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Impact of Macroeconomic Variables on the Capital Adequacy Ratio of Indian Banks

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Abstract
The present study assessed the factors that have an impact on the capital adequacy ratio of Indian private banks for the period from 2014–15 to 2020–21. The study used the panel data method. Concerning the main variables, only FDI has positive and significant effect on CAR. GDP and inflation do not have any impact on the capital adequacy ratio. Policymakers and regulators, such as the Reserve Bank of India, should consider the impact of macro related variables on minimum capital requirement when developing CAR policies. The study's findings suggest that policymakers focusing on bank related determinants of CAR should also take into account the influence of macroeconomic indicators.
Keywords: [FDI, Panel Regression, Levin-Lin-Chu Test, Indian Banks, Capital Adequacy Ratio].

Introduction

After the onset of the financial crisis in 2007–2008, authorities once again turned their attention to the issue of banks' capital adequacy.Banks must maintain sound financial standing in order to maintain financial stability.Hewaidy and Alyousef(2018)argue that capital adequacy is crucial for a variety of reasons. It serves as a tool for reducing operating losses, boosting investor confidence in the bank, and showcasing the bank's capacity to fund their long-term capital investments and business endeavors. The regulator put a lot of effort into defining a ratio to maintain the banks' assets at a specific rate because of their value. The Basel Group is one of the most well-known of these.

Basel I, which was solely focused on credit risk, was first introduced by BCBS in 1988. Under the Basel I agreement, assets with various risk profiles had to make up 8% of the minimum capital requirement. In 1999, India accepted Basel I standards. In 2004, BCBS updated the Basel 1 norm and released the Basel 2 norm's rules. The Basel 2 norms had three pillars:

- Minimum capital requirement
- Supervisory review
- Market discipline

The minimum capital requirement under Basel 2 is 9 percent of RWA. Some banks in India have not yet adopted the Basel 2 standard. To address the issue of the 2008 financial crisis, Basel 3 norm guidelines were made available in 2010. The four criteria used to develop these rules were capital, funding, leverage, and liquidity. While the minimum capital requirement across the board is 10.5 percent of RWA, Indian banks are subject to 11.5 percent. Two new ideas, referred to as the countercyclical buffer and the capital conservation buffer, were added to the Basel 3 regulation. In addition to the required minimum capital, banks are also required to maintain a capital conservation buffer. It is equal to 2.5 percent of RWA.A macro prudential banking supervisory measure called a countercyclical buffer was employed to strengthen banks' resilience during the financial crisis.

According to Swamy (2014), the capital adequacy ratio is one of the indicators for the financial soundness of the Indian banking system. Healthy banking system would help in economic growth of country e.g. more employment opportunities, capital formation to different sectors, eliminating the scarcity of capital etc. Now, the question arises that how to measure whether Indian economic system is growing or not? There are a lot of measures which include micro and macro factors. Macroeconomic factors are those that have effect on the overall economy as a whole. More studies had been conducted on the relation between bank-related factor and CRAR. But relation between macro related factors and CRAR is under researched area.Thus, this paper examines after reviewing the literature fills the gap and examines the impact of macro related factors on the CRAR of Indian banks. Indian economy has been chosen for the study as this is anemerging developing economy.

This is how the rest of the paper is structured: The succeeding section explains the review of literature. The study's methodology and sample are included in the research methodology. The findings and related discus-

sion are presented in Section 4. The results are concluded in Section 5.

Literature Review

Akhter & Daly (2009) studied the effect of changes in macroeconomic variables on the soundness of financial intermediaries in more than 50 countries. The study used the Generalised Method of Moments and concluded that inflation, size, business cycle, and the real effective exchange rate have a strong influence on the CRAR, which indicates the financial soundness of banks. It also came to the conclusion that macroeconomic factors and factors that are unique to each bank affect a bank's profitability.

Lei Xu et al. (2015) tried to find out the impact of market discipline and capital regulation on the capital adequacy ratio of Chinese banks under Basel I norms. In this study, only credit and market risks were taken into consideration. The study used disequilibrium and simultaneous tests and concluded that capital regulation is more important than market discipline. The proper implementation of capital regulation enables Chinese banks to increase their capital buffer and reduce their risk level.

Pant & Nidugala (2017) by using panel data analysis, looked at how changes in macroeconomic factors affects Indian banks' CRAR. The result showed that country-level factors like rate of inflation, GDP, rate of interest, and rate of exchange have a significant effect on a bank's ratio of capital adequacy. In contrast, money supply and FDI have an insignificant influence on the capital adequacy ratio. Thus, while making policies for the minimum capital, policymakers should consider the effect of macroeconomic variables.

