Prediction of Bank Failure using Financial Ratios

Madhvi[1] and Amit Srivastava[2]

[1]*Research Scholar, Department of Humanities and Social Sciences, Jaypee University of Information Technology, Waknaghat, Solan, Himachal Pradesh, INDIA. Email: madhviverma904@gmail.com*

[2]*Associate Professor, Department of Humanities and Social Sciences, Jaypee University of Information Technology, Waknaghat, Solan, Himachal Pradesh, INDIA. Email: sriam_2000@yahoo.com*

ABSTRACT

Banking industry is widely using CAMEL rating system for long years to analyse the performance of banks. In current study, financial ratio have been to predict failure of bank using data from 2005-2016. The study is organized in two parts, in first part CAMEL ratio is utilized to analyse the banking performance whereas in second part same ratios have been used to predict bank failure using discriminant analysis and logistic regression. The study revealed that it is possible to predict bank failure using MDS with the help of financial ratios.

Keyword: Bank failure, Performance, Financial Ratios, Discriminant Analysis, insolvency.

1. INTRODUCTION

The last few decades are noticeable for banking and a financial crunch that has increase the banks operating cost and reduces banks efficiency. In fact, many developing countries and developed too has faced insolvency, extreme losses, disturbance in cash flow that has even led to shut down the number of bank branches. Today, most countries are affected by banking inefficiency and downfall of the revenue due to 2008 crisis and could not find any solution to come out of it yet. Furthermore, recent crisis 2008 needs to give greater attention because of its long lasting effect on banking performance. Failure in adopting BASEL norms effectively along with implementing necessary rules and regulations are major reason for bank failure and downfall in revenue. (Ayyoup, 2002: Hungarian Banking Association, 1999). Banks must do their operation according the guidance of banking rule book given by central bank. Generally banking activities are supervised by using two approaches named on-site and off-site supervision approach. The first approach includes supervisory staff evaluating the qualitative components defining efficiency and performance of bank such as administrative mechanism defiance with commandment and practice, with

the support of composed evidence through CAMEL rating system. Whereas offsite supervision includes evaluation of cash flow and material on the financial standing of the banks. This paper has applied Logistic Regression, Multivariate Discriminant analysis to predict misery of Indian banks. Bankruptcy of any bank creates externalities and sufferers in productivity, and due to negligence of vigilance staff that takes losses to the higher level that cannot compensate even by using any predictive tool (Kupiec & Ramirez, 2009). Present literature has examined the effect of financial crisis has given equal impact on small or big organization without any differentiation of company structure and stability, the only thing is which bank is more strong to come out of sinking sail of financial depression. The empirical result shows that even large organization are more likely to fail in these crisis because of having big spread of their financials and low capital and reserve ratios. Their deposits, liquidity are depending on broken portfolios that raise the level of their non-performing assets from each and every portfolio relatively (Mester, 1996). A large portion of non-performing assets banks inefficiency, their poor credit evaluation and negligent loans monitoring process. It was also observed in the literature that those banks that grew prior period of financial distress went through operation failure as compared to established banks. (West, 1985) introduce a novel approach as an early warning system for banking sector and discovered Logit estimation and factor analysis is a favourable technique of weighing banks performance and its stability. (Espahbodi, 1991) improves and tests discriminant and logit models in detecting the probable failure in banking industry. His study also calculated and compared the failure parameters and reason of failed and non-failed banks. (Lu & Whidbee, 2009) discussed that insolvency of bank having number of side effects that cannot be cured in in long term. Due to those stakeholders including depositors, individual and institutions have to lose their deposits at the cost of failure and inefficiency of banks. Moreover escalation of bank failure and insolvency effects on overall health of economy and nation wealth too. Therefore RBI has given the strict regulation for banking industry has stress on identifying those factors that may contribute to insolvency of banks so that banks can take corrective action to eliminate risk of failure (Li & Qingyu, 2013). Capital ratios have been used while analysing the bank failure. Some other ratio have also been considered in current literature involving capital to gross revenue ratio, debt ratio, leverage ratio to study the bank failure and its stability (Wheelock & Wilson 2000; Estrella & Park 2000). In few cases ratios are proposed as bottom level of acceptance, whereas in other cases, ratios are considered at suitable level of capital for the bank. This differentiation between two different levels is discussed in depth (Estrella 1995). While other current researches have prolonged this study to numerous emerging countries (Leightner & Lovell, 1998; Hardy & Patti, 2001; Sufian & Habibullah, 2009; Thagunna & Poudel, 2013), most important part of the literature is dedicated in inspecting the banking efficiency using cross country sample (Berger & Humphrey, 1997).

