

## Assessing the Sustainable Financial Performance of Regional Rural Banks: A Quantitative Analysis of Digital Innovation

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### ABSTRACT

The study presents a quantitative comparison of the financial performance of Regional Rural Banks (RRBs) working in Uttar Pradesh. Regional Rural Banks play a vital role in the economic growth of rural areas by providing accessible financial services. The financial health of RRB in the state is critical not only for its stakeholders but also for the wider rural economy. The study employs a range of financial indicators, including Net Interest Margin, CD Ratio, CRAR, cost to Income ratio, Employee Productivity, return on Equity and Net profit to total Assets to assess and compare selected RRBs in Uttar Pradesh. Secondary data from the annual reports of RRBs, covering the last fifteen years, are analyzed using statistical tools such as ratios, trend analysis, and comparative tables. The findings provide insights into the relative financial stability, growth potential, and operational competence of RRB, offering valuable recommendations for policymakers, management, and stakeholders to enhance the bank's performance and its input to rural financial inclusion in Uttar Pradesh.

**Keywords** *Regional Rural Banks, RRBs, Financial Performance, Credit Deposit Ratio, Qualitative analysis, Machine learning, India.*

### INTRODUCTION:

Regional rural banks (RRBs) play a significant role in providing financial services to the rural population of the country like India [11]. RRBs serve a dual purpose: they provide vital banking services to the underserved rural population and help the government's initiatives in rural development. In Uttar Pradesh, the biggest state of India, agriculture is the primary occupation and is necessary to the state's economic growth. The study embraces a significant status in the context of financial institutions functioning in rural areas, particularly in India. This research investigates a comparative appraisal of the financial health of the selected regional rural banks (RRBs) in Uttar Pradesh, which is critical for numerous reasons:

The core input of this study lies in evaluating the financial health of distinct types of rural banking institutions, i.e., regional rural banks, as they offer credit, financial services, and loans to farmers, small traders, and rural entrepreneurs [9]. The financial health of RRBs sprightly influences their capacity to adopt rural economic development. A well-capitalized and financially firm RRB can provide timely and adequate loans for agricultural expansion, infrastructure development, and rural enterprise progress. Understanding the financial wealth of these banks can help policymakers, regulators,

and bank managers identify exposures and spaces for improvement, ensuring that these institutions can effectively serve rural populations. A comprehensive analysis of its performance, compared with other RRBs, delivers valuable insights into its competitiveness, efficiency, and financial strength [15]. The study assistances identify the strengths and weaknesses of various RRBs in terms of profitability, asset quality, risk management and liquidity.

### LITERATURE REVIEW

According to the study conducted by [13], the authors tried to find in the study that how the demographic variables stimulate the service quality in regional rural banking. The findings of the study revealed that a bank's success is determined by its capacity to hold existing customers while also enticing new ones. In their study, [14] advocate for the establishment of a regulatory framework that encourages prudential norms and risk management practices. Likewise [07], emphasises the focus on transparency and accountability, in line with national banking policies, which reinforced public confidence in RRBs. In the Study of [1] observed that RRBs banks benefited the recipients of their services by increasing their earnings, productivity, occupation, and use of modern practices.

Regional Rural Banks were created to deepen rural credit and financial inclusion, with strong focus on priority sector lending and underserved geographies. Their performance must therefore be evaluated not only in terms of profitability, but also resilient and outreached.

The present study is devoted to analysing the financial health of the selected banks operating in Uttar Pradesh till 2018-19 before the merger, by various financial indicators like Net Interest Margin, Credit Depository Ratio etc This study evaluates and contrasts RRBs' financial status operating in Uttar Pradesh 2018-19, from 2002. Authors have considered the data till 2018-19 to avoid the COVID-19 shock and merger in the study [9]. The four regional rural banks are as RRB 1 is Allahabad UP Gramin Bank; RRB 2 is Baroda UP Gramin Bank; RRB 3 is Gramin Bank of Aryavart and RRB 4 is Kashi Gomti Samyut Gramin Bank considered for study.

H1: There are significant differences in net interest margin (NIM) of all selected sample Regional Rural Banks.

H2: There are significant differences in credit depository ratio of all selected sample Regional Rural Banks.

H3: There are significant differences in capital-to-risk weighted assets ratio (CRAR) of all selected sample Regional Rural Banks.

