

# BASEL CAPITAL REGULATIONS OVER PRE AND POST BASEL III REGIME: AN INDIAN SCENARIO

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**Abstract** *The adequacy of capital has become a concerned issue because banks being the highly leveraged sector face high risks. So, it is desirable to know at which level of capital is adequate for banks. The focus on capital have existed for a long time but now the definition of capital has changed for banking business due to changes and advancement in banking operations. A bank with higher capital adequacy ratio is considered safe and capable to meet its obligations. The Reserve Bank of India requires all scheduled commercial banks to meet the capital level as stipulated under Basel III norms to comply with international standards. According to the guidelines of Bank for International Settlements (BIS), the banks should maintain that level of capital where a bank can easily recover unexpected shocks and crisis. The adequacy of capital is the measure of financial soundness of banks and indicator of financial health of banks. The banking activities are exposed to various kinds of risks and to manage these risks, banks must maintain sufficient capital. Therefore, it is necessary to set the regulatory guidelines for limits of capital hold by banks. Thus, the present study intends to examine the trends and consistency of capital adequacy ratio of twenty one Indian public sector banks for the period of ten years (2008–2017). The results conclude that the level of capital ratio as per Basel III norms maintained by Indian public sector banks determines the bank's strength and position.*

**Keywords:** *Basel III, Capital Regulations, Capital Adequacy Ratio, Indian Public Sector Banks*

## INTRODUCTION

Capital is the very essential and critical element for long term continuity of the bank's operations. A minimum capital is always held by the banks to maintain the safety and soundness. A financial institution with strong capital base is capable to protect the interest of its depositors and can smoothly pursue its business operations. In this way, a minimum ratio has been set by regulators that specify the minimum amount of capital that a bank should hold. This minimum amount of capital is called as capital adequacy ratio which is regarded as the sign of financial soundness of banks. This ratio is used to promote the financial stability which brings efficiency in the financial system.

The capital adequacy ratio indicates the financial strength of banks to absorb unexpected losses occurring in the future. Thus, maintaining adequate capital is mandatory for banks as it is the integral part of its financial resources. CAR (Capital adequacy ratio) is the ratio of bank's capital to its

risk level. The international regulators set bank's CAR in form of statutory norms.

The financial and operating issues such as non-performing assets of public sector banks, money laundering cases, prevailing in Indian banking sector indicates the inability to implement Basel III due to weak financial position and low profitability which require special attention by banking industries worldwide and have been widely debated both in academic and policy level. Thus, it is mandatory for banks to maintain sufficient capital to better withstand for crisis. The proposed capital regulations would enhance the stability of financial system and economic growth of a nation (Shukrant, 2018).

The prudential regulations on capital adequacy of banks have traditionally been a matter of concern. In the wake of financial reforms in India, a capital to risk weighted asset (CRAR) system was adopted by Indian commercial banks in 1992 as per the instructions of Reserve Bank of India. The regulatory framework had been designed by BCBS in

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form of Basel norms. The CRAR can be defined as a ratio of bank's capital to its risk weighted assets and also known as Capital adequacy ratio (CAR). The level of CAR has been ascertained by the financial regulators to provide a cushion to soak up the unexpected losses and risks because an efficient and stable banking system is essential for productivity of the economy (Jyoti et al., 2016).

In 1992, the CAR was specified at 8% under Basel I norms. After 2004, the capital norms under Basel I had changed because more capital was added for market risk and these regulations have been known as Basel II norms.

In 1991, Narasimham Committee was appointed by the government of India to evolve banking reforms in financial system and during 1992-1993 the committee submitted its recommendations and suggested that all scheduled commercial banks have to maintain 8% of CAR. In 1997, 27 Indian public-sector banks had maintained the 8% level of capital adequacy. In the second report submitted by this committee in 1998, it was suggested that all banks have to maintain 10% of CAR in phased manner by the year 2000.

In 2010 a regulation named Basel III has come up with the more comprehensive set of regulation focusing on the quality, quantity and transparency of capital. The requirement of CAR has been set at 11.5% under Basel III capital regulations. The Indian banks enforced Basel I in 1999 and Basel II in 2009. The Basel III guidelines have been adopted by Indian commercial banks since April, 2013.

In this regard, D. Subbarao, Former Governor of RBI, in his speech in 2013 said that proper implementation of Basel reforms would make Indian banks more stable and stronger and banks will be capable to deliver high value to other sectors of economy. *"The adoption of Basel III norms would enable banks to manage their capital more efficiently and enhance their profitability"* he said.

## New Capital Requirements

As per existing norms, the total capital adequacy ratio is 11.5%, comprising Tier-I and Tier-II capital. Basel III regulatory capital is percentage to Risk weighted assets (RWA's). These are the components of capital adequacy norms:

- Minimum common equity Tier-I ratio 5.5%.
- Capital conservation buffer (comprising common equity) 2.5%.
- Minimum common equity Tier-I ratio + capital conservation buffer (a + b)8%
- Additional Tier-I capital 1.5%.
- Minimum Tier-I capital ratio (a + d) 7%.
- Tier-II capital 2%.
- Minimum total capital ratio (e + f) 9%.
- Minimum total capital ratio plus capital conservation buffer (g + b) 11.5%.

