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Determinants of Public and Private Sector Bank's in India: A Discriminant Model

A. Subbarayan[1], S. Albert Antony Raj[2] and J. Jothikumar[3]

[1]*Professor, Department of Computer Applications, Faculty of Science and Humanities, SRM University, Kattankulathur, Chennai, India*

[2]*Assistant Professor (Sr.G), Department of Computer Applications, Faculty of Science and Humanities, SRM University, Kattankulathur, Chennai, India*

[3]*Professor of Statistics and Associate Dean, Faculty of Science and Humanities, SRM University, Kattankulathur, Chennai, India*

ABSTRACT

In this paper an attempt is made to employ discriminant analysis for identifying the major discriminants of thirty eight public and private sector banks for the year 2015-2016 in India. The banking sector has experienced a major transformation in its operating environment for the last twenty five years. It is stated that a sound and profitable banking sector is better able to withstand negative stocks and will contribute for the stability of the financial system. The authors have considered the ratios viz., Capital Adequacy, Total Advances to Assets, Net Nonperforming Assets to Net Advances, Expenditure to Income, Liquid Assets to Total Assets, and Risk Sensitive Assets to Risk Sensitive Liabilities in this study. The correlation matrix has revealed that there does exist any multicollinearity among predictor variables (financial ratios). The square of canonical correlation is high and this indicates that variance in the discriminant model between the two groups of banks (banks earning profits and banks incurring losses) is due to changes in the predictor variables. Wilk's Lambda test confirms statistical significance of research results. The standardized discriminant model clearly indicates that the predictor variable viz., Return on Assets is the primary one which discriminates between the two groups of banks. The cut-off scores for the two groups of banks is also computed and presented. The classification matrix shows that hundred percent of the originally developed cases are correctly classified and this demonstrates that the discriminant model developed is a valid one.

JEL Classification: G2, G21, G210.

Keywords: Discriminant Analysis, Bank Profitability, Financial Ratios, Predictor variables, Correlation Matrix, Classification Matrix.

1. INTRODUCTION

The initiation of economic reforms in 1991-92 has resulted with numerous development and policy changes in the Indian banking sector. Both external and domestic factors affected the structure of performance of the banking sector. Financial analysts asserts that banking sectors are considered as the blood of trade and commerce. They have also pointed out that a sound and profitable banking sector will contribute to the stability of financial system.

The important reforms introduced in the banking sector are adoption of prudential norms in terms of capital Adequacy, assets classification and provisioning deregulation of interest rates, liberalization of foreign direct investments etc.,. The Indian banking industry has entered new areas such as wealth management, private banking, electronic banking and investment advisory services.

In recent years the banks are facing a number of challenges in technology adoption for modern banking, increasing competition, disturbing levels of nonperforming assets (NPA), asset liability management, raising operating expenses and increasing pressure of profitability. It is also important to note that Reserve Bank of India (RBI) efforts to adopt international banking standards further forced the banks to shift their focus on profitability. Hence, profitability has become the major area of concern for management of banks.

Bolda and Verma (2006) have attempted to identify the key determinants of profitability of public sector banks in India. They have analysed the temporal data from 1991-92 to 2003-04 and constructed a Multivariate Regression Model. The study revealed that non-interest income, operating expenses and spread have significant relationship with net profits.

Siva Reddy Kallurn and Sham Bhat (2008) examined the profitability of 87 commercial banks in India by applying fixed and random effects models for unbalanced panel data for the period 1992-2006. The empirical results revealed that the profitability of banks was affected not only by bank's own characteristics but also by industry structural variables and macro-economic variables.

Nandy (2011) has performed a multivariate analysis approach for selecting profitability indicators of commercial banks in India and identified the factors responsible for profitability and examined their influence on profitability.

