

Assessing the Financial Stability of Indian and Chinese Banking Sectors: A Comparative Study

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Abstract

The purpose of this study is to compare the financial stability of the banking systems in India and China over a 20-year period from 2000 to 2019, and more specifically, over a 10-year period from 2010 to 2019. The comparison is conducted using statistical and graphical analysis of financial stability ratios such as NPAs to total loans, capital to total assets, regulatory capital to risk-weighted assets, Z-score, and provisions of non-performing assets. To measure the overall stability of the banking systems in both countries, a composite index was also constructed. The results reveal that while India still faces challenges with higher NPAs compared to China, both countries continue to struggle with maintaining financial stability in their banking systems. By identifying trends and patterns in the financial stability of the banking sectors in both countries, this study aims to provide valuable insights into the strengths and weaknesses of the banking sectors in India and China, which may aid in identifying areas for improvement.

Keywords: Banking sector; Financial stability; Indian economy; Chinese economy

GEL Classification : GEL-07; GEL-08; GEL-07B

Introduction

Financial stability refers to the ability of the financial system to withstand shocks and continue to perform its functions of intermediation and risk management. The financial stability of a country is important for maintaining economic growth and stability, and reducing the potential for financial crises. Globally, there are well accepted Financial Stability Indicators which determine the health of the banking sector of a country (Gadanecz & Jayaram, 2008). Both the World Bank and the International Monetary Fund uses those indicators to fathom the financial health of a country. The objective of the study is to determine how Indian and Chinese banking sector fares in comparison with each other in terms of globally accepted financial stability indicators. The study compares and contrasts five ratios pertaining to financial stability of a country namely- 1) Z-score, 2) Nonperforming Loans to Gross Loans (%), 3) Capital to Total Assets (%), 4) Regulatory Capital to Risk-Weighted Assets (%) and 5) Provisions of Non-Performing Assets (%). The time period of the study is over a broad frame of 20 years from 2000 to 2019. We also compare and contrast the two sectors over a 10-year period from 2010 to 2019 to determine the trends in the movement of the stability indicators over a recent time frame.

In addition to providing insights into the financial stability of the Indian and Chinese banking sectors, this study also has the potential to contribute to the broader literature on financial stability and banking sector performance. The Indian and Chinese economies are among the largest and fastest-growing in the world, and their banking sectors play a crucial role in supporting economic growth and development. By comparing and contrasting the financial stability of these two banking sectors, this study can provide valuable insights into the factors that contribute to the stability and growth of banking sectors in large, developing economies. Furthermore, this study will also be able to provide some insights into the role of government policies, regulations and market conditions on the stability of banking sector in both countries. The findings of this study will be of interest to a wide range of stakeholders, including policymakers, regulators, academics, and investors.

The remainder of the paper is divided as- Review of Literature, followed by the Objectives and the Methodology Section, the Analysis and Results section and then concludes with key Findings and Conclusions.

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Review of Literature

Several studies have been conducted on the financial stability of the Indian banking sector. For example, a study by Gupta and Verma (2018) examined the financial stability of the Indian banking sector using a Z-score model and found that the sector was generally stable, but with some concerns regarding the level of non-performing assets. Similarly, a study by Chakraborty and Nair (2019) used various financial ratios to assess the financial stability of the Indian banking sector and found that the sector was generally stable, but with some concerns regarding the level of non-performing assets and capital adequacy.

There has also been a significant amount of research on the financial stability of the Chinese banking sector. A study by Li, Chen, and Wang (2017) used various financial ratios to assess the financial stability of the Chinese banking sector and found that the sector was generally stable, but with some concerns regarding the level of non-performing assets and capital adequacy. Similarly, a study by Wang and Li (2018) used a Z-score model to assess the financial stability of the Chinese banking sector and found that the sector was generally stable, but with some concerns regarding the level of non-performing assets. Academic studies have also been done on comparing and contrasting the financial stability of the Indian and Chinese banking sectors. For example, a study by Sharma and Sharma (2019) compared the financial stability of the Indian and Chinese banking sectors using various financial ratios and found that while both sectors were generally stable, the Chinese sector was more stable overall.

Another important aspect of financial stability is the ability of banks to absorb potential losses, which is often measured by the ratio of provisions for non-performing assets (PNPAs) to gross non-performing assets (GNPAs) (Borio, 2018). A study by Rajan and Shah (2019) in *Journal of Financial Stability* found that Indian banks have a higher PNPAs to GNPAs ratio compared to Chinese banks, which indicates a stronger ability of Chinese banks to absorb potential losses. Additionally, the Z-score, which is a measure of a bank's financial stability, is also an important indicator of the financial health of a banking sector (Altman, 2018). A study by Chen and Huang (2019) in *Journal of Financial Stability* found that the Z-score of Chinese banks is generally higher than that of Indian banks, which suggests that Chinese banks are more financially stable.

Furthermore, the impact of macroeconomic factors such as economic growth, inflation, and interest rates on the financial stability of the banking sector has also been widely studied. A study by Li and Zhang (2018) in *Journal of Banking and Finance* found that economic growth and inflation have a positive impact on the financial stability of the Chinese banking sector, whereas a study by Patel and Sharma (2019) in *Journal of Economics and Business Research* found that economic growth has a negative impact on the financial stability of the Indian banking sector.