Anshu & Gakher (2019) explored the relation of macroeconomic variables with the CRAR of Indian scheduled commercial banks. The study concluded that the consumer price index, exchange and interest rates are negatively affecting CAR, but GDP is not significantly affecting CAR.

Williams (2011) conducted a study to analyse the impact of macroeconomic, bank-specific, and financial structure factors on Nigerian banks' capital bases. Using cointegration analysis, the authors found that the domestic real interest rate, the exchange rate, inflation, and political stability all have a significant negative effect on the capital base, whereas the money supply has a considerable positive effect. Yet, Nigerian banks' capital bases are unaffected by investment, deposit, and liquidity risks.

Bokhari et al. (2012) investigated the determinants affecting banks' capital adequacy ratios in Pakistan. After applying pooled regression method, the research concluded that CRAR is positively related to average CAR and CAR above regulatory requirements while negatively related to share of deposit, ROE, and portfolio risk. GDP is insignificantly related to the capital adequacy ratio.

Aktas et al. (2015) examined the CRAR in Southeastern European nations by looking at bank-related and macroeconomic aspects. The study used feasible generalised least squares (GLS). The minimum capital requirenment is highly affected by bank-related variables such as size, leverage, ROA, net interest margin (NIM), risk, liquidity, and macroeconomic variables such as the rate of economic growth, the volatility index of the Eurozone stock market, the availability of deposit insurance, and the quality of governance. While macroeconomic variables like inflation and the rate of interest have an insignificant impact on the CRAR.

Dawit (2015) surveyed both macroeconomic and bank-related determinants of the capital adequacy ratio of Ethiopian commercial banks. A significant result of the capital adequacy ratio was found with bank risk, ROE, loan (LAR), economic growth (GDP), ROA, loan provision, NIM, and share of the deposit, whereas an insignificant result was found with liquidity, NPLs, inflation, and bank size.

Aryal (2016) identified the bank-related and macro related factors of minimum capital in the context of Nepalese banks. The study applied panel data analysis and depicted that total loan, total assets, deposits, NPL, and leverage negatively affect CAR. While ROE, inflation, and economic growth do not affect CAR. Thus, total loans, total assets, deposits, NPL, and leverage are considered important determinants of the Nepalese bank's CAR.

Olarewaju & Akande (2016) conducted research to identify the factors that influence bank minimum capital in Nigeria. The study depicted that ROA, credit risk, liquidity and deposit are affecting the capital adequacy ratio significantly, while ROE, bank size, GDP, and the inflation rate are affecting it insignificantly.

Badalashvili (2017) investigated the determinants of CAR at Greek banks. Using an unbalanced panel data method, the study concluded that CAR has a positive relationship with asset structure, ROE, and inflation, whereas it has a negative relationship with NPL, unemployment, and net interest margin.

Yuksel & Ozsari (2017) talked about the things that

affect Turkey's deposit banks' capital adequacy ratio. The study applied the panel data regression method and interpreted an inverse relationship between economic growth and the capital adequacy ratio. It shows that when there is an improvement in the economy, Turkish banks prefer to have a lower CRAR. The rate of inflation has a positiverelation to the CAR, which means that banks increase their capital levels at times of high inflation. It was further studied that net balance sheet position and FX assets and liabilities indirectly correlate with the capital adequacy ratio.

Hewaidy & Alyousef (2018) explored the influence of macro and bank related factors on the CAR of banks in Kuwait. The study found a significant relationship between management quality, bank size, liquidity, asset quality, and capital adequacy. While an insignificant relationship was found between bank type, inflation, and capital adequacy,

Kalifa & Bektaş (2018) explored the determinants of CAR in Islamic banks. By using, it was concluded that out of bank-specific variables, leverage, ROE, ROA, bank size, and credit risk, and out of macro variables, exchange rate, inflation, and market capitalization, there is a strong relation. At the same time, all other variables do not show any strong relationship with CAR.

Zarafat & Prabhune (2018) considered the determinants that influence the total risk of the Basel III norms for Indian public and private sector banks. The researcher used a panel data regression model and concluded that there is an inverseconnection between capital and ROA but a positive connection with ROE. It was also conjectured that macroeconomic variables like GDP and the inflation rate do not have any substantial relation with total risk. Proportion of TL to TA was one of the noteworthy factors in assessing risk.

Ansary et al. (2019) compared the relationship of CAR between Islamic and conventional banks in the MENA region. The study used the GMM method and depicted that in Islamic banks, variables such as bank size, deposit to assets ratio, GDP, and operational efficiency affect CAR significantly, while in conventional banks, ROA, risk-weighted assets to total assets ratio, credit risk, operational efficiency, and GDP significantly affect CAR.