Poonam Mahajan et. al., (2012) studied in detail Return on Assets (ROA) performance of public sector banks in India. In this study, spread, credit deposit ratio, non-performing assets, non-interest income and provisions and contingencies are identified as the parameter for predicting the profitability (measured by ROA) of public sector banks in India.

Nicolae Petria et. al., (2015) assessed the main determinants of profitability in European Union (EU) banking systems. In this study, they have considered Return on Average Assets (ROAA) and Return on Average Equity (ROAE) as proxy for banks profitability. It is concluded that the credit and liquidity risks, management efficiency, the diversification of business, the market concentration, competition and economic growth have influence on bank's profitability, both on ROAA and ROAE.

1.1. Motivation for Present Study

The studies relating to the determinants of profitability of banking sector has attracted the attention of academic researchers as well as the management of banks and policy makers. Most of the research studies relating to the determinants of bank profitability have focused either on a panel of countries or an individual

country. These studies considered both internal and external factors for examining the determinants of profitability.

The authors of this study would like to investigate and identify the major determinants of profitability of public and private sector banks for the year 2015-2016.

2. METHODOLOGICAL ASPECTS FOR THE STUDY OF PROFITABILITY OF PUBLIC AND PRIVATE SECTOR BANKS IN INDIA

2.1. Discriminant Analysis

Discriminant Analysis is an important statistical tool and this can be used for determining the factors that discriminant between two or more groups. The Discriminant Analysis also calculate the relative importance of the variables that discriminate between groups. If there are two categories to be discriminated, the analysis is called two-group Discriminant Analysis and if there are more than two categories, the analysis is called a multiple (Canonical) Discriminant Analysis.

The discriminant function is expressed as a linear combination of two or more independent variables and this is given by:

$$Z = a + w_1x_1 + w_2x_2 + \ldots + w_nx_n \tag{1.1}$$

where, Z is the discriminant score, a is a constant, w_1, w_2, w_3, …, w_n are the discriminant weights and x_1, x_2, x_3, …, x_n are independent variables/predictor variables.

The discriminant function calculates the weights (coefficients) that maximize the between-group variance, given the within-group variance. Then each weight is multiplied by the related independent variable x and they are added up. The result is one single discriminant score or value (Z).

The result of the Discriminant Analysis will be more reliable when the sample size is greater than 30 for each independent variable in the analysis. The number of independent variables, on the other hand, can atmost be two-less than the sample.

Discriminant Analysis is widely applied to solve many issues in the financial theory and practice. Financial analysts apply discriminant analysis technique for modelling bankruptcy of financial institutions and or non-financial companies.

2.2. Review of Literature relating to Discriminant Analysis

Altman (1965) for the first time developed a bankruptcy prediction model for non-financial enterprises using certain financial ratios and this model is named as Z-Score model. Sinky (1975) developed discriminant model for predicting financial distress of banks in USA. Halsem et. al., (1971) have attempted to apply discriminant analysis for studies relating to commercial bank profitability. They have identified a 'key' financial ratios which explained variations in commercial bank profitability. Since then determinants of bank profitability have been theoretically and empirically explored.

Bramhandkar (1989) has summarized a number of important studies relating to the use of discriminant analysis in finance and stated that majority of the studies relied on this techniques for classifying firms into two distinct groups.

Pai (2009) has studied the profitability and efficiency of banks in India. The discriminant model developed in this study revealed that foreign banks have performed well compared to public sector and scheduled commercial banks.

Shobana and Shanthi (2010) constructed a multidiscriminant model for foreign banks operating in India and concluded that the ratios viz. Internet Earned/Total Assets, Internet Earned/Total Income and Earning Assets/Shareholders Equity discriminate high profitability group of foreign banks from the low profitability group.

Sen (2010) studied the factors that discriminate between domestic and foreign banks operating in Turkey and concluded that there do not remain significant operational differences between them.