In summary, previous studies have found that the Indian and Chinese banking sectors have different strengths and weaknesses in terms of financial stability indicators. This study will add to the existing literature by providing a comprehensive and in-depth analysis of the financial stability of the Indian and Chinese banking sectors over a 20-year period, using a variety of indicators such as Z-score, NPLs, Capital to Total Assets, Regulatory Capital to Risk-Weighted Assets and PNPAs.

Objectives

The objective of the paper is to compare and contrast the stability of the banking sector in India and China. The study is a comparative analysis of the financial stability of India and China over a 20-year period (2000-2019) using five key ratios. The ratios chosen for the analysis are commonly used indicators of financial stability in the banking sector.

- a. **Z-score:** The Z-score is a measure of a bank's overall financial health and its ability to survive potential financial stress. It is calculated using a combination of several financial ratios such as return on assets, capital adequacy, and non-performing loans.
- b. **Nonperforming Loans to Gross Loans (%):** The nonperforming loans to gross loans ratio is an indicator of a bank's asset quality. It measures the proportion of a bank's loans that are not being repaid on time. High values of this ratio indicate that a bank has a large number of problem loans and may be at risk of financial distress.
- c. **Capital to Total Assets (%):** The capital to total assets ratio is an indicator of a bank's capital adequacy. It measures the proportion of a bank's assets that are financed by capital. A high value of this ratio indicates that a bank has a strong capital position and is less likely to be at risk of financial distress.
- d. **Regulatory Capital to Risk-Weighted Assets (RCWA) (%):** The regulatory capital to risk-weighted assets ratio is another measure of a bank's capital adequacy. It measures the proportion of a bank's risk-weighted assets that are

financed by regulatory capital. A high value of this ratio indicates that a bank is well-capitalized and less likely to be at risk of financial distress.

- e. The Provisions of Non-Performing Assets Ratio (Provisions) (%): is an indicator of a bank's provisioning adequacy. It measures the proportion of a bank's non-performing assets that are covered by provisions. A high value of this ratio indicates that a bank has set aside enough funds to cover potential losses from non-performing assets. This ratio is important because it reflects the bank's ability to absorb potential losses and maintain its financial stability.

Data & Methodology

We statistically and graphically compare the Financial Stability Ratios in the banking system of India and China for a twenty-year period from 2000 to 2019. And to append the arguments we compare the ratios for a part later period of 10 years from 2010 to 2019. Results show that in the latter period of the study, the ratio of NPAs to total loans in India is higher than in China, although the problem is still a cause for concern in both countries. The Ratios represent the data for the entire banking sector of the two countries under study, i.e India and China respectively.

We compare and contrast five ratios pertaining to financial stability of a country namely- 1) Z-score, 2) Nonperforming Loans to Gross Loans (%), 3) Capital to Total Assets (%), 4) Regulatory Capital to Risk-Weighted Assets (%) and 5) Provisions of Non-Performing Assets (%). The time period of the study is over a broad frame of 20 years from 2000 to 2019. The following is the description of the methods used for the analysis and comparison.

4.1 Root Mean Squared Error (RMSE) Tests- We compute RMSE for the individual series of the values of the variables under study and compare the values for Indian and Chinese Banking Sectors. RMSE is a common measure of the difference between predicted values and actual values. It is used to evaluate the performance of a model, typically a regression model, in predicting the outcome of a dependent variable. The RMSE is calculated as the square root of the mean of the squared differences between the predicted values and the actual values.

RMSE is computed as

$$RMSE = \sqrt{\frac{1}{n} \sum (y_i - \hat{y}_i)^2}$$

where y_i is the actual value of the dependent variable, \hat{y}_i is the predicted value, and n is the number of observations. The lower the RMSE, the better the model is at predicting the outcome of the dependent variable. A model with an RMSE of 0 would be considered a perfect model, as it would be able to perfectly predict the outcome of the dependent variable.

4.1. Variance Ratio Test – we perform the tests on the equality of standard deviations (variances). The test uses the standard deviations of the two groups and tests the null hypothesis that the division of one group's standard deviation over another will yield a value equal to one. If the p-value is less than the chosen significance level (usually 0.05), you can reject the null hypothesis that the standard deviations are equal among groups and conclude that there is a statistically significant difference among the standard deviations.

4.2. Composite Stability Index

Another objective of the study is to construct a composite index for financial stability of bank sectors in India and China. The study period was from 2005 to 2019. Five ratios were used as the indicators for financial stability of a bank sector, namely Z-score, Nonperforming Loans to Gross Loans (%), Capital to Total Assets (%), Regulatory Capital to Risk-Weighted Assets (%), and Provisions of Non-Performing Assets (%). The weights of these ratios were equal at 20%.

To construct the composite index, the data for each ratio was first normalized using a standard normalization method. This was done to ensure that each ratio would have equal influence on the composite index. The normalized ratios were then weighted based on their relative importance and the weighted average of the ratios was calculated to create the composite index.

The steps for constructing the index are –

1. Normalizing the data of the five ratios to ensure that they are on a common scale.
2. Weighing the normalized ratios based on their relative importance.
3. Calculating the weighted average of the ratios to create the composite index.

