RESEARCH ARTICLE

Does Capital Adequacy Affect Bank Performance? A Comparative Study of Select Public and Private Sector Banks in India

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Purpose – The purpose of this paper is to investigate the relationship between capital adequacy (CA) and the performance of select public and private sector banks and thereby to attain an insight of whether the capital adequacy maintenance affects bank performance differently or not based on their nature of concern.

Design/methodology/approach –The study utilized a balanced panel data set using bank level data of 37 banks indexed at Bombay stock exchange (BSE) across public and private sector for the period of 10 years (2009-2018). The study takes 370 observation into consideration (i.e.,37 banks over time frame of 10 years). The study is based on secondary financial data obtained from the capital line database. The balanced panel regression model for capturing the performance of banks in relation to capital adequacy has been adopted for the study.

Findings – The results of the study confirm that there is a significant impact of capital adequacy on performance of the banks. In addition to it, it also confirms the differentiating performance of banks based on the nature of concern (i.e public and private) with respect to the variable discussed herewith.

Originality/value – Unlike prior studies that found a positive relationship between CAR and the performance of banks. This study provides the latest insight into differentiating approach of capital maintenance by public and private sector banks and thereby analyzes its impact on their performance. Besides, this study controls for the potential problem of heteroscedasticity and autocorrelation by producing robust standard errors.

Keywords: India, Capital adequacy, capital adequacy ratio, banks performance, panel data.

JEL Classifications: G21, G28, G32

Capital being primary requisite and critical for perpetuity of any concern in the economy, so is for the banking industry. A standard measure of capital is needed to guarantee the security and safety of banks and also to create trust and certainty among its clients. Bank capital is considered as a significant element of banks funding cost. Therefore, the amount of capital can be examined to understand a banks level of risk in the market. It also helps to evaluate the corresponding risk premiums to be paid by the bank when acquiring funds and attracting customers. This lead financial institutes and banks to optimize their capital base adequately in order to utilize their resources and hence emphasize the concept of capital adequacy. Capital adequacy implies the minimal level of capital required by banks to absorb potential risks that can impact the survival of banks. It involves the conventional assessment of minimum amount of capital allocated to provide backup to different investments of banks. It analyses the amount of a bank's capital in relation to the amount of its risk weighted exposures.

The capital maintained by banks proportionally affects the level of funds available for assets creation like loans, which always influences the level and degree of risk absorption. Therefore, the impact of capital on performance of banks cannot be underrated. Ezike and Mo (2013) stated that Graham (1985) emphasized that, the level of capital should grow, if depositors are growing. He asserted that management discipline has an effect on capital.

The significance of adequate capital lies in the way that it helps banks to expand the business portfolio wisely and stops the criminally mined. Umoh (1991), explains that as every business requires capital so do the banks have to maintain it as per the required standards, since banks deal with other people's money is safe. Highlighting the importance of capital adequacy, Bank of International Settlement (BIS) stated that the capital is one of the major factors to be weighted in assessing the performance (strength and weakness) of the equity values of banks net earnings. It also stressed that proper quality capital is required to enable banks to perform its functions effectively and to maintain public confidence.

Substantial research has been conducted on banks across the globe and the research has suggested a positive relationship between banks' capital adequacy and profitability (see for example Bahiru, 2014; Demirguc-Kunt & Huizinga, 1999; Elizabeth & Ellot,

2004; Goldberg & Rai., 1996; Romdhane, 2010; Smirlock, 1985; Yu & Neus., 2005). Further, many studies have suggested that with higher capital, banks operate more efficiently than those of undercapitalized banks (Abreu & Mendes, 2001; Staikouras &Wood, 2003).

In contrast to it, different studies highlighted significant negative relationship between capital adequacy and profitability (see for example, Goddard et al., 2004; Majnoni, 2000; Thakor, 1996). This is probably due to the fact that some banks operate over cautiously that result in ignoring the profitable trading opportunities. According to Goddard et al., (2004), the relationship between profitability and capital adequacy must be negative. Overcapitalization of bank is usually a sign of unused investment opportunities (Thakor, 1996).

Aforesaid studies reveal that capital adequacy and bank performance has remained a point of interest for researchers as well as banking institutions. Based on the literature above, this study tries to further emphasize how maintenance of capital affects the performance of banks in Indian context. Further, this study also attempts to add to the literature that how public and private sector banks have been able to maintain capital adequacy and how differently it has affected the performance of these banks in India. Furthermore, this study undertakes ROA and NIM as performance measures to evaluate the overall functioning of banks under study. The reason behind using ROA is due to the fact that it measure the overall performance of banks while as, NIM is used due to its particularity with regard to the operational performance of banks i.e. with interest based activities which is considered as major activity that any bank undertakes in normal course of time. Besides, the present study is expected to enrich the literature on capital adequacy and bank performance by improving the modeling approach and developing a robust relationship between the variables of the study. For instance, unlike prior studies, the present study controls for the potential problems of heteroscedasticity and autocorrelation by producing robust standard errors. Furthermore, the present study develops alternative sensitivity analysis/robustness analysis, in order to check whether the results remain robust across alternative specifications and assumptions.These relationships have not been yet investigated in the emerging markets in general and the Indian context in particular to the effective information

of the researcher.

The results indicate that during the period of study, overall performance of banking sector has remained satisfactory and interest based activities have enabled the banking firms to earn adequate profits having the capital requirement generally as per proposed standards . However, it was found that private sector banks are more efficient in profitability than public sector banks. The results were confirmed and remained same with respect to both dependent variables (i.e ROA and NIM). The CAR has been found to be significant across the sectors and more specifically in public sector banks. The performance of banks in the sample is more or less influenced with the level of CAR. The results on control variables revealed different approach regarding to the profitability of banks.

Further, the paper has been divided into five sections. Second section of the paper contains the brief overview of literature. The methodology used to arrive at the results are drafted in section three of the paper. However, section four reports the results of the paper and is concluded in the last section of the paper.

Literature Overview

Capital Adequacy, Basel Norms and Bank Performance

Capital can be defined as the amount that any business organization needs to operate smoothly. It forms sublime liquidity position for the business organization in general and for any financial institution in particular. Therefore, capital makes the base for every business. It must be noted that apart from using capital for operation and expansion purposes, it is also used to absorb losses. Losses incurred in business, if any, are deducted from capital. So, usually capital increases if the business is profitable. In case of financial institutions, this capital base is referred to as capital adequacy. It can be defined as the amount of capital which acts as a cushion in case of adversities (Athanasoglou et al., 2006). Hence, adequate capital is considered as a scenario where the maintained capital is sufficient to back the risk weighted assets of bank after deducting a comfortable amount for making operations and expansions (Ebhodaghe, 1991).

Banking regulators emphasize more on the security of banks by ensuring maintenance of adequate capital to support risk weighted assets and stability of financial markets. Initially, these regulations were put forth by a committee called Basel Committee for Banking Supervision (BCBS) which consists of members from ten countries namely Belgium, Canada, France, Italy, Japan, Netherland, United Kingdom, United States, Germany and Sweden known as G-10. This Committee was established in 1974 after witnessing the disturbances in international currency markets.

