

APPLICATION OF TOPSIS METHOD FOR FINANCIAL PERFORMANCE EVALUATION: A STUDY OF SELECTED SCHEDULED BANKS IN BANGLADESH

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Abstract *The main objective of our study is to analyze the financial performance of select scheduled banks (namely, the state-owned commercial banks, private commercial banks and foreign commercial banks) in Bangladesh during the period 2000-2013 with the help of TOPSIS (i.e., Technique for Order Preference by Similarity to an Ideal Solution). In the context of banking sector in Bangladesh, the broad classification of ratios/indicators has been done with the help of the methodology of Bangladesh Institute of Bank Management [Bank-Reviews, (2012-2013)]. After computing all category wise ratios/indicators (i.e., profitability and efficiency ratios, size and growth indicators, strength and soundness ratios and asset quality ratios) for all the select nineteen banks during the study period, the weights of the selected ratios/indicators have been calculated with the help of Shannon entropy method. Composite index values of the select banks have been determined on the basis of TOPSIS and from major findings of the present research work it can be concluded that the profitability, efficiency, strength and soundness, size and growth and asset quality positions of foreign commercial banks and private commercial banks are better than those of state-owned commercial banks.*

Keywords: *Financial Performance, Shannon Entropy, TOPSIS*

INTRODUCTION

Banking industry in Bangladesh up till now is leading the financial system [Samina and Alam, (2011)] and according to Siddique and Islam (2001), banking sector of Bangladesh is one of the major sectors that contribute significantly to the national economy. After the independence in 1971, the banking industry in Bangladesh started its voyage with six nationalized commercial banks, two state-owned specialised banks and three foreign Banks. Central bank of Bangladesh renamed as the “Bangladesh Bank” fully controls, supervises and regulates the other banks of the country under the Bangladesh Bank order, 1972 and Bank Company Act, 1991 (Amended in 2003). Bangladesh Bank (BB), as the central bank, assesses the overall financial performance of the banking system in order to find out the strength and weakness as well as the safety and soundness of each individual banking company as a whole [Iqbal, (2012)]. At present the banking industry of Bangladesh is diverse, comprising of state-owned commercial banks, private commercial banks, foreign commercial banks, specialised banks and Islamic banks. Many efforts have been made to assess the financial performance of these banks. According to Bhunia, Mukhuti and Roy (2011), ‘Financial performance analysis is the process

of determining the operating and financial characteristics of a firm from accounting and financial statements. The goal of such analysis is to determine the efficiency and performance of firm’s management, as reflected in the financial records and reports’. Understanding the financial performance of banks requires a broad knowledge about the profitability, liquidity and efficiency position of the banks. Indeed, the performance evaluation of commercial banks is especially important today due to severe competition. The banking industry in Bangladesh has been experiencing a major transition for the last two decades. It has become imperative for banks to tolerate the pressure coming from both domestic and external factors and still prove to be financially viable. [Islam *et al.* (2014)]. However, it is very difficult to compute the overall financial performance, (i.e., rank of the organization) due to different performance dimensions (i.e., profitability, liquidity and efficiency positions) that provide different results but are contrasting. In such scenario, TOPSIS (i.e., Technique for Order Preference by Similarity to an Ideal Solution) method plays a vital role for evaluating the overall financial performance of the organization. According to Ridvan and Yigider (2014), “TOPSIS method is a process of determining the rank of the alternative with respect to their distances and has also been applied in many areas relying on computer support to overcome evaluation

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problems under a finite number of alternatives”. According to Zanakis, Solomon, Wishart and Dubliss (1998), ‘TOPSIS method is one of the best methods for calculating the rank of the organization’. TOPSIS method can be applied in any sector and is very helpful procedure for decision making situation for a business manager. Kazan and Ozdemir (2014) opined, ‘TOPSIS is a very easy method to apply and it has the capability of providing the evaluation of the index i.e., creating the performance assessment of the index by using different criteria’. Keeping this in mind evaluation of the financial performance of selected scheduled banks in Bangladesh is made using TOPSIS analysis.