The regulators have set the higher capital requirements for better quality and quantity of capital. It means that capitalisation profile and the liquidity position of banks will be according to Basel III. Financial regulators have imposed capital regulation norms on financial system in order to provide a buffer to absorb unexpected losses due to risky investments (Lelissa & Kuhil, 2018). The proposed Basel III guidelines include the followings:

- Definition of capital made more stringent, capital buffers introduced and loss absorbing capacity of Tier 1 and Tier II capital instrument of internationally active banks proposed to be enhanced.
- These regulations have been framed to enhance the quality, consistency and transparency of the capital base and strengthening the risk coverage of the capital frameworks.

**Table 1: Comparison of Minimum Capital Requirements under Basel II and Basel III**

Requirements	Under Basel II	Under Basel III
Minimum Ratio of Total Capital To RWAs	8%	11.50%
Minimum Ratio of Common Equity to RWAs	2%	4.50% to 7.00%
Tier I capital to RWAs	4%	6.00%
Core Tier I capital to RWAs	2%	5.00%
Capital Conservation Buffers to RWAs	None	2.50%
Leverage Ratio	None	3.00%
Countercyclical Buffer	None	0% to 2.50%
Minimum Liquidity Coverage Ratio	None	TBD (2015)
Minimum Net Stable Funding Ratio	None	TBD (2018)

Source: Reserve Bank of India.

The capital requirements were different under Basel II guidelines. The capital standards have been changed under Basel III and specified higher than Basel II norms. This is the biggest challenge for Indian commercial banks to meet the Basel III capital guidelines within a stipulated time period.

## REVIEW OF LITERATURE

The BCBS released revised capital regulations in 2010 specified under Basel III and it has become effective from January, 2013 and banks have declared their capital ratio as per the revised guidelines.

Carosio (2001) discussed that BCBS released guidelines on the first capital Accord in 1988 and presented the vital components of new reforms. The findings revealed that banks need to work on some of the operational aspects of the regulations. The study concluded that high capital requirements will decline the rate of loans during recession.

Nag and Das (2002) assessed the impact of implementing uniform capital norms on Indian public-sector banks. The Indian banking sector undergone through a shift of reforms in 1991 and the significant factor was capital adequacy regulations envisaged by Basel I. The evolution of capital standards impacted the risk-taking attitude and financial statements of banks. The findings ascertained that banks in Japan and US decrease lending during the cyclical downturns and conducted to weakness in economy.

Chen (2003) examined the new capital regulations in the state commercial banks in China. The study found that government support has proved useful for state banks to comply with required capital norms. China adopted the new capital Accord but banks in China need additional funds to compete with the foreign banks operating in China. The Chinese banks will require new resources in future to manage their capital appropriately.

Singer (2004) highlighted that central regulator of the developed nations have adopted the international capital standards. The variety of steps had been taken by banks in developed countries to harmonise the international financial stability and strengthen the banking system. The stringent capital regulations made the banks to compete globally and capable to respond to the unexpected shocks.

Fouche et al. (2005) examined that capital adequacy norms have become the critical issues in banking industry which measure the stability of financial position of banks. The study taken the two ratios namely non-risk based and risk based to measure the bank capital level. The results demonstrated that capital adequacy ratio plays crucial role as the benchmark of measuring financial health of banks. The CAR ascertains the relative amount of adequate capital maintained by bank against the risks faced by banks.

Sarma and Nikadio (2007) analysed the present state of the capital adequacy ratio in the Indian banking sector. In the regime of Basel I, the Indian banks were performing well and accounted 12% CAR which was found higher than globally admitted 8% level of CAR and accepted ratio of 9% by RBI. The Basel II capital regulations are being implemented in banks since 2008 but various issues were emerging in the implementation process because of the complexities involved in the Basel norms.

Vyas et al. (2008) attempted to explore the impact of capital adequacy ratio and other factors on the performance of Indian commercial banks. The study carried out for the period of 10 years (1997–2007). The findings indicated that well capitalised banks would not face any chance of bankruptcy due to the higher capital ratio determine the higher profitability of banks. The study concluded that Indian commercial banks can sustain when banks will generate non-interest income because in coming years there will be high competition in banking sector due to the easy entry of foreign banks.

Drumond (2009) explained that financial crisis and instable financial markets created the need of pro-cyclicality in the capital reforms. The study advocated that raising additional capital would be costly and difficult task for banks specifically in bad times. The banks will have to reduce lending practices because of increasing financial cost. The Basel II capital guidelines can lead to higher financial expansion of the business cycle than Basel I capital Accord which would negate the goal of capital guidelines.

Dhanda and Rani (2010) highlighted the status of capital adequacy ratio of scheduled commercial banks of India and determined the impact of implications of capital regulations. The global value of CAR is ranging between 7.1% and 34.9%. The CAR of Indian banks was lying at 12.3% which was above the regulatory limit of 9% means the Indian banks are performing well. The highest value of CAR was observed for the State bank group and lowest was recorded in foreign banks.

Varotto (2011) measured the impact of new guidelines that will require banks to maintain capital reserve against various kinds of risks. The study found that new requirements for credit risk may be substantial as compared to the old capital requirements. The study concluded that capital required for absorbing losses in stress scenario can be increased more than ten times.

Kudinska and Konovalova (2012) depicted that capital adequacy has become the most debatable topic after the financial crisis during 2008 and encouraged the banks to strengthen the capital base. The study determined the factors influence the capital level and financial strength of banks in

Latvia. The results indicated that Latvian commercial banks were maintaining the required level of capital adequacy and ensuring the stability and safety of banks. The banks in Latvia did not require additional buffers capital because the banking system is stable and hold sufficient capital as risk coverage.