The first set of norms known as Basel-I was proposed in 1998 which directed the banks to maintain minimum level of 8% ratio of capital to risk weighted assets. However, in 2004, the first set of regulations was revised and a new set of norms which is generally known as Basel-II normswas issued. The additional aspects which were brought into the existing framework of Basel-I norms are supervision of banks' capital, internal assessment process, effective disclosure in financial statements as a tool to strengthen market discipline and encourage sound banking practices. After witnessing the financial crisis in 2009, the framework was further revised to overcome the limitations which were encountered during the crisis such as mispricing of credit limits, increase of liquidity risk and excessive credit growth rate and were addressed in the new framework. The consequences were comprehensively studied by the Miu et al., (2010) and came up with the suggestions to strengthen the firmness of the financial system. One such attempt includes the maintenance of adequate capital buffers by financial institutions. The revision brought fundamental changes in the existing Basel framework which is popularly known as Basel-III accord.

Prior studies have shown mixed results on whether banks mitigate excessive risks and reduce the probability of failures by maintaining adequate capital and thus decrease the likelihood of collapse. Banks need consistent regulatory capital that acts as an insurance premium for the risk weighted assets. Banks are thus encouraged to keep higher level of capital and lower the risk in case of default (see for example, Aggarwal & Jacques, 2001; Berger, 1995; Furlong & Keeley, 1989; Furlong, 1992; Jacques & Nigro, 1997).

Performance of a bank can be interpreted in terms of overall profitability of the bank. Profitability can be defined as the bank's ability to reap profits from all the business activities of the concern. It is related with the efficiency of the bank and shows how optimally the management of banks can make profits by using

all the available resources in the market. According to Harward and Upton (1991) profitability is related with the utilization of an investment to earn returns. However, it should be noted that profitability is not synonymous to term efficiency, rather is regarded as a measure of efficiency and the guide to appraise the performance of banks. Prior literature has used different proxies for measuring profitability. For instance, studies like Alemu (2016) and Athanasoglou, Brissimis and Delis (2008) typically measured performance by return on assets (ROA), Bahiru (2014) used return on equity (ROE), while as, studies like Prayudi (201Non Performing Loan (NPL 1) used net interest margins (NIM), profit after tax (PAT), earnings per share (EPS) and level of NPAs to measure the performance of banks. However, ROA and NIM are the most preferred measures of bank performance.

It may be noted that for any bank, ROA mainly depends upon banks' policy and the general factors related to the economy of the particular country and the regulations of the government. From the literature, it can be found that researchers regarded ROA as the best measure of bank performance (see for example, Alemu, 2016; Hassan & Bashir, 2003 among others) because ROA represents the ability of banks to generate returns on its assets portfolio (Rivard & Thomas 1997). On the other hand, some studies have taken NIM as performance indicator as this ratio measures the disparity between the interest earnings generated by the bank and the amount of interest expended to its depositors. This variable is defined as the amount of net interest income earned divided by total earnings of the banks. This ratio provides the relevant information about the operational efficiency of banks. Ahmad (2009) and Abdioglu and Buyuksalvarci (2011) used net interest margin as the measure of performance evaluation of banks. Other studies that included net interest margin as the measure of performance include Bahiru (2014), Demirguc-Kunt & Huizinga (1999), Elizabeth & Ellot (2004), Gul et al., (2011), Goldberg et.al, (1996), Romdhane (2012), Smirlock & Michael (1985) and Yu et al., (2005).

The performance of banks is affected due to impact of capital adequacy and is dependent upon many factors including the regulatory body prevailing in the country (Murinde & Yaseen, 2006). One of the main determinants of bank performance is capital adequacy as asserted by many studies cited earlier. The studies argued that capital has many roles and functions and

always acts as defensive cushion against losses that may occur due to various eventualities. This view represents the capital adequacy as a measure taken to ensure default free operations and as a backup to deposits and other banks creditors (Gardner, 1981). Further, as Graham (1985) asserted that capital grows alongside with the growth in depositors. However, the accumulation of capital comes at cost, so the banks often try to lower the costs in order to increase their profits. This argument brings into the role of optimality of capital. Adequate but optimal capital means that the average cost of capital should be least which in turn increases the profitability of the bank (Rouhi & Mohammadi, 2013; Zaroki, 2015). Further, with growth in capital, managerial discipline needs to be in place in order to have effective use of all the financial resources available. It is also suggested that over-trading and malpractices by management are also avoided with such capital regulations.Supporting this view about capital adequacy and bank performance, Graham (1989) asserted that such guidelines has significant impact on bank's capital and its overall operations vis~a~vis profitability and costs. Several studies have found positive relationship between capital adequacy and performance of banks (see for instance, Abreu & Mendes, 2001; Goddard et al., 2004; Pasiouras & Kosmidou, 2007; Staikouras & Wood, 2003).

Contrary to the above, certain studies have found negative impact of capital adequacy on the performance of banks. They have asserted that regulatory capital requirements increases the portfolio risk as it forces the banks to relocate their assets inefficiently and consequently increases apprehension of loss. Further, increase in capital requirements leads to increase in portfolio risk as increased exposures cause banks to face different risks that can turn into potential loses (Gennotte & Pyle, 1991; Koehn & Santomero, 1980; Ogboi & Unuafe, 2013; Shrieves & Dahl, 1992). Given the literature reviewed above, it can be asserted that capital adequacy is a significant indicator for soundness of banks. However, requirement of larger capital restricts banks to take advantages from investments opportunities and therefore, compromises the profitability target of banks. The capital adequacy emphasizes generating and restructuring of balance sheet taking linear relationship between profitability and core capital into consideration.Given the arguments made above, development of the link between CA

and bank performance is a possible question for investigation. Therefore, this study apart from assessing the impact of capital adequacy on performance of banks also attempts to draw an insight to differentiating performance of banks across the sectors with respect to maintainance of sufficient capital.

Control variables

Numerous studies have tried to investigate the relationship between capital adequacy and bank performance while taking such factors into considerations (see for instance, Ayuso & Saurina, 2004; chole, 2000; Demsetz & Strahan, 1997; Ho & Hsu 2010; Yu, 2000). The factors that have the potential impact on bank performance, as pin pointed by various researchers, can be summed up into two groups' i.e. 'micro factors' and 'macro factors'. Micro factors include bank size, cash to deposit ratio, loans and advances, shareholders' funds, loan loss reserve and liquidity position. While as, macro factors include inflation, real exchange rate, money supply, political instability, and return on investment.

The studies that took micro factors into consideration for determination of performance of banks seem to be more prudent because of its peculiarity with different banks that kept on changing from time to time with the change in the level of competition. Ayuso and Saurina (2004) and Demsetz and Strahan (1997) in their studies revealed that larger banks often tend to operate with a lower capital ratio. In contrary, other studies like Abreu and Mendes (2001) revealed that the bank with higher regulatory ratio tends to be more profitable. However, it depends upon the risk taking nature of banks. Yu (2000) in his study revealed that bank size and liquidity ratios (cash to deposit ratio) are the major factors that are to be taken into consideration while determining the performance of banks. It was also revealed that smaller banks tend to maintain higher capital adequacy ratio than the larger banks due to the threat of insolvency in case of any failure. Another study done in Taiwan indicated that bank size, leverage and financial cost are significantly and positively related to the performance of banks (Ho & Hsu, 2010). However, yet another study showed significant and inverse relationship between bank size and performance mostly in the interest based activities (Ahmed, 2009).