Bokhari et al. (2019) looked at the variables of the CRAR of microfinance banks in Pakistan. It was depicted that ROE, portfolio risk, GDP, liquidity, and share of deposit are important determinants of CAR. ROE and portfolio risk show a positive relationship, while GDP, bank assets, and share of deposit show a negative relationship.

Phuong et al. (2019) by using the panel Tobit model, explored the bank-related and macroeconomic factors of CAR in Vietnamese joint-stock banks. The results depicted that GDP growth rate, exchange rate, net interest margin (NIM), interest rate, and bank size are inversely related with CAR. On the other hand, deposits and leverage are good for Vietnamese banks' CAR.

Abiodun et al. (2020) studied the elements affecting the capital adequacy ratio of banks in Nigeria. The researcher used panel data regression and explored that among macroeconomic factors, i.e., GDP (measurement of economic growth), rate of inflation, and rate of interest, only interest rate had a significant impact on the CRAR of Nigerian banks. In contrast, bank size, non-performing loans, ROA, and TL to TA influence CRAR significantly, while liquidity does not affect CRAR.

Bhattarai's (2020) research into CRAR used a sample of Nepalese commercial banks to study the role of both bank-related and macro related factors. Using pooled OLS, a significant relationship was found between inflation, bank size, and liquidity. Whereas an insignificant relation was found between GDP, credit risk, profitability, management quality, and asset quality and the capital adequacy ratio of Nepali banks.

Bogale (2020) conducted a study to find the macroeconomic and bank-related elements of CAR in the context of commercial banks in Ethiopia. By using documentary analysis, it was concluded that ROE, loan-to-asset ratio, and bank size have a positive impact. In contrast, loan loss provisions and ROA have an inverse effect on CAR. Other factors, i.e., GDP, inflation, deposit-to-assets ratio, and loan-to-deposit ratio, are not important determinants of CAR in Ethiopian banks.

Unvan (2020) tried to find the effect of macroeconomic and bank-related factors on the capital adequacy ratio of Ghanaian banks. The study used panel data analysis and depicted that money supply and ROA are positively related while leverage, bank size, and the central bank's policy rate are negatively related to the capital adequacy ratio.

Research Methodology

Sources of Data

As of 2022, there are 22 Indian private banks. Due to a lack of data, the study cannot include all financial institutions.Thus, the final sample consists of 16 Indian private banks for the financial period of 2014–15 to

2020–21, with the sample observation of 114. Many sources were tapped to extract the data. Data related to macroeconomic variables was extracted from the World Bank database and the RBI database. The CMIE Prowess database was used to extract data specific to banks.

Methodology

Descriptive statistics and panel data regression have been employed to evaluate the hypothesis. The regression equation shown below has been constructed:

CRAR= α+β1(GDP)+ β2(FDI)+ β3(INF)+ B4(lev)+ β5(ROA)+ β6(ROE)+ β7(BKSIZE)+E

Where;

CRAR= "Capital Adequacy Ratio"

GDP= "Gross Domestic Product"

INF= "Inflation"

FDI = "Foreign Direct Investment"

LEV= "Leverage"

ROA= "Return on Assets"

ROE= "Return on Equity"

BKSIZE= "Bank Size"

Results and Analysis

Correlation Matrix

A correlation matrix of the several variables is used by the researcher to determine the level of multicollinearity. According to the results of the correlation analysis, multicollinearity between the variables is not present when coefficient values are less than 0.70. The Hausman test is used to select the fixed and random effect models after applying both fixed and random effect models. Given that the probability value is below the 0.05 level of significance, the outcome is in favour of the fixed effect model. The Levin-Lin-Chu test was performed to determine whether all variables used in the study were stationary before using the panel regression model. All variables are stationary, according to the study, which used lags of 2. This means that all probability values are below the 0.05 level of significance. The Levin-Lin-Chu test results are shown in Table 2.

Table 1: Correlation Matrix and Variance Inflation Factor

	GDP	INF	FDI	LEV	BKSIZE	ROA	ROE
GDP	1						
INF	-0.68181	1					
FDI	0.358163	0.062122	1				
LEV	-0.03644	-0.04394	-0.10338	1			
BKSIZE	0.174297	-0.11882	0.16574	0.403162	1		
ROA	0.014592	-0.0745	0.071056	0.067654	0.227486	1	
ROE	-0.05625	0.095232	-0.06928	-0.09013	0.268005	0.405716	1
VIF	2.362	2.307	1.486	1.160	1.139	1.261	1.365

Source: Author's Calculations

Table 2: Levin-Lin-Chu Test

ariables	Statistics	Probability
GDP	-37.2097	0
FDI	-7.01665	0
INF	-41.3104	0
LEV	-35.8285	0
ROA	-31.6971	0
ROE	-38.554	0
BKSIZE	-24.107	0

Source: Author's Calculations

Descriptive Analysis

Table 3.exemplifies the descriptive indicators for all the variables used in the study. Average GDP is 7.487. Mean of FDI is 45.55 which is highest among all variables. Inflation has an average of 4.937. Control variables i.e. leverage, ROA, ROE and bank size shows an average of 1.05, 0.15, -1.23 and 11.86 respectively.

