	–0.224	–0.203	–0.021	–0.019
	(0.034)***	(0.039)***	(0.007)***	(0.010)*
LQD	4.343	4.376	–0.171	–0.323
	(1.039)***	(1.189)***	(0.400)	(0.579)
NII	–829.7	–948.4	–0.039	–0.032
	(1956.3)	(2238.9)	(0.016)***	(0.023)
NIM	160.7	175.5	0.086	0.085
	(696.6)	(797.3)	(0.079)	(0.115)
OPEF	–0.534	–4.03	–24.74	–31.24
	(3.372)	(3.859)	(2.255)***	(3.262)***
AM	–4.663	4.785	12.396	17.026
	(5.002)	(5.725)	(2.754)***	(3.983)***
		External factors:		
GDP	–0.018	–0.009	–0.014	–0.026
	(0.013)***	(0.015)	(0.004)***	(0.005)***
IFR	0.225	0.298	–0.006	–0.008
	(0.123)*	(0.141)**	(0.004)	(0.006)
Adjusted R-squared	0.203	0.25	0.147	0.349
Prob (F-statistic)	0.0000	0.0000	0.0000	0.0000
No. of observation	333	333	333	333

*, ** and *** indicate at 10%, 5% and 1% level of significance respectively.

5.6 GMM estimation

Generalised methods of moments (GMM) is conducted to verify the results of the estimated models above. A two-step system GMM models are applied to control the problems of correlation between lagged dependent variable and the error term.

Chowdhury and Rasid (2017) stated that GMM can solve only the 'fixed effect' problems by fixing the problem of correlation between the lagged of a dependent variable and the error term and the indigeneity of some explanatory variables. Further, the system GMM tries to deal with weak instrument problems by augmenting instruments.

The results of GMM confirm that there is no order correlation within the error. The *p*-value of the Arrellano and Bond test of second-order correlation suggests that there is no significant order correlation in both cases, namely ROA and ROE. Further, the Sargent test has been conducted which shows that the value of this test is more than 0.05 (ROA = 0.12 and ROE = 0.38) which confirms the usage of the dynamic panel data model.

Table 8 show the results of GMM estimation for the banks' profitability. Overall, we observe some significant and interesting differences between the estimation results for ROA and ROE, both with respect to the significance and the size of the coefficients. The results for the determinants of the profitability measures ROA and ROE are presented as follows. In some details, the banks size LOGAT is represented by the natural logarithm of total assets. The banks size has a positive and significant effect at the level of 10% on ROA and highly significant effect at the level of 1% on ROE. These results are supported by Chowdhury and Rasid (2017), Francis (2013), Gul et al. (2011), Masood and Ashraf (2012), Menicucci and Paolucci (2016), Naeem et al. (2017) and Yahya et al. (2017) and the results reveal that the profitability of large banks are better because they may have more expanded investment chances, better management and better technology. Furthermore, the capital adequacy (CA), which is defined as equity over total assets, has a negative and significant effect on ROA at the level of 10% and a negative and insignificant effect on return on equity ROE. As mentioned above, capital adequacy is a measure of bank risk and may have a weak effect on bank profitability. The banks with high capital adequacy ratio are safer compared to those with lower CA and may face lower costs of funding due to lower prospective bankruptcy costs. These findings, consistent with the findings of Masood and Ashraf (2012) and Naeem et al. (2017).

Table 8 GMM estimation

Variables	*ROA*	*ROE*
Lag of dependent variable	0.7728397	–0.0058174
	(9.55)***	(–2.81)***
Internal characteristics		
LOGAS	0.5854114	0.8707707
	(1.75)*	(3.14)***
CA	–15.89528	–11.27305
	(–1.770)*	(–0.91)
AQ	2.419237	–0.9562999
	(2.26)**	(–0.88)
LQD	2.348981	–0.0801262
	(1.60)	(–0.95)
DP	–0.9141231	0.6785499
	(–1.23)	(0.32)

Table 8 GMM estimation (continued)

Variables	*ROA*	*ROE*
Internal characteristics		
OPEF	–59.07361	–23.43126
	(–5.32)***	(–3.15)***
NIM	0.056129	0.2043249
	(0.82)	(1.89)*
NII	–583.4203	–0.2231209
	(–0.33)	(–1.07)
AM	38.99014	18.21835
	(3.17)***	(3.44)***
External variables		
GDP	–0.0317175	–0.144231
	(–2.22)**	(–2.18)**
IFR	–0.0214299	–0.0495394
	(–2.63)***	(–0.27)
Constant	0.4436078	0.0738989
	(0.49)	(0.28)
Observations	333	333
Hansen test	27.47	23.24
p-value of Hansen test	1.000	1.000
Sargan test	327.88	305.42
p-value of Sargan test	0.121	0.387
Arrellano and Bond test AR (1)	–2.65	–3.94
p-value d'AR (1)	0.008	0.000
Arrellano and Bond test AR (2)	0.34	1.04
p-value of AR (2)	0.734	0.300