## RESEARCH OBJECTIVE

The present study is analytical and exploratory in nature and makes use of secondary data. The pertinent fifteen years of the secondary data have been collected mainly through the databases of the National Bank for Agricultural and Rural Development (NABARD) and, Reserve Bank of India (RBI). The various research papers and journals have also been referred [12]. Machine learning techniques have been applied. Firstly, Levene's statistic is applied to check the homogeneity of the data. Analysis of the Variance (ANOVA) has been used to when the homogeneity of the variance assumption has been fulfilled; otherwise, Welch's ANOVA has been used. The result of the Welch's ANOVA test only shows the significant difference in all the indicators for the performance, but fails to show the differentiation among the groups. For this purpose, post-Hoc, Tukey Honestly Significant Difference (HSD), test has been applied if the data satisfy the assumption of the homogeneity; otherwise, Games Howell Post-Hoc test has been used [8].

The difference between total interest earned (including from investments) and total interest expenses (including from inter-bank borrowings), normalized by assets, is referred to as net interest margin. This ratio indicates how effective banks deploy all of their funds (deposits and borrowings) to generate revenue from credit and investment operations. A higher value of this ratio indicates higher profitability, whereas a lower number indicates poorer profitability [10].

The net interest margin position of the sample banks is depicted in Table 1. As it could be observed that among all sample banks, RRB 1 has the highest NIM ( $M=4.90$ ) during the study period, followed by RRB 2 ( $M=3.27$ ), RRB 3 ( $M=3.13$ ) and RRB4 ( $M=2.38$ ).

In Table 2, the authors have shown the result of Levene's statistics, the p-value (0.445), which is greater than the recommended value of 0.05, which supports the idea of homogeneity of variances. The ANOVA results also clarify the suggestion that the net interest margin of the Banks differ significantly (0.010); therefore, the null hypothesis is rejected at 5% level of significance and there is a significant difference between the NIM of selected banks. For future checking of individual differences between banks, post-hoc comparisons were applied using the Tukey HSD test. The test statistics show that the difference in NIM is not significant in any pairs of regional rural banks since their p-value exceeds the expected levels of Significance (0.05) in Net Interest Margin Ratio [06].

CD ratio is the ratio of total advances outstanding to total deposits outstanding. It illustrates the patterns in credit flow for each period and is expressed as a percentage. In other words, it depicts the amount of resources mobilized by banks locally. Commercial banks should obtain at least 60% of CDR. According to RBI regulations; the Credit Deposit Ratio is affected by the diversification strategy of a bank's management. An aggressive banker may raise the ratio, whereas a conservative banker may lower the ratio and invest a greater proportion of deposits in secure government securities.

In Table 3, the CD ratio position of the sample banks is depicted. As it could be observed that among all sample banks, RRB 1 sustained the highest CD Ratio during the study period, followed by RRB 3, RRB 2 and RRB 3.

Levene's statistics show that the significant ( $p$ -value=0.00) is less than the recommended value of 0.05, which indicates no homogeneity of variances, as shown in Table 3. Because the assumption of equal variance is violated in this case, Welch ANOVA is applied to test the hypothesis. The Welch ANOVA results suggest that the CD Ratio of the Banks differ significantly (0.00), therefore the null hypothesis is rejected at 5% level of significance and there is a significant difference between the samples banks in case of CD Ratio of selected Banks. The Games Howell test post-Hoc comparison (Table 4) shows that the difference in CD Ratio is significant in all pairs of RRBs since their p-value is less than the expected levels of Significance (0.05) in CD Ratio [9].

The capital adequacy ratio, which measures a bank's capital to its risk-weighted credit exposures, is the most widely used measure of a bank's soundness. It determines a bank's ability to withstand unexpected losses resulting from its operations. Banks are required to maintain the CRAR set by the RBI regularly. CRAR is calculated by dividing the sum of Tier I and Tier II by the total of risk-weighted assets [04]. Equity capital, surplus capital reserve, share capital deposits, free reserves and surplus in profit and loss account are all added up to form Tier-I capital. Tier II capital comprises undisclosed reserves, a revaluation reserve, a general provision and loss reserve, and an investment fluctuation reserve. Risk-adjusted assets are the weighted aggregate of funded and non-funded items. A higher value of this ratio indicates that banks have stronger solvency and financial strength, while

a lower number specifies that banks have poor solvency and financial strength [13].

The Capital-to-Risk Weighted Assets ratio (CRAR) position of sample banks is depicted in Table 5. As it could be observed that among all sample banks, RRB 4 sustained the highest Capital-to-Risk Weighted Assets ratio during the study period, followed by RRB 3, RRB 2 and RRB 1.

