"Capital adequacy determinants of Indian banks listed on the Bombay Stock Exchange"

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CAPITAL ADEQUACY DETERMINANTS OF INDIAN BANKS LISTED ON THE BOMBAY STOCK EXCHANGE

Abstract

This study examines the influence of corporate-specific factors and external factors on capital adequacy of Indian banks listed on the Bombay Stock Exchange (BSE). This study used a GMM estimation (pooled, fixed, and random) for the period 2009–2018 to study thirty-seven Indian listed commercial banks. Banks' capital adequacy (CAAD) is used as a dependent variable measured by equity to total assets. While corporate specifics factors include bank size, asset quality, liquidity ratio, deposit ratio, asset management, operating efficiency, return on assets, net interest margin, and non-interest income, external factors are economic activity, exchange rate, and interest rate. The results of this paper found that the deposit ratio, asset management, bank size, and operating efficiency are the main factors influencing banks' CAAD of Indian listed firms during the period of the study. The outcomes revealed that the deposits ratio, asset management, and bank size have a negative and significant influence on banks' CAAD, while operating efficiency has a positive and significant impact on CAAD. In terms of external indicators, the results revealed that gross domestic product and interest rate have a negative and significant effect on CAAD of Indian listed banks, except that the exchange rate has a positive and significant influence on CAAD.

Keywords	commercial banks, capital adequacy, firm-specific, GMM, external factors, India
JEL Classification	N10, M40, F65, G21

INTRODUCTION

Capital adequacy is defined as the adequacy of a bank's information aggregation with respect to the risks associated with its assets, off-balance-sheet transactions, trading operations, and other business hazards. Before Basel 1 codified the concept of capital adequacy, banks operated in an age marked by disparate and inconsistent approaches to capital sufficiency. Dow (2017) demonstrated that banks recognized the value of capital reserves in the early 1970s and early 1980s, which were used to handle the risks inherent in the banking business.

India has a huge and sophisticated financial system that is characterized by a diverse array of financial firms, including banks and non-bank financial companies (Ghosh, 2016). Since the 1990s, India's economy has experienced major liberalization and policy adjustments to increase banking performance, revenue, and productivity, thus strengthening business competitiveness (Ghosh, 2016). However, as a result of information asymmetries, the Indian banking product markets are more competitive and transparent (Sinha & Sharma, 2016). A distinguishing element of the liberalization reforms is their emphasis on improving banking sector competitiveness through the expansion of the financial system to include private and foreign institutions (Ghosh, 2016). According to the database's statistics, the "Indian bank-

ing system currently consists of 27 public banks, 26 private banks, 46 foreign banks, 56 rural regional banks, 1,574 urban co-operative banks, and 93,913 rural co-operative banks, as well as cooperative credit institutions". (From the Indian Reserve Bank (RBI)). Public sector banks account for between 70% and 73% of total bank assets in India (Ghosh, 2016; Shrivastava, Sahu, & Siddiqui, 2018).

This study used a GMM estimation (pooled, fixed, and random) to examine thirty-seven Indian listed commercial banks. Banks' capital adequacy, which is used as a dependent variable defined by equity to total assets, has been considered as a function of internal factors and external indicators. Whereas corporate specific characteristics include bank size (BASZ), asset quality (ASQU) ratio, liquidity ratio (LQDR) ratio, deposit ratio (DEPO) ratio, asset management (ASMA) ratio, operating efficiency (OPEF) ratio, return on assets (ROAS) ratio, net interest margin (NIMA) ratio, and non-interest income (NIIN) ratio, external (macroeconomic) factors are economic activity (EGDP), exchange rate (EXCH) rate, and interest rate (INTR) rate.

1. LITERATURE REVIEW

Numerous empirical studies analyzed the correlation between capital adequacy with corporate-specific factors and financial performance in various countries (e.g., Koehn & Santomero, 1980; Endri, 2011; Ali et al., 2011; Ajlouni et al., 2011; Rao & Lakew, 2012; Choong et al., 2012; Firdaus & Hosen, 2013; Al-Homaidi et al., 2018, 2019, 2020). Several researchers have found that the capital ratio of a bank has a significant and positive impact on the financial performance of the bank (e.g., Bougatef, 2017; Salike & Ao, 2017), However, according to Naeem et al. (2017), capital ratio has a positive but small link with the profitability.