We use the GMM method as developed by Areliano and Boverb, (1995) and Blundell and Bond, (1998). *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

In addition, the quality of the asset is normally based on loans. The lower value of the assets quality ratio, the better the asset quality of the bank. The results show a positive and significant impact at the level of 5% on the return of assets ROA as in the study of (AL-Omar and AL-Mutairi, 2008), while it shows a negative and insignificant impact on ROE which indicates that a better assets quality of Banks is an index of banking stability. Moreover, the operational efficiency reflects the ability of bank management in controlling the operating expenses, the results show negative but high significant impact at the level of 1% on both profitability measures ROA and ROE. These results were supported by Akhtar et al. (2011), Alexiou and Sofoklis (2009), Ali et al. (2011), Masood and Ashraf (2012), Naeem et al. (2017), Sufian and Chong (2008) and Yahya et al. (2017). Additionally, the asset management is the highly effective internal indicator in case of the profitability of banking sector. The results of AM are in the line with

(Ali et al., 2011; Masood and Ashraf, 2012; Yahya et al., 2017) report appositive and high significant impact at the level of 1% on the banks' profitability measured by ROA and ROE.

On the other hand, all other internal factors such as liquidity LQD ratio, deposits, and NIM shows an insignificant relationship with ROA and ROE. Notably, these variables have negative coefficient except DP ratio. LQD ratio and NIM ratio have a negative but insignificant impact on ROA. However, DEP ratio shows an insignificant positive impact on ROA.

With regard to the external determinants, the impact of economic activity (GDP) in prior research is mixed. Anbar and Alper (2011), Masood and Ashraf (2012) and Combey and Togbenou (2017) concluded that GDP is negatively insignificant as far as banks' profitability is concerned. Acaravci and Çalim (2013), Jara-Bertin et al. (2014) and Yahya et al. (2017) reported that banks' performance is positively related to economic growth. Further, Marijana et al. (2012), Petria et al. (2015), and Salike and Ao (2017) concluded that GDP has an influence on banks' profitability. The results show that GDP has a negative significant impact on ROA at the level of 5% (p-value < 0.05). However, INF rate has a negative insignificant impact on ROA. Concerning the relationship of external determinants with ROE, the results reveal that both GDP and IFR demonstrate a negative significant impact on ROE. They are found significant at the level of 5% and 1% respectively. Finally, comparison of results of the present study with prior studies are presented in Table 9.

Table 9 Comparison of results of the present study with prior studies

			Exp. Sign		*Results of the study*		*Results of prior studies*	
Variables	*Description*		*ROA*	*ROE*	*ROA*	*ROE*	*ROA*	*ROE*
LOGAS	Impact (+/–)	+	±	±	+	+	AL-Omar and AL-Mutairi (2008) and Masood and Ashraf (2014)	
							Chowdhury Rasid (2017), Masood and Ashraf (2012), Menicucci and Paolucci (2016) and Yahya et al. (2017)	
		–					Francis (2013), Gul et al. (2011) and Naeem et al. (2017)	
CA	Impact (+/–)	+	±	±	–	–	AL-Omar and AL-Mutairi (2008)	Ali et al. (2011) and Yahya et al. (2017)
							Bougatef (2017), Chowdhury and Rasid (2017), Francis (2013) and Jara-Bertin et al. (2014)	
		–					Yahya et al. (2017)	Masood and Ashraf (2012) and Naeem et al. (2017)
AQ	Impact (+/–)	+	±	±	+	–	Menicucci and Paolucci (2016)	
							AL-Omar and AL-Mutairi (2008)	Masood and Ashraf (2012)
		–					Gul et al. (2011) and Naeem et al. (2017)	

Table 9 Comparison of results of the present study with prior studies (continued)