Ante and Ana (2013) employed discriminant analysis method for identifying key features of bank profitability level for Croatian banks. They have classified banks into two categories viz. Profitable group and non-profitable group based on average profitability with very high precision. Pam (2013) used discriminant analysis for predicting corporate bankruptcy in the banking sector of Nigeria and concluded that Multiple Discriminant Analysis (MDA) model is a potent tool and pointed out the need for unifying MDA model with other models.

3. AN ACCOUNT OF FINANCIAL RATIOS CONSIDERED FOR THE STUDY

The authors have considered the ratios viz., Capital Adequacy, Total Advances to Assets, Net Nonperforming Assets to Net Advances, Expenditure to Income, Liquid assets to Total Assets and Risk sensitive assets to Risk sensitive liabilities relating to public and private sector banks in India. A brief account of the ratios noted above is presented below.

3.1. Capital Adequacy Ratio(CAR)

Capital Adequacy Ratio is an indicator of financial health of banking system. Capital Adequacy Ratio has a direct effect on the profitability of banks by determining its expansion to risk of but profitable ventures. It is defined as given below:

$$\text{Capital Adequacy Ratio} = \frac{\text{(Tier-I + Tier-II)}}{\text{Risk Weighted Assets}}$$

3.2. Advances to Asset Ratios (AD/AS)

This ratio represents banks aggressiveness in offering loans to the individuals/firms which will ultimately result in improved profitability. It is stated that this ratio is also used to know the existing relationship between total advances of banks and its total assets.

3.3. Return on Assets (ROA)

Return on Assets reflects how will a bank's management is using the bank's real investment resources to generate profits. It is calculated as:

$$\text{ROA} = \text{Net Income/Total Assets}$$

3.4. Expenditure to Income Ratio (EXP/IN)

It is the ratio between operating expenses to total income. The lower the ratio is better for banks and vice-versa. This ratio is useful for comparing the management efficiency of banks.

3.5. Liquid Assets to Total Assets Ratio (LA/TA)

This ratio measures the overall liquidity position of a bank. The liquid assets includes cash in hand, money at call and short notice, balance with Reserve Bank of India (RBI) and other banks. Financial analysts emphasize that liquidity expresses the degree to which a bank is capable of fulfilling its respective obligations.

3.6. Risk Sensitive Assets to Risk Sensitive Liabilities Ratio (RSA/RSL)

Sensitivity of bank is determined by computing the ratio between Risk Sensitive Assets to Risk. The Risk Sensitive Assets consists of net advances, net Investments and money at call. Deposits and borrowings of banks constitute the Risk Sensitive Liabilities. The ratio can be interpreted as given below:

(i) Sensitive Ratio <1 implies banks liabilities reprice quicker than assets (Liability Sensitive).

(ii) Sensitive Ratio >1 implies banks assets reprice faster than liabilities (Asset Sensitive).

4. EMPIRICAL ANALYSIS BASED ON DISCRIMINANT FUNCTION

4.1. Financial Ratios

The data in respect of financial ratios relating to 38 banks are presented in Table 1(a) and Table 1(b). In this study, we have taken 38 commercial banks (public sector banks 28 and 14 private sector banks).