According to Trad et al. (2017), capital adequacy and bank size are the most important elements in reducing credit risk, enhancing efficiency, and obtaining flexibility for Islamic firms. Researchers also discovered that, with the exception of inflation, macroeconomic indices have the potential to improve the stability of Islamic institutions. A study by Trad et al. (2017) looked into the prospect of Islamic financial banks serving as an alternative to traditional banks and ensuring stability during times of crisis. Based on the research findings, capital adequacy and bank size are the major characteristics responsible for lowering credit risk, increasing performance, and ensuring the long-term stability of Islamic banks. Al-Homaidi et al. (2019) demonstrated that bank size, capital adequacy ratio, deposit-to-total-assets ratio, operational efficiency ratio, and return on assets ratio all have a significant but positive influence on LQD. Firm size, capital adequacy,

deposit rate, and inflation rate all have a relatively substantial impact on financial performance, however gross domestic product (GDP) has a little effect on ROA (Allamy et al., 2020).

Allamy et al. (2020). In addition, the results revealed that business size (LOGAS) and capital adequacy (CA) have a negative impact on financial results. According to Al-Homaidi et al. (2020), "Capital adequacy, deposits, operational efficiency, gross domestic product, and inflation rate" are all determined to have a negatively substantial effect on return on assets (ROA). Furthermore, the findings reveal that "capital sufficiency, bank size, operational efficiency, gross domestic product, and the rate of inflation" all have a "significant negative impact on return on investment (ROI)". According to Almaqtari et al. (2018), "bank size, assets quality, capital sufficiency, liquidity, operating efficiency, deposits, leverage, assets management, and the number of branches" are all considered to be bank-specific variables. Dao and Nguyen (2020) investigated the association between the capital adequacy ratio and profitability of Vietnamese banks. According to Al-Homaidi et al. (2018), factors were used to account for bank-specific aspects such as bank size, "assets quality, capital adequacy, and liquidity as well as operating efficiency and deposits, as well as leverage and assets management and the number of branches." Al-Homaidi et al. (2020) discovered that the capital adequacy ratio has a negative relationship with liquidity. The capital adequacy ratio (CAR) has a statistically significant negative effect. The findings were discovered in investigations conducted by Firdaus and Hosen (2013).

Ali et al. (2011) discovered that "there is a positive and statistically significant association between capital adequacy and profitability model in the financial sector." Based on their research, it has been discovered that bank capital adequacy, loans to assets, and asset management performance have a positive and significant association with return on assets (ROA) and return on equity (ROE), which are important factors in banks' financial performance. There are many studies that have suggested that capital adequacy has a negative (Yayar & Karaca, 2014) or a positive effect on the efficiency of a financial institution (Rao & Lakew, 2012). According to the previously conducted studies on the microeconomic variables, capital sufficiency, bank size, and operational efficiency are the most important bank-specific elements to take into consideration (Ameur & Mhiri, 2013). Choong et al. (2012) proposed that the ratio of total equity to total assets be used as a surrogate for capital adequacy in financial institutions. In addition to representing the capital sufficiency of capital strength of banks, capital ratios should also serve as a proxy for risk and regulatory burdens for the financial sector (Wasiuzzaman & Tarmizi, 2010). As Koehn and Santomero (1980) observed, rules that increase the capital adequacy requirements in order to reduce risk will cause the banks to take on more risk in their investment portfolios to produce bigger profits (Guru et al., 2002). A negative link, according to Berger (1995), is proposed because having a low capital adequacy ratio suggests that the bank is exposed to a high level of risk, which in turn positively affect bank profitability (Sufian & Habibullah, 2009). Almumani (2013) discovered that financial firms with a greater capital adequacy ratio are not as efficient as their counterparts. According to Ajlouni et al. (2011), a higher capital adequacy ratio results in the least amount of efficiency.

As such, this paper aims to examine the factors that influence the capital adequacy of Indian listed banks. The study accomplishes the primary purpose through the use of two sub-objectives:

1) To examine the impact of corporate-specific factors on capital adequacy of Indian listed banks during the period from 2009 to 2018.

2) To assess the influence of external variables on capital adequacy of Indian listed banks during the period from 2009 to 2018.

This paper bridges a divide in firm-specific factors, external factors, and literature on capital adequacy in India, Besides, the current study expands and complements earlier research from various countries by using panel data from 37 Indian publicly traded banks from 2009 to 2018 and fully examining numerous company and external dimensions of the environment.

2. METHODS

2.1. Study population and data collection

Corporate-specific factors and external proxies have been examined to test the link with capital adequacy of listed commercial banks in India. This study used a GMM estimation as well (pooled, fixed, and random) for the period 2009–2018, this study examined thirty-seven Indian listed commercial banks during the period from 2009 to 2018. Using a panel data approach, this study is based on secondary data analysis. This paper analyzed the data by using EViews 10 and Stata MP 13 and collected the data from the Prowess QI Database for the period from 2009 to 2019. According to the database's statistics, "the Indian banking system currently consists of 27 public banks, 26 private banks, 46 foreign banks, 56 rural regional banks, 1,574 urban co-operative banks, and 93,913 rural co-operative banks, as well as co-operative credit institutions." (From the Indian Reserve Bank (RBI)). Public sector banks account for between 70% and 73% of total bank assets in India.