Research Gap

Looking into Literature review, lot of research has been done to measure the efficiency of banks on different parameters including NPA, Profits, CAR, Equity return Some work has also been done to predict the bank working capability and utilization of resources However, there appears to be not much research on predicting factors that can help in forecasting bank defaults and failure rate.

The Study Tries to Answer Following Questions

1.   What are ratings of bank on CAMEL parameters?

2.   Differentiate efficient and inefficient bank among different sectors.

3. How failure of bank can be predict by using different financial ratios.

4. Is there any method that can predict bank failure in advance?

Data Collection

This study incorporates a sample of 24 commercial banks. Data has been collected for a period of eleven years (2005-16) from RBI website while financial statements information is gathered from the database of Moneycontrol.com Reason for choosing particular set of banks in this paper is based on old studies that have proven these banks as efficient and good performer in their respective sector (Madhvi & Srivastava, 2017).

Methodology, Analysis and Results

1. CAMEL

CAMEL is a model that is based on different ratios used to study the performance and efficiency of banks with the support of different criteria like Capital adequacy, Asset quality, Management capability, Earning capacity and liquidity level. The current study is descriptive in nature based on analytical research design. To study the capital adequacy, top officials at present using capital- risk asset ratio. The capital adequacy is examined by using two very important measures named capital to risk-weighted assets or capital adequacy ratio and ratio of capital with comparison to assets. The capital adequacy is calculated using key financial ratios as under:

Table 1
Capital Ratios Analysis

Ratios	Formula	Criteria
CAR	$CAR = \dfrac{\text{Tier One Capital} + \text{Tier Two Capital}}{\text{Risk Weighted Assets}}$	≥ 8%

Source: Credit Analysis of Financial Institution.

The capital adequacy ratio is required to maintain at level of 8 % that is fix by (BIS) Bank of International Settlement whereas Central bank has set the level of CAR at 9%. Ratios may slight vary for some different countries depending on different regulators.

Table 1.1
Capital Adequacy Ratio Scale

Assigned Scale	Scale 1 (Well Capitalized)	Scale 2 (Adequately Capitalized)	Scale 3 (Significantly Capitalized)	Scale 4 (Under Capitalized)	Scale 5 (critically undercapitalized)
Range	Between CAR 12% +	Between CAR 12% - 9%	Between CAR 9%-6%	Between CAR 6%-3%	Less than CAR 3%

Source: Credit Analysis of Financial Institution.

Every element of CAMEL is rated at scale of 1 to 5. 1 rating stands for high level capital with the relation to financial institution risk whereas rating 5 indicated very poor or needs to be corrective level of capital.

Table 2
Asset Quality Ratios Analysis

Ratios	Formula	Criteria
Net NPA Ratio	$\dfrac{\text{Net NPA}}{\text{Total Advance}}$	≤ 1 %

Source: Credit Analysis of Financial Institution.

Asset Quality: low asset quality is the most important reason of bank failure because that includes NPA of bank in which huge portion and funds of banks are stuck. Poor lending policies and negligent credit evaluation process is main reason for poor asset quality. That increases the stress on banks for short term funding position in the market.

Table 2.2
Non Performing Asset Ratio Scale

Assigned Scale	Scale 1 (Very Good)	Scale 2 (Satisfactory)	Scale 3 (Fair)	Scale 4 (Marginal)	Scale 5 (Worst)
Avg Net NPA	< 1 %	> 1 % < 4 %	> 4 % < 7 %	> 7% < 10 %	> 10 %

Source: Credit Analysis of Financial Institution.

As NPA is biggest criteria to judge banks asset quality so, that has been divided in scale of 1-5 for the evaluation purpose. To be in scale 1 (Very Good) NPA ratio should be less than 1 % whereas scale 5 or ratio greater than 10% is considered worst or bad signal for bank.