SURVEY OF LITERATURE

MODM (Multiple Objective Decision Making) approach was first used in operations research and decision theory areas in 1970's, and later on, it was applied to the finance sector as well. In the MODM environment, the TOPSIS can be employed to judge the financial performance of any business unit. Demireli (2010) investigated performance of public sector banks operating in Turkey for the period 2001-2007, by using TOPSIS method with the help of 10 most commonly used ratios. Akyuz et al. (2011) evaluated financial performance of an ISE-listed ceramics company over the period of 1999-2008 by using TOPSIS method on nineteen financial ratios. Gundogdu (2015) analyzed the overall financial performance of foreign banks in Turkey for a 10 years period ranging from 2003 to 2013 with the help of multiple decision matrix TOPSIS method. The author highlighted that Deutsche Bank's financial performance was the highest among the foreign banks operating in Turkey during the period 2003 to 2009 and due to global financial crisis the Turkland and Burgan Bank were the lowest performers in Turkey. Tunay and Akhisar (2015) evaluated the financial performance of the private banks operating in Turkey by using TOPSIS method during the period 2009 to 2013. The authors recommended that, in order to prevent the bank's failure, a large bank was needed to maintain a higher capital adequacy ratio than a smaller bank. Jaksic *et al.* (2016) assessed the financial performance of the banking industry in Serbia with the help of new fuzzy multi criteria decision making (FMCDM) model. For determining the weights of the financial performance evaluation, the authors used FAHP (Fuzzy analytic hierarchy process) and FTOPSIS (Fuzzy technique for order preference by similarity to an ideal solution) method in order to find the ranks of the banks. The authors remarked that the new fuzzy multi criteria model was very useful for banks to improve their management process, organizational structure and market position. Konak and Celik (2016) determined the financial performance of 28 commercial banks, i.e., 3 public banks, 11 private banks and 14 foreign banks in Turkey during the period 2009 to 2014. For statistical analysis the authors used

multi criteria decision making (MCDM) method as well as TOPSIS approach. The authors revealed that banks which were operating all around in Turkey got affected from global financial crisis in the period of 2008 and still now there were continuous fluctuations in their performance points. Oral (2016) measured the financial performance of ten privately owned deposit banks in Turkey by using TOPSIS between the periods 2012 to 2014. The author used 10 financial ratios for evaluating the performance of banks and based on the computed results the rank of each private bank was calculated. Rezaei and Ketabi (2016) evaluated the financial performance of 21 Iranian private banks through FAHP and TOPSIS analysis during the year 2015. The authors focused that Mellat, Saderat Iran and Tejarat were the highest ranking banks and Resalat, Hekmat Iranian and Khavarmianeh were the lowest ranking banks among the others private banks operating in Iran. To the best of our knowledge, there exists no study that examined the financial performance of select scheduled banks in Bangladesh based on TOPSIS. In this paper we have ranked the select scheduled banks in Bangladesh by using TOPSIS method on the basis of twenty five ratios during the period 2000-2013.

OBJECTIVE

The main objective of our study is to analyze the financial performance of select scheduled banks (namely, the state-owned commercial banks, private commercial banks and foreign commercial banks) in Bangladesh during the period 2000-2013 with the help of TOPSIS.

HYPOTHESES

The main hypothesis of the study is that the financial performances of the foreign commercial banks and private commercial banks are better than the state-owned commercial banks.

DATABASE AND METHODOLOGY

For the purpose of the study, three state-owned commercial banks (i.e., Sonali Bank Ltd., Agrani Bank Ltd. and Janata Bank Ltd.), twelve private commercial banks [i.e., Pubali Bank Ltd., IFIC (International Finance Investment and Commerce) Bank Ltd., The City Bank Ltd., AB Bank Ltd., National Bank Ltd., Dutch Bangla Bank Ltd., Eastern Bank Ltd., Dhaka Bank Ltd., NCC (National Credit and Commerce) Bank Ltd., Southeast Bank Ltd., Prime Bank Ltd. and United Commercial Bank Ltd.] and four foreign commercial banks (i.e., Citi Bank, N.A., Habib Bank Ltd., Standard Chartered Bank and State Bank of India) have also been selected for the purpose of the study from the scheduled banks in Bangladesh during the period of 2000 to 2013.