To ascertain the most suitable expected outcomes, the Hausman test is used to compare the results of the random and fixed effect models in the aggregate. When the Hausman test is performed, the p-value reveals that the fixed effect model is more appropriate than the random effect (p-value < 0.01) and that the random effect model is less appropriate. As seen in Table 4, the fixed effect model performs significantly better than the random effect model. The outcomes also reveal that all models are well-fit, as shown by a probability value of less than one percent (p-value < 0.01) for each model.

Table 1. Definitions of the variables

Variable		Notation	Measure	Expect effect	Data source
Dependent factor					
Capital adequacy		CAAD	$CAAD_{it}$ is an equity$_{it}$ to total assets$_{it}$	NA	
Bank-specific independent variables	Bank size	BASZ	$BASZ_{it}$ is a natural logarithm of total assets	±	Prowess QI database
	Asset quality	ASQU	$ASQU_{it}$ is a loan$_{it}$ to total assets$_{it}$	±	
	Liquidity ratio	LQDR	$LQDR_{it}$ is liquid assets$_{it}$ to total assets$_{it}$	±	
	Deposit ratio	DEPO	$DEPO_{it}$ is deposits$_{it}$ to total assets$_{it}$	+	
	Asset management	ASMA	$ASMA_{it}$ is an operating income$_{it}$ to total assets$_{it}$	+	
	Operating efficiency	OPEF	$OPEF_{it}$ is a total operating expense$_{it}$ to total assets$_{it}$	−	
	Return on assets	ROAS	$ROAS_{it}$ is a net profit$_{it}$ to total assets$_{it}$	±	
	Net interest margin	NIMA	$NIMA_{it}$ is a net interest income$_{it}$ to total assets$_{it}$	−	
	Non-interest income	NIIN	$NIIN_{it}$ is a non-interest income$_{it}$ to total assets$_{it}$	+	
External factors	Economic activity	EGDP	$EGDP_{it}$ is an annual real GDP growth rate	+	World bank
	Exchange rate	EXCH	$EXCH_{it}$ is an average exchange rate	+	
	Interest rate	INTR	$INTR_{it}$ is a lending interest	−	

2.2. Model specification

This study employs three analysis methods tools ((pooled, fixed and random) and Generalized Method of Moments (GMM)). One model has been developed to evaluate the dimensions that may identify banks' capital adequacy in listed financial institutions in India, which are as follows:

$$CAAD_{it} = \alpha_i + \beta_1 BASZ_{it} + \beta_2 ASQU_{it} +$$
$$+\beta_3 LQDR_{it} + \beta_4 DEPO_{it} + \beta_5 ASMA_{it} +$$
$$+\beta_6 OPEF_{it} + \beta_7 ROAS_{it} + \beta_8 NIMA_{it} + \quad (1)$$
$$+\beta_9 NIIN_{it} + \beta_{10} EGDP_{it} + \beta_{11} EXCH_{it} +$$
$$+\beta_{12} INTR_{it} + \varepsilon_{it}.$$

For example, in the case of equity, capital adequacy equals equity divided by total assets; where i = 1, …, N and t = 1, …, T are constant terms, and all other variables are described in Table 1. The generalized method of moments (GMM) adopted by Arellano and Bover (1995) is incorporated. Following that, and in accordance with Saona (2016), these considerations recommend the use of a dynamic model of banking capital adequacy, which takes the following form:

$$Capital\ adequacy_{it} =$$
$$= \beta_0 + \beta_1 Capital\ adequacy_{it-1} + \quad (2)$$
$$+\sum_{j=1}^{9} \delta_j X_{it} \sum_{k=1}^{3} \theta_k Y_t + \eta_i + \mu_t + \varepsilon_{it}.$$

For example, the vector of intra-bank factors of capital adequacy (X_{it}) is defined as follows: Y_t denotes the vector of extra-bank factors of capital adequacy (Y_t) is defined as follows: i denotes the individual effect, t denotes the temporal effect, and t is the random error.

$$\sum_{j=1}^{9} \delta_j X_{it} = \delta_1 DEPO_{it} + \delta_2 ASMA_{it} +$$
$$+\delta_3 ASQU_{it} + \delta_4 BASZ_{it} + \delta_5 NIIN_{it} + \quad (3)$$
$$+\delta_6 NIMA_{it} + \delta_7 OPEF_{it} + \delta_8 ROAS_{it} +$$
$$+\delta_9 LQDR,$$

and

$$\sum_{j=1}^{3} \theta_k Y_t = \theta_1 EGDP_{it} + \theta_2 INTR_{it} + \quad (4)$$
$$+\theta_3 EXCH_{it}.$$

As seen in Table 1, the fixed effect model outperforms the random effect model. A probability value of less than one percent (p-value < 0.01) for each model also shows that they are well fit.