Research Methodology

Sampling

With an aim to analyse the imapact of capital adequacy on performace of banks and to determine whether the performance of banks across the sectors differentiate with respect to their capital adequacy approach, we have used an online database namely Capitaline to gather the bank level information of all the variables used in the study. It may be noted that the present study has been confined to listed Indian banks, both public and private sector. Thus, in order to choose the sample for the study, purposive sampling technique has been used in which sample has been collected from BSE (BANK EX). BSE BANK EX is a broad bank index of Indian economy representing 67% market capitalization. The total number of banks forming BSE BANK EX was 42 as on 24-09-2018. Out of 42 banks, 19 were private sector and 23 public sector banks. Further, the banks at BSE BANKEX were listed under different base line criteria viz market capitalization, market sales, net sales, net profit, total assets, earning per share (EPS), investments etc. The base line criteria used for the present study is total assets as it has been widely used in different studies (see for instance, Almazari, 2013; Demsetz & Strahan, 1997). It must be noted that the banks from both the sectors have been taken as only a few studies have been conducted analyzing the relationship between capital adequacy and bank performance from the two sectors. More specifically, for refining the sample, systematic deletion process was adopted. The systematic deletion process began by dropping 2 private sector banks that were operational for less than ten years and hence eliminated from the sample, thus reducing the sample from 19 to 17 banks. In the next step, banks having missing data were identified. It was found that only one bank had missing data under private sector and 2 banks were have missing information in public sector, and therefore were eliminated to reach the final sample for analysis. Hence, the net sample of banks remained 37 banks, out of which 16 are private and 21 are public.

Variables

In order to measure the impact of capital adequacy on performance of banks, capital adequacy ratio has been used as an independent variable. On the other hand, two variables have been used to evaluate the performance of banks i.e, return on assets (ROA)

and net interest margin (NIM). ROA has been used to depict the overall performace of banks, while as, NIM has been used to evaluate the impact of capital adequacy standards on the major business activity of banks i.e fund based or interest based activity which is lending and borrowing of funds. Furthermore, Control variables have been used in the present study for minimizing the impact of extraneous variables in order to retain the basic purpose of the study. These variables are loans and advances (L&A) , total assets as proxy of size of banks (TA), shareholders funds (SF) and cash to deposit ratio (CD) .Table I depicts all the variables used in this study.

Model Specifications

The balanced panel regression model for capturing the performance of banks in relation to capital adequacy has been adopted for the study. The models were estimated using panel data methodology. Further, analysis has been conducted on full sample and as well as on sectoral samples separately in order to assess the relationship of capital adequacy and performance of banks among the sectors as well. In each of the models presented below, ROA and NIM has been taken as dependent variable with CA as independent variable and SF, LA, TA and CD as controls.

The general model specification to identify the relationship between the sets of independent variables and dependent variables is given as under:

$$\pi i,t = f (CAi,t, LTAi,t, , SFi,t, LTAi,t, CDi,t) \quad (I)$$

Where,

$\pi i,t$ = performance measure of bank i at time t.

CAi,t = capital adequacy ratio used as proxy for capital adequacy of firm i at time t.

LAi,t= Loans and Advances of firm i at time t.

LTAi,t = Log of Total Asset as proxy of size of firm i at time t.

Where,

$\pi i,t$ = performance measure of bank i at time t.

CAi,t = capital adequacy ratio used as proxy for capital adequacy of firm i at time t.

LAi,t= Loans and Advances of firm i at time t.

LTAi,t = Log of Total Asset as proxy of size of firm i at time t.

SFi,t = Shareholders Fund of firm i at time t.

CDi,t = Customer to Deposit ratio of firm i at time t.

To be more precise, above model can be divided into two equations to assess the impact of independent variables on the overall performance indicated by ROA and on operational performance indicated by NIM. The two said equation are as follows:

$$ROA = f (CAi,t, LTAi,t, SFi,t, LAi,t, CDi,t) \quad (1)$$
$$NIM = f (CAi,t, LTAi,t, , SFi,t, LAi,t, CDi,t) \quad (2)$$

Table I

S.No	Variable description	Abbreviation	Brief Discription/Formula
1.	Dependent Variables		
a.	Return on Assets	**ROA**	*ROA=Net Income/Total Assets*
b.	Net Interest Margin	**NIM**	*NIM=Net Inetrest Income/Total Assets*
2.	**Independent Variables**		
a.	Capital Adequacy Ratio	**CAR**	*CAR=Tier I+Tier II+Tier III/Risk Weighted Assets*
2.1	**Control variables**		
b.	Loans and Advances	**LD**	Loan is a kind of debt that a bank lends to its customers for a specified period of time and money provided by the bank to entities for fulfilling their short term requirements is known as advances which is unlike of loans.
c.	Shareholder Funds	**SF**	Shareholders" funds refer to the amount of equity raised by banks to generate funds for the company.
d.	Total Assets	**LTA**	*Log of Total Assets as proxy of Bank size*
e.	Cash Deposits	**CD**	*CD= Total Cash/Total Deposit*

Where, ROA = return on assets

NIM= net interest margin

In the above equation, Capital Adequacy Ratio (CAR) is used as explanatory variable with shareholders" funds (SF), Loans and Advances (LA), Log of Total Assets (LTA) and Cash to Deposit Ratio (CD) are used as control variables. The Ordinary Least Square (OLS) technique of multiple regression has been applied to evaluate and determine the effect of independent variables on the dependent variables. The reason behind adoption of OLS is its ability to provide consistent and satisfactory results in a wide range of economic. The following equation in linear form was generated from the above equation:

$$\pi i,t = \beta_1 + \beta_2 CARi,t + \beta_3 LTAi,t + \beta_4 SFi,t + \beta_5 LAi,t + \beta_6 CDi,t + \varepsilon i,t \qquad (II)$$

Along with the coefficients and error terms, eq.1 and eq.2 can be interpreted as follows:

$$ROA = \beta_1 + \beta_1 CARi,t + \beta_1 LTAi,t + \beta_1 SFi,t + \beta_1 LAi,t + \beta_1 CDi,t + \varepsilon i,t \qquad (3)$$
$$NIM = \beta_1 + \beta_1 CARi,t + \beta_1 LTAi,t + \beta_1 SFi,t + \beta_1 LAi,t + \beta_1 CDi,t + \varepsilon i,t \qquad (4)$$

Where β_1 is intercept,

β_2, β_3, β_4, β_5, β_6 are slope coefficients.

$\varepsilon_{i,t}$ is error term.

Panel data methodology has been used because of its merits to estimate the above specified model. Primarily, panel data helped to control for unobservable heterogeneity because it assumes heterogeneity in individual observations (Altaf & Shah, 2017; Hsiao, 2005; Klevmarken, 1989; Moulton, 1986. Secondly, panel data gives the expanded model of information, creates more variability and less collinearity and ensures more efficiency among the variables (Hsiao, 2005). Another advantage of using panel data is that it helps to study the fluctuations of adjustment. Lastly, it helps the model to attain technical efficiency in a better way by allowing to construct complicated models (Koop and Steel, 2001).