The basic data required for analysis are: net profit after tax, total assets, total equity, operating expenses, total revenue, total employees, operating revenue, interest income, interest expense, average total assets, investment income, investment, interest bearing liabilities, cash in hand and at banks, total deposits, total loans and advances, classified loans, provision against classified loans, borrowed liabilities, total liabilities, liquid assets, short term liabilities and total loans and advances. These data have been collected for a period of 14 years from 2000 to 2013 from the annual reports of all the selected nineteen scheduled banks in Bangladesh.

In the present study four wide categories of ratios/indicators, namely, profitability and efficiency ratios, size and growth indicators, strength and soundness ratios and asset quality ratios have been used for determining the financial performance of selected scheduled banks in Bangladesh. In the context of banking sector in Bangladesh, the broad classification of ratios/indicators has been done with the help of the methodology of Bangladesh Institute of Bank Management [Bank-Reviews, (2012-2013)]. Accordingly, twelve profitability and efficiency ratios, namely Return on Assets (ROA) ratio, Return on Equity (ROE) ratio, Total expense to total revenue ratio, Profit per employee ratio, Net profit margin ratio, Net interest margin ratio, Asset utilization ratio, Interest spread ratio, Cash ratio, Loans to assets ratio, Loans to deposit ratio and Temporary investment ratio have been computed. The following six size and growth indicators/ratios have been calculated: Total revenue indicator, Total asset indicator, Total deposit growth ratio, Total advance growth ratio, Net profit growth ratio and Net interest income growth ratio. The following four ratios have been used for measuring strength and soundness of banks: Non-performing loan (NPL) to equity ratio, borrowing liability to total liability ratio, Liquid assets to short term liabilities ratio and Advance deposit ratio. Three ratios, viz. Growth in gross NPL ratio, Gross NPL to total advances ratio and Credit concentration by loan size ratio have been computed for judging the asset quality of the banks.

After computing all the category wise ratios/indicators (i.e., profitability and efficiency ratios, size and growth indicators, strength and soundness ratios and asset quality ratios) for all the selected nineteen banks during the study period, the weights of the selected ratios/indicators have been calculated with the help of Shannon entropy method. Shannon entropy method is very vital for calculating the weights of the ratios/indicators under MCDM approach. The entropy method estimates the weights of the various criteria from the given payoff matrix and is independent of the views of the decision maker [Retrieved from http://shodhganga.inflibnet.ac.in/bitstream/10603/2896/12/12_chapter%205.pdf].

After computing the weights of the selected ratios/indicators through Shannon entropy method the composite index values

of the selected banks have been determined. The procedures of TOPSIS method are as follows:

Step 1: In this step we have calculated the normalized decision matrix (r_{ij}) for each select bank with the help of the following formula.

$$r_{ij} = x_{ij} / \sqrt{\sum_{j=1}^m x_{ij}^2}, \forall_{i,j} \quad i = 1, 2, \dots, n \quad (n = \text{Total number of ratios/indicators})$$

And $j = 1, 2, \dots, m$ ($m = \text{Total number of banks}$).

Step 2. After that, we computed the weighted normalized decision matrix (v_{ij}) by using the following formula.

$$v_{ij} = w_i \cdot r_{ij}, \forall_{i,j}; i = 1, 2, \dots, n$$

And $j = 1, 2, \dots, m$ where w_i is the weight of the j^{th} criterion or attribute and $\sum_{i=1}^n w_i = 1$

Step 3. We measured the positive ideal and negative ideal solution by using the following formula.

$$A^+ = \{v_1^+, \dots, v_m^+\} = \text{Positive ideal solution,}$$

$$\text{Where } v_i^+ = \{(i^{\max} v_{ij} \mid j \in C_b), (i^{\min} v_{ij} \mid j \in C_c)\}$$

$$A^- = \{v_1^-, \dots, v_m^-\} = \text{Negative ideal solution,}$$

$$\text{Where } v_i^- = \{(i^{\min} v_{ij} \mid j \in C_b), (i^{\max} v_{ij} \mid j \in C_c)\}$$

Where, C_b is associated with benefit criteria and C_c is associated with cost criteria.