Wall (2013) investigated that bank in United States measured capital adequacy by using stress tests. The study examined that stress testing can overcome with the weaknesses of Basel III in measuring the credit and interest rate risk. The capital ratio measured the financial stability of the banking sector. The study concluded that banks in US responded to the new Accord by reducing the capital in a way that will not affect the shareholder value.

Dalecka and Konovalova (2014) evaluated the capital adequacy requirements in Latvian banks and highlighted the problems regarding enforcement of capital requirements as per Basel III. The capital adequacy norms ensure the relation between risk and capital and indicate the status of the financial soundness of banks. The findings revealed that banks will require additional fund of 577 billion to comply with minimum capital norms and banks have maintained capital ratio of 10.5% which is more than stipulated by new regulations. The study concluded that state banks in Latvia ensured capital ratio at 9.89 % showing that banks partially satisfied the new capital standard.

Fatima (2014) depicted the elements of regulatory capital and explained the basic concepts of Basel norms. The study examined the trends of CAR of 10 commercial banks in India. The results found that ICICI banks hold the highest CAR and lower CAR recorded in Bank of India but all Indian banks have maintained the capital adequacy ratio more than the specified requirements. The author concluded that private banks maintained higher capital ratio as compared to public banks. All Indian banks are ready for Basel III implementation and it will not create more difficulty for banks in initial years.

Nghiem (2015) analysed the capital adequacy and financial performance of 25 public-sector banks and 15 private banks. The panel data were taken into consideration for the period of 17 years (1994–2011). The average low capital ratio recorded at 5.5% for public banks and results indicated the low lending rate in public banks. On the other hand, private banks found with more risk-taking ability and more profit efficient than public banks.

Li et al. (2016) analysed the capital adequacy ratio of 31 banks in Taiwan for the period of 2007-09. The findings portrayed that 93.5% banks have made capital ratio higher than 8% and 88.2% banks hold optimal capital adequacy above the 10.5% and almost 73% of the banks will have to raise the capital to comply with the optimal Basel capital

regulations. The higher capital requirements may foster Taiwan banks to reach the level of efficiency in banking operations but higher requirements of capital may lead to reduction in loan and will have negative effect on the operational performance.

Goel and Kumar (2016) examined the capital adequacy ratio of five Indian public-sector banks for the period of 10 years. The period has been categorised 5 years before and five years after the implementation of Basel II norms. The CAR was not more increased after the Basel II implementation but public-sector banks has maintained capital adequacy ratio more than 9%. This shows banks maintained sufficient capital indicating the stable financial position of banks.

Maraghni (2017) highlighted the impact of variability in the CAR value on the risk-taking behavior of banks in Tunisia for the period of 1990-2012. The Tunisian banks were found under the regulatory pressure to comply with the Basel III Accord. The results of the study observed that regulatory pressure made Tunisian banks to meet the capital standard and capital does not entail a decrease or increase in the risk-taking attitude of banks. The change in risk level has not impacted the level of capital ratio during the analysis period of the study. The banks in Tunisia were giving preference to risk level but the efforts for capital norms were not sufficient.

Singh and Seth (2017) attempted to compare the capital adequacy ratio of four private and four public banks in India during the period of nine years (2006–2015). The capital norms are vital to protect the stakeholders and create confidence in investment decisions. The position of banks was found sound as far as capital adequacy is concerned. The Central Bank of India should focus on the soundness because the banks have not fulfilled the minimum requirements of capital and other selected banks in the study maintained their capital adequacy above the prescribed criteria of RBI.

Sunita and Kshamta (2018) attempted to examine the relationship among the following variables CAR, profitability, deposit, liquidity, size of banks and loan growth. The capital adequacy is the important benchmark to measure the safety and stability of banking sector as it is used as a guard to absorb the shocks. The results indicated that profitability, deposit and size of the banks are negatively correlated with the CAR values.

Vinod and Mohammed (2018) expressed the significance of adopting Basel III capital norms in Indian banking sector. The capital norms have been enforced to absorb the losses due to risks in banking business. The findings concluded that banks have maintained capital adequacy ratio above the ratio specified by regulators. The higher capital requirements would enhance the stability, risk taking ability and efficiency of banks.

Ramesh (2019) identified the bank specific factors that determine the performance of 39 Indian commercial banks during 2009–2017. The results revealed that capital adequacy ratio has a significant impact on return on assets whereas insignificant impact on return on equity. The banks will have to hold adequate capital in relation to the risk level of banks because there was found a relationship between the amount of capital and level of risk

Jangra (2020). The study recommended that banks with low operational efficiency should focus on improving their financial performance to boost their level of efficiency to comply with Basel norms. Moreover, financial health of banks plays significant role in implementing financial regulations as poor financial performance of banks may lead to bankruptcy. Jadhav et al. (2021) analysed the relation between capital adequacy ratio and bank's profitability. The findings concluded that banks should develop a reliable framework for efficient capital management that can bring overall efficiency in banking operations. Rizvi et al. (2021) examined the challenges faced by bankers in implementing Basel III in India. The findings advocated that many emerging countries lack the technology and infrastructure to implement Basel III norms. The authors recommended that a holistic view of banking experts on Basel III in India is required to implement these norms efficiently.

The banking sector in Indian context has been witnessing several dynamic changes from time to time. It forms an imperative constituent of any financial and economic system. The predominance of public sector banks in the industry has reduced considerably as private sector banks are accomplished to build up a sound position within the industry by utilising technology and skilled management (Biswas & Bhattacharya, 2020).