3. RESULTS

3.1. Descriptive statistics

Table 2 presents the results of the descriptive analysis of indicators of the present investigation. The outcomes of capital adequacy (CAAD) indicated that average value is 0.0051%, median value is 0.0033%,

Table 2. Descriptive analysis

Variable	CAAD	DEPO	ASMA	ASQU	BASZ	NIIN	NIMA	OPEF	ROAS	LQDR	EGDP	INTR	EXCH
Mean	0.0051	−0.2045	−2.6486	−0.4964	2.6269	−4.548	1.0706	−2.494	−0.1887	−2.5759	1.9582	1.3600	4.0080
Median	0.0033	−0.1594	−2.6454	−0.4854	2.6431	−4.487	1.0561	−2.490	0.0050	−2.5885	1.9664	1.6033	4.0511
Maximum	0.0709	−0.0883	−2.1727	−0.3622	2.8400	0.145	5.5645	−1.940	0.7031	0.1235	2.3283	2.0516	4.1934
Minimum	0.0000	−0.6502	−3.0392	−0.9216	2.2618	−9.823	−1.6482	−2.849	−3.9120	−3.2667	1.3584	0.0583	3.7381
Std. dev.	0.0076	0.1111	0.1306	0.0747	0.0954	1.562	0.3737	0.127	0.6570	0.3715	0.2694	0.6533	0.1646
Skewness	5.4286	−1.8697	0.1381	−1.3752	−0.8000	−0.064	3.7936	0.227	−1.4929	1.4943	−0.7279	−0.848	−0.4372
Obs.	370	370	370	370	370	370	366	370	370	370	370	370	370

max value is 0.0709, min value is 0.0000, and Std. dev. value is 0.0076, respectively.

The results of deposit ratio (DEPO), asset management (ASMA), and asset quality (ASQU) revealed that maximum values are −0.0883, −2.1727 and −0.3622, and minimum values are −0.6502, −3.0392 and −0.9216, while mean values are −0.2045, −2.6486 and −0.4964, and std. dev. values are 0.1111, 0.1306 and 0.0747. However, the outcomes of bank size (BASZ), non-interest income (NIIN), net interest margin (NIMA), operating efficiency (OPEF), return on assets (ROAS) and liquidity ratio (LQDR) showed that mean values are 2.6269%, −4.5480%, 1.0706%, −2.4940%, −0.1887% and −2.5759%, median values are 2.6431%, −4.4875%, 1.0561%, −2.4909%, 0.0050% and −2.5885%, maximum values are 2.8400, 0.1457, 5.5645, −1.9400, 0.7031 and 0.1235, minimum values are 2.2618, −9.8232, −1.6482, −2.8499, −3.9120and −3.2667 and Std. Dev. values are 0.0954%, 1.5629%, 0.3737%, 0.1278%, 0.6570%, and 0.3715%, respectively.

With respect to external dimensions, the results revealed that economic activity (EGDP), an exchange rate (INTR), and interest rate (EXCH) revealed that mean values are 1.9582%, 1.3600%, and 4.0080%, median values are 1.9664%, 1.6033%, and 4.0511%, maximum values are 2.3283, 2.0516 and 4.1934 and minimum values are 1.3584, 0.0583 and 3.7381, respectively. Whereas, Std. dev. values are 0.2694%, 0.6533%, and 0.1646%. The results according to Skewness test indicated that there are normal distribution values presented in (Table 2).

3.2. Correlation matrix

Table 3 offers the outcomes of the link results between dependent factors and independents proxies during a period of this investigation. The outcomes showed that capital adequacy (CAAD) has a negative link with independent indicators such as a deposit ratio (DEPO), asset quality (ASQU), bank size (BASZ), and non-interest income (NIIN), while it has a positive correlation with asset management (ASMA), net interest margin (NIMA), operating efficiency (OPEF), return on assets (ROAS), and liquidity ratio (LQDR). The results also revealed that the capital adequacy ratio (CAAD) has the highest link with the liquidity ratio (LQDR). Deposit ratio (DEPO) has a highest relationship with the asset quality (ASQU). Asset management (ASMA) has a highest association with operating efficiency (OPEF). Net interest margin (NIMA) has a highest link with return on assets (ROAS).

