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Measurement of Financial Performance of Banks in India pre, during and post-Covid-19 using TOPSIS method.

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Abstract

TOPSIS is a mathematical model which compares alternatives while taking multiple criteria into consideration.This is done normalising scores, and computing the difference between the ideal best and worst. This paper analyses the performance of eight banks in India using the data by calculating banking performance ratios. Performance of three years is analysed- 2019 that is pre covid,2020 which is during covid and 2021 which is after covid. We analyse these years as Covid has had a major macro-economic impact on every sector. Many sectors saw the blues, but the banking sector was relatively stable. We will analyse this in detail further in the paper.

Keywords

TOPSIS, Indian banks, Covid-19, Banking Ratios, Operations Research

Introduction

The COVID-19 event has been dubbed the century's "black swan," having a substantial macroeconomic influence on both the global and Indian economies. Major indexes have experienced a considerable decline as a result of the exponential spread of COVID-19, which highlights the impact and prospective impact on GDP growth. Although COVID-19 is anticipated to have a negative overall impact on credit growth across the majority of sectors, the specific impact's type and severity are likely to differ depending on how long and how severely the disruption lasts. COVID-19's negative effects on banking will include a sharp decline in demand, decreased incomes, and production stoppages. Staffing issues, a lack of digital maturity, and stress on the current infrastructure are making the situation worse as businesses hurry to address COVID-19's effects on financial services. Given the unexpected coronavirus epidemic of COVID-19, banks undoubtedly have a lot on their plates.

As the virus continues to spread around the globe, borrowers and businesses are dealing with job losses, sluggish sales, and diminishing earnings. Customers of banks may begin looking for financial assistance. The tremendous economic costs associated with pandemics are an obvious way in which they might affect financial institutions. Banks must have a strategy in place to safeguard staff and clients from the coronavirus's spread to manage the direct economic impact of the disease. Many institutions are already encouraging some workers to work remotely. In this essay, we'll show how the pandemic COVID-19 has

affected the banking and financial industries. According to the Indian bank, a lengthy clean-up of its financial system is threatened by the coronavirus outbreak in India. The financial engine of the economy, banks finances both businesses and people. For the system to continue to function, its stability is essential.

Investors and market analysts utilize some important financial ratios to assess firms in the retail banking sector in order to comprehend this. Because banks operate and produce profit in fundamentally different ways from most other firms, it has always been difficult to analyze banks and banking stocks. While other companies produce or develop goods for sale, a bank's main product is money. Banks often have significantly more complicated financial statements than businesses that participate in nearly any other sort of company. These ratios were employed in this study:

1. Return on Capital Employed- It is a financial measure that may be used to evaluate the capital efficiency and profitability of an organization.

2. Current account Savings account- A bank's CASA ratio measures the proportion of deposits in current and savings accounts to all deposits. Because banks typically do not pay interest on current account deposits and savings account interest is often relatively low—between 3 and 4%—a greater CASA ratio denotes a lower cost of funding.

3. Net Profit Margin- The net profit margin, often known as the "net margin," calculates the amount of net income or profit as a proportion of revenue.

4. Net Interest Margin- The net return on a bank's earning assets, which include investment securities, loans, and leases, is measured by the term "net interest margin" (NIM). It is calculated by dividing interest revenue less interest expense by assets with a positive yield.

5. Operating Profit Margin-The operating margin calculates the profit an organization makes on each dollar of sales after deducting variable production costs.

6 . Return on Equity/Net Worth- Return on equity (ROE) is a metric that is calculated by dividing a company's net income by the equity held by its shareholders. A company's profitability and the effectiveness of its revenue generation are measured by its return on equity (ROE). A corporation is better at turning its equity financing into profits the higher the ROE.

7. Return on Assets- A company's ability to profit from its assets is indicated by the profitability ratio known as return on assets. To put it another way, return on assets (ROA) gauges how effectively a company's management generates revenue from the assets or financial resources that appear on its balance sheet.

10. Interest Income to Total assets- Banks' reliance on interest from bank lending as a source of funding is shown in the "Interest Income to Total Assets Ratio." While a low ratio can mean that banks rely on non-interest sources of funding, a high ratio is a good indicator (albeit one that is too high is not always a good indicator).

Literature Review-

There are several voluminous studies and published research papers which have elaborated on the importance of "Decision Making". According to (Ahmad et al., 2020) it is the best procedure for choosing the best alternative from all feasible options.
Often times satisfying certain criteria contrast one another which gives rise to "Multi Criteria Decision Making" (MCDM) problems. One of the methods presented by (Hwang and Yoon, 1981) in their seminal book – Multi Attribute Decision Making – is the Technique for Order Performance by Similarity to Ideal Solution (TOPSIS).