Islam (2023) explored that banks with lower liquidity, high capital and profit efficiency are more successful. Increased access to loans, a strong capital base, and efficiency in profitability actually raise the number of prospective borrowers, build public confidence and bank resilience and enhance the scrutiny. The author reported that maintaining a safe level of capital and predicting risk tolerance levels are the best ways for banks to devise proper risk management approaches (Karen & Madhumathi, 2022).

The study concluded that the capital adequacy ratio and net interest margin to be positively related in the case of public and private sector banks. This relationship may be due to further tightening of the capital requirements under Basel III norms (Prakhar et al., 2021).

Khan (2022) explored that return on assets and financial leverage increased the effectiveness of banks in India, and

determine revenue efficiency, return on assets and return on equity, indicate that better the quality of management.

The findings indicated far-reaching implications for banking regulation and policy, as efficiency and performance measures can be the paramount indicators for future management of banks (Chawla & Rani, 2021).

As stated in previous studies, the capital adequacy norms are being implemented all over the world and it is also mandatory for Indian public-sector banks to disclose their capital ratio as per Basel III. This has enforced to examine the trends and consistency of capital adequacy requirements of Indian public-sector banks as per Basel III. Hence, the present study tries to find the answers of the following questions:

- Are Indian public-sector banks maintaining their CAR as per Basel III?
- Is capital adequacy ratio of Indian public-sector banks different over two periods that are Pre-Basel III and post-Basel III period?

## OBJECTIVES

The present study has following objectives:

- To examine the trends and consistency of capital adequacy requirements of Indian public-sector banks as per Basel III.
- To analyse the CAR (capital adequacy ratio) of banks before and after implementation of Basel III capital norms.

Hypotheses for analysing the consistency of capital adequacy requirements of Indian public-sector banks as per Basel III:

H1: There is no significant difference between the mean values of CAR over the two periods (Pre- and post-Basel III period).

## RESEARCH METHODOLOGY

The present study is based on secondary data collected from the annual reports of the banks for the period of 2008–2017 divided into two phases: Pre Basel III period (2008–2012) and Post Basel III period (2013–2017). In order to achieve the objectives of this study, descriptive and analytical approaches have been used. The present study estimates capital adequacy ratio (CAR) of twenty one Indian public sector banks for the period of 2008-2017. The analysis was carried out through descriptive statistics, and histogram, chart and graphs. Further, the study used pair t-test for testing the hypotheses using MS-Excel.

### Period of the Study

In order to examine the capital adequacy ratio of public-sector banks as per Basel III, the period of 10 years has been divided into two phases to evaluate the changes in selected variables after implementation of Basel III:

- Pre-Basel III Phase/Period: 2008–2012.
- Post-Basel III Phase/Period: 2013–2017.

In order to examine the trends and consistency of capital adequacy requirements of Indian public-sector banks as per Basel III, following indicator has been selected: CAR (Capital Adequacy Ratio).

Variable	Descriptions	Computations
CAR	It is the ratio of bank’s capital to its risk which determines the bank’s capacity to meet all liabilities and risks. A bank with high CAR is considered safe and sound.	Tier 1 capital + Tier 2 capital/ Risk weighted assets (Credit risk + market risk + operational risk)

## RESULTS AND DISCUSSION

### Trends in CAR (Capital to Risk Weighted Asset Ratio) of Public-Sector Banks (2008–2017)

This part depicts the trend in Capital adequacy ratio of all public-sector banks in India over the period of 10 years (2008–2017).

