

Comparative Analysis of the Profitability Aspects of Banks using Fuzzy Logic based Multi Criteria Decision Making method

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Abstract— Whether it is the manufacturing or service industry, data analytics plays a pivotal role in generating professional validated reports that aid in the smooth functioning with reduced operation costs. In fact, while retrieving the data for the customized reports generation, the application of an appropriate multi criteria decision making(MCDM) tool gives fruitful results which are of much useful in corporate decision making. Every organization has to accomplish its goal and banks are nowadays struggling and starving to make profit by effectively trying to utilize all the resources. Banks, being an important service sector, employ people , assign role and utilize properly to accomplish the overall objective. This paper has attempted to evaluate , analyze and rank the Indian banks using an MCDM technique named fuzzy logic decision making method with a specific focus/objective of maximizing the profit and considering many parameters/criteria and moreover a comparative study on the financial performance of the Indian banks is made between the year 2011 and 2015 as this seems out to be the period where there was a rapid growth in the banking sector of India and revolutionary change in the financial performance of the banks .

Our paper has scientifically ranked the banks considering the profitability of the banks and using non interest income (NII) as it is one of the the major influencing factors for high profitability in all banks . The paper also highlights interesting findings regarding the profit maximization over the years and analysis about the current marketing challenges.

Keywords—Multi-criteria decision making , Fuzzy logic, Non interest income

I. INTRODUCTION

In recent years , the banking industry is undergoing a rapid transformation in the global economy . Internationally accepted prudential norms have been adopted, with higher disclosures and transparency. Indian banking industry is gradually moving towards adopting the best practices in accounting, corporate governance and risk management. The deepening of information technology has facilitated better tracking and fulfilment of commitments with multiple delivery channels for online customers . The Indian banking has welcomed this change . The country witnessed branch expansion in public sector banks , private sector banks and foreign banks in absolute term during the period 2010-2011. The basic principle of branch expansion is to tap deposit and culminate saving habit among the community . Tapping of potential savings and uses them for a productive purpose in

particular , is the main objective . Upgradation of technology , innovation and mordernization are the key factors of having excellence in banking sector . But still the banking sector faces the issues like consolidation , management of costs , credit delivery systems , and management of sticky assets .

II. BANKING SECTOR

The banking sector is the section of the economy devoted to the holding of financial assets for others, investing those financial assets as leverage to create more wealth, and the regulation of those activities by government agencies .

Banking in India in the modern sense originated in the last decades of the 18th century. Among the first banks were the Bank of Hindustan, which was established in 1770 and liquidated in 1829-32; and the General Bank of India, established in 1786 but failed in 1791. In the early 1990s, the then government embarked on a policy of liberalisation, licensing a small number of private banks. These came to be known as *New Generation tech-savvy banks*, and included Global Trust Bank (the first of such new generation banks to be set up), which later amalgamated with Oriental Bank of Commerce, UTI Bank (since renamed Axis Bank), ICICI Bank and HDFC Bank. Since then the performance of the banks improved ^[5] . Initially pioneered by financial institutions during the 1970s as interest rates became increasingly volatile, **asset and liability management** (often abbreviated ALM) is the practice of managing risks that arise due to mismatches between the assets and liabilities. The process is at the crossroads between risk management and strategic planning^[8,9]. It is not just about offering solutions to mitigate or hedge the risks arising from the interaction of assets and liabilities but is focused on a long-term perspective: success in the process of maximising assets to meet complex liabilities may increase profitability.

III. FUZZY LOGIC

The concept of fuzzy logic was coined by Lofti Zadeh in 1965. It helps us to unravel the quantum of uncertainty associated with events . It is essential to realize that fuzzy logic uses truth degrees as a mathematical model of the vagueness phenomenon while probability is a mathematical model of ignorance.

IV. FUZZY DECISION MAKING METHOD

Fuzzy Multicriteria Decision-Making addresses theoretical and practical gaps in considering uncertainty and multicriteria factors encountered in the design, planning, and control of complex systems. Fuzzy Multicriteria Decision-Making will appeal to a wide audience of researchers and practitioners in disciplines where decision-making is paramount, including various branches of engineering, operations research, economics and management. Most decisions that people make are logical decisions, they look at the situation and make a decision based on the situation. The generalized form of such a decision is called a generalized modus ponens. If we knew about the states of future with certainty there is no problem. But in most cases it is not so. So we use of classical Bayesian decision method.

Fuzzy logic decision making is based on the following equation,

$$\mu = \sum W_i \mu_i$$

where i = 1 to n
 W_i – weightings

μ_i – Membership grade for each individual input
 μ - Output membership grade

V. BANKING DATA AND ANALYSIS

Banking data : The following data are collected from the IBA bulletin

Table 1 : Public Sector Banks in ten millions (2015)
 The Public Sector Banks in India as per IBA Bulletin is shown below .