Further, multiple linear regression (MLR) of bank performance on CA variable is examined by a dynamic approach. Accordingly, F statistics have been used to find better model between fixed effect (FE) model and ordinary least squares (OLS) under the null hypothesis that the parameters for all the dummy variables except for the one that is dropped, are zero ($H0: \mu1=\mu2\ldots=\mu N-1=0$). Further, Breusch-Pagan Lagrange Multiplier (B-P LM) test for random effects is used for choosing a better model among random effect (RE) and OLS under the null hypothesis that the individual time-varying components are equal to zero ($H0: \sigma2=0$). On the basis of results obtained with F-test and B-P LM test, effectiveness of these models has been analysed in terms of obtaining better estimates. Hence, the researcher used alternative panel data approach to proceed further. Moreover, in order to obtain better model between FE and RE, Hausman test is applied. The Hausman test runs under the null hypothesis that there is no correlation between the individual effects and regressors. The results of these tests are reported in respective tables of analysis. The test statistics for the specifications are significant at 5 percent level, meaning that FE model would be able to produce best, linear, unbiased estimator (BLUE) estimates. Hence, FE model was used to determine the relationship between capital adequacy and performance of select public and private sector banks. Knowing the problem of endogeneity may persist, we use the instrumental variable estimation method to avoid that problem. More specifically we use the two-step GMM estimator proposed by Arellano and Bond (1991) to avoid the problem of endogeneity.

Empirical findings

This section highlights the results obtained after applying the empirical models presented in the previous section and thus, paved way for testing the proposed hypotheses. In addition, we also discuss the findings of the study in the light of theory and empirical literature available on the subject. Accordingly we set the stage for drawing inferences, highlighting the implications and putting forth suggestions and policy recommendations.

Descriptive statistics of variables across and among the sectors

The descriptive statistics of all the dependent, explanatory and control variables across and among the sectors under the study are presented in Table II. It is evident from the reports in the table that mean values of return on assets (ROA) and net interest margin (NIM) across the sectors are 1.37 and 2.40 respectively. While as, same for public sector banks is found to be

0.56 and 1.64 and for private sector banks is 2.44 and 3.42 respectively. These results indicate that over the period of study, overall performance of banking sector has remained good and interest based activities have also enabled the banks to earn satisfactory profits. In addition, these results particularly signify the efficiency of private sector banks in generating performing assets and utilization of their resources. However, the minimum values across the sectors for ROA and NIM is 1.63 and -2.33 respectively. It is indicative of the fact that the overall performance of the banks has remained profitable, while as certain banks in the sample have not been able to generate adequate earnings out of their interest based activities which thereby has affected their net interest margin (NIM).

Further, the difference between the minimum and maximum value of ROA 1.63 and 8.48 respectively signifies homogeneity in the sample banks, while as the difference between the minimum and maximum of NIM -2.33 and 12.18 respectively suggests heterogeneity in the sample. Furthermore, in case of public sector banks, it can inferred from the mean values of ROA (0.56) and NIM (1.64) that overall performance as well as the profitability from interest based activites of banks has remained better. However, the difference between the respective minimum and maximum values of ROA and NIM indicates heterogeneity among the sample banks. On the other hand, both the overall performance and performance related to interest based activities of private sector banks were found to be highly satisfactory as the mean values for ROA and NIM is reported as 2.44 and 3.42 respectively. It can be inferred from respective minimum and maximum values related to ROA and NIM that sample banks showed homogeneity in performance.

These findings support the argument that all the banks in the sample have maintained satisfactory overall performance while as, a few banks were found to have negative spread and the possible reasons that may lead a bank to have negative interest income are larger non-performing assets, higher interest rates on lending which make loans unattractive to customers and thereby effects the profitability of the banks. However, the variation in overall performance across the observations is quite normal, since the coefficient of the standard deviation on ROA is (1.63). On the other hand, in case of NIM the observations are quite dispersed as standard deviation is higher. Notably, the coefficient of standard deviation in ROA of public sector banks was relatively normal but at the same time lower than the private sector banks implying the consistent returns to public sector banks . In addition, the standard devaiton of NIM related to private sector banks was also found to be higher than public sector banks implies higher fluctuations in interest incomes across the private banking sectors. These findings are substantiated by the results reported by some earlier studies (see for example, staikouras & wood, 2004; Goddard et al., 2004).

With regard to CAR reported in table II, the mean values for across and among the sectors are 13.22, 11.86 and 15.00 respectively clearly implying that banks across and among the sectors are adequately capitalized throughout the period of the study. This suggests that most of the banks are functioning with more capital to risk weighted asset ratio than what is recommended by the regulatory authorities. However, among the sectors, private sector banks were found to keep higher level of CAR than public sector banks. Further, in case of public sector banks, the minimum

Table II

Descriptive Statistics													
Variables		**ACROSS THE SECTORS**				**PUBLIC SECTOR BANKS**				**PRIVATE SECTOR BANKS**			
		Mean	S. D	MIN	MAX	Mean	S. D	MIN	MAX	MEAN	S. D	MIN	MAX
Dependent variables	**ROA**	1.37	1.63	1.63	8.48	0.56	1.00	-2.31	3.23	2.44	1.69	0.03	8.48
	NIM	2.40	1.56	-2.33	12.18	1.64	1.01	-2.33	3.51	3.42	1.58	1.23	12.18
Explanatory Variable	**CAR**	13.22	3.97	1.09	59.42	11.86	1.45	1.09	15.3	15.00	5.31	8.21	59.42
	L&A*	147780	211640	1107	1934880	197489	24844	24615	1934880	82539	123559	1107	658333
Control variables	**LTA**	5.09	0.55	2.99	6.53	5.35	0.34	4.62	6.54	4.76	0.58	2.99	6.03
	SF*	660.56	48.49	38.98	4890.77	870.79	678.18	143.4	4890.77	384.63	412.31	38.98	2807.8
	CD	6.22	5.13	3.08	18.78	6.17	1.94	3.08	18.78	6.29	1.57	4.01	11.32

*Note: * = Rupees in Crores*

CAR value of 1.09 suggests that few banks may have remained undercapitalized with regard to the proposed standards by Basel. Additionally, it is found that CAR variable has a high standard deviation across and among the sectors, which suggests higher heterogeneity among the banks in managing their capital adequacy standards. These results go in line with the findings reported by some researchers (see for example, Naceur, 2003; Kosmidou, 2008; Demirguc-Kunt & Huizinga, 1999; Kosmidou & Pasiouras, 2005). However, these results go in contrast with the findings of some studies conducted in developed nations which can be due to the different macro economic factors (see for instance, Berger & Bouwman, 2013; Goddard et al., 2004).

Under control variables, it is found that mean value of loans and advances (L&A) are 147780,197489 and 82539 for across the sectors and among the sectors respectively. While as, the standard deviation of the sample banks across the sectors tends to be higher means that banks across the sectors has heterogeneity in their lending approach. Same is found in case of public as well as private sector banks. The minimum and maximum values suggest high variation in lending patterns of selected banks across and among the banking sector. These findings support the observations of other studies which have used L&A as independent variable (Jalloh & guevera, 2017; Ezike & Oke, 2013;Olalekan & Adeyinka, 2013).

With regard to size of the banks, log of total assets have been used as proxy to determine the size of banks (Fan & Titman, 2003). The log of total assets across the sectors was found to be 5.09. However, for public and private sector banks, it was found to be 5.35 and 4.77 respectively. The lesser coefficient of variations across and among the sectors supports the fact that banks under study were taken from top listed banks at BSE on the basis of size of the organization. Due to the fact, the difference between the maximum and minimum was noted to be small and hence the banks under study across the sectors were found to be more or less homogeneous in size in terms of total assets for the duration of study. This helped the researcher to make a healthy assessment of the performance of the banks and thereby the comparison across the sectors. These results were found in line with other studies (Almazari, 2013; Gropp & Heider 2007; Ho & Hsu 2010; Jackson & Perraudin, 2002; Shrieves & Dahl, 1992).