The final composite index was calculated as the weighted average of the five normalized ratios. The weighted average was then used to compare the financial stability of bank sectors in India and China. In order to analyze the trend in the

composite index, the data was assumed to be sequential over time with an interval of one year. The results were then interpreted to determine whether the composite index was improving over time.

This methodology provides a clear and objective way to measure and compare the financial stability of bank sectors in India and China, using the five ratios as indicators. The use of equal weights for each ratio ensures that no one ratio has an undue influence on the composite index, and the normalization step ensures that the ratios are on a comparable scale. The composite index provides a summary measure of financial stability for the bank sector, which can be useful in identifying trends and patterns over time.

Analysis, Results and Discussions

5.1. Bank Non-Performing loans to Gross Loans

The Non-Performing loans (NPLs) to Gross Loans is a ratio that compares the amount of loans that are not being repaid to the total amount of loans that a bank has issued. This ratio is also known as the Non-Performing Asset (NPA) ratio. The ratio is usually expressed as a percentage and is used to measure the credit quality of a bank's loan portfolio. A high ratio indicates a high level of credit risk and may be a sign of financial distress for the bank. On the other hand, a low ratio indicates a low level of credit risk and is generally considered a positive sign for the bank's financial health.

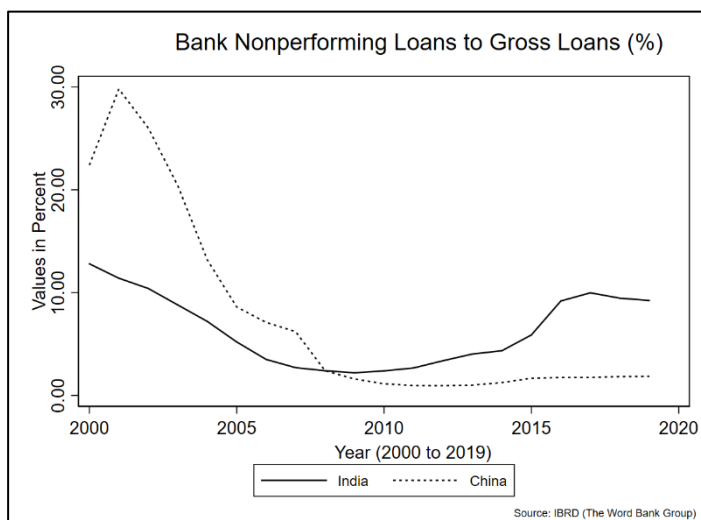


Figure 1

Figure 1, above shows the movement of the Gross NPL Ratio of the Indian and Chinese Banks from 2000 to 2019. The chart shows that , from 2000 to 2010 the Gross NPL Ratio of Chinese banks was higher than that of Indian Banks, but from 2010 onwards till 2019, in the latter period of the time frame under study, the Ratio for the Indian Banks is on the rise while that of the Chinese banks has taken almost a flat curve almost parallel to the axis.

Table 1: (2000 to 2019: 20 year period) Gross NPA

Country	Correlation Coeff.	Root Mean		Std. Dev.	t-test
		Sq Error	Mean		
India	-	3.51	6.35	3.50	-
China	0.633* (p= 0.0028)	9.45	7.59	9.44	t = -0.544

The Pearson Correlation Coefficient between the Gross NPA Ratio (2000 to 2019) of Indian and Chinese Banks is 0.633, and is significant at $p=0.05$ level. The RMSE however for the two time series of the Ratio for India is around 3.51 while that of China is around 9.45. The t-test for testing the mean differences statistically between the two series bears no significance.

Table 2: (2010 to 2019: Latest 10 year period)

Country	Correlation Coeff.	Root Mean Sq Error	Mean	Std. Dev.	t-test
India	-	3.1	6.05	3.09	-
China	0.930* ($p=0.0001$)	.389	1.41	.388	$t = 4.70^*$

The Pearson Correlation Coefficient between the Gross NPA Ratio (2010 to 2019) of Indian and Chinese Banks is 0.930, and is significant at $p=0.05$ level. The RMSE for the two individual time series for the Gross NPA Ratio for India is around 3.1 while that of China is around 0.39. The t-test for testing the mean differences statistically between the two series is significant at $p=0.05$, substantiating the RMSE test, and inferring that the Gross NPAs of Chinese Banks in the period 2010 to 2019 is significantly lower than that of Indian Banks.

Variance Ratio Test (2000 to 2019): Gross NPA Ratio

For the period under study 2000 to 2019, we test the Null Hypothesis that the ratio = $sd(\text{India_GNPA}) / sd(\text{China_NPA}) = 1$. i.e. $H_0: \text{Ratio} = 1$. The test for alternative hypothesis ($H_a: \text{Ratio} < 1$) is found to be significant at $p=0.0001$, with $df=19$ and $f = 0.138$, thus rejecting the null and accepting the alternative $H_a: \text{Ratio} < 1$.