In our time, this method is used in various disciplines of life such as medicine engineering, energy, manufacturing systems safety, environmental fields and water resources studies (Ignatius et al., 2012). In humanity's quest for accuracy and precision, we constantly try to adapt real world data to mathematical models which do not take fuzziness into account (Kauffmann, 1975), (El Alaoui M., 2021). Fuzzy data arises due to the ever-present existence of uncertainty. It is also known as "real data". Examples where this fuzziness is noticeable are quality of life data, medical, environmental, sociological and economics data. In a study published by (Kruse R. et al., 2014) they specified that an array of accurate conclusions can be arrived at due to the existence of fuzzy data sets. TOPSIS is one such method which paints a picture closer to the truth.

When on the topic of performance of financial institutions (including, but not limited to – business organisations) there are an n-number of ratios, profit margins which vary year on year, depending on the operative efficiency of the company in that year (Chitnis and Vaidya, 2018). (Chitnis and Vaidya, 2016) have used TOPSIS to rank efficiency in the case of branches of an Indian bank. The proposed model provides a solution based on a score obtained by considering the minimum distance from the best value and maximum distance from the worst value. The proposed methodology is capable of handling negative data and undesirable output variables. This approach is unit invariant and makes the calculations simple.

(Ho and Wu, 2006) In their study the authors attempted to implement FSA (five-power analysis and stock performance) to select different ratios, the ratios were classified in accordance with the respective attributes under six sets: profitability, asset utilization, leverage, liquidity, growth and stock performance. The authors selected 59 financial ratios as the aggregated indicators for evaluating the performance of the banks. They found that liquidity ratios were the ones which most affected the bank's overall performance.

In a country like India, (Nanda and Banerjee, 2021) identified that a consumer's subjective idea of financial well-being impacts their decision-making when it comes to opening an account in a certain bank. Financial well-being is a critical research area that explores a consumer's money management, savings, spending and investment behaviour. (Chaudhary and Sharma, 2011) in their comparative study of public sector and private sector banks highlighted that Return on Capital Employed (ROCE), Current Account Savings Account Ratio (CASA), Net Profit Margin, among others are the key financial indicators which influence a consumer's choice in India. They are the chief determinants of profitability, financial security and liquidity in Indian banks (Verma, 2006). Upon reviewing this paper, we have taken the aforesaid ratios and others to elucidate our conclusion for the ranking of the best performing Indian banks.

In March, 2020, the Covid-19 pandemic devastated many economies of the world. Even in India, many sectors experienced a significant slowdown, however, the consumer confidence wavered only by a small margin (Kumar Mishra et al., 2021). This is mainly due to the performance of the banking sector which

provided the public with liquidity support, extended credit, borrower assistance programs and monetary easing which curbed the adverse impact from the crisis. (Demirgüç-Kunt et al., 2021) specified in their study that India was one of the countries where the Government eased the flow of credit to firms which trickled down to the normal population due to which bank balances increased but paradoxically the stocks of such banks underperformed.

The government (namely, the Reserve Bank of India), on its part, has also raised the deposit insurance limit from Rs 1 lakh to Rs 5 lakh per depositor per bank. In fact, the banks in India are well capitalized with the exception of a few (Perwej, 2020). This data has not been taken in our research paper due to the fact that this is a variation in figures which is a result of a change in policy and is therefore not a true indicator of a bank's financial performance.

(Unvan, 2020) published a paper in Gazi University, Turkey which tracked the performance of 7 banks using the Fuzzy TOPSIS method. When the 2014-2018 period was studied, it was determined that bank performances vary. It can be said that these changes don't show a regular trend. For example; while HB ranked first on the list in 2014 and 2015, it was at the end of the list in 2016 in terms of financial performance. Moreover, while the GB bank was in the lower ranks in 2014 and 2015, it reached the upper ranks in the 2016-2018 period. This is because the dataset includes both private and state banks.

(Gündoğdu, 2015) Furthermore, there is explicit evidence that political and economic crises in the country have had different effects on banks. Even in the case of Serbian banks (Mandic, 2014) when financial values related to banks are taken into consideration, there is a similarity between the non-performing loans / total loans ratio and TOPSIS performance scores.

Mirroring the paper's core objective by (Kumar and Gulati, 2010), our writers have applied TOPSIS method to rank the banks in India as per their financial performance pre, during and post pandemic. Consequently, indicating the best bank to open an account in, when considering their financial ratios.

Methodology

TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) was developed in the 1980s as a multi-criteria decision-making method. TOPSIS selects the option with the shortest Euclidean distance to the ideal solution and the greatest distance to the negative ideal solution.TOPSIS is a method for allocating ranks based on the weights and impact of the given factors.

Weights indicate how much a given factor should be considered.The term "impact" refers to whether a given factor has a positive or negative impact.