The perusal of table results further reveal that the mean value of share holders funds (SF) is 660.56,

implying that banks on an average use 661 crores in their capital structure in terms of share capital. However, in particular, mean SF in public sector banks was found to be 678.18 and 384.63 in private sector banks. Therefore, reserves and public deposits constitute a huge portion as source of funds in the capital structure of banks under study. This also indicates that share holders fund contributes very less to the capital of banks which signifies the reliance of banks over debt capital and internal funding. The average value for cash/deposit ratio is 6.22, 6.17 and 6.29 for across and among the banks respectively. The minimum and maximum value reflects the fact that how banks in the sample maintains a healthy cash-deposit ratio. It is due to the fact that banks usually rely more upon lending and borrowing activities as their main operation. The less difference between the minimum and maximum values also supports the same finding.

Capital adequacy and performance of banks across the sectors

In order to assess the impact of capital adequacy on the performance of banks across and among the sectors, two performance parameters viz; return on assets (ROA) and net interest margin (NIM) were used.

Firstly, an overall assessment was undertaken which was followed by the individual assessment of the relationship between capital adequacy and performance among public and private sector banks. As stated in earlier section, capital adequacy has both positive as well as negative impact on the performance of banks. Accordingly, banks' profitability may get affected due to varying approach of banks towards maintaining the level of capital to meet the eventualities. In order to test whether the performance of banks across the sector gets affected with capital adequacy or not, the Eq. (3) and Eq. (4) as mentioned in earlier section is estimated. It must be noted that Table III reports the results of Eq. (3) and Eq.(4) that takes ROA and NIM as the proxy of banks performance. Further, column (2) and column (6) of the Table 4.3 reports the results including outliers, while as column (4) and (8) reports such results after excluding outliers. Following, Stephen and Senthamarai (2011), outliers were treated by using standardized residual analysis, wherein the standardized residual being of the range ≥ ±3 are considered as outliers. Such observations were dropped and the models were run again. Notably, major influence of outliers was observed as the results changed

significantly after dropping variables. The table reveals that the adjusted R^2 before dropping the outliers was found to be 87 percent implying that 87 percent of the variation in the dependent variable is explained by the independent variable. Furthermore, after dropping the outliers, R^2 was reduced to 61 percent which supports the partial influence of outliers. The F-test for fixed effects is a test for choosing a better model among FE and OLS under the null hypothesis that the parameters for all the dummy variables except for the one that is dropped, are zero ($H0:\mu1=\mu2\ldots=\mu N-1=0$). The Sargan test examines the relationship between instruments and the error term. Because the Sargan test p-values are non-significant, there is no association between the instruments and the error term.

It can be inferred from Table III that F-test statistics are significant at 1 percent level of significance in both columns (2) and (4), (6) and (8) implying that use of FE model would considerably increase the goodness-of-fit other than OLS. On the other hand, Breusch-Pagan Lagrange Multiplier (B-P LM) test for random effects is used for choosing a better model among RE and OLS under the null hypothesis that the individual time-varying components are equal to zero ($H0:\sigma2=0$). The statistical results of B-P LM test reported in column (2) and (4), (6) and (8) are significant at 1 percent level of significance, suggesting that RE model is more effective to deal with heterogeneity than OLS. On the basis of results obtained with F-test and B-P LM test, it can be safely concluded that OLS is relatively less effective than FE and RE models in terms of obtaining better estimates. Hence, the researcher used alternative panel data approach to proceed further. Moreover, in order to obtain better model between FE and RE,

Table III

Impact of Capital Adequacy on Performance of Banks across the Sectors using ROA and NIM as Performance Measures

Variables (1)		Return On Assets (ROA)				Net Interest Margin (NIM)			
		With Outliers (2)	VIF (3)	Without Outliers (4)	VIF (5)	With Outliers (6)	VIF (7)	Without Outliers (8)	VIF (9)
Explanatory Variable	CA	.09128* (4.49)	1.14	.08606* (6.04)	1.15	.08449* (4.35)	1.14	.09066* (6.27)	1.14
	LTA	-1.2473* (-6.78)	2.44	-.2106 (-1.19)	2.83	-1.51214* (-7.91)	2.44	-.238364 (-1.43)	2.73
	SF	-.000255 (-1.24)	1.13	-.00062* (-7.54)	1.27	.0002547 (1.28)	1.13	-.0003521* (-4.62)	1.25
Control Variables	LA	1.26e-1* (3.28)	2.11	9.44e-08 (0.26)	2.25	1.47e-06* (5.06)	2.11	6.56e-07** (2.02)	2.23
	CD	-.015541 (-0.37)	1.03	.07224** (2.35)	1.08	-.0766*** (-1.77)	1.03	-.03996*** (-1.57)	1.07
	Sargan	0.414		0.421		0.422		0.498	
	DW	1.90		1.76		1.764		1.747	
	BP-LM	960.98*		561.70*		1024.28*		846.69*	
	F	51.99*		21.51*		70.40*		42.34*	
	HETERO	105.57*		0.19*		250.94*		8.14*	
Diagnostics	ADJ R²	0.87		0.61		0.2374		0.2221	
	HAUS	10.09**		11.23**		0.76*		3.00*	
	OBS	370		347		370		351	
	FIRM FE	YES		YES		YES		YES	
	YEAR FE	YES		YES		YES		YES	

This table reports empirical results after estimating equations specified in section 3. Specifically, the results presented in this table are obtained fromtwo-step GMMapproach. The variables are same as defined in Table I. Z-statistics of two-step GMM model are reported in parentheses and based on robust standard errors. Sargan refers to p-values for over-identifyingrestrictions distributed asymptotically under the null hypothesis of the validity of instruments.*,**,***Significant at 1, 5 and 10 percent levels, respectively.

Hausman test is applied. The Hausman test runs under the null hypothesis that there is no correlation between the individual effects and regressors. The test statistics for the specifications are significant at 5 percent level, meaning that FE model would be able to produce best, linear, unbiased estimator (BLUE) estimates.

Further, use of panel data modeling, raises the concerns for the existence of heteroscedasticity, autocorrelation, multicollinearity and the presence of outliers. For this purpose, Breusch-Pagan / Cook-Weisberg test for heteroscedasticity test was used to check whether the heteroscedasticity exists or not. It was found that the p-value for BP/C-W test for the specifications is less than the 10 percent level of significance, signifying the presence of heteroscedasticity. Further, existence of autocorrelation has been tested by using Durbin-Watson test (DW-test) of autocorrelation. It can be inferred from Table III that the DW statistics for both of the specifications is 1.90 and 1.76 for ROA and 1.764 and 1.747 for NIM, implying the presence of no autocorrelation before or after dropping the outliers as the obtained values are within the acceptable range of 1.75-2.25. Having known that only the problem of heteroscedasticity persists, therefore, following Petersen (2009), heteroscedasticity has been corrected by producing robust standard errors. It may be noted that VIF's were calculated for testing the multicollinearity for all the independent variables. If the value of VIF for any of the predictor is greater than or equal to 10, it is an indication of multicollinearity (Field, 2005). The results of VIFs for the models presented in Table III are presented in column (3), (5), (7) and column (9) for before and after dropping outliers. It can be inferred from the table results that no VIF is greater than 10, suggesting that multicollinearity is unlikely a problem.