Variance Ratio Test (2010 to 2019): Gross NPA Ratio

For the period under study 2010 to 2019, We test the Null Hypothesis that the ratio = $sd(\text{India_GNPA}) / sd(\text{China_NPA}) = 1$. i.e. $H_0: \text{Ratio} = 1$. The test for alternative hypothesis ($H_a: \text{Ratio} > 1$) is found to be significant at $p=0.0001$, with $df=9$ and $f = 63.44$, thus rejecting the null and accepting the alternative $H_a: \text{Ratio} > 1$.

5.2. Bank Z-Score

The Z-score of a bank is a metric that reflects its comparative standing within its industry or market by measuring the deviation of its financial metrics from the mean of its peers, expressed in terms of standard deviations. It functions as a tool for evaluating the risk of insolvency or default and provides a quantitative assessment of the bank's stability and creditworthiness for purposes of informed financial decision making. In essence, the Z-score represents a crucial indicator of the financial health of a bank, facilitating the quantification of its solvency and risk profile.

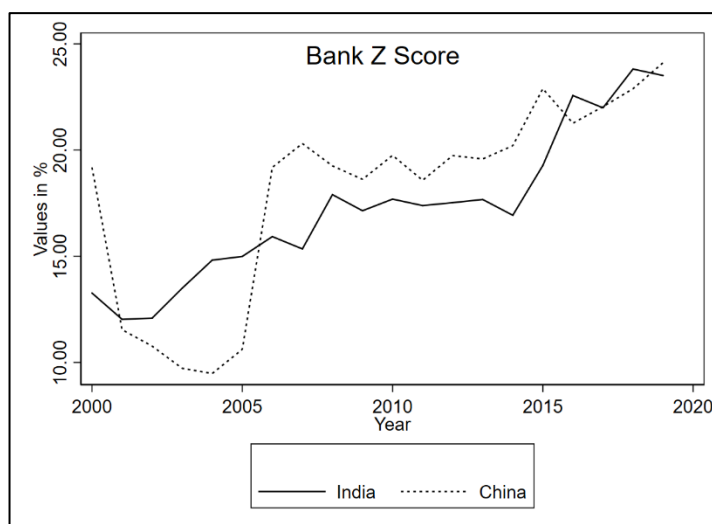


Figure 2

Figure 2, above shows the movement of the Bank Z Score Ratio of the Indian and Chinese Banks from 2000 to 2019. The chart shows that , the figure shows that the ratio for Chinese banks has been on the rise after 2005, whereas the Indian banks have a steady and increasing ratio during the period under the study.

Table 3: (2000 to 2019: 20 year period) Z-Score

Country	Correlation Coeff.	Root Mean		Std. Dev.	t-test
		Sq Error	Mean		
India	-	3.54	17.26	3.54	-
China	0.7775* (p= 0.0028)	4.73	17.98	4.733	t = -0.5434

The Pearson Correlation Coefficient between the Gross NPA Ratio (2000 to 2019) of Indian and Chinese Banks is 0.633, and is significant at p=0.05 level. The RMSE however for the two time series of the Ratio for India is around 3.51 while that of China is around 9.45. The t-test for testing the mean differences statistically between the two series bears no significance.

Table 4: (2010 to 2019: Latest 10 year period) Z-Score

Country	Correlation Coeff.	Root Mean		Std. Dev.	t-test
		Sq Error	Mean		
India	-	3.1	19.83	2.80	-
China	0.82* (p=0.0001)	.389	21.10	1.81	t = -1.20

The Pearson Correlation Coefficient between the Gross NPA Ratio (2010 to 2019) of Indian and Chinese Banks is 0.930, and is significant at p=0.05 level. The RMSE for the two individual time series for the Gross NPA Ratio for India is around 3.1 while that of China is around 0.39. The t-test for testing the mean differences statistically between the two series is significant at p=0.05, substantiating the RMSE test, and inferring that the Gross NPAs of Chinese Banks in the period 2010 to 2019 is significantly lower than that of Indian Banks.

Variance Ratio Test (2000 to 2019): Z-Score

For the period under study 2000 to 2019, We test the Null Hypothesis that the ratio = $sd(\text{India_Z Score}) / sd(\text{China_Z Score}) = 1$. i.e. $H_0: \text{Ratio} = 1$. The test is not found to be significant at p=0.05, with df=19 and f = 0.560, therefore the null cannot be rejected.

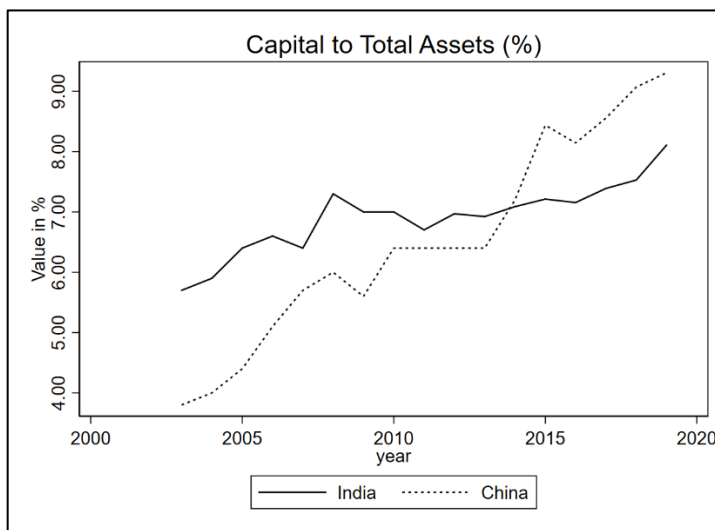
Variance Ratio Test (2010 to 2019): Z-Score

For the period under study 2010 to 2019, We test the Null Hypothesis that the ratio = $sd(\text{India_Z Score}) / sd(\text{China_Z Score}) = 1$. i.e. $H_0: \text{Ratio} = 1$. The test is not found to be significant at p=0.05, with df=19 and f = 2.4, therefore the null hypothesis cannot be rejected.