Step 4. We determined the separation measures (positive ideal and negative ideal separation) with the help of the m -dimensional Euclidean distance. The separation of each alternative from the positive ideal solution is given as:

$$S_i^+ = \sqrt{\sum_{j=1}^m (v_{ij} - v_j^+)^2}, \forall_{i,j}, j = 1, 2, \dots, m$$

Similarly, the separation from the negative-ideal solution is given as:

$$S_i^- = \sqrt{\sum_{j=1}^m (v_{ij} - v_j^-)^2}, \forall_{i,j}, j = 1, 2, \dots, m$$

Step 5. The relative closeness to the ideal solution (PC_i) has been calculated based on the positive ideal and negative ideal solution for each select bank. The formula is given below.

$$CI_i = \frac{S_i^-}{S_i^+ + S_i^-}, \forall_{i,j}, 0 \leq (CI_i) \leq 1$$

$(CI_i) = 1$ indicates the closeness to the positive ideal solution and $(CI_i) = 0$ expresses the closeness to the negative ideal solution.

Step 6. In the end the rank of the banks was computed according to the preference order of the composite index value (CI_i) whereas the larger composite index value reveals the first position and smaller value exposes the last position.

Analysis and Interpretation

For determining the weights of all selected ratios/indicators, they were normalized by computing profitability and efficiency ratios, size and growth indicators, strength and soundness ratios and asset quality ratios through UNDP (United Nations Development Programme) data driven method. After that the weights of these ratios/indicators of select scheduled banks were calculated by using Shannon entropy method over the study period. The weights were calculated on the basis of all select ratios/indicators and category wise ratios/indicators and the computed results of weights of all select ratios/indicators are reported in Table 1. The highest weight was found for return on equity (ROE) ratio among the sample ratios/indicators, followed by asset utilization ratio. The same weights were noticed for the ratios, namely, return on assets (ROA), total expense to total revenue, net interest margin, interest spread, loans to assets, and net interest income growth ratios. The low weight was observed for net profit growth ratio during the period under study.

In order to determine the rank of the selected scheduled banks TOPSIS analysis was used after calculating the weights of the ratios/indicators of selected scheduled banks through Shannon entropy method over the study period 2000

to 2013. According to TOPSIS analysis, the best alternative would be the one that is nearest to the positive ideal solution and farthest from the negative ideal solution (Benitez, Martin and Roman, 2007). The positive ideal solution reveals the highest value and the negative ideal solution exposes the lowest value of the respective ratios/indicators of each bank. The computed results of positive ideal solution (S^+), negative ideal solution (S^-), composite index and rank for all select ratios/indicators of selected scheduled banks have been reported in Table 2.

Among the banks, it was observed from Table 2 that the best performance in terms of profitability and efficiency, size and growth, strength and soundness and asset quality conditions, was found to be Standard Chartered Bank as its composite index was highest. It implies that Standard Chartered Bank was very successful in its performance during the period under study. Citi Bank, N.A. obtained the second rank amongst the other banks for the study period. According to the ranks of the composite index, it was found that the third best performance was of Prime Bank Ltd., followed by Dutch Bangla Bank Ltd., State Bank of India, Pubali Bank Ltd. and Southeast Bank Ltd. The performances of Dhaka Bank Ltd., Habib Bank Ltd., Eastern Bank Ltd. and NCC Bank Ltd. were better than the remaining banks for the whole study period. As per the ranks of the composite index, it may be said that, the positions of United Commercial Bank Ltd., National Bank Ltd., AB Bank Ltd., The City Bank Ltd., IFIC Bank Ltd., Janata Bank Ltd. and Sonali Bank Ltd. were not up to the mark over the study period. As per this study, the performance of Agrani Bank Ltd. was not good enough and it obtained the lowest rank amongst the banks.