Taking ROA and NIM as the dependent variables, it was found that the coefficients on CA variable (.09128 and .08449) are positive and significant at 1 percent level and after dropping the outliers, the results on CA still remained the same (significant and positive). This confirms that performance and capital adequacy shares the positive relationship, implying that higher or increase in core capital enhances the performance of the banks. Further, these results are indicative to the fact that banking firms across the sectors tend to focus more on their capital to support their risk weighted exposures and thereby to expand their operations. Further, it is

due to the fact that higher capital enables the banks to create more assets and provides cushion to other risk exposures. This finding also indicates the consistency with which banks adhere to capital adequacy standards put forth by Basel accords. These results confirm H_1^1 that the performance of the banks is affected by capital adequacy. Further, it leads to the ascertainment that the banks with adequate regulatory capital operate better because they have satisfactory amount of capital to absorb undesirable shocks and/or losses that would lower the bank profitability. Thus, banks with higher regulatory capital ratios would be more profitable than banks with lower regulatory capital ratio. These results are in line with previous literature that reports a positive impact of capital adequacy on performance of the banks (see for instance, Abreu & Mendes, 2001; Kipruto et.al, 2017; Staikouras & Wood, 2003). However these results are in contradiction with other several studies (see for example, Ochieng, 2014; Odunga, Nyangweso & Nkobe, 2013) who found negative relationship between capital and performance of the banks. these studies reason out that capital accumulation is unnecessary cost for banks and hence may decrease its performance.

The results vis-à-vis control variables reveal that the coefficients on log of total asset variables (LTA-used as proxy for size of the banks) has shown significant negative impact on ROA and NIM but these results changed entirely as the coefficients became non-significant after dropping the outliers. In addition, the coefficients on shareholders' funds (SF) have shown significant negative impact on both ROA and NIM respectively after dropping the outliers. However, loans and advances were found to have significant positive impact on ROA before dropping the outliers and insignificant after dropping the variables. While as, for NIM, the cofficient on loans and advances have significant and positive impact at 1 percent level of significance and after dropping the variables it was found to be positive and significant at 5 percent significance level. Lastly, cash-deposit ratio (CD) has shown no significant impact on ROA but has significant and negative impact on NIM of banks across the sectors. While as, after dropping the outliers, it shows positive and significant impact at 5 percent level of significance and in case of NIM, after dropping the outliers, results remained the same. It should be noted that the variation in significance of results is due to the fact that banks across the sectors in the sample

may have different approaches towards their lending patterns, credit rating systems in place and therefore, the banks in the sample has shown higher level of heterogeneity in maintaining its approach during the time of study. Other studies that go in same vein like one by Sajjadi and colleagues (2010) evaluated the impact of six factors on performance of the banks including the size of bank. The findings revealed that the size of banks has positive significant impact on performance of the banks. This was further supported by (Pasiouras & Kosmidou, 2007). The possible reason could be that larger size of banks' indicates larger scale of operations which includes investment in more fee based investment activities along with core operations. In addition, large size allows the banks to charge lower interest rates on their borrowers which increase the overall profitability of the banks. These results were found in line with other previous studies (Ezike & Oke, 2013; Sangmi, Mohi-ud-Din, Nazir, 2010).

Capital adequacy and performance of banks among the sectors using ROA and NIM as performance measures.

Capital adequacy and performance among public and private sectors using ROA as performance measure

In order to test whether the performance (ROA) of the banks among the sector gets affected with the level of capital adequacy, Eq. (3) is estimated on the sample of public and private sector banks. The result of such estimation is given in Table IV. It must be noted that Table IV reports the results by taking ROA as proxy of banks performance for banks belonging to public and private sector banks. In addition, column (2) and (6) of the table reports the results including outliers, while as column (4) and (8) of the table reports the results excluding outliers. Following, Stephen and Senthamarai (2011), outliers were treated by using standardized residual analysis, where in the standardized residual being of the range $\geq \pm 3$ are considered as outliers.

The table IV reveals that the adjusted R^2 before dropping the outliers was found to be 82 percent implying that 82 percent of the variation in the dependent variable is explained by the independent variable in case of public sector banks. while as, for private sector banks, it was found to be 79 percent. Furthermore, after dropping the outliers, for it was reduced to 67 percent and 65 percent respectively for

public and private sector banks, which supports the literature indicating the nominal influence of outliers. The F-test for fixed effects is a test for choosing a better model among FE and OLS. It can be inferred from table IV that F-test statistics before and after dropping the outliers are significant at 1 percent level of significance among the sectors, implying that use of FE model for analysis. On the other hand, Breusch-Pagan Lagrange Multiplier (B-P LM) test for random effects is used for selecting a better model among RE and OLS. The statistical results of B-P LM test reported in columns (2) and (4), (6) and (8) are significant at 1 percent level of significance, suggesting that RE model is more effective to deal with heterogeneity than OLS. On the basis of results obtained with F-test and B-P LM test, it can be concluded safely that OLS is relatively less effective than FE and RE model in terms obtaining better estimates. Hence, the researcher used alternative panel data approach to proceed further in the study. Moreover, in order to obtain better model between FE and RE, Hausman test is applied. The test statistics for the specifications are significant at 1 percent level of significance, meaning that FE model would be able to produce BLUE estimates.

In order to get the insight of overall performance of public and private sector banks, ROA is used as parameter of performance and as the dependent variable, it was found that the coefficient on the explanatory variable CA is .0477 and implying a positive and significant impact on ROA at 10 percent level of significance. In addition, the results remain more or less the same even after dropping the outliers. However, CA was found to be insignificant before and after drpping the outliers for private sector banks. This indicates that all the public banks in the sample tend to focus more on their capital to ensure the safety of their risk weighted exposures. Another reason that can be ascribed to it is that public banks remain under direct supervision of government regulatory bodies like Reserve Bank of India (RBI). These findings are in conformity with the previous studies and thus it can be concluded that public sector banks remains more conservative regarding the creation of fund based assets and the possible reason could be threat of nonperforming assets. But this finding also directs towards the overcautious behavior of the banks that could limit them to explore more opportunities in market. The possible reason behind excessive NPA's is inefficient credit rating system, mismanagement of

Table IV

Variables (1)		Public Sector				Private Sector			
		With outliers (2)	VIF (3)	Without outliers (4)	VIF (5)	With outliers (6)	VIF (7)	Without outliers (8)	VIF (9)
Explanatory variable	**CA**	.047*** (4.54)	1.06	.044*** (4.45)	1.06	.000521 (0.02)	1.15	.024978 (1.22)	1.25
	LTA	-1.83 (-1.34)	3.65	-1.878 (-1.38)	3.64	-2.024263* (-6.27)	3.27	-1.171381* (-3.44)	3.59
Control Variables	**SHF**	-.00047* (-2.89)	1.06	-.00048* (-3.08)	1.06	.0020737 (1.48)	1.20	.00064 (1.19)	2.26
	LA	1.25e-07 (0.59)	3.48	1.44e-07 (0.67)	3.45	6.08e-06* (3.85)	3.49	4.72e-06* (2.77)	3.79
	CD	.044** (3.23)	1.15	.0445** (3.23)	1.15	-.197564* (-2.84)	1.10	-.0845638 (-1.21)	1.14
	DW	1.79		1.76		1.89		1.83	
	BP-LM	211.00*		211.30*		365.67*		179.71*	
	F	14.22*		14.31*		89.19*		67.67 *	
	HETERO	7.53*		7.34*		15.90*		43.96*	
Diagnostics	**ADJR**	0.82		0.67		0.79		0.65	
	HAUS	10.21*		13.02*		81.10*		15.06*	
	OBS	210		209		160		154	
	Firm FE	Yes		Yes		Yes		Yes	
	Year FE	Yes		Yes		Yes		Yes	

Impact of Capital adequacy on performance of public and private sector banks (using ROA as performance indicator)

This table reports empirical results after estimating equations specified in section 3. The variables are same as defined in Table I.
*,**,***Significant at 1, 5 and 10 percent levels, respectively.

credit policy and collateral assessments (Kosmidou & Pasiouras, 2007; Olalekan & Adeyinka, 2013).