Table 2: CAR over the Period of 10 Years

PSB	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Mean	S.D.	Min	Max
Allahabad bank	11.99	13.11	13.62	12.96	12.83	11.03	10.26	10.52	11.24	11.45	11.901	1.174171	10.26	13.62
Andhra bank	11.61	13.22	13.93	14.38	13.18	11.76	11.18	10.7	11.58	12.38	12.392	1.230463	10.7	14.38
Bank of Baroda	12.94	14.05	14.36	14.52	14.67	13.3	12.28	12.6	13.17	12.24	13.413	0.926415	12.24	14.67
Bank of India	12.04	13.01	13	12.24	12.03	11.11	9.97	11.22	12.37	12.14	11.913	0.923905	9.97	13.01
Bank of Maharashtra	10.85	12.05	12.78	13.35	12.43	12.59	10.79	11.94	11.2	11.18	11.916	0.881819	10.79	13.35
Canara Bank	13.25	14.1	13.43	15.38	13.76	12.4	10.63	10.56	11.08	12.86	12.745	1.587649	10.56	15.38
Central Bank of India	10.42	13.12	12.24	11.64	12.4	11.49	9.87	10.9	10.41	10.95	11.344	1.023732	9.87	13.12
Corporation Bank	12.09	13.66	15	14.11	13	12.33	11.64	11.09	10.56	11.32	12.48	1.434279	10.56	15
Dena Bank	11.09	12.07	12.77	13.41	11.51	10.47	11.14	10.93	11	11.39	11.578	0.91109	10.47	13.41
Indian Bank	12.9	13.98	12.71	13.56	13.47	13.08	12.64	12.86	13.2	13.64	13.204	0.444477	12.64	13.98
Indian Overseas Bank	11.93	13.2	14.78	14.55	13.32	11.85	10.78	10.11	9.66	10.5	12.068	1.831228	9.66	14.78
Oriental Bank of Commerce	12.12	12.98	12.54	14.23	12.69	12.04	11.01	11.41	11.76	12.4	12.318	0.897624	11.01	14.23
Punjab National Bank	13.46	14.03	14.16	12.42	12.63	12.72	12.11	12.89	13.15	11.66	12.923	0.79811	11.66	14.16
Punjab & Sind Bank	11.57	14.35	13.1	12.94	13.26	12.91	11.04	11.24	10.91	11.05	12.237	1.213114	10.91	14.35
Syndicate Bank	11.82	12.52	12.7	13.04	12.23	12.59	12.01	10.54	11.16	12.03	12.064	0.750751	10.54	13.04
UCO bank	11.02	11.93	13.21	13.71	12.35	14.15	12.68	12.17	9.63	10.93	12.178	1.375773	9.63	14.15
Union Bank of India	12.51	13.27	12.51	12.95	11.85	11.45	10.8	10.22	10.56	11.79	11.791	1.035476	10.22	13.27
United Bank of India	11.24	13.28	12.8	13.05	12.69	9.01	9.81	10.57	10.08	11.14	11.367	1.514185	9.01	13.28
Vijaya Bank	11.22	13.15	12.5	13.88	13.06	11.32	10.56	11.43	12.58	12.73	12.243	1.052965	10.56	13.88
State Bank of India	13.54	14.25	13.39	11.98	13.86	12.92	12.44	12	13.12	13.11	13.061	0.75244	11.98	14.25
State Bank of Hyderabad	12.35	11.53	14.9	14.25	13.56	11.65	12	11.26	11.62	11.73	12.485	1.281694	11.26	14.9
State Bank of Patiala	13.56	12.6	13.26	13.41	12.3	11.12	10.38	12.06	11.5	12.43	12.262	1.033342	10.38	13.56
State Bank of Mysore	11.73	12.99	12.42	13.76	12.55	11.79	11.08	11.42	12.43	12.41	12.258	0.78484	11.08	13.76
State Bank of Travancore	13.53	14.03	13.74	12.54	13.55	10.74	10.79	10.89	11.6	12.19	12.36	1.306709	10.74	14.03
State Bank of Bikaner & Jaipur	12.51	14.52	13.3	11.68	13.76	12.16	11.55	11.57	11.06	9.25	12.136	1.497206	9.25	14.52
Bhartiya Mahila Bank	NA	NA	NA	NA	NA	NA	13.01	13.09	13.7	13.8	13.4	6.923729	13.01	13.8
IDBI	11.95	11.57	11.31	13.64	14.58	13.13	11.68	11.76	11.67	10.7	12.199	1.194864	10.7	14.58
Mean	12.12462	13.17577	13.24846	13.36846	12.98154	11.96577	11.26407	11.40556	11.55556	11.82963	12.30504	1.325261	10.72815	14.01704
S.D.	2.49308	2.672448	2.692741	2.731327	2.614511	2.530088	0.900022	0.828499	1.105814	0.997229	0.544297	1.160577	0.954512	0.643021
Min	10.42	11.53	11.31	11.64	11.51	9.01	9.81	10.11	9.63	9.25	11.344	0.444477	9.01	13.01
Max	13.56	14.52	15	15.38	14.67	14.15	13.01	13.09	13.7	13.8	13.413	6.923729	13.01	15.38

Source: Compiled from the annual reports of banks.

Table 2 shows that all the public-sector banks have maintained capital adequacy norm of 11.5% stipulated under Basel III norms and 12.5% prescribed by RBI for the year ending March 2013 to March 2017. The minimum capital ratio hold by banks is above 11.5% but CAR of banks is ranging from 9% to 15.38% over the period of 10 years. The all scheduled commercial banks of India were required to disclose their capital ratio as per Basel III from March 2013.

The period from 2008 to 2012 has been considered as the Basel II period but during this period most of the banks have achieved CAR norms stipulated under Basel III.

This indicates the strong capital base of Indian public-sector banks as the banks have maintained more than 10% of capital adequacy ratio. This shows that Indian public-sector banks were well capitalised during the financial crisis in 2008. That's why banks were resilient and no impact of financial crisis on Indian banks had been observed.

In year 2008 the CAR was varying between 10.42% and 13.56% and maximum CAR increased over the next three years, that is, year ending 2008–2011. The maximum CAR was higher in 2011 recorded at 15.38%. In 2012, the maximum capital ratio continued to decline to 13.01% in 2014 and again increased to 13.09% in 2015. The maximum CAR was recorded higher 13.8 in 2017 as compared to 13.7% in 2016.

The lower CAR was accounted at 9.9% in 2014 by Bank of India and 9.8% by Central Bank of India. The United Bank of India recorded very lower level of CAR at 9.01% and 9.81% in 2013, 2014 respectively. In 2016, the Indian Overseas Bank and UCO Bank registered lower CAR value. Over the period of 10 years, the average capital adequacy ratio increased from 12.12% in 2008 to 13.17% in 2009 and continued to increase to 13.24% in 2010 and decreased from 13.36% in 2011 to 12.98% in 2012 and continued to decline to 11.96% in 2013.

In 2015, the average CAR increased from 11.26% in 2014 to 11.4% in 2015 and then continued to rise in 2016 and 2017, recorded at 11.55% and 11.82% respectively. During the 10 years of the study, the average CAR varied between 11.26% to 13.24% and the minimum CAR was registered at 9.01% in 2013 and maximum CAR was 15.38% in 2011 by Canara bank. The Indian Bank had lowest standard deviation of 0.44 and Bhartiya Mahila Bank had highest standard deviation of 6.92. In 2011, highest standard deviation has been observed and minimum S.D was in 2015.