In terms of external factors, the outcomes indicated that the capital adequacy ratio (CAAD) has a negative link with exchange rate (EXCH), whereas it has a positive association with the gross domestic product (EGDP) and interest rate (INTR). The outcomes also showed that exchange rate (EXCH) has a highest correlation with asset quality (ASMA), bank size (BASZ), non-interest income (NIIN), operating efficiency (OPEF), and interest rate (INTR). The Variance Inflation Factor (VIF) test was used in this study to determine whether or not there was a problem with multicollinearity. There is no evidence of a multicollinearity problem among the autonomous variables, according to the findings. All of the VIF values are less than 5, indicating that there is no evidence of a multicollinearity concern among the independent factors in this investigation (see Table 3).

Table 3. Correlation and diagnostics of the multicollinearity test

Variable	CAAD	DEPO	ASMA	ASQU	BASZ	NIIN	NIMA	OPEF	ROAS	LQDR	EGDP	INTR	EXCH
Capital adequacy	1	−0.1763	0.0853	−0.3844	−0.6426	−0.0482	0.0834	0.0197	0.0030	0.1488	0.0066	0.0008	−0.1935
Deposits ratio	−	1	0.0421	0.2593	−0.1067	0.0382	−0.1069	0.0003	−0.3159	0.1000	0.0031	0.0253	−0.0275
Asset management	−	−	1	0.0718	−0.3338	0.2453	−0.0116	0.5955	−0.1762	−0.4449	−0.3245	0.1521	0.2867
Asset quality	−	−	−	1	0.2412	0.0586	0.0523	0.0336	−0.1349	−0.2608	−0.0111	−0.1032	0.2443
Bank size	−	−	−	−	1	−0.0069	−0.1491	−0.1539	−0.1034	−0.0073	−0.0086	0.0302	0.3482
Non−interest income	−	−	−	−	−	1	−0.1263	0.2785	−0.1884	−0.1371	−0.0015	0.2087	0.5126
Net interest margin	−	−	−	−	−	−	1	−0.0263	0.2304	−0.0923	0.0995	−0.1449	−0.1004
Operating efficiency	−	−	−	−	−	−	−	1	−0.1509	−0.3894	−0.2655	0.2501	0.4171
Return on assets	−	−	−	−	−	−	−	−	1	0.1205	0.0046	−0.1314	−0.2607
Liquidity ratio	−	−	−	−	−	−	−	−	−	1	0.0470	0.0875	−0.3698
Gross domestic product	−	−	−	−	−	−	−	−	−	−	1	−0.0151	−0.0055
Interest rate	−	−	−	−	−	−	−	−	−	−	−	1	0.1157
Exchange rate	−	−	−	−	−	−	−	−	−	−	−	−	1
Diagnostics of multicollinearity test													
Variance inflation factor (VIF)	1.0967	1.3104	1.1264	1.3477	1.3195	1.0506	1.8491	1.0904	1.3434	1.4498	1.3206	*2.0946*	

3.3. Multiple regression analysis

The outcomes of the regression model for capital adequacy (CAAD) are explained in detail in Table 4, where the values of Adjusted R-squares are 0.4740, 0.9003, and 0.5980, respectively. This reveals that both corporate-specific factors and external factors contribute approximately 47 percent, 90 percent, and 59 percent to capital adequacy (CAAD), respectively (CAAD).

The results of this paper found that the deposits ratio (DEPO), asset management, bank size (BASZ), and operating efficiency (OPEF) are the most factors that influence bank capital adequacy (CAAD) of Indian listed firms during the period of the examination. The results indicated that the deposit ratio (DEPO) and bank size (BASZ) have a significant effect on bank capital adequacy (CAAD) at a level 1% in all models. The outcomes revealed that the deposit ratio (DEPO), asset management (ASMA) and bank size (BASZ) have a negative and significant effect on bank capital adequacy (CAAD) at the level 1% in all models except that asset management (ASMA) has a negative and significant effect on bank capital adequacy (CAAD) at the level 10% in a fixed-effects model, while operating efficiency (OPEF) has a positive and significant impact on banks' capital adequacy (CAAD) at

the level 1% in all models. The results also showed that asset quality has a significant impact on banks' capital adequacy (CAAD) in both (pooled and random) models, while in the fixed model it revealed no significant effect on banks' capital adequacy (CAAD). Non-interest income (NIIN) and net interest margin (NIMA) have a negative effect on capital adequacy (CAAD) of Indian banks in all models. Liquidity ratio (LQDR) has a positive and significant influence on capital adequacy (CAAD) in all effects models. On the other hand, the return on assets (ROA) has a negative and minor impact on the capital adequacy of a company (CAAD) in both models (pooled and fixed), except that in the random model it is significant at the level of 5%.

In terms of external indicators, the results revealed that gross domestic product (EGDP) and interest rate (INTR) have a negative and statistically significant impact on capital adequacy (CAAD) of Indian banks in all models in both fixed and random effect models, except that in the pooled model, gross domestic product (EGDP) has a negative and significant influence on capital adequacy (CAAD) at the level of 5%, and interest rate (INTR) has a negative and insignificant impact on capital adequacy (CAAD) of Indian commercial financial banks. Exchange rate (EXCH) has a positive and significant impact on banks' capital adequacy (CAAD) at the level 1%.