The reason that can be ascribed to the insignificance of CA in case private sector banks may be that private sector banks have higher degree of scruitinization before grating credits and creating customers. It also implies that private sector banks don't rely more upon on-balance sheet assets to cover their risk weighted assets. It is also due to the reason that private banks guarantee their risk weighted exposures by effective assessment of collaterals through effective credit rating, credit scoring system and credit policy which includes individual credit rating system. The finding goes in line with previous literature indicating no significant

impact of capital adequacy on performance of the banks (Olalekan & Adeyinka, 2013; Singla, 2008).

The estimation of Eqs. (3), also helps to examine various control variables that can have an impact on performance of the banks among the sectors. The results in this regard are presented in Table IV, infers that the estimated coefficients on shareholders' funds (SF) is negative and significant for public sector banks, where as, no impact was witnessed in private sector banks. Cash deposit (CD) has positive and significant impact on performance of public sector banks at 5 percent level of significance. In private sector banks, significant and negative impact of CD was found at 1 percent level of significance before dropping the outliers and no impact

was found after dropping the outliers. In addition, the results reveal that the estimated coefficients on bank size (total assets-LTA) variable and loans and advances are not significant. However, in case of private sector banks, the respective cofficients were found to be significant (negative for LTA and positive for LA). It must be noted that the results do not change for both the sectors after dropping outliers thus, these findings are robust with and without the inclusion of outliers. These findings are partially consistent with those of the prior studies on relationship between capital adequacy and performance (see for example, Abreu & Mendes, 2001; Athanasoglou et al., 2008; Demirguc-Kunt & Huizinga, 1999; García-Herrero, Gavilá, & Santabárbara, 2009; Goddard et al., 2004; Molyneux & Thornton, 1992; Micco, Panizza, & Yanez, 2007; Naceur & Goaied, 2008; Pasiouras & Kosmidou, 2007; Staikouras & Wood, 2003). The partial inconsistency in the results may be attributed to the fact that these studies have not controlled the potential problems of heteroscedasticity and autocorrelation.

Capital adequacy and performance among public and private sectors using NIM as performance measure

In order to test whether the interest based performance of the banks among the sector gets affected with capital adequacy, the Eq. (4) as mentioned earlier is estimated. In tabe V, NIM is used as dependent variable, while as CA is explanatory variable and rest are kept as control variables. The adjusted R^2 is more or less 58 percent, while as after dropping the outliers, it is approximately 61 percent in case of public sector banks. whileas, the same for private sector banks before and after dropping the outliers is 35 percent and 38 percent respectively. Further, it can be inferred that the F-test statistics before and after dropping the outliers are significant at 1 percent level of significance, implying that use of FE model is more effective than OLS for analysis. Meanwhile, Breusch-Pagan Lagrange Multiplier (B-P LM) test is used for random effects. The statistical results of BP -LM test reported in column (2) and (4) for public sector banks and in (6) and (8) for private sector banks are significant at 1 percent level of significance, suggesting that RE model is more effective to deal with heterogeneity than OLS. On the basis of results obtained with F-test and B-P LM test, it can be concluded safely that FE and RE model is more effective to obtain better estimates than OLS. Hence, alternative panel data approach is

used. Moreover, Hausman test is used to obtain better model between FE and RE. The test statistics are significant at 1 percent level of significance among the sectors, meaning that FE model would be able to produce BLUE estimates. In order to deal with heteroscedasticity, autocorrelation, multicollinearity and the presence of outliers which are related with the use of panel data. The heteroscedasticity is checked by conducting Breusch-Pagan / Cook-Weisberg test. It was found that the p-value for BP/C-W for the specifications is less than the 1 percent level of significance before dropping the outliers and it was significant at 10 percent significance after dropping the outliers, signifying the presence of heteroscedasticity for public sector banks and for private sector banks it was found to be significant at 1 percent level of significance for both before and after dropping the outliers. Further regarding autocorrelation, it has been tested by using Durbin-Watson test (DW-test) and can be inferred from Table V that DW statistics for both of the specifications among the sectors nullifying the presence of autocorrelation before or after dropping the outliers as the obtained values are within the acceptable range. Petersen (2009) procedure for clustering by the firm was followed to control the potential level of heteroscedasticity. It may be noted that VIF's were calculated for all the independent variables and all the values were found less than the accepted range of 10 indicating presence of no multicollinearity between the variables. Following, Stephen and Senthamarai (2011), outliers were treated by using standardized residual analysis, wherein the standardized residual being of the range $\geq \pm 3$ are considered as outliers. These observations were dropped and the models were run again.

In order to check the impact of capital adequacy on NIM of public and private sector banks, the equation 4 is used again. The results are reflected in table V suggests that capital adequacy plays an important role in NIM as the results reveals positive and significant impact on NIM of public sector banks. It indicates that public sector banks tend to rely more upon core capital value to operate efficiently. It is supported by the findings in previous literature (see for example, KNG, 2001). This is because banks with higher CAR would seek more interest income in order to maintain high levels of capital. This in turn is reflected at higher rate of NIM. Another reason that can be ascribed to it is that public sector banks tend to be conservative in

Table V

Impact of Capital adequacy on performance of public and private sector banks (using NIM as performance indicator)

Variables (1)		Public Sector				Private Sector			
		With outliers (2)	VIF (3)	Without outliers (4)	VIF (5)	With outliers (6)	VIF (7)	Without outliers (8)	VIF (9)
Explanatory variable	**CA**	.0410347* (1.51)	1.14	.0423268* (1.55)	1.06	.0055862 (0.29)	1.15	.0026372 (0.14)	1.17
	LTA	-.583414* (-1.97)	2.44	-.62904** (-2.09)	3.64	-1.24945*** (-4.22)	3.27	-1.28738*** (-4.34)	3.28
Control Variables	**SHF**	.0000738 (0.93)	1.13	.0000702 (0.89)	1.06	.0023871*** (9.40)	1.20	.0027288*** (8.03)	1.42
	LA	1.22e-06* (3.12)	2.11	1.25e-06* (3.20)	1.06	1.75e-06* (1.51)	3.49	1.38e-06* (1.95)	3.08
	CD	.0406562 (1.31)	1.03	.0431637 (1.40)	1.14	-.1917558** (-3.01)	1.10	-.1961092** (-3.08)	1.10
	DW	1.786		1.790		1.81		2.23	
	BP-LM	470.91*		448.34*		266.31*		299.10*	
	F	36.05*		35.50*		57.44*		55.51*	
	HETERO	2.49*		2.93***		58.84*		52.60*	
Diagnostics	**ADJR**	0.581		0.619		0.3878		0.3509	
	HAUS	3.56*		11.15*		80.74*		33.54*	
	OBS	210		209		160		158	
	Firm FE	Yes		Yes		Yes		Yes	
	Year FE	Yes		Yes		Yes		Yes	

This table reports empirical results after estimating equations specified in section 3. The variables are same as defined in Table I.
*,**,***Significant at 1, 5 and 10 percent levels, respectively.

terms of asset portfolio creation. These banks usually tend to shift their loan portfolio to less riskier activities which would have proved to affect the spread if gone otherwise.