Table 3
Business per Employee Ratio Scale

Assigned Scale	Scale 1 (Very Good)	Scale 2 (Satisfactory)	Scale 3 (Fair)	Scale 4 (Marginal)	Scale 5 (Worst)
Business per Employee	> 4 Crore	< 4 Crore > 3 Crore	< 3 crore > 2 Crore	< 2 Crore > 1 Crore	< 1 Crore

Source: Credit Analysis of Financial Institution.

Management Efficiency: Management plays a vital role in CAMEL rating model because management is core part of business strategies and implementation. Every decision of management has relative impact on every sub-system and operating activities of the banks. Effective implementation of strategies results in business brought by every employee, so business per employee is considered as a very important parameter to measure management efficiency level. Again that has been divided in the scale of 1 to 5. Banks coming in category of scale 1 means their management is very effective whereas scale 5 shows that their management is not able to control the strategies and working structure of the organization.

Table 4
Earnings Ratio

Ratio	Formula	Criteria
Return on Asset	$\dfrac{\text{Net Interest Income}}{\text{Assets Growth Rate}}$	≥ 1 %

Source: Credit Analysis of Financial Institution.

Earning Capability: A sustainable profit builds the confidence of stake holders of banks and also protects the banks from contingencies by helping them in creating different reserves and provisions. A stable and

healthy earning is very important for the survival of the banks. Here profitability ratio is considered as key criteria to evaluate banks earning capability.

Table 4.1
Return on Asset Ratio Scale

Assigned Scale	Scale 1 (Very Good)	Scale 2 (Satisfactory)	Scale 3 (Fair)	Scale 4 (Marginal)	Scale 5 (Worst)
RoA	> 1.5 %	< 1.5 % > 1.0 %	< 1.0 % > 0.5 %	< 0.5 % > 0.25 %	< 0.25 %

Source: Credit Analysis of Financial Institution.

Banks scoring rating 1 reflects that they have strong earning and future protection for bank to support their operations whereas rating 5 shows constant losses and big threat for banking future and its solvency.

Table 5
Liquidity Ratio

Ratio	Formula	Criteria
Credit Deposit Ratio	$\dfrac{\text{Total Credit}}{\text{Total Deposits}}$	≤ 80 %

Source: Credit Analysis of Financial Institution.

Liquidity Ratio: last but very important component to study bank efficiency and performance is liquidity. Liquidity for any bank is plays vital role in order to fulfil so many needs involving minimizing the risk of recalls existing loans and to meet daily cash calls in deposits. Banks have to maintain interest rate structure in order to balance liquidity ratio by balancing interest rate spread. It is not affordable by bank to have mismatch between lending and borrowing interest rate.

Table 6
Credit Deposit Ratio Scale

Assigned Scale	Scale 1 (Very Good)	Scale 2 (Satisfactory)	Scale 3 (Fair)	Scale 4 (Marginal)	Scale 5 (Worst)
Credit Deposit Ratio	< 50 %	>50 % < 55 %	> 55 % < 60 %	> 60 % < 65 %	> 65 %

Source: Credit Analysis of Financial Institution.

Liquidity Ratio: As liquidity of any bank regulated by interest rate spread so, credit deposit ratio is considered one of the major factor to measure liquidity ratio. Rating one represents strong liquidity of bank whereas rating 5 shows critical and poor level of liquidity that shows that bank is in financial danger and not able to fulfil future and present cash need of business necessary for survival.

The computation will be in such a way that after calculating rating of each component (CAMEL), rating is being combined and average of sum has been calculated. Rating from 1.0-1.4 comes under outstanding category and that indicate that bank is able to perform all of its functions fully with future protection of solvency. Whereas rating range 4.6- 5.0 comes under doubtful performance that indicates that banks financial health is in danger and it is on the way of bankruptcy expressing high probability of bank failure. So it is not at all recommended for bank to reach at this rating scale. Banks that comes in rating scale of 4 or 5 should not considered by investors as an investment option.

Thus the purpose of paper is to observe banks different level of efficiency with the help of CAMEL and build a model that can predict bank failure which will be early warning system for banking industry.