5.3. Capital to Total Assets Ratio

Capital to Total Assets Ratio provides a metric for evaluating the proportion of a bank's assets that are financed by its core capital, thereby indicating the bank's capacity to absorb potential losses and maintain solvency in the event of an economic downturn or financial crisis.

Figure 3



The graph labeled as Figure 3 displays the trend of the Capital to Total Assets Ratio for both Indian and Chinese banks from the year 2000 to 2019. The chart depicts that after 2005, the ratio for Chinese banks has experienced an upward trend, whereas the Indian banks have demonstrated a constant and upward progression in the ratio over the analyzed time period.

Table 5: (2003 to 2019: 17 year period) Capital to TA Ratio %

Country	Correlation Coeff.	Root Mean Sq Error	Mean	Std. Dev.	t-test
India	-	.389	6.90	.389	-
China	0.8946* (p= 0.0000)	1.719	6.52	1.719	t = 0.8627

The Pearson Correlation Coefficient between the Capital to TA Ratio (2003 to 2019) of Indian and Chinese Banks is 0.895, and is significant at p=0.05 level. The RMSE however for the two time series of the Ratio for India is around .389 while that of China is around 1.72. The t-test for testing the mean differences statistically between the two series bears no significance.

Table 6: (2010 to 2019: Latest 10 year period) Capital to TA Ratio %

Country	Correlation Coeff.	Root Mean Sq Error	Mean	Std. Dev.	t-test
India	-	.394	7.20	.394	-
China	0.868* (p=0.0001)	1.31	7.63	1.31	t = -1.06

The Pearson Correlation Coefficient between the Capital to TA Ratio (2010 to 2019) of Indian and Chinese Banks is 0.868, and is significant at $p=0.05$ level. The RMSE for the two time series of the Ratio for India is around .394 while that of China is around 1.31. The t-test for testing the mean differences statistically between the two series bears no significance.

Variance Ratio Test (2000 to 2019): Capital to Total Assets Ratio

For the period under study 2000 to 2019, We test the Null Hypothesis that the ratio = $\frac{sd(\text{India_Capital to TA})}{sd(\text{China_Capital to TA})} = 1$. i.e. $H_0: \text{Ratio} = 1$. The test is found to be significant at $p=0.05$, with $df=16$ and $f = 0.11$, therefore the null is rejected and we accept the alternative hypothesis that , $H_a: \text{ratio} < 1$ at $p=0.05$.

Variance Ratio Test (2010 to 2019): Capital to Total Assets Ratio

For the period under study 2000 to 2019, We test the Null Hypothesis that the ratio = $\frac{sd(\text{India_Capital to TA})}{sd(\text{China_Capital to TA})} = 1$. i.e. $H_0: \text{Ratio} = 1$. The test is found to be significant at $p=0.05$, with $df=09$ and $f = 0.0983$, therefore the null is rejected and we accept the alternative hypothesis that , $H_a: \text{ratio} < 1$ at $p=0.05$.

5.4. RCWA –Regulatory Capital to Risk Weighted Assets Ratio (%)

The Regulatory Capital to Risk Weighted Assets Ratio, commonly referred to as the Risk-Based Capital Ratio, is a metric employed in the evaluation of a bank's capital adequacy as per the regulations imposed by supervisory authorities such as the Basel Committee on Banking Supervision. This ratio is calculated through the division of the bank's regulatory capital, which encompasses both Tier 1 Capital and Tier 2 Capital, by its risk-adjusted assets.

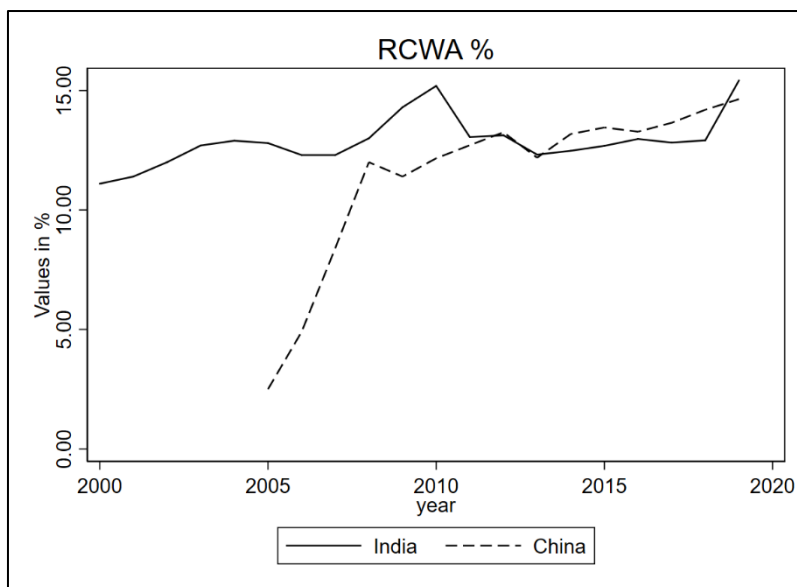


Figure 4

The figure of RCWA above clearly shows that the RCWA for Indian Banks has been constantly above the 10% mark for the entire duration from 2000 to 2019 and has been steady with little variations, whereas the RCWA for Chinese Banks has been on the rise since 2005 and has met the match of Indian Banks only around 2012.