The lesser coefficient on CAR indicates the lower change in NIM as low riskier activities decreases the return and therefore further supports the previous finding. Different arguments in support of this finding has been offered by Bhaumik & Dimova (2004) and Sensarma & Ghosh, (2004) who argue that capital adequacy has positive impact on performance measured by using NIM of the banks. In contrast, in case of private sector banks, it is found that capital adequacy has no significant impact on NIM as p-value for CAR is well above the conventional level

of significance. The reason could be that the private sector banks try to avoid any threat on their core capital (capital adequacy include the core capital and supplementary capital) which can later turn the bank insolvent in case of any operational failure particularly in case of interest based activities. The banks often apply robust credit rating mechanism, effective credit policy and collateral assessment to avoid chances of facing any sort of defaulters.

In case of the control variables, bank size is found to have significant and negative impact on NIM among the sectors at 1 percent and 5 percent level of significance for public sector banks before and after excluding the outliers respectively and at 10 percent level of significance for private sector banks

for both before and after excluding the outliers. It indicates that larger size assets encourages the banks to diversify its operational activities among different investing activities and hence decreases the income from interest based activities. It is because of the reason that banks among the sectors face higher threat of non-performing assets (NPAs) once any exposure takes place as suggested by Sensarma and Ghosh, (2004) and further indicated that banks diversify their activities in fee based investments to secure the banks from major risk exposures of credit risk or counter party risk. In addition, banks with larger portfolio try to optimize interest income through lowering interest rates on borrowers and hence increasing overall profitability of the banks but decreases NII. Whereas, loans and advances was found to have significant positive impact on NIM as the net interest income basically depends upon interest earned on loans and advances extended by the banks to its customers among the sectors. This usually will increase the operational earnings of the banks, if not turn otherwise like that of NPAs. Apart from it, shareholders funds (SF) is found to have significant impact on NIM at 10 percent level of significance for private sector banks only. The underlying reason for increase in SF leading to increase in NIM is that the private banks under study may be using retained earnings to create interest based assets. It gives an advantage to the management of these banks to set favorable interest rate on deposits and hence provides an impetus to asset base of the banks. In the same vien, cash to deposits ratio is found to have significant and negative impact on NIM at 1 percent level of significance for private banks only. It is because of the fact that increase in deposits increases the interest expenses and hence decreases the net interest margin (NIM). Thus, it can be safely concluded that the impact of capital adequacy on performance (NIM) varies among the banking sectors.

Summary of findings and conclusions

This main aim of the study is to provide better understanding vis-à-vis the impact of capital adequacy on the performance of banks on a sample of 37 banks including 21 public sector banks and 16 private sector belonging to BSE banking Index for a period of 10 years (2009-2018). Knowing that there are different benefits and costs attached to the maintenance of capital as reflected in literature, it seemed quite interesting to determine the impact of capital adequacy on the bank performance across and among the public and private sector banks. Accordingly, the study tried to address certain queries like; whether there is any impact of capital adequacy on performance of banks across the sectors and does this impact vary among sectors or not. It also helps to give an insight about the varying approach of banks to deal with capital adequacy standards in order to optimize their performance.

To investigate the above phenomenon, first ROA and then NIM have been taken as the dependent variables while as, capital adequacy has been taken as the independent variable along with loans and advances, log of total assets (as proxy for the size of the banks), shareholders funds and cash to deposits as control variables. This arrangement helped in determining the impact of capital adequacy on profitability of banks. Further, the study attempted to investigate the varying impact of capital adequacy on performance of banks among public and private sector banks. More specifically, this study focused on strategies regarding capital adequacy adoption by banks and the impact of such strategies on their overall performance vis-à-vis operational performance related to interest based activities. To examine this phenomenon, same dependent variables are used to evaluate the overall performance of banks across the sector and then separately for public and private banks respectively. Panel data methodology procedure was followed as suggested by Park (2011). In addition, Petersen (2009) procedure for clustering by the banks was followed to control the potential level of heteroscedasticity and autocorrelation as done in prior studies like one by altaf and shah (2017).

The results indicate that over the period of study, overall performance of banking sector have remained profitable and interest based activities have also led banks to earn satisfactory profits. In addition, these results also signify the efficiency of selected banks in generating performing assets and utilization of their resources. Although, the overall performance of banks has remained profitable, however, some banks in the sample may have not been able to control their interest based investments which thereby have affected their net interest margin (NIM). Although the overall performance of banks asserts consistency, the performance regarding interest based activities of the sample banks is fluctuating in the sample. The mean value of ROA for public sector banks is considerably

much lower than private ones'. Since, the public sector banks were not able to obtain overall profitability during the period of study, private sector banks have performed quite satisfactorily. It must be noted that all private banks in sample were found to have satisfactory overall profitability. With regard to NIM, private sector banks are found to have much satisfactory results than that of public sector banks. The possible reasons could be efficient management system and credit rating/granting system of private sector banks. Although higher heterogeneity was found in NIM of private sector banks but still the net interest income was found to be satisfactory. These findings supports the fact that all the banks in the sample have maintained satisfactory overall performance while as, few banks have negative spread and the reason could be larger non-performing assets, higher interest rates on lending which restricts the asset creation capability of banks.

With regard to independent variables, all the banks across sectors have maintained surplus capital throughout the period of study. This suggests that most of banks are working with more capital to risk weighted asset ratio than what is recommended by the regulatory authorities i.e. 9%. Further, it is found that CAR variable suggests higher heterogeneity among the banks in managing their capital adequacy standards which is based on decision making bodies and supervisory committees of the banks. The CAR has been found to be significant across the sectors and more specifically in public sector banks. The performance of banks in the sample is more or less influenced with the level of CAR. The results on control variables revealed different approach with regard to the profitability of banks. For instance, log of total assets (LTA) is found to be significant and negative in all the specifications except in overall performance of the public sector banks, where it was found to have no significant impact on profitability. Further, shareholders funds (SF) is found to have significant and negative impact on overall performance of banks (ROA), while as, it has significant and positive impact on NIM indicating the proper utilization of retained earnings in private sector banks. Furthermore, loans and advances (LA) is found to have significant and positive impact on ROA of private sector banks and on NIM of banks across the sectors and among them as well. Moreover, cash to deposits (CD) has a significant and negative impact on overall performance (ROA) of private sector banks while as, it is found to have significant and negative

impact on NIM of banks across the sectors and more specifically on NIM of private sector banks.

Any study is hardly perfect and without any limitation, and therefore this study is no exception. Although utmost care has been taken while framing, designing and executing the present study, yet some limitations still do exist. First, the study used the sample of Indian listed firms belonging to the banking sector which are listed at BSE BANKEX means that the findings of this study can't be attributed to any other non-listed bank in banking sector or to any financial institution, whether listed or otherwise. This is obvious because of the fact that the characteristics of listed banks at BSE are one way or the other different from the unlisted ones. The study being empirical in nature, considered only quantitative variables while as, equally important non-quantitative behavioral finance approach to manage capital adequacy has been altogether neglected. A number of qualitative factors like management efficiency, proficiency to manage cash flows and the overall organizational culture been omitted by the researcher and hence a limitation. Further, the study used only two accounting-based measures of profitability (ROA and NIM) while as, other accounting measures have not been taken into account. Researchers have used different measures to evaluate profitability of the banks based on the nature of studies.

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