The table depicts that most of the public-sector banks are operating above the minimum level of CAR. In the year 2017, the following banks UCO bank, State Bank of Bikaner & Jaipur, Indian Overseas Bank and Central Bank

of India could not maintain the capital norms prescribed by RBI and stipulated under Basel III. The five banks namely corporation Bank, Dena Bank, Bank of Maharashtra, United Bank of India and Punjab & Sind Bank could not fulfill the RBI stipulations of 12.5% but their capital ratio was near about the Basel III capital norms of 11.5% and above 11%. The capital ratio of most of the public-sector banks has improved over the period of the study.

As per the findings of Table 2 the public-sector banks are well capitalised and banks have maintained capital adequacy ratio of 11.5% as per Basel III capital regulations.

### Comparison of CAR of Banks Before and After Implementation of Basel III Norms

The present study covered the period of 10 years from 2008 to 2017 divided into two phases namely pre-Basel III consisting the period of 5 years (2008–2012) and post Basel III from 2013 to 2017. The banks were required to maintain their capital ratio as per Basel III in 2013. To compare the differences in capital adequacy ratio in two phases: pre-and post-Basel III period, Paired *t*-test has been used. Table 3 discloses the capital ratio of public-sector banks during pre-Basel III regime. Before enforcement of Basel III capital guidelines, banks were maintaining their capital ratio stated under Basel II. But, public-sector banks had achieved the capital ratio more than 11% during pre-Basel III regime. This indicates that Indian banks have already maintained the capital ratio specified by international regulatory authorities.

During Pre-Basel III regime, Bank of Baroda had highest mean of CAR showing the adequate capital maintained by banks and Central Bank of India had lowest mean value but above BCBS norm of 11.5%. The public banks were performing well even before implementing the stringent capital regulations of Basel III. The small value of S.D. shows that the values were closer to the mean. There were low variations in CAR values.

As shown in Table 4, the highest mean of CAR value was recorded at 13.08% by Indian bank and lowest mean was 10.12% by United Bank of India during post Basel III regime. There found more variations in CAR of UCO Bank as bank had highest standard deviation. The CAR of banks was more consistent during post Basel III regime as S.D. depicts the low variations in CAR. All banks have already achieved the capital norms and CAR value of banks varied between 10.50% and 13.7% over the period of 5 years. All banks have done a good job to implement the regulatory capital guidelines.

**Table 3: CAR of Public Banks Before Implementing Basel III Norms**

Public sector Banks	2008	2009	2010	2011	2012	Mean	Max	Min	S.D.	Variance
Allahabad bank	11.99	13.11	13.62	12.96	12.83	12.902	13.62	11.99	0.59	0.34
Andhra bank	11.61	13.22	13.93	14.38	13.18	13.264	14.38	11.61	1.05	1.1
Bank of Baroda	12.94	14.05	14.36	14.52	14.67	14.108	14.67	12.94	0.69	0.47
Bank of India	12.04	13.01	13	12.24	12.03	12.464	13.01	12.03	0.5	0.25
Bank of Maharashtra	10.85	12.05	12.78	13.35	12.43	12.292	13.35	10.85	0.93	0.87
Canara Bank	13.25	14.1	13.43	15.38	13.76	13.984	15.38	13.25	0.84	0.71
Central Bank of India	10.42	13.12	12.24	11.64	12.4	11.964	13.12	10.42	1.01	1.02
Corporation Bank	12.09	13.66	15	14.11	13	13.572	15	12.09	1.1	1.21
Dena Bank	11.09	12.07	12.77	13.41	11.51	12.17	13.41	11.09	0.93	0.87
Indian Bank	12.9	13.98	12.71	13.56	13.47	13.324	13.98	12.71	0.51	0.26
Indian Overseas Bank	11.93	13.2	14.78	14.55	13.32	13.556	14.78	11.93	1.15	1.32
Oriental Bank of Commerce	12.12	12.98	12.54	14.23	12.69	12.912	14.23	12.12	0.79	0.63
Punjab National Bank	13.46	14.03	14.16	12.42	12.63	13.34	14.16	12.42	0.79	0.62
Punjab & Sind Bank	11.57	14.35	13.1	12.94	13.26	13.044	14.35	11.57	0.99	0.98
Syndicate Bank	11.82	12.52	12.7	13.04	12.23	12.462	13.04	11.82	0.46	0.21
UCO bank	11.02	11.93	13.21	13.71	12.35	12.444	13.71	11.02	1.05	1.12
Union Bank of India	12.51	13.27	12.51	12.95	11.85	12.618	13.27	11.85	0.53	0.28
United Bank of India	11.24	13.28	12.8	13.05	12.69	12.612	13.28	11.24	0.8	0.64
Vijaya Bank	11.22	13.15	12.5	13.88	13.06	12.762	13.88	11.22	0.99	0.98
State Bank of India	13.54	14.25	13.39	11.98	13.86	13.404	14.25	11.98	0.86	0.74
State Bank of Hyderabad	12.35	11.53	14.9	14.25	13.56	13.318	14.9	11.53	1.37	1.89
State Bank of Patiala	13.56	12.6	13.26	13.41	12.3	13.026	13.56	12.3	0.54	0.29
State Bank of Mysore	11.73	12.99	12.42	13.76	12.55	12.69	13.76	11.73	0.74	0.56
State Bank of Travancore	13.53	14.03	13.74	12.54	13.55	13.478	14.03	12.54	0.56	0.31
State Bank of Bikaner & Jaipur	12.51	14.52	13.3	11.68	13.76	13.154	14.52	11.68	1.1	1.21
Bhartiya Mahila Bank	NA	NA	NA	NA	NA	NA	0	0	0	0
IDBI	11.95	11.57	11.31	13.64	14.58	12.61	14.58	11.31	1.42	2.03

Source: Compiled from the Annual Reports of banks.