Table 4. Multiple regression analysis

Variable	Pooled				Fixed				Random			
	Coeff.	Std. error	t-statistic	Prob.	Coeff.	Std. error	t-statistic	Prob.	Coeff.	Std. error	t-statistic	Prob.
C	0.1092	0.0140	7.7711	0.0000***	0.3659	0.0157	23.3061	0.0000***	0.2432	0.0120	20.3425	0.0000***
Deposits ratio	−0.0259	0.0086	−3.0015	0.0029***	−0.0130	0.0041	−3.1831	0.0016***	−0.0214	0.0040	−5.3276	0.0000***
Asset management	−0.0244	0.0062	−3.9371	0.0001***	−0.0064	0.0037	−1.7313	0.0845*	−0.0170	0.0035	−4.8082	0.0000***
Asset quality	0.0135	0.0059	2.2967	0.0223**	0.0024	0.0027	0.8908	0.3738	0.0066	0.0027	2.4288	0.0157***
Bank size	−0.0602	0.0040	−15.0932	0.0000***	−0.1842	0.0078	−23.6647	0.0000***	−0.1199	0.0056	−21.3365	0.0000***
Non-interest income	−0.0002	0.0002	−0.8556	0.3929	−0.0002	0.0001	−1.8888	0.0600*	−0.0002	0.0001	−2.2237	0.0269**
Net interest margin	−0.0004	0.0008	−0.5457	0.5857	−0.0003	0.0003	−0.9291	0.3537	−0.0004	0.0003	−1.0943	0.2746
Operating efficiency	0.0145	0.0057	2.5585	0.0110***	0.0060	0.0030	1.9972	0.0468**	0.0141	0.0029	4.8573	0.0000***
Return on assets	−0.0003	0.0004	−0.5742	0.5663	−0.0002	0.0002	−1.1865	0.2364	−0.0004	0.0002	−2.0970	0.0368**
Liquidity ratio	0.0015	0.0009	1.7249	0.0855*	0.0011	0.0005	2.2020	0.0285**	0.0016	0.0005	3.4280	0.0007***
Gross domestic product	−0.0028	0.0014	−1.9613	0.0507**	−0.0013	0.0007	−1.8286	0.0685*	−0.0017	0.0007	−2.4533	0.0147***
Interest rate	−0.0001	0.0005	−0.1637	0.8701	−0.0011	0.0002	−4.5045	0.0000***	−0.0006	0.0002	−2.3607	0.0188***
Exchange rate	0.0087	0.0029	2.9613	0.0033***	0.0315	0.0021	15.0382	0.0000***	0.0186	0.0018	10.4333	0.0000***
R-squared	0.4933				0.9150				0.6128			
Adjusted R-squared	0.4740				0.9003				0.5980			
S.E. of regression	0.0051				0.0022				0.0026			
F-statistic	25.5570				62.5382				41.5421			
Prob(F-statistic)	0.0000***				0.0000***				0.0000***			
Hausman test					0.0000***							

*Note: significance at ***1, **5, *10 percent levels.*

3.4. Robust regression

Table 5 summarizes the varied outcomes obtained through the various strategies (Pooled, Robustness, and GMM estimates). The outcomes of robust regression analysis are comparable to those of pooled multiple regression, also known as ordinary least squares (OLS) and generalized least squares (GMM) estimation models. The results indicated that the coefficient estimates obtained by robust regression are not statistically different from those obtained through ordinary least squares (OLS) and generalized least squares (GMM) estimation methods. This demonstrates that the regression parameters were properly estimated. Additionally, the results of robust regression imply that the data is free of outliers. Additionally, there are no significant data that affect the anticipated outcomes (see Table 5).

3.5. GMM estimation

GMM is used to validate the outcomes of the estimated models above. GMM approaches are used in two steps to address the issue of association between the lagged dependent variable and the error term. According to Chowdhury and Rasid (2017), GMM can resolve only 'fixed effect' concerns by resolving the link between the lagged dependent variable and the error term, as well as the indigeneity of some explanatory factors. Additionally, the GMM system attempts to address instrument weakness by supplementing instruments. The GMM results demonstrate that no order relationship exists inside the mistake. The Arrellano and Bond test for second-order correlation indicates that no significant order correlation exists in capital adequacy (CAAD). Additionally, the Sargent analysis is run, and the result indicates that the value of this analysis is greater than 0.05 (*CAAD* = 0.101), confirming the use of the dynamic panel data model.