Table 1
(a) .Financial Ratios of Public Sector Banks

S.No.	*Name*	*CAR*	*AD/AS*	*ROA*	*EXP/IN*	*LA/AS*	*RSA/RSL*
1.	United Bank of India	11.86	0.5258	–0.21	0.9759	0.0643	0.9642
2.	United Commercial Bank	14.2	0.5141	–1.14	0.8792	0.0758	0.9828
3.	Allahabad Bank	12.05	0.6461	–0.31	0.9655	0.0842	1.0138
4.	Corporation Bank	12.16	0.5975	–0.2	0.0999	0.0646	0.9561
5.	Canara Bank	10.98	0.5872	–0.5	0.9456	0.1026	0.9929
6.	Central Bank of India	10.88	0.5893	-0.46	0.9614	0.0509	0.9817
7.	Union Bank	13.41	0.6606	0.33	1.0392	0.0723	0.9908
8.	Indian Overseas Bank	13.33	0.5861	–1.05	0.8999	0.0811	0.4192
9.	State Bank of Bikaner and Jaipur	13.24	0.6610	0.77	1.0867	0.0890	0.9891
10.	Syndicate Bank	11.15	0.6539	–0.53	0.9399	0.0949	0.9952
11.	Punjab and Sind Bank	12.8	0.6231	0.32	1.0378	0.0478	0.9846
12.	Andra Bank	12.99	0.6541	0.26	1.0289	0.0449	1.0044
13.	State Bank of Mysore	11.68	0.6502	0.43	1.0472	0.0446	0.9900
14.	Bank of India	10.49	0.5889	–0.99	0.8819	0.1626	0.9630
15.	Bank of Maharastra	10.46	0.6683	0.06	1.0072	0.0579	0.9765

S.No.	Name	CAR	AD/AS	ROA	EXP/IN	LA/AS	RSA/RSL
16.	State Bank of Travancore	11.33	0.5717	0.29	1.0324	0.0683	0.9996
17.	State Bank of India	12.02	0.6479	0.44	1.0547	0.0225	1.0121
18.	OBC	12.5	0.6268	0.06	1.0072	0.0419	0.9920
19.	Vijaya Bank	16.97	0.6120	0.26	1.0303	0.0455	0.9664
20.	Punjab National Bank	15.8	0.6178	–0.59	0.9318	0.1103	1.0074
21.	Industrial Development of Bank of India	14.03	0.5767	–0.97	0.8956	0.0443	0.9474
22.	Indian Bank	9.71	0.6335	0.34	1.0375	0.0589	1.0174
23.	Dena Bank	14.73	0.6170	–0.7	0.9240	0.0403	0.9505
24.	Bank of Baroda	19.08	0.5716	–0.8	0.9009	0.1994	1.0147

Table 1
(b) Financial Ratios of Private Sector Banks

S.No.	Name	CAR	AD/AS	ROA	EXP/IN	LA/AS	RSA/RSL
1.	Dhanalaxmi Bank	10.73	0.5579	–1.68	0.8597	0.0668	0.9477
2.	Lakshmi Vilas Bank	11.07	0.6837	0.62	1.0668	0.0476	1.0045
3.	Jammu and Kashmir Bank	11.75	0.6253	0.57	1.0600	0.0399	0.9859
4.	South Indian Bank	11.14	0.6504	0.52	1.0582	0.0491	0.9706
5.	Karur Vysya Bank	12.9	0.6778	0.98	1.1016	0.0484	1.0178
6.	Karnataka Bank	12.79	0.6000	0.73	1.0811	0.0539	0.9810
7.	Dcbbank	16.8	0.6758	1.01	1.1131	0.0466	1.0851
8.	Federal Bank	11.78	0.6353	0.52	1.0591	0.0593	1.0074
9.	City Union Bank	12.67	0.6738	1.42	1.1530	0.0832	1.0494
10.	Hdfc Bank	12.26	0.6554	1.73	1.2096	0.0549	1.0632
11.	Axisbank	19.01	0.6447	1.56	1.1952	0.0634	1.0318
12.	Yes Bank	10.98	0.5943	1.53	1.1852	0.0497	1.0426
13.	Kotak Mahendrabank	12.06	0.6172	1.08	1.1236	0.0566	1.0895
14.	Icicibank	17.7	0.6040	1.34	1.1667	0.0831	1.0540

4.2. Group Statistics

For comparative purposes we have presented the mean and standard deviation of the independent variables in Table 2 for the two categories of banks viz., banks earning profit and banks incurring losses.