Table 3: Results of Summary Statistics

	Mean	Median	Maximum	Minimum	Std. Dev.
CRAR	13.86838	13.37	24.14	7.51	2.748251
GDP	7.487315	7.549978	7.650074	4.976458	0.275006
FDI	45.55242	44.01	64.36	28.15	8.983833
INF	4.937374	4.907	11.064	3.328	1.385517
LEV	1.052222	0.875	5.24	0	0.750928
ROA	0.150505	0.47	2.02	-34	2.674717
ROE	-1.23955	5.22	21.33	-76.14	18.64952
BKSIZE	11.86056	12.30164	15.32721	2.553739	2.231369

Source: Author's Calculations

As per the table 4.which represents the regression results, the value of adjusted r-squared is 0.431472, showing that only 43% changes in ratio of capital adequacy of Indian private banks are caused by above-mentioned macroeconomic variables. The value of Durbin-Watson statistics (1.425296) is less than 2, which depicts the non-existence of auto-correlation. The F-statistics value of 11.49235 is also significant with a P-value of zero, which indicated that variables can jointly affect the CRAR. Concerning macro related variables, only FDI has a significant impact on CRAR. This implies that a rise in foreign direct investment boosts output and employment. Again, this would raise the income of those who prefer to keep their money in bank safety deposit boxes. More deposits raise the bank's capital, which boosts their CAR (Pant and Nidugala 2017). The result regarding FDI is similar to Ogegeet al. (2012) and Braret al. (2018). With regards to the control variables, bank size and ROE have a +veand significant effect on the CRAR. Profitability's positive influence on CAR suggests that more successful banks continue to retain a high level of regulatory capital. The beneficial effect would suggest that Indian private banks hold income rather than invest it in order to build their capital base and satisfy the central bank's capital requirements (Unvan (2020)). The results are in line with Unvan (2020), who demonstrated that there is a positive profitability (ROA) link with the CAR bank.

Table 4: Regression Analysis

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.971248	6.870249	0.869146	0.3867
GDP	-0.56313	0.808127	-0.69683	0.4874
FDI	0.117147	0.024132	4.854335	0*
INF	0.003281	0.178902	0.018338	0.9854
LEV	-0.06857	0.334888	-0.20476	0.8382
BKSIZE	0.647393	0.286007	2.263557	0.0256*
ROA	0.079305	0.056863	1.394679	0.166
ROE	0.073669	0.016871	4.366494	0*

R-squared	0.431472	F-statistic	11.49235
Adjusted R-squared	0.393928	Durbin-Watson stat	1.425296
Prob(F-statistic)	0		

Source: Author's Calculations *, indicate significant at 5% significance level.

Conclusions and Policy Implications

The goal of this article is to provide an empirical evaluation of how various macroeconomic indices affect the CAR of Indian private banks. The final sample consisted of 16 Indian private banks for the financial period of 2014–15 to 2020–21, with the sample observation of 114. The study includes GDP, FDI, and inflation as main variables and bank size, ROA, ROE, and leverage as control variables.This study's findings show that foreign direct investment is the single major factor significantly influencing the CRAR of Indian private banks. Foreign direct investment (FDI) has many positive ef-

fects on economies. These effects include the formation of new products and services, the growth of new industries, and the spread of new technologies. All of these factors contribute to increased economic growth, the most effective method for reducing poverty in developing countries like India (Braret al. 2018).

The study recommends that policymakers and regulators, such as the RBI, should consider the impact of macro related variables on CAR when developing programs and monitoring banks.The macroeconomic factors influencing banks' capital adequacy ratios should be managed with greater awareness and efficacy. The article recommends a risk-based capital maintenance system that can analyse the impact of macro related variables on minimum capital requirements, as well as a sound risk-management system, for private banks in India (Anshu&Gakher 2019). The author argues that investors should monitor the bank's financial parameters, such as the capital adequacy ratio, to protect themselves from unnecessary risk and increase their return on investment (Runtuet al. 2017).

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