Table 7
The CAMEL's Composite Rating

Rating Scale	Rating Range	Rating Analysis	Exposure Limits	Rating Interpretation
1	1.0-1.4	Outstanding	1st limit	The bank outperforms the average bank in all respects and by easily measurable differences
2	1.6-2.4	Superior	2nd limit	Measurably better than the average bank, but not quite outstanding in all respects
3	2.6-3.4	Average	3rd limit	A well-run, good bank that just meets all of the major standards
4	3.6-4.4	Under-perform	NR*	The bank demonstrates a major weakness that if not corrected, could lead to a very severe or unsatisfactory condition that will threaten its existence. This would also include major financial and/or managerial surprises
5	4.6-5.0	Doubtful	NR*	The bank's financial health is substandard, with asset quality impairing over half of the bank's primary capital. If not corrected further deterioration will lead to regulatory control and a high probability of failure

Source: Credit Analysis of Financial Institution.

Table 8
Overall Rating of CAMEL ANALYSIS

Banks	C	A	M	E	L	AVG	Rating Scale	Rating Analysis
State Bank of India	1	2	5	3	5	3	3rd	Average
Allahabad Bank	1	2	5	3	5	3	3rd	Average
Andhra Bank	1	2	5	2	5	3	3rd	Average
Bank of Baroda	1	2	4	3	5	3	3rd	Average
Bank of India	2	2	4	3	5	3	3rd	Average
Canara Bank	1	2	4	3	5	3	3rd	Average
Central Bank of India	2	2	5	3	5	3	3rd	Average
Corporation Bank	1	2	4	3	5	3	3rd	Average
IDBI Bank Limited	1	2	3	3	5	3	3rd	Average
Oriental Bank of Commerce	2	2	4	3	5	3	3rd	Average
Punjab and SIND Bank	1	2	5	3	5	3	3rd	Average
Punjab National Bank	1	2	5	3	5	3	3rd	Average
Uco Bank	1	2	5	3	5	3	3rd	Average
Union Bank of India	2	2	5	3	5	3	3rd	Average
Vijaya Bank	1	2	5	3	5	3	3rd	Average
Axis Bank	1	1	4	1	5	2	2nd	Superior
City Union Bank Limited	1	2	5	1	5	3	3rd	Average
DCB Bank Limited	1	2	5	5	5	4	4th	Under Performer
Dhanlaxmi Bank	2	2	5	5	5	4	4th	Under Performer
HDFC Bank	1	1	5	1	5	3	3rd	Average
ICICI Bank	1	2	5	2	5	3	3rd	Average
Indusind Bank	1	2	5	2	5	3	3rd	Average
Kotak Mahindra Bank Ltd	1	2	5	1	5	3	3rd	Average
Yes Bank Ltd.	1	1	4	1	5	2	2nd	Superior

Source: Authors Calculation From data available with RBI website.

Table 8 depicts the ranking of banks in the period between 2005-2016. It is found that under CAMEL rating system, Axis bank and Yes bank Superior performer. Whereas DCB bank and Dhanlaxmi bank come under below performer rating and rest of bank comes under average performer rating. That shows that performance of banks in India is not satisfactory where banks included in sample are topmost banks in India that raise big question on efficiency of Indian banking sector.

Now up to here we have only analyse the performance of Indian banks but these ratios have not given any clue that, which ratios are important that can predict bank failure. For this purpose Discriminant analysis is used to get same set of ratios which helps in identification of financially troubled banks.

2. MULTIVARIATE DISCRIMINANT ANALYSIS

Multivariate Discriminant Analysis also known as (MDA) is very is a very influential classificatory and descriptive technique developed by Fisher in 1936 to define components that are specific to different groups called Descriptive Discriminant Analysis and categorising different cases into pre-existed groups based on connections between different cases belong to the groups called predictive discriminant analysis.

Discriminant Analysis Involves

Discriminant Analysis involves the determination of a linear equation like regression that will predict which group the case belongs to. The form of the equation or function is:

$$D = v_1 X_1 + v_2 X_2 + v_3 X_3 + \ldots + v_i X_i + a$$

where,

D = Discriminant Function

v = Discriminant coefficient or weight for that variable

X = Variable Score (Independent)

a = Constant

i = number of predictive variables

MDA is applied on 13 banks which are merged with different banks from year 2005 to 2016. As those merged banks are considered as the banks which are not performing well and are financially unstable banks but still have scope to improve if associated with other bank. Here 2 groups are created one group is '1' one which is considered as group of below average banks (merged bank) or financially troubled banks. Another group is '2' Two which is a group of financially unstable banks. RBI is thinking to windup these banks in year 2017. Here 13 banks are used in this MDA analysis.