Table 2
Group Statistics

Category of Banks	Financial Ratio	Mean	S.D
Banks earning profits	CAR	12.9621	2.4297
	AD/AS	0.5878	0,0398
	ROA	–0.7236	0.4129
	EXP/IN	0.8615	0.2220
	LA/AS	0.0887	0,0477
	RSA/RSL	0.9383	0.1513

Category of Banks	*Financial Ratio*	*Mean*	*S.D*
Banks incurring losses	CAR	12.9175	2.3539
	AD/AS	0.6394	0.0294
	ROA	0.7154	0.5000
	EXT/IN	1.0825	0.0603
	LA/AS	0.5539	0.0153
	RSA/RSL	1.0127	0.0349

4.3. Tests for difference in Group Means

One-way analysis of variance is carried out to ascertain the differences in means of the ratios between banks earning profits and banks incurring losses. The results are presented in Table 3.

Table 3
Test of Equality of Group Means

	Wilk's Lambda	*F*	*df1*	*df2*	*Significance*
CAR	1.000	0.003	1	36	0.956
AD/AS	0.630	21.180	1	36	0.000
ROA	0.303	82.734	1	36	0.000
EXP/IN	0.626	21.470	1	36	0.000
LA/AS	0.762	11.250	1	36	0.002
RSA/RSL	0.869	5.409	1	36	0.026

It is observed from the Table 3 that the significant difference in the mean exists for the ratio viz., AD/AS, ROA, EXP/IN, LA/AS and RSA/RSL [for which the *p* values are 0.000, which is less than 0.05, the assumed level of significance]. There does not seem to be any significant difference in the mean in respect of the Capital Adequacy Ratio.

4.4. Correlation Matrix

The correlation matrix for the entire predictor variable is presented in Table 4. We examined the correlation matrix for detecting the occurrence of multicollinearity (a high correlation between pairs of independent variables). The results presented in the table indicates that the correlation between any pair of values is not greater than 0.75. It is observed that there does not seem to be any problem of multicollinearity.

Table 4
Correlation Matrix

	CAR	*AD/AS*	*ROA*	*EXP/IN*	*LA/AS*	*RSA/RSL*
CAR	1	–0.053	0.222	0.142	0.286	0.068
AD/AS	–0.053	1	0.166	–0.007	0.022	0.061
ROA	0.222	0.166	1	0.179	0.078	0.325
EXP/IN	0.142	–0.007	0.179	1	0.147	0.075
LA/AS	0.286	0.022	0.078	0.147	1	0.141
RSA/RSL	0.068	0.061	0.325	0.075	0.141	1

4.5. Unstandardized Discriminant function

Canonical discriminant function coefficients are presented in Table 5.

Table 5
Canonical Discriminant Function Coefficients

Predictor Variable	*Function 1*
CAR	–0.041
AD/AS	8.796
ROA	1.619
EXT/IN	2.490
LA/AS	–13.097
RSA/RSL	–0.239
(Constant)	–6.604

The unstandardized discriminant function is given by

$$Z = -6.604 - 0.041X_1 + 8.796X_2 + 1.619\ X_3 + 2.490X_4 + 3.047X_5 - 0.239X_6$$

The eigen value of the above discriminant function is given in Table 6. The larger the eigen value, the better is the model in discriminating between the two groups of banks. The eigen value is 3.463. The value of the canonical correlation coefficient is also given in the table and its value is 0.881. The square of the canonical correlation coefficient is 0.7762. This means that 77.62% of the variance in the discriminant model between two groups of banks is due to the changes in the predictor variables noted above. Wilk's lambda and chi-square values are presented in Table 7. The value of Wilk's lambda provides the proportion of total variants not explained by the discriminant function. The value of Wilk's lambda and chi-square are 0.229 and 49.362. Wilk's lambda value is low and the same reveals the discrimination power of the function. Chi-squarevalue clearly indicates the discrimination between the two groups banks is significant.