Table 7: (2005 to 2019: 15 year period) RCWA %

Country	Correlation Coeff.	Root Mean			t-test
		Sq Error	Mean	Std. Dev.	
India	-	.992	13.17	.9929	-
China	0.3142 ($p= 0.2541$)	3.499	11.46	3.499	$t = 1.8294^*$

The Pearson Correlation Coefficient between the RCWA Ratio (2005 to 2019) of Indian and Chinese Banks is .315, and is not significant at $p=0.05$ level. The RMSE for the two time series of the Ratio for India is around .992 while that of China is around 3.5. The t-test for testing the mean differences statistically between the two series bears significance at $p=0.05$ level. The mean value of the RCWA for India is 13.17, which is higher than that of mean value for China at 11.46.

Table 8: (2010 to 2019: Latest 10 year period) RCWA %

Country	Correlation Coeff.	Root Mean Sq Error	Mean	Std. Dev.	t-test
India	-	1.0896	13.29	1.089	-
China	0.1849 ($p= 0.6091$)	.79061	13.27	.790	$t= 0.0634$

The Pearson Correlation Coefficient between the RCWA Ratio (2010 to 2019) of Indian and Chinese Banks is .185, and is not significant at $p=0.05$ level. The RMSE for the two time series of the Ratio for India is around 1.089 while that of China is around 0.79. The t-test for testing the mean differences statistically between the two series bears no significance.

Variance Ratio Test (2000 to 2019): RCWA

For the period under study 2000 to 2019, We test the Null Hypothesis that the ratio = $sd(\text{India_Capital to RCWA}) / sd(\text{China_RCWA}) = 1$. i.e. H_0 : Ratio = 1. The test is found to be significant at $p=0.05$, with $df=14$ and $f = 0.0805$, therefore the null is rejected and we accept the alternative hypothesis that , H_a : ratio < 1 at $p=0.05$.

Variance Ratio Test (2010 to 2019): RCWA

For the period under study 2010 to 2019, We test the Null Hypothesis that the ratio = $sd(\text{India_RCWA}) / sd(\text{China_RCWA}) = 1$. i.e. H_0 : Ratio = 1. The test is not found to be significant at $p=0.05$, with $df=9$ and $f = 1.89$, therefore the null hypothesis cannot be rejected.

5.5. PROVISIONS

The Concept of Provisions for Bad Loans, referred to as Allowances for Loan and Lease Losses, constitutes the reserves established by a financial institution to account for the expected shortfall in the repayment of loans extended as part of its credit portfolio. These provisions, functioning as a bulwark against credit risk, are determined through a meticulous evaluation of credit risk profiles and are reflected as expenses on the financial statements of the bank, thus reducing its net income.

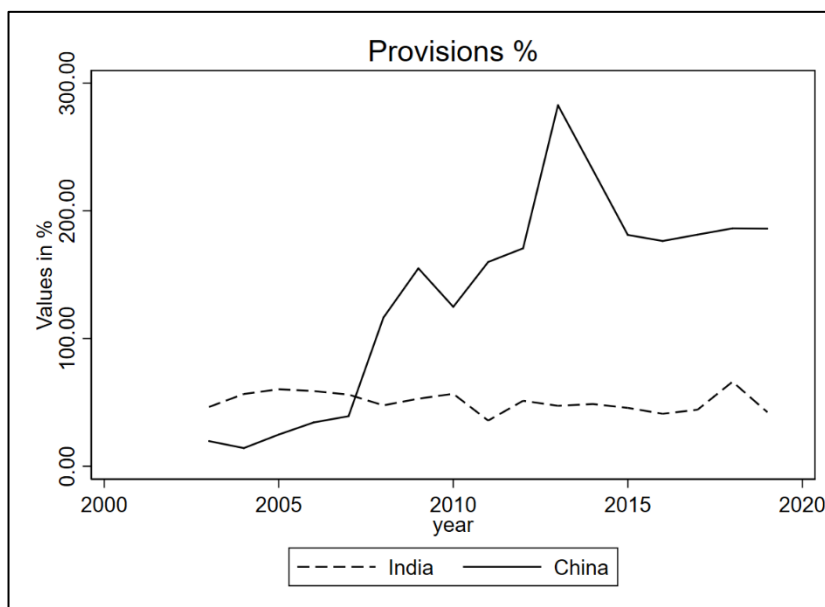


Figure 5

As depicted in the afore mentioned illustration, it is discernible that the provisions in Indian Banks have been stable, as indicated by the nearly level slope. It is curious to note that the trajectory of the time series for Chinese banks has exhibited an upward inclination after the year 2005, and notably, has surpassed the 100% threshold for a significant portion of the time frame under consideration.