Levene's statistics show that the p-value (0.000) is less than 0.05, which means there is no homogeneity of variances, as shown in Table 5. Because the assumption of equal variance is violated in this case, Welch ANOVA is applied to test the Hypothesis. The Welch ANOVA results (Table 5) suggest that the capital-to-risk weighted assets ratio (CRAR) of the Banks differ significantly (0.02), therefore null hypothesis is rejected at 5% level of significance and there is a significant difference between selected banks in case of CRAR of selected Banks. The Games Howell test post hoc comparison in Table 6 shows that the difference in CRAR is insignificant in all the pairs of regional rural banks since their p-value exceeds the expected levels of Significance (0.05).

## RESULTS AND DISCUSSION

The NIM position of sample Banks is depicted in Tables 1 & 2. It had been observed that among all sample banks, the net interest margin position of the sample banks depicted in Table 1. As it could be observed that among all sample banks, RRB 1 has the highest NIM ( $M=4.90$ ) during the study period, followed by RRB 2 ( $M=3.27$ ), RRB 1 ( $M=3.13$ ) and RRB4 ( $M=2.38$ ) respectively. Levene's statistics, the p-value (0.445), which is greater than the recommended value of 0.05 that supports the idea of homogeneity of variances. The ANOVA results also clarify the suggestion of the net interest margin of the banks differs significantly (0.010); therefore, the null hypothesis is rejected at 5% level of significance and there is a significant difference between the NIM of selected banks. For future checking of individual differences between banks, post-hoc comparisons were applied using the Tukey HSD test. The test statistics show that the difference in NIM is not significant in any pairs of regional rural banks since their p-value exceeds the expected levels of Significance (0.05) in Net Interest Margin Ratio [05].

The CD ratio position of the sample banks depicted. As it could be observed that among all sample banks, RRB 1 sustained the highest CD Ratio during the study period, followed by RRB 3, RRB 2 and RRB 3. Levene's statistics show that the significant (p-value=0.00) is less than the recommended value of 0.05, which indicates no homogeneity of variances, as shown in Table 3. Because the assumption of equal variance is violated in this case, Welch ANOVA is applied to test the hypothesis. The Welch ANOVA results suggest that the CD Ratio of the Banks differ significantly (0.00), therefore the null hypothesis is rejected at 5% level of significance and there is a significant difference between the samples of banks in case of the CD Ratio of selected banks. The Games Howell test post-Hoc comparison (Table 4) shows that the difference in CD Ratio is significant in all pairs of RRBs

since their p-value is less than the expected levels of Significance (0.05) in CD Ratio [02].

The Capital-to-Risk Weighted Assets ratio (CRAR) position of the sample banks is depicted in Table 5. As it could be observed that among all sample banks, RRB 4 sustained the highest Capital-to-Risk Weighted Assets ratio during the study period, followed by RRB 3, RRB 2 and RRB1. Levene's statistics show that the p-value (0.000) is less than 0.05, which means there is no homogeneity of variances, as shown in Table 5. Because the assumption of equal variance is violated in this case, Welch ANOVA is applied to test the Hypothesis. The Welch ANOVA results (Table 5) suggest that the capital-to-risk weighted assets ratio (CRAR) of the Banks differ significantly (0.02), therefore null hypothesis is rejected at 5% level of significance and there is a significant difference between selected banks in case of CRAR of selected Banks. The Games Howell test post hoc comparison in Table 6 shows that the difference in CRAR is insignificant in all the pairs of regional rural banks since their p-value exceeds the expected levels of Significance (0.05) [03].

## CONCLUSION

The present study delivers valuable insights into the financial health of four main regional rural banks in Uttar Pradesh, the largest state of India. It is seen through significant differences in key financial ratios that affect their stability and performance. Gramin Bank of Aryavart appears as the leader in both Net Interest Margin and Credit Depository ratio, representing strong profitability and efficient utilization of deposits. KGSGB, on the other hand, is delayed in both Net Interest Margin and Credit Depository ratio, representative areas for potential improvement, especially in enhancing its lending activities to better serve rural communities. In terms of capital adequacy, KGSGB's higher CRAR signals a stronger financial position compared to the other banks, which highlights the importance of maintaining sufficient capital buffers in the face of economic challenges. The significant differences observed in the Credit Depository ratio suggest that banks like KGSGB could benefit from a more aggressive lending strategy, while the findings on NIM indicate that better interest rate management and asset quality could enhance profitability. The inferences of these findings are vital for the management of these RRBs, regulatory authorities, and policymakers. Regional rural banks play a vital role in rural development, financial inclusion and economic stability of rural areas. Therefore, improving the financial performance of these institutions is not only critical for their long-term feasibility but also for supporting the growth of India's rural economy. Improved focus on refining, managing interest income, lending efficiency and firming capital adequacy will be vital for these banks to continue playing their key role in the Indian banking system. KGSGB necessities to emphasize better management of its assets and liabilities to amend its Net Interest Margin. By offering better or competitive interest rates, they could increase their customer base, and they would also be able to increase the difference between the interest earned and the interest paid on the loan. A key recommendation for KGSGB is to