			Exp. Sign		*Results of the study*		*Results of prior studies*	
Variables	*Description*		*ROA*	*ROE*	*ROA*	*ROE*	*ROA*	*ROE*
LQD	Impact (+/–)	**?**	±	±	+	–	Ongore and Kusa (2013) and Tiberiu (2015)	
		+					Gul et al. (2011) and Naeem et al. (2017)	
		+					Bougatef (2017), Marijana et al. (2012) and Yahya et al. (2017)	
		–						Gul et al. (2011) and Naeem et al. (2017)
		–					Francis (2013), Jara-Bertin et al. (2014) and Masood and Ashraf (2012)	
DP	Impact (+/–)	**?**	+	+	–	+	Menicucci and Paolucci (2016)	
		+					Francis (2013), Rashid and Jabeen (2016) and Yahya et al. (2017)	
		–					Naeem et al. (2017)	
OPEF	Impact (+/–)	+	–	–	–	–	AL-Omar and AL-Mutairi (2008)	Chowdhury and Rasid (2017) and Naeem et al. (2017)
		+					Marijana et al. (2012), Petria et al. (2015), Rashid and Jabeen (2016) and Salike and Ao (2017)	
		–					Naeem et al. (2017)	Alexiou and Sofoklis (2009), Ali et al. (2011)
		–					Sufian and Chong (2008), Alexiou and Sofoklis (2009), Akhtar et al. (2011), Masood and Ashraf (2012), Yahya et al. (2017)	
NIM	Impact (+/–)	–	±	±	+	+	Anbar and Alper (2011)	
NII	Impact (+/–)	+	–	–	–	–	Sufian and Chong (2008)	
		+					Anbar and Alper (2011)	
AM	Impact (+/–)	+	+	+	+	+	Masood and Ashraf (2012) and Yahya et al. (2017)	
GDP	Impact (+/–)	+	+	+	–	–	Acaravci and Çalim (2013), Jara-Bertin et al. (2014), Marijana et al. (2012), Petria et al. (2015), Salike and Ao (2017) and Yahya et al. (2017)	
		–					Anbar and Alper (2011), Masood and Ashraf (2012), Garcia and Guerreiro (2016) and Rashid and Jabeen (2016)	
INF	Impact (+/–)	+	±	±	–	–	Jara-Bertin et al. (2014) and Yahya et al. (2017)	
		–					Chowdhury and Rasid (2017)	

6 Conclusion and recommendations

The present study attempted to examine the impact of internal and external determinants of listed banks' profitability during the period from 2006 to 2017. A sample of 37 banks was selected among 42 listed banks on BSE. Profitability which is an indicator of efficient financial performance of a bank has been measured by ROA and ROE. Bank size, capital adequacy, assets quality, liquidity, deposits, assets management, operation efficiency, net interest margin, and non-interest income were taken as internal determinants, while GDP and Inflation rate were considered as external determinants of banks' profitability.

The results of the study revealed that bank size, assets quality, liquidity ratio, assets management ratio, and net interest margin were important internal determinants of banks' profitability which affect ROA. Further, capital adequacy, deposits ratio, and operational efficiency were found to have a negative significant impact on ROA. However, no evidence was found on the effect of net interest income on ROA. On the other hand, almost all external variables exhibited a significant negative impact on ROA. With regard to the impact of internal and external variables on banks' profitability as measured by ROE, the results revealed that capital adequacy, bank size, and operating efficiency were found to have a statistically significant negative impact on banks' profitability as measured by ROE. However, assets quality and assets management exhibited a statistically significant positive impact on ROE. The results also concluded that other variables; liquidity ratio, deposits ratio, net interest margin, and non-interest income had an insignificant impact on ROE. Similarly, both external determinants; GDP and inflation rate were found to have a significant negative impact on ROE.

The findings of this study provide important insights for policymakers, bankers, shareholders, financial analysts, and academicians. In view of these findings, the internal and external determinants that explain profitability of the Indian banks are highlighted. Therefore, it is important for the interested parties to formulate more consistent policies with internal and external determinants of banks' profitability to increase the profitability of the Indian banks. Policymakers should consider the external determinants in their banks. They should attempt to reinforce the capital structure of their banks, rely on current and potential investors, and minimise their operating expenditure.

The present study seeks to fill a serious gap in banks' profitability by highlighting the internal and external determinants that affect the profitability of the Indian banks. A practical contribution of this study is its emphasis on better financial performance and efficient profitability of the Indian banks for competitive and sustainable banking sector. The success of the Indian banking sector depends on banks' profitability. To attain this objective, this paper attempted to identify profitability determinants of Indian banks. From a methodological contribution, this study has used a panel data approach with pooled, fixed, random effect models and GMM estimation. To date, very few econometric studies have empirically identified profitability determinants using this approach.

Based on this study, many other studies could investigate this issue by including some new variables or extending the time period of investigation. Further, future research may increase the sample size or make a comparison between private and public banks or foreign and national banks. Other possible extension studies could be the examination of profitability determinants using cluster analysis. Further, it could be an interesting area

for future studies to address the impact of demonetisation on the profitability of the Indian banks.

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