Analysis : The performance of the banks are evaluated^[10] using fuzzy tool as follows

As per the procedures of Fuzzy logic decision making (Timothy J. Ross), goals and constraints are considered . The following table reveals the performance of various banks , comparison of Fuzzy scores of Public Sector Banks for the year 2011 and 2015 (major revolution era) is also shown

| S.No | Banks | Net Profit | Non interest Income | Total Expenditure | Profit Per Employee | Fuzzy scores (2015) | Fuzzy scores (2011) |
|------|---------------------------|--------------------|---------------------|-------------------|---------------------|---------------------|---------------------|
| I | NATIONALISED BANKS | 2015 | 2015 | 2015 | 2015 | 2015 | 2011 |
| 1 | Allahabad Bank | 621 | 1,996 | 17,252 | 2.56 | 0.040 | 0.0866 |
| 2 | Andhra Bank | 638 | 1,500 | 14,570 | 3.00 | 0.041 | 0.0567 |
| 3 | Bank of Baroda | 3,398 | 4,402 | 37,450 | 6.88 | 0.191 | 0.1775 |
| 4 | Bank of India | 1,709 | 4,233 | 40,175 | 7.00 | 0.113 | 0.1669 |
| 5 | Bank of Maharashtra | 451 | 1,006 | 11,316 | 3.00 | 0.029 | 0.0336 |
| 6 | Canara Bank | 2,703 | 4,550 | 41,350 | 5.00 | 0.179 | 0.1776 |
| 7 | Central Bank of India | 606 | 1,894 | 24,744 | 1.53 | 0.039 | 0.0800 |
| 8 | Corporation Bank | 584 | 1,482 | 18,011 | 3.25 | 0.038 | 0.0794 |
| 9 | Dena Bank | 265 | 721 | 10,155 | 1.95 | 0.017 | 0.0338 |
| 10 | Indian Bank | 1,005 | 1,363 | 14,203 | 4.95 | 0.058 | 0.0747 |
| 11 | Indian Overseas Bank | -454 | 2,139 | 22,755 | negative | 0.039 | 0.0774 |
| 12 | Oriental Bank of Commerce | 778 | 2,121 | 17,856 | 2.46 | 0.051 | 0.0607 |
| 13 | | Punjab & Sind Bank | 121 | 429 | 8,242 | 1.00 | 0.0074 |
| 14 | Punjab National Bank | 3,062 | 5,891 | 40,251 | 5.00 | 0.203 | 0.2283 |
| 15 | Syndicate Bank | 1,523 | 2,110 | 19,717 | 5.55 | 0.091 | 0.0578 |
| 16 | UCO Bank | 1,138 | 2,004 | 16,452 | 4.82 | 0.075 | 0.0584 |
| 17 | Union Bank of India | 1,782 | 3,523 | 29,783 | 5.00 | 0.118 | 0.1289 |
| 18 | United Bank of India | 256 | 1,747 | 9,499 | 15.98 | 0.016 | 0.0403 |
| 19 | Vijaya Bank | 439 | 879 | 11,893 | 3.00 | 0.028 | 0.0336 |
| II | State Bank of India (SBI) | 13,102 | 22,576 | 136,059 | NA | 0.301 | 0.3219 |

| | | | | | | | |
|-----|--------------------------------|-------|-------|--------|------|---------|--------|
| III | ASSOCIATES OF SBI | | | | | | |
| 1 | State Bank of Bikaner & Jaipur | 777 | 926 | 7,828 | 6.00 | 0.039 | 0.0404 |
| 2 | State Bank of Hyderabad | 1,317 | 1,325 | 12,235 | 8.29 | 0.057 | 0.0622 |
| 3 | State Bank of Mysore | 409 | 768 | 6,377 | 4.00 | 0.026 | 0.0288 |
| 4 | State Bank of Patiala | 362 | 1,007 | 9,759 | 2.00 | 0.023 | 0.0477 |
| 5 | State Bank of Travancore | 336 | 1,015 | 9,211 | 3.00 | 0.021 | 0.0367 |
| IV | Other Public Sector Banks | | | | | | |
| 1 | IDBI Ltd. | 873 | 4,008 | 26,434 | NA | 0.057 | 0.1354 |
| 2 | Bharatiya Mahila Bank | 20 | 19 | 106 | 0.05 | 0.00004 | N.A |

Table 2 : Private Sector Banks in ten millions (2015)
The Private Sector Banks in India as per IBA Bulletin , is shown below .