Table 4: CAR of Public Banks After Implementing Basel III Norms

PSBs	2013	2014	2015	2016	2017	Mean	Max	Min	S.D.	Variance
Allahabad bank	11.03	10.26	10.52	11.24	11.45	10.9	11.45	10.26	0.49	0.24
Andhra bank	11.76	11.18	10.7	11.58	12.38	11.52	12.38	10.7	0.63	0.39
Bank of Baroda	13.3	12.28	12.6	13.17	12.24	12.71	13.3	12.24	0.49	0.24
Bank of India	11.11	9.97	11.22	12.37	12.14	11.36	12.37	9.97	0.95	0.91
Bank of Maharashtra	12.59	10.79	11.94	11.2	11.18	11.54	12.59	10.79	0.71	0.51
Canara Bank	12.4	10.63	10.56	11.08	12.86	11.5	12.86	10.56	1.05	1.11
Central Bank of India	11.49	9.87	10.9	10.41	10.95	10.72	11.49	9.87	0.61	0.37
Corporation Bank	12.33	11.64	11.09	10.56	11.32	11.38	12.33	10.56	0.65	0.43
Dena Bank	10.47	11.14	10.93	11	11.39	10.98	11.39	10.47	0.34	0.11
Indian Bank	13.08	12.64	12.86	13.2	13.64	13.08	13.64	12.64	0.37	0.14
Indian Overseas Bank	11.85	10.78	10.11	9.66	10.5	10.58	11.85	9.66	0.82	0.68
Oriental Bank of Commerce	12.04	11.01	11.41	11.76	12.4	11.72	12.4	11.01	0.54	0.29
Punjab National Bank	12.72	12.11	12.89	13.15	11.66	12.5	13.15	11.66	0.6	0.37
Punjab & Sind Bank	12.91	11.04	11.24	10.91	11.05	11.43	12.91	10.91	0.83	0.69
Syndicate Bank	12.59	12.01	10.54	11.16	12.03	11.66	12.59	10.54	0.81	0.65
UCO bank	14.15	12.68	12.17	9.63	10.93	11.91	14.15	9.63	1.72	2.95
Union Bank of India	11.45	10.8	10.22	10.56	11.79	10.96	11.79	10.22	0.64	0.41
United Bank of India	9.01	9.81	10.57	10.08	11.14	10.12	11.14	9.01	0.8	0.64
Vijaya Bank	11.32	10.56	11.43	12.58	12.73	11.72	12.73	10.56	0.91	0.83
State Bank of India	12.92	12.44	12	13.12	13.11	12.71	13.12	12	0.48	0.23
State Bank of Hyderabad	11.65	12	11.26	11.62	11.73	11.65	12	11.26	0.26	0.07
State Bank of Patiala	11.12	10.38	12.06	11.5	12.43	11.49	12.43	10.38	0.8	0.64
State Bank of Mysore	11.79	11.08	11.42	12.43	12.41	11.82	12.43	11.08	0.59	0.35
State Bank of Travancore	10.74	10.79	10.89	11.6	12.19	11.24	12.19	10.74	0.63	0.4
State Bank of Bikaner & Jaipur	12.16	11.55	11.57	11.06	9.25	11.11	12.16	9.25	1.11	1.24
Bhartiya Mahila Bank	NA	11.01	12.09	13.7	11.8	9.72	13.7	11.01	1.12	1.25
IDBI	13.13	11.68	11.76	11.67	10.7	11.78	13.13	10.7	0.86	0.75

Source: Compiled from the annual reports of banks.

Table 5 depicts the comparison between the mean value of CAR during the pre-and post-Basel III regime. It can be observed that mean value of CAR of public-sector banks were higher in Pre-Basel III era as compared to Post Basel III period. The CAR of all public banks has decreased in Post Basel III years as compared to Pre-Basel III years but CAR was above the prescribed norms of Basel. There can be several reasons behind it such as banks are unable to raise

required funds to meet the new capital norms and banks are operating under the regulatory pressure. So, the level of CAR of banks has decreased in last five years.

There found a difference between mean values of CAR of banks during Pre-and Post-Basel III regime. Paired *t*-test has been applied to compare the mean of CAR at two different periods such as CAR of banks before implementing Basel III and after implementing Basel III.

**Table 5: Comparison of Mean Value of CAR for Two Periods: Pre-Basel III (2008–2012) and Post-Basel III (2013–2017) Regime**

PSBs	Average CAR Mean of Pre-Basel III Regime	Average CAR Mean of Post Basel III Regime
Allahabad bank	12.9	10.9
Andhra bank	13.26	11.52
Bank of Baroda	14.1	12.71
Bank of India	12.46	11.36
Bank of Maharashtra	12.29	11.54
Canara Bank	13.98	11.5
Central Bank of India	11.96	10.72
Corporation Bank	13.57	11.38
Dena Bank	12.17	10.98
Indian Bank	13.32	13.08
Indian Overseas Bank	13.55	10.58
Oriental Bank of Commerce	12.91	11.72
Punjab National Bank	13.34	12.5
Punjab & Sind Bank	13.04	11.43
Syndicate Bank	12.46	11.66
UCO bank	12.44	11.91
Union Bank of India	12.61	10.96
United Bank of India	12.61	10.12
Vijaya Bank	12.76	11.72
State Bank of India	13.4	12.71
State Bank of Hyderabad	13.31	11.65
State Bank of Patiala	13.02	11.49
State Bank of Mysore	12.69	11.82
State Bank of Travancore	13.47	11.24
State Bank of Bikaner & Jaipur	13.15	11.11
Bhartiya Mahila Bank	NA	10.72
IDBI	12.61	11.78

Source: Compiled from the annual reports of banks.