This method can be used to rank machine learning models based on various factors such as correlation, R2, accuracy, Root mean square error, and so on. Now that we understand what TOPSIS is and where we can apply it. Let's see what happens the procedure is to use TOPSIS on a dataset with multiple rows and columns.

Procedure:

Step 1: Normalized matrix and weighted normalise matrix calculation Each value is normalised by becoming: where m is the number of rows in the dataset and n is the number of columns. I varies along the rows, while j varies along the columns. Then, for each value in the column, we multiply it by the corresponding weight.

Step 2: Calculating the ideal best and ideal worst values, as well as the Euclidean distance between the ideal worst and ideal best values for each row. First, we'll determine the ideal best and worst values: Now we must determine whether the impact is positive or negative. If a column has a '+' impact, the ideal best value is the maximum value in that column, and the ideal worst value is the minimum value in that column, and vice versa for a column with a '-' impact.

.Step 3: Topsis Score and Ranking Calculation We now have Distance positive and Distance negative, and we use them to calculate the Topsis score for each row. Now rank according to the TOPSIS score, with higher scores ranking higher.

Application

Primary Data

Table 1- 8 banks are numbered and 8 ratios are used to analyse them

	Banks
b1	HDFC Bank
b2	State Bank of India
b3	ICICI Bank
b4	Axis Bank
b5	Kotak Mahindra Bank
b6	IndusInd Bank
b7	Yes Bank
b8	Punjab National Bank

Decision Matrix-

Table 2- a matrix is formed using the data of year 2019. The denominators are found by finding the square root of the sum of squares of each value in a row.

As per March 19									
	r1	r2	r3	r4	r5	r6	r7	r8	Denominator
b1	3.34	42.37	21.29	3.87	3.48	14.12	1.69	7.95	50.51887667
b2	0	0	0.35	2.4	-14.14	0.39	0.02	6.59	15.79248872
b3	2.52	49.61	5.3	2.8	-17.58	3.19	0.34	6.57	53.53452624
b4	2.47	44.37	8.5	2.71	-15.37	7.01	0.58	6.86	48.85862155
b5	2.77	52.49	20.32	3.6	1.09	11.47	1.55	7.66	58.15980141
b6	3	43.14	14.82	3.18	-10.53	12.52	1.18	8.01	49.32533021
b7	2.24	33.06	5.8	2.57	-9.68	6.39	0.45	7.77	36.51487368
b8	1.7	42.16	-19.44	2.21	-33.81	-24.2	-1.28	6.62	62.74848365

Normalised Decision Matrix-

Table 3- A normalised decision matrix is made by dividing each value with the denominator.

	Evaluation Ratios
r1	Return on Capital Employed
r2	Current Account Saving Account
r3	Net Profit Margin
r4	Net Interest Margin
r5	Operating Profit Margin
r6	Return on Equity/Net worth
r7	Return on Asset
r8	Interest Income/Total Asset

As per March 19								
Rij(r1)	Rij(r2)	Rij(r3)	Rij(r4)	Rij(r5)	Rjj(r6)	Rij(r7)	Rij(r8)	Weightage
0.066113901	0.8386964	0.42142663	0.076605	0.068885142	0.2794995	0.0334528	0.15737	8
0	0	0.02216244	0.151971	-0.895362362	0.0246953	0.0012664	0.41729	8
0.047072426	0.926691679	0.09900153	0.0523027	-0.328386207	0.0595877	0.006351	0.12272	8
0.050554026	0.90813041	0.17397134	0.0554662	-0.314581122	0.1434752	0.011871	0.14041	8
0.047627398	0.902513398	0.34938221	0.0618984	0.018741467	0.1972153	0.0266507	0.13171	8
0.060820677	0.874601342	0.30045415	0.0644699	-0.213480578	0.253825	0.0239228	0.16239	8
0.061344865	0.905384482	0.15883938	0.0703823	-0.265097453	0.1749972	0.0123237	0.21279	8
0.027092288	0.671888746	-0.3098083	0.03522	-0.538817801	-0.3856667	-0.0203989	0.1055	8

Weighted Normalised Decision Matrix-

Table 4- The normalised vale is multiplied with the weightage given.The ideal best is the maximum and the ideal worst is the minimum.

	Rij(r1)	Rij(r2)	Rij(r3)	Rij(r4)	Rij(r5)	Rjj(r6)	Rij(r7)	Rij(r8)
	0.53	6.71	3.37	0.61	0.55	2.24	0.27	1.26
	0	0	0.18	1.22	-7.16	0.2	0.01	3.34
	0.38	7.41	0.79	0.42	-2.63	0.48	0.05	0.98
	0.4	7.27	1.39	0.44	-2.52	1.15	0.09	1.12
	0.38	7.22	2.8	0.5	0.15	1.58	0.21	1.05
	0.49	7	2.4	0.52	-1.71	2.03	0.19	1.3
	0.49	7.24	1.27	0.56	-2.12	1.4	0.1	1.7
	0.22	5.38	-2.48	0.28	-4.31	-3.09	-0.16	0.84
Ideal Best	0	7.41	3.37	0.28	0.55	2.24	-0.16	3.34
Ideal Worst	0	0	-2.48	1.22	-7.16	-3.09	0.27	0.84

Table 5 and 6- Distance of our weighted value from the ideal best and worst is found by finding the difference of squares of difference of the actual value from the ideal best and worst.