Table 9: (2003 to 2019: 17 year period) Provisions %

Country	Correlation Coeff.	Root Mean Sq Error	Mean	Std. Dev.	t-test
India	-	7.895	50.489	7.895032	-
China	-0.4094 (p= 0.1027)	80.843	134.4249	80.84347	t = -4.2605

The Pearson Correlation Coefficient between the Provisions Ratio (2003 to 2019) of Indian and Chinese Banks is -0.40, and is not significant at p=0.05 level. The RMSE for the two time series of the Ratio for India is around 7.9 while that of China is around 80.8. The t-test for testing the mean differences statistically between the two series bears no significance at p=0.05 level. The mean value of the ratio for India is 50.5, which is lower than that of mean value for China at 134.43.

Table 10: (2010 to 2019: Latest 10 year period) Provisions %

Country	Correlation Coeff.	Root Mean Sq Error	Mean	Std. Dev.	t-test
India	-	8.604	47.94145	8.604035	-
China	-0.0590 (p= 0.8713)	42.451	188.1623	42.45144	t = t = -10.23*

The Pearson Correlation Coefficient between the Provisions Ratio (2010 to 2019) of Indian and Chinese Banks is -0.059; and is not significant at p=0.05 level. The RMSE for the two time series of the Ratio for India is around 8.6 while that of China is around 42.5. The t-test for testing the mean differences statistically between the two series bears significance at p=0.05 level. The mean value of the ratio for India is 47.9, which is lower than that of mean value for China at 188.16.

Variance Ratio Test (2000 to 2019): Provisions

For the period under study 2003 to 2019, We test the Null Hypothesis that the ratio = sd (India_ Provisions) / sd (China_ Provisions) =1. i.e. Ho: Ratio = 1. The test is found to be significant at p=0.05, with df=16 and f = 0.0095, therefore the null is rejected and we accept the alternative hypothesis that , Ha: ratio < 1 at p=0.05.

Variance Ratio Test (2010 to 2019): Provisions

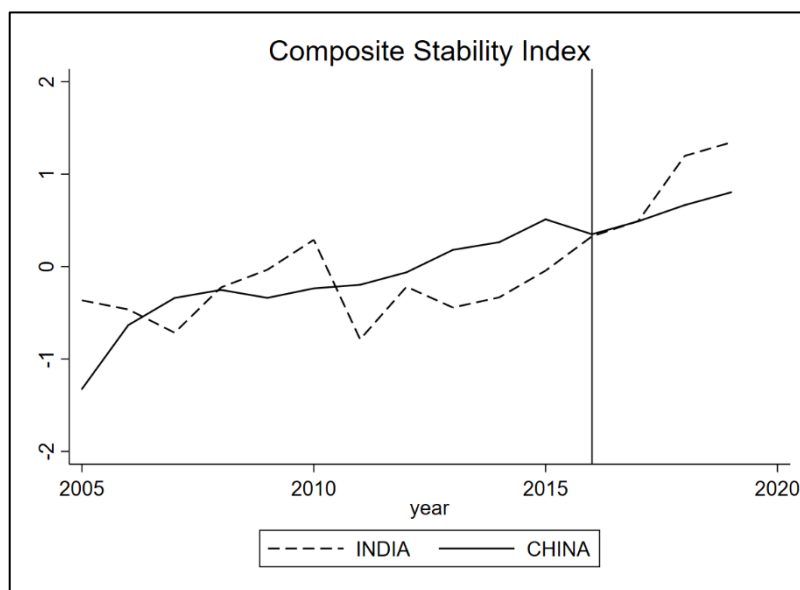
For the period under study 2010 to 2019, We test the Null Hypothesis that the ratio = sd (India_ Provisions) / sd (China_ Provisions) =1. i.e. Ho: Ratio = 1. The test is found to be significant at p=0.05, with df=9 and f = 0.0411, therefore the null is rejected and we accept the alternative hypothesis that , Ha: ratio < 1 at p=0.05.

Composite Stability Index

This data represents the composite index of financial stability for the banking sector in India. The index has been calculated by normalizing and combining five ratios that pertain to financial stability, as reported by the IBRD. These five ratios are Z-score, Nonperforming Loans to Gross Loans (%), Capital to Total Assets (%), Regulatory Capital to Risk-Weighted Assets (%), and Provisions of Non-Performing Assets (%). The data covers the period from 2005 to 2019 and the composite index has been calculated as a weighted average of these five ratios, with equal weights of 20%.

If the values in the series are increasing, it suggests that the financial stability of the sector is improving. i.e. If the slope is positive, it indicates that the composite index is increasing over time, implying improvement in the financial stability of the banking sector in India. If the slope is negative, it indicates that the composite index is decreasing over time, implying a decline in financial stability. A higher value of the composite index indicates a more stable financial sector.

Figure 6



The composite index values for India are in the data range from -0.79 to 1.34, indicating the level of financial stability of the banking sector in India over this period. The values of the composite index for China are between -1.325357 and 0.8031159. The Karl Pearson's Coeff. of Correlation between the two series is 0.66. The t-test for determining statistical significance between the two composite series is not established.