use a more aggressive lending strategy, confirming that available deposits are being mobilized effectively into productive loans for MSME, Agriculture, and rural infrastructure. Increasing the scope of lending to underserved areas or sectors could boost credit flow and advance the Credit Depository Ratio. To strengthen capital adequacy across these banks, it is vital for them to focus on increasing their capital base through retained earnings or by raising funds from alternative sources.

Increasing their capital base by retained earnings or by raising funds from effective alternative sources, they are able to strengthen their capital adequacy.

**ACKNOWLEDGMENT**

The authors acknowledge participants' support for the survey and the required assistance given by Institutions for conducting the present study.

**Table 1: One Way ANOVA Result of NIM**

Bank Name	Mean	SD	Test of Homogeneity		ANOVA	
			Levene's Statistic	Sig.	F	Sig.
RRB 1	3.13	0.90	0.899	0.445	4.58	0.010
RRB 2	3.27	0.58				
RRB 3	4.90	0.46				
RRB 4	2.38	0.42				

Source: Author's Calculation

**Table 2: Multiple comparison of net interest margin**

Bank (x)	Bank (y)	Mean Difference (x-y)	Sig.
RRB 1	RRB 2	-0.4670	0.600
	RRB 3	-0.7008	0.100
	RRB 4	0.4770	0.500
RRB 2	RRB 1	0.4100	0.600
	RRB 3	-0.3700	0.700
	RRB 4	0.8900	0.090
RRB 3	RRB 1	0.7800	0.100
	RRB 2	0.3700	0.700
	RRB 4	-0.2600	0.110
RRB 4	RRB 1	-0.4800	0.500
	RRB 2	-0.8800	0.090
	RRB 3	-0.2600	0.110

Source: Author's Calculation

**Table 3: CD Ratio Welch ANOVA details for reference.**

¶ Bank Name	¶ Mean	SD	Test of Homogeneity		Welch ANOVA	
			Levene's Statistic	Sig.	F	Sig.
RRB 1	75.70	8.500	7.550	0.000	146.22	0.00
RRB 2	58.43	3.400				
RRB 3	68.72	5.890				
RRB 4	25.30	1.840				

Source: Author's Calculation

Source: Author's Calculation

Table 4: Games Howell test post-Hoc comparison details for reference.			
Bank (x)	Bank (y)	Mean Difference (x-y)	Sig.
RRB 1	RRB 2	27.165	0.000
	RRB 3	-19.031	0.000
	RRB 4	40.500	0.000
RRB 2	RRB 1	-27.165	0.000
	RRB 3	-29.100	0.000
	RRB 4	13.400	0.000
RRB 3	RRB 1	19.031	0.000
	RRB 2	29.100	0.000
	RRB 4	42.500	0.000
RRB 4	RRB 1	-40.500	0.000
	RRB 2	-13.400	0.000
	RRB 3	-42.500	0.000

Source: Author's Calculation

Table 5: CRAR Welch ANOVA details for reference.						
Bank Name	Mean	SD	Test of Homogeneity		Welch ANOVA	
			Levene's Statistic	Sig.	F	Sig.
RRB 1	11.80	3.400	3.350	0.000	4.300	0.02
RRB 2	14.24	0.590				
RRB 3	14.90	0.480				
RRB 4	15.40	1.350				

Source: Author's Calculation

Table 6: Games Howell test post-Hoc comparison details for reference.			
Bank (x)	Bank (y)	Mean Difference (x-y)	Sig.
RRB 1	RRB 2	-3.340	0.201
	RRB 3	-3.001	0.260
	RRB 4	-4.760	0.100
RRB 2	RRB 1	3.340	0.200
	RRB 3	0.340	0.700

	RRB 4	-1.418	0.200
RRB 3	RRB 1	3.001	0.260
	RRB 2	-0.340	0.700
	RRB 4	-1.760	0.100
RRB 4	RRB 1	4.760	0.100
	RRB 2	1.418	0.180
	RRB 3	1.760	0.100
Source: Author's Calculation			

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