| S.No | Banks | Net Profit | Non interest Income | Total Expenditure | Profit Per Employee | Fuzzy scores (2015) | Fuzzy scores (2011) |
|------|-------------------------------|------------|---------------------|-------------------|---------------------|---------------------|---------------------|
| | | 2015 | 2015 | 2015 | 2015 | | |
| 1 | City Union Bank Ltd. | 395.02 | 404.10 | 2,410.31 | 9.00 | 0.28 | 0.2397 |
| 2 | ING Vysya Bank Ltd. | N.A. | N.A. | N.A. | N.A. | 0.5 | 0.4571 |
| 3 | Tamilnad Mercantile Bank Ltd. | 379.40 | 291.88 | 2,520.05 | 9.21 | 0.19 | 0.2870 |
| 4 | The Catholic Syrian Bank Ltd. | (53.17) | 127.34 | 1,621.81 | -1.78 | 0.002 | 0.0195 |
| 5 | Dhanlaxmi Bank Ltd | (241.47) | 84.95 | 1,351.96 | -10.60 | 0.11 | 0.0423 |
| 6 | The Federal Bank Ltd. | 1,005.75 | 878.31 | 6,669.99 | 9.38 | 0.64 | 0.7326 |
| 7 | The Jammu & Kashmir Bank Ltd. | 508.00 | 593.00 | 5,819.00 | 5.48 | 0.38 | 0.5572 |
| 8 | The Karnataka Bank Ltd. | 451.00 | 507.00 | 4,432.00 | 6.00 | 0.333 | 0.3333 |
| 9 | The Karur Vysya Bank Ltd. | 455.61 | 580.84 | 5,033.42 | 6.45 | 0.339 | 0.4031 |
| 10 | The Lakshmi Vilas Bank Ltd. | 132.29 | 284.03 | 2,122.13 | 3.82 | 0.06 | 0.1642 |
| 11 | Nainital Bank Ltd. | 67.18 | 49.20 | 451.35 | 9.00 | 0.01 | 0.0168 |
| 12 | RBL Bank | 207.17 | 403.41 | 1,996.37 | 6.00 | 0.13 | 0.0244 |
| 13 | The South Indian Bank Ltd. | 307.20 | 497.07 | 4,901.29 | 4.00 | 0.21 | 0.3007 |
| II | NEW PRIVATE SECTOR BANKS | | | | | | |
| 14 | Axis Bank Ltd. | 7,357.82 | 8,365.04 | 30,458.21 | 17.07 | 0.603 | 0.6577 |
| 15 | Development Credit Bank Ltd. | 191.18 | 165.72 | 1,310.69 | 6.00 | 0.147 | 0.0046 |
| 16 | HDFC Bank Ltd. | 10,215.92 | 8,996.34 | 40,061.78 | 10.00 | 0.144 | 0.3528 |
| 17 | ICICI Bank Ltd. | 11,175.35 | 12,176.13 | 41,547.36 | 16.00 | 0.138 | 0.4787 |
| 18 | Indusind Bank Ltd. | 1,793.72 | 2,403.87 | 8,997.62 | - | 0.047 | 0.1074 |
| 19 | Kotak Mahindra Bank Ltd. | 1,866.00 | 2,028.00 | 8,750.00 | 11.00 | 0.011 | 0.0952 |
| 20 | YES Bank | 2,005.36 | 2,046.46 | 10,368.88 | 20.96 | 0.0012 | 0.0937 |

VI. SUMMARY OF FINDINGS

1. Inferring table 1 , State Bank of India stands at the top , based on the fact of high profitability compared to other public sector banks right from 2011 to 2015 .
2. Inferring table 2 , Federal Bank Ltd occupies first position , on the fact of high profitability compared to other private sector banks from 2011 to 2015 .
3. Inferring table 2 , Axis bank is the highly profitable among the new private sector banks identified from 2011 till 2015 .

VII. CURRENT SCENARIO OF BANKING SECTOR

Currently the banking sector faces a lot of challenges day by day , and moreover several factors lead to the increment as well as the decrement of the performance of the banks .

The current scenario of the banks are as follows ,

1. Banking sector is experiencing a shift from the traditional branch customer channel to more technology-centric channels.
2. Banking sector has undertaken several technology initiatives like internet banking, mobile banking, online fund transfer, passbook printing self service and financial supply chain management facility for corporate customers
3. For Public Sector Bank , high provision requirements due to their staff expenses (including pension liabilities) dented their profitability.
4. Private sector banks were able to maintain profitability in a tough operating environment as their commission, exchange and brokerage income increased
5. Fiscal indiscipline leading to fiscal deficit
6. High inflation leading to high interest rate
7. Rupee devaluation which further deteriorates the current account deficit
8. Non-interest income as a proportion of total income for all banks under study has declined , leading to declining profitability. However, private sector banks continued to fare better on this aspect as compared with Public sector banks .
9. Amid the challenging macroeconomic environment and increased credit cost, banks continued to employ cost control measures, such as salary optimization, negotiating on rentals and using technology
10. The banks witness mixed trends on their Cost to Income (C-I) ratios.

CONCLUSION

Our paper has scientifically ranked and compared the performance of the banks considering the profitability and using non interest income (NII) and an attempt has been made to analyze the current marketing challenges in banking scenario .

And our future works will be based on the analysis of how do these influencing factors of banking performance lead to the improvement in the value of our currency .

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