Table 6 summarizes the results of the GMM estimation model between variables. The outcomes indicated that Lag capital adequacy (CAAD) has a positive and very high significant at the 1% level. The findings also suggested that bank size (BASZ), non-interest income, net interest margin, and liquidity are the most bank-specific factors affecting banks' capital adequacy (CAAD)

in India from 2009 to 2019. The results also indicated that bank size (BASZ), NIIN, NIMA, and liquidity ratio (LQDR) have a negative and significant effect on banks' capital adequacy (CAAD), while operating efficiency (OPEF) has a negative and significant influence on capital adequacy (CAAD) at the level 5%. The findings of the deposit ratio (DEPO), asset management (ASMA), asset quality (ASQU), and return on assets (ROAS) revealed that there is a negative and insignificant relationship with capital adequacy (CAAD), while asset management (ASMA) has a positive link with capital adequacy (CAAD) during the period of the article.

Concerning external indicators, the outcomes suggested that EGDP and INTR rate have a positive and insignificant influence on banks' CAAD ratio, while EXCH rate has a negative and high significant effect on banks' CAAD ratio at the 1% level.

4. DISCUSSION

This study compares its results with those of earlier studies conducted in other countries. It was found that capital adequacy has a negative association with the deposit ratio, asset quality, bank size, and non-interest income, while a positive correlation was found with asset management, net interest margin, operating efficiency, return on assets and liquidity ratio. The results also revealed that the capital adequacy ratio has a highest link with liquidity ratio. Deposit ratio has a highest relationship with asset quality. Asset management has a highest association with operating efficiency. Net interest margin has a highest link with return on assets.

The results are supported by Olalekan and Adeyinka (2013) who indicated that capital adequacy has a positive link with the profitability of Nigerian banks. The results similar with Bateni et al. (2014) who revealed that bank size has a negative association with the capital adequacy of banks. The outcomes are consistent with Bateni et al. (2014) and Mohanty (2017) who suggested that return on assets has a positive relationship with the CAAR. Ikpefan (2013) found that capital adequacy has a negative link with return on assets (ROA). Similarly, Mohanty (2017) found that liquidity ratio was strongly correlated to CAAR.

Table 5. Robust regression

Variable	Pooled				Robustness				GMM			
	Coeff.	Std. error	t	Prob.	Coeff.	Std. error	z-Statistic	Prob.	Coef.	Std. err.	t	P > |t|
Constant	0.1092	0.0140	7.7711	0.0000***	0.0532	0.0048	11.1917	0.0000***	0.0819	0.0125	6.5700	0.0000***
Deposits ratio	−0.0259	0.0086	−3.0015	0.0029***	0.0037	0.0031	1.2084	0.2269	−0.0059	0.0045	−1.3200	0.1960
Asset management	−0.0244	0.0062	−3.9371	0.0001***	0.0071	0.0012	5.8312	0.0000***	0.0029	0.0038	0.7400	0.4620
Asset quality	0.0135	0.0059	2.2967	0.0223**	−0.0032	0.0021	−1.5033	0.1328	−0.0031	0.0019	−1.6500	0.1070
Bank size	−0.0602	0.0040	−15.0932	0.0000***	−0.0081	0.0014	−5.7109	0.0000***	−0.0300	0.0049	−6.1900	0.0000***
Non-interest income	−0.0002	0.0002	−0.8556	0.3929	−0.0001	0.0001	−0.7624	0.4458	−0.0002	0.0000	−4.7100	0.0000***
Net interest margin	−0.0004	0.0008	−0.5457	0.5857	−0.0001	0.0003	−0.3862	0.6993	−0.0007	0.0002	−3.2100	0.0030***
Operating efficiency	0.0145	0.0057	2.5585	0.0110***	−0.0031	0.0012	−2.6062	0.0092***	−0.0088	0.0045	−1.9600	0.0570**
Return on assets	−0.0003	0.0004	−0.5742	0.5663	0.0003	0.0002	1.8365	0.0663*	−0.0003	0.0004	−0.7500	0.4580
Liquidity ratio	0.0015	0.0009	1.7249	0.0855*	−0.0002	0.0003	−0.6384	0.5232	−0.0421	0.0063	−6.7400	0.0000***
Gross domestic product	−0.0028	0.0014	−1.9613	0.0507*	0.0009	0.0005	1.7894	0.0735*	0.0002	0.0002	0.9800	0.3360
Interest rate	−0.0001	0.0005	−0.1637	0.8701	−0.0003	0.0002	−1.3980	0.1621	0.0000	0.0001	0.3500	0.7310
Exchange rate	0.0087	0.0029	2.9613	0.0033**	−0.0030	0.0010	−2.8844	0.0039***	−0.0111	0.0025	−4.3700	0.0000***