Table 1: Results of Weights Based on Shannon Entropy Method for all Select Ratios/Indicators of the Banks

Ratios/Indicators	Weights
Return on Assets(ROA)	0.047
Return on Equity(ROE)	0.050
Total Expense to Total Revenue	0.047
Profit per Employee	0.040
Net Profit Margin	0.030
Net Interest Margin	0.047
Asset Utilization	0.049
Interest Spread	0.047
Cash Ratio	0.033
Loans to Assets Ratio	0.047
Loans to Deposit Ratio	0.046
Temporary Investment Ratio	0.045
Total Revenue	0.046
Total Asset	0.041
Total Deposit Growth	0.044
Total Advance Growth	0.046

Ratios/Indicators	Weights
Net Profit Growth	0.018
Net Interest Income Growth	0.047
NPL to Equity Ratio	0.026
Borrowing Liability to Total Liability	0.029
Liquid Assets to Short term Liabilities	0.039
Advance Deposit Ratio	0.045
Growth in Gross NPL	0.024
Gross NPL to Total Advances	0.032
Credit Concentration by Loan Size	0.035

Table 2: Results of TOPSIS Analysis-Ranking of the Banks According to the Composite Index Based on all Select Ratios/Indicators During the Period 2000-2013

Bank Name	Positive Ideal (S^+)	Negative Ideal (S^-)	Composite Index(CI)	Rank
Citi Bank, N.A.	0.042	0.075	0.640	2
Habib Bank Ltd.	0.058	0.060	0.511	9
Standard Chartered Bank	0.039	0.079	0.671	1
State Bank of India	0.057	0.063	0.524	5
Sonali Bank Ltd.	0.073	0.054	0.424	18
Agrani Bank Ltd.	0.077	0.040	0.342	19
Janata Bank Ltd.	0.061	0.054	0.472	17
Pubali Bank Ltd.	0.055	0.059	0.514	6
IFIC Bank Ltd.	0.061	0.055	0.476	16
The City Bank Ltd.	0.059	0.055	0.482	15
AB Bank Ltd.	0.059	0.056	0.490	14
National Bank Ltd.	0.057	0.056	0.494	13
Dutch Bangla Bank Ltd.	0.053	0.064	0.546	4
Eastern Bank Ltd.	0.058	0.059	0.505	10
Dhaka Bank Ltd.	0.056	0.059	0.511	8
NCC Bank Ltd.	0.058	0.058	0.501	11
Southeast Bank Ltd.	0.056	0.060	0.514	7
Prime Bank Ltd.	0.052	0.063	0.549	3
United Commercial Bank Ltd.	0.057	0.057	0.497	12

Notes: CI = Composite index based on profitability and efficiency, size and growth, strength and soundness and asset quality conditions, S^+ = Positive ideal solution and S^- = Negative ideal solution

CONCLUSION

From the major findings of the present research work it can be concluded that as per the composite index of the profitability, efficiency, strength and soundness, size and growth and asset quality positions, foreign commercial banks (*viz.*, Standard Chartered Bank, Citi Bank, N.A., State Bank of India, etc.) and private commercial banks (namely, Prime Bank Ltd, Dutch Bangla Bank Ltd., Pubali Bank Ltd., Southeast Bank Ltd, United Commercial Bank Ltd., National Bank Ltd., AB Bank Ltd., etc.) have been performing better than

those of state-owned commercial banks (Janata Bank Ltd., Sonali Bank Ltd., Agrani Bank Ltd.) in Bangladesh during the study period. The present study is very helpful for the retail customers who are going to invest their small savings in different banks for their livelihood purposes. The overall ranking decision of TOPSIS also has implication to the investors for their investment decisions in banking sector of Bangladesh. Besides, the study of TOPSIS analysis provides information regarding an overall position of any bank to the policy makers for adopting future strategies. However, the TOPSIS method for all categories of banks along with the

other methods like fuzzy analytic hierarchy process (FAHP) and FTOPSIS (Fuzzy technique for order preference by similarity to an ideal solution) method can be applied to get better results in the banking sector of Bangladesh. These are left for future studies.

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