By applying Discriminant analysis we got the ratios that are very important indicator of bank failure and observance of these ratios are very important for bank to keep eye on bank failure Earning capability and management efficiency are found critical ratios that can put bank in financial trouble.

In table 10 Group means has been shown that has clearly shown that group 1 i.e merged banks have positive mean and group 2 i.e those bank RBI is thinking of winding up has negative mean which shows that these group of bank can not survive now and need to be shut down.

Table A
Different Bank Group

Group 1	Group 2
Below Average(Merged)	About to Fail
State Bank of Hyderabad	Uco bank
State Bank of Mysore	Indian Overseas Bank
State Bank of Patiala	Central bank of India
State Bank of Travancore	Dena Bank
INGVyasya	Bank of Maharashtra
Bank of Rajasthan	
Centurian Bank	
Bharat Overseas bank	

Table 9
Classification Function Coefficients

	Group(Banks)	
	Below AVG	About to fail
Liquidity ratio	.612	.539
Earning Capability	-5.248	-8.560
Management Efficiency	-.062	-.027
Capital Adequacy Ratio	3.882	4.486
Asset Quality	2.129	3.739
(Constant)	-44.393	-59.324

Source: Author's Calculation.

Table 10
Functions at Group Centroids

Group (Banks)	Function 1
Below AVG	1.311
About to fail	-2.360

Unstandardized canonical discriminant functions evaluated at group means

Table 11 shows very important result of the study which clearly shows that after discriminant analysis we got clear result that group 1 discriminant score is positive whereas group 2 score is negative that signifies that RBI thinking of winding up of bank is not performing well. Discriminant score of the banks has been calculated of previous year when decision is taken to merged or shut down the units. Results prove that is discriminant analysis can be used as prediction of bank failure. Negative score means banks are going in direction of closing down and soon it will fail or bankrupt. Hence MDA is successful in predicting bank failure 1 year prior to merger with another bank.

3. CONCLUSION

This paper concludes, that overall rating of banks give the clear picture of performance of Indian banking industry. Axis Bank and Yes bank is top rated, Whereas DCB bank and Dhanlaxmi bank come under below performer rating and rest of bank comes under average performer rating. That shows that performance

Table 11
Casewise Statistics

	Case Number	Actual Group	Highest Group					Second Highest Group			Discriminant Scores
			Predicted Group	P(D>d | G=g)		P(G=g | D=d)	Squared Mahalanobis Distance to Centroid	Group	P(G=g | D=d)	Squared Mahalanobis Distance to Centroid	Function 1
				p	df						
Original	1	1	1	.747	1	1.000	.104	2	.000	15.960	1.634
	2	1	1	.725	1	.996	.124	2	.004	11.019	.959
	3	1	1	.396	1	.974	.719	2	.026	7.974	.463
	4	1	1	.083	1	.593	3.004	2	.407	3.759	-.422
	5	1	1	.662	1	.994	.191	2	.006	10.467	.875
	6	1	1	.339	1	1.000	.913	2	.000	21.411	2.267
	7	1	1	.742	1	1.000	.108	2	.000	16.005	1.640
	8	1	1	.205	1	1.000	1.605	2	.000	24.390	2.578
	9	1	1	.620	1	1.000	.246	2	.000	17.374	1.808
	10	2	2	.434	1	1.000	.612	1	.000	19.841	-3.143
	11	2	2	.128	1	1.000	2.319	1	.000	26.984	-3.883
	12	2	2	.454	1	.982	.560	1	.018	8.548	-1.612
	13	2	2	.687	1	.995	.162	1	.005	10.689	-1.958
	14	2	2	.248	1	.924	1.333	1	.076	6.336	-1.206

of banks in India is not satisfactory where banks included in sample are topmost banks in India that raise big question on efficiency of Indian banking sector. The discriminant model gives 5 such ratios from set of 35 ratios prescribed by RBI while evaluating performance of banks in India. Further analysis is done to check whether these ratios are capable to predict bank failure or not. As analysis is done on the basis of 5 ratios, MDA score of banks 1 year prior to merger is negative in case of bank RBI is proposing to shut down. MDA is applied on same set of ratios of bank to whom RBI has merged with other banks and the results are positive. Hence it can be concluded that MDA model is useful in predicting bank failure 1 year prior to merger or closing down.

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