*Note: significance at ***1, **5, *10 percent levels.*

Table 6. GMM estimation

Variable	Coef.	Std. Err.	t	P>|t|
Lag capital adequacy	0.3018	0.0300	10.0600	0.0000***
Deposits ratio	−0.0059	0.0045	−1.3200	0.1960
Asset management	0.0029	0.0038	0.7400	0.4620
Asset quality	−0.0031	0.0019	−1.6500	0.1070
Bank size	−0.0300	0.0049	−6.1900	0.0000***
Non-interest income	−0.0002	0.0000	−4.7100	0.0000***
Net interest margin	−0.0007	0.0002	−3.2100	0.0030***
Operating efficiency	−0.0088	0.0045	−1.9600	0.0570**
Return on assets	−0.0003	0.0004	−0.7500	0.4580
Liquidity ratio	−0.0421	0.0063	−6.7400	0.0000***
Gross domestic product	0.0002	0.0002	0.9800	0.3360
Interest rate	0.0000	0.0001	0.3500	0.7310
Exchange rate	−0.0111	0.0025	−4.3700	0.0000***
Constant	0.0819	0.0125	6.5700	0.0000***
Observations	332	332	332	332
AR(1):	z = −2.21			
	Pr > z = 0.027			
AR(2):	z = 1.35			
	Pr > z = 0.177			
F(13, 36)	124.97			
Number of groups	37			
Sargan test:	chi2(284) =1171.78			
	Prob > chi2 = 0.101			
Hansen test:	chi2(284) = 19.31			

*Note: significance at ***1, **5, *10 percent levels.*

CONCLUSION

This study attempts to identify the impact of internal and external factors on capital adequacy (CAAD) of banks in India. Capital adequacy dimension has been considered a dependent factor, and firm-specific determinants and external factors are the independent variables. Corporate specific variables include: bank size, asset quality, liquidity ratio, deposit ratio, asset management, operating efficiency, return on assets, net interest margin, and non-interest income, external factors are economic activity, exchange rate, and interest rate. The study firstly provided descriptive analysis. Then, correlation analysis was used to test the link between variables. Finally, an estimation of the influence of internal and externals factors on CAAD was introduced by conducting multiple regression analysis (pooled, fixed, and random) and GMM estimation.

The results of this paper found that the deposit ratio (DEPO), asset management, bank size (BASZ), and operating efficiency (OPEF) are the main factors influencing bank capital adequacy (CAAD) of Indian listed firms during the period of the examination. The results indicated that the deposit ratio (DEPO) and bank size (BASZ) have a significant effect on banks' capital adequacy (CAAD). The outcomes revealed that deposits ratio (DEPO), asset management (ASMA), and bank size (BASZ) have a negative and significant effect on banks' capital adequacy (CAAD) in all models, except that asset management (ASMA) has a negative and significant effect on banks' capital adequacy (CAAD) in a fixed-effects model, while operating efficiency (OPEF) has a positive and significant impact on banks' capital adequacy (CAAD) in all models. The results also showed that asset quality has a significant impact on banks' capital adequacy (CAAD) in both (pooled and random) models, while in the fixed model, no significant effect on banks' capital adequacy (CAAD) was revealed. Non-interest income (NIIN) and net interest margin (NIMA) have a negative effect on capital adequacy (CAAD) of Indian banks in all models. Liquidity ratio (LQDR) has a positive and significant influence on capital adequacy (CAAD) in all effects models. On the other hand, the return on assets (ROAS) has a negative and minor impact on the capital adequacy of a company (CAAD) in both models (pooled and fixed). In terms of external indicators, it was revealed that gross domestic product (EGDP) and interest rate (INTR) have a negative and statistically significant impact on capital adequacy (CAAD) of Indian banks in all models, in both fixed and random effect models, except that in the pooled model, gross domestic product (EGDP) has a negative and significant influence on capital adequacy (CAAD), and interest rate (INTR) has a negative and insignificant impact on capital adequacy (CAAD) of Indian commercial financial banks.

This paper bridges a difference in the literature on capital adequacy in India between company factors and external factors. Additionally, this study expands and contributes to prior studies from various countries by using panel data from 37 Indian listed banks from 2009 to 2018 and fully examining numerous company and external aspects. The recent study has three practical consequences, which are as follows: First and foremost, it tries to address a vacuum in the literature about the capital adequacy of publicly traded commercial banks. Second, it makes a methodological contribution by presenting fresh empirical evidence obtained via the use of several statistical tools. In the end, the present study provides valuable insights and empirical information on the internal and macroeconomic dimensions of commercial listed banks' capital adequacy in India, which will be of great benefit to bankers, researchers, authorities, shareholders, and other relevant individuals.

AUTHOR CONTRIBUTIONS

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