Euclidean distance from ideal best		
-1.3860435055449	1.386043506	1.18
-133.5964850124140	133.596485	11.56
-21.0565011374075	21.05650114	4.59
-15.2795469897286	15.27954699	3.91
-2.0460460510890	2.046046051	1.43
-6.6629756232800	6.662975623	2.58
-13.0246698023879	13.0246698	3.61
-93.5890429327857	93.58904293	9.67

Euclidean distance from ideal worst		
-153.345276704025	153.3452767	12.38
-42.735092137853	42.73509214	6.54
-83.755222344027	83.75522234	9.15
-94.676538768747	94.67653877	9.73
-138.706634636351	138.7066346	11.78
-118.310411298572	118.3104113	10.88
-99.610291826293	99.61029183	9.98
-19.835334093832	19.83533409	4.45

Ranking-

Table 7- Shows the final ranking based on the procedure for 2019

As per March 19					
Company	Euclidean distance from		1+2	Performance Score	Ranking
	ideal best(1)	ideal worst(2)			
b1	1.18	12.38	13.5606	0.91	1
b2	11.56	6.54	18.0956	0.36	7
b3	4.59	9.15	13.7405	0.67	6
b4	3.91	9.73	13.6391	0.71	5
b5	1.43	11.78	13.2078	0.89	2
b6	2.58	10.88	13.4583	0.81	3
b7	3.61	9.98	13.5895	0.73	4
b8	9.67	4.45	14.1278	0.32	8

Table 8- Shows the final ranking based on the procedure for 2020

As per March 20					
Company	Euclidean distance from		1+2	Performance Score	Ranking
	ideal best(1)	ideal worst(2)			
b1	1.24	12.44	13.6754	0.91	1
b2	5.3	9.19	14.4903	0.63	5
b3	3.25	10.2	13.4523	0.76	4
b4	5.65	8.26	13.9081	0.59	7
b5	1.43	11.86	13.2824	0.89	2
b6	2.36	11.09	13.4536	0.82	3
b7	12.88	0.67	13.5462	0.05	8
b8	5.3	8.58	13.8822	0.62	6

Table 8- Shows the final ranking based on the procedure for 2021

As per March 21					
Company	Euclidean distance from	Euclidean distance from	1+2	Performance Score	Ranking
	ideal best (1)	ideal worst(2)			
b1	1.13	10.19	11.32	0.9	1
b2	3.33	7.45	10.78	0.69	4
b3	1.63	9.01	10.64	0.85	3
b4	3.66	7.09	10.75	0.66	5
b5	1.33	9.61	10.94	0.88	2
b6	3.72	7.03	10.75	0.65	6
b7	10.44	0.64	11.07	0.06	8
b8	4.76	6.11	10.87	0.56	7

Formula Used-

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{k=1}^{m} x_{kj}^2}}$$

$$S_i^+ = \left[\sum_{j=1}^{m} (V_{ij} - V_j^+)^2\right]^{0.5}$$

$$S_i^- = \left[\sum_{j=1}^{m} (V_{ij} - V_j^-)^2\right]^{0.5}$$

Conclusion

Covid 19 brought many challenges to many sectors. Particularly, when we look at the banking sector in India and performance of 8 major banks a conclusion can be drawn. There are some banks who have kept their position stable relatively. On the other hand there are some banks who show major positive or negative changes in their performance through these three years.

Starting with Bank 1- HDFC Bank, all three years its position is number 1. "The bank's lower vulnerability in terms of asset quality than most of its peers in these trying times is a reflection of its risk selection and capital productivity consciousness," said Edelweiss Securities. The State Bank of India and Kotak Bank also showed the same stability.

When it comes to ICICI bank its banking lowered every year by 2 points. Axis bank went 2 points down in 2020 but again recovered its position in 2021.The trend showed by Indusland Bank was completely different, it was stable in 2020 that is during the crisis but then went 3 points down in 2021.This could mean its performance was affected by the post-covid structural changes.Yes Bank went down by 1 point in 2020 and maintained the same in 2021.This could be because of their financial crisis not only Covid .Punjab National bank is the only bank who showed appreciation in performance in 2020 but went down again in 2021.

This analysis shows how effective TOPSIS is in analysing multicriteria and multi attribute models and helps in decision making by rankings.

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