Findings and Discussions

1. The RMSE of the Gross NPA Ratio for Indian Banks and Chinese Banks show significant divergences in the movement of the two series. While for the entire time period of 20 years the RMSE of Indian Banks is lower (at around 3.5) and that of Chinese Banks (at around 9.45); in the latter 10-year period under study, the RMSE of Chinese banks is near to 0.39 and that of Indian banks is around 3.1. The variance of India's GNPA is significantly lower than the standard deviation of China's NPA for the period 2000 to 2019, however, for the period 2010 to 2019 the standard deviation of India's GNPA is significantly higher than the standard deviation of China's NPA. We infer that in the latter period under study the Gross NPAs of Chinese Banks have not only decreased significantly than Indian Banks, but they have also stabilised and show marked lower variances in movement.
2. For a 20 year period from 2000 to 2019, the RMSE of the Z Score of the two series are 3.54 and 4.73 for India and China respectively, with mean score of 17.26 and 17.98. the test of significance of the mean for the period is not significant. Graphical analysis also shows that the Z Score of both the countries have improved during the period with marked movement after 2005. The variance ratio test between the two countries Z Score also does not bear significant result inferring that the Z Scores of both the countries for the period 2000 to 2019 and later from 2010 to 2019 are statistically non-divergent. It is worth noting that however for the period from 2010 to 2019 the RMSE for India (3.1) and China (.389) and mean score India (19.83) and China (21.10) show marked improvement in China's Z Score, however still not statistically divergent than that of India.
3. The Capital to Total Assets data is available from 2004 to 2019. The analysis show that the said ratio for India for the period 2004 to 2019 has an RMSE of .389 and mean value of 6.90, while that of China has a RMSE of 1.72 and mean value of 6.52 for the period 2004 to 2019, however hypothesis test for mean does not show statistical significance. The values for the period 2010 to 2019 has an RMSE of .394 and mean of 7.20 for India and RMSE of 1.31 and mean of 7.63 for China. Overall the results do not show statistical divergence. Interestingly enough, the variance ratio test for two series from 2004 to 2019 and from 2010 to 2019 for India and China show statistical significance. The variance ratio value less than 1 being significant, inferring that the variation in the Capital to Assets

Ratio for India has been markedly lower than that of China. We infer that the Capital to Total Assets Ratio of India being steady than that of China.

4. For a 15 year period from 2005 to 2019, the RMSE of the RCWA of the two series are .992 and 3.5 for India and China respectively, with mean score of 13.17 and 11.46. The test of significance of the mean for the period is significant inferring that the RCWA mean score for India is significantly higher than that of China during the period. Graphical analysis also shows that the RCWA for India has not only been higher than that of China for most part of the period under study but it is also steady during the period. The variance ratio test between the two countries for RCWA bears significant result for the 15 year period inferring that the variance in the movement of RCWA for India has been lower than that of China inferring steadiness of Regulatory Capital requirements in Indian Banking Sector.
5. It is worth noting that as for the Provisions for bad loans in the two countries, there is marked divergence in percent terms. While the Indian banking sector has a steady Provisions percentage at about 50% (mean score) the values for Chinese banking sector is about 134% (mean score) during the 17 year period from 2003 to 2019. Also there is marked increase in Chinese banks provisions after 2006 as seen graphically.
6. The Composite Index to determine and analyse the overall stability of the Indian and Chinese Banks does not bear any statistical significance suggesting that the robustness of the banks in India and China may not have marked divergences, and we infer that the differences or disparities in the movements of the index for India and China may not be confirmed.

The high Gross NPA Ratio of Chinese Banks as compared to Indian Banks suggests that the management of the Chinese Banks needs to improve their loan management and risk assessment processes. The higher Z Score of Chinese Banks as compared to Indian Banks suggests that the management of Chinese Banks should focus on improving their capital adequacy and risk management strategies to increase the stability and robustness of their banks. The steady Capital to Total Assets Ratio of Indian Banks as compared to China suggests that the management of Indian Banks has been successful in maintaining a balance between the capital and risk, which can be seen as a positive signal for the management. The higher and steady RCWA of Indian Banks as compared to China suggests that the management of Indian Banks has been successful in maintaining the regulatory capital requirements, which is critical for the stability of the banking sector. The higher Provisions for bad loans in Chinese Banks as compared to Indian Banks suggests that the management of Chinese Banks needs to improve their loan management and risk assessment processes.

Conclusions

The findings from the analysis of the Gross NPA Ratio, Z Score, Capital to Total Assets, RCWA and Provisions for bad loans suggest that there are differences in the stability and robustness of the Indian and Chinese Banks. The RMSE and mean score for the Gross NPA Ratio of Indian Banks shows a significant improvement compared to the Chinese Banks for the period 2010 to 2019. The Z Score for both countries has improved over the years, however, the improvement in the Chinese Banks is more significant. The Capital to Total Assets Ratio for India is more steady compared to China, and the RCWA of Indian Banks is higher and more steady compared to the Chinese Banks. The Provisions for bad loans in Indian Banks are significantly lower compared to the Chinese Banks. However, the Composite Index to determine the overall stability of the Indian and Chinese Banks does not show any statistical significance.

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