Before applying Paired *t*-test, the normality test has been done to check the assumptions of Parametric test (*t*-test). The data are distributed normally and satisfied the condition of parametric test. Paired *t*-test has been used as data are normally distributed.

The calculated *t*-value in respect of comparison of CAR mean over two periods indicates that there is significant difference between the mean of CAR of banks in view of pre-and post-Basel III regime. The difference is significant at 95% level. Based on the results given by Table 6, *p*-value ( $0.04 < 0.05$ ) is less than alpha resulting the rejection of null hypothesis H2. The absolute value of *t* statistics ( $2.099 > 2.055$ ) is larger than critical value indicating the significant difference in the CAR (capital adequacy ratio) of public banks over two regimes.

**Table 6: Paired T-Test**

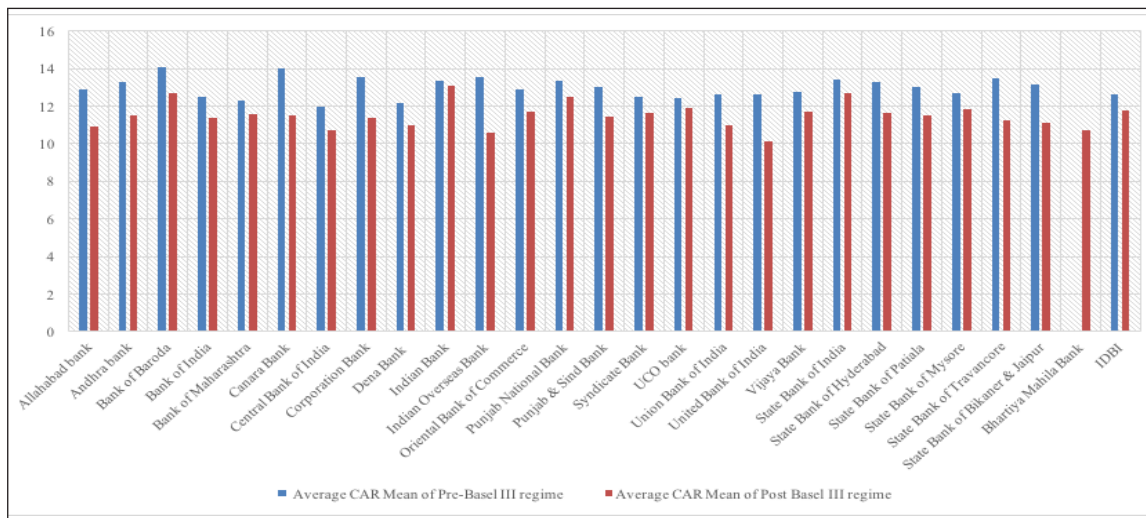
	Pre-Basel III CAR	Post Basel III CAR
Mean	12.49	11.51
Variance	6.524	0.465
Observations	27	27
Df	26	
<i>t</i> Stat	2.099	
<i>P</i> value (two-tailed)	0.045	
<i>t</i> Critical two-tail	2.055	

H1: There is no significant difference between the mean of CAR over the two phases of Basel III.

The *t*-test used to compare the difference in mean of CAR for two different phases rejects the null hypothesis. The

CAR of public banks is significantly different at 95% level in two phases of Basel III that is before implementing Basel III norms and after implementing Basel III. It has been found that CAR ratio of public banks was higher before implementing Basel III (2008–2012). It may be seen that the

mean of CAR has decreased in post Basel III phase. The mean of the CAR for two different periods is not equal and mean of pre-Basel III CAR is higher than mean of post Basel III CAR.



Source: Compiled from the annual reports of banks.

Fig. 1: Average CAR of Public-Sector Banks during Pre-and Post-Basel III Regime

The above chart reflects the average CAR of Indian public-sector banks during pre-and post-Basel III regime. It can be seen that average CAR was lower in post Basel III (2013-2017) but more variations in CAR value were not observed. The CAR ratio was found higher during 2008–2012. The CAR of banks was different in both the periods.

## CONCLUSION

It is concluded that Indian public-sector banks are stronger and stable due to high CAR recorded by all banks during post Basel III period. This indicates that after the implementation of Basel III capital norms, higher CAR of banks has been observed. In this way, well capitalised banks would enhance the stability in overall financial system and growth in economy whereas the low capital ratio will increase the insolvency risk for banks. On the other hand, well capitalised banks will reduce the chances of insolvency risk and achieve higher profitability.

The study recommended that international regulations should be well balanced and comprehensive. The key elements of an effective regulation must be focused on the individual features of banks such as reducing the chance of bankruptcy and all elements are necessary that should be enforced uniformly over the world. The study concluded that

for effective implementation of Basel Accord, the proper coordination is necessary at international level which would enhance the productivity and profitability of banks all over the world.

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