Table 6
Eigen Values

Function	*Eigen Value*	*% of Variance*	*Cumulative*	*Canonical Correlation*
1	3.463	100.0	100.0	0.881

Table 7
Wilk's Lambda

Test Function	*Wilk's Lambda*	*Chi-Square*	*d.f*	*Significance*
1	0.224	49.362	6	0.000

4.6. Standardized Discriminant Function

The standardized canonical discriminant function coefficients are given in Table 8.

The absolute values of the coefficients in standardized discriminant function indicate the relative contribution of the predictor variables in discriminating between the two groups. The standardized discriminant function is given by,

Table 8
Standardized Canonical Discriminant Function Coefficients

Predictor variables	*Function*
CAR	–0.097
AD/AS	0.293
ROA	0.762
EXP/IN	0.353
LA/AS	–0.387
RSA/RSL	–0.023

$$Z = -0.097X_1 + 0.293X_2 + 0.762X_3 + 0.353X_4 - 0.387X_5 - 0.023X_6$$

The discriminant function clearly indicates that the predictor variable Return on Assets is the primary one which discriminates between the two groups of banks. The structure Matrix is given in Table 9.

Table 9
Structure Matrix

Predictor variables	*Function*
ROA	0.815
EXP/IN	0.415
AD/AS	0.412
LA/AS	–0.300
RSA/RSL	0.208
CAR	–0.005

By comparing the structural coefficients also we can find the relative contribution of the predictor variables in discriminating between the two groups of banks. The structural coefficients are obtained by computing the correlation between discriminant score and each of the predictor variables. These are called discriminant loadings.

The correlation coefficient between the discriminant score and the variable ROA is 0.815, whereas the correlation with LA/LS and CAR are -0.300 and -0-005. It is observed that the predictor variable viz. ROA is the most important one in discriminating between the two groups, followed by EXP/IN, AD/AS, LA/AS, RSA/RSL and CAR. It is important to note that the relative importance of the variables have undergone a change what we obtained through standardized discriminant function. The change is the relative importance of the variables using structure matrix is comparison to what is obtained through standardized coefficient is due to an inter correlation between predictor variables.

4.7. Group Centroid

We wish to develop a decision model for classifying a bank into two categories, ie profit carrying bank and loss incurring bank. The detailed aspects of this procedure is discussed below.

We can compute the mean discriminant scores for both the groups of banks. In our data set the sample size in two groups is not equal, the cut-off score for classification is computed as given below:

$$C = \frac{n_1 Z_2 + n_2 Z_1}{n_1 + n_2}$$

where, Z_1 and Z_2 mean discriminant score for group 1 and group 2,

n_1 and n_2 sizes of group 1 and group 2

The cut-off score for two groups is presented in Table 10.

Table 10
Function at Group Centroids

P/L	*Function*
1	–2.372
2	1.383

4.8. Classification Matrix

We construct a classification matrix which shows the summary of correct and wrong classification of cases in both the groups on the basis of the developed discriminant model. The details are presented in Table 11. This table shows that 100% of the original grouped cases correctly classified. We can conclude that the model can be considered as valid.

Table 11
Classification Results

	P/L		*Predicted Group Membership*		*Total*
			1	*2*	
Original	Count	1	14	0	14
		2	0	24	24
	%	1	100	0	100
		2	0	100	100
Cross validated	Count	1	12	2	14
		2	0	24	24
	%	1	85.7	14.3	100
		2	0	100	100

5. RESULT AND DISCUSSION

The detailed analysis has shown that the predictor variable viz, Return on Assets (ROA) plays an important role compared to the other predictor variables noted by us. The Correlation Matrix clearly show that none of the correlation coefficient is greater than 0.75 and this indicates the absence of multicollinearity. The unstandardized discriminant model shows that 78% of the variance in the discriminant model between the two groups of banks (banks earning profits and banks incurring losses) is due to changes in the predictor variables. The cut-off score for the two groups are –2.372 and 1.383 respectively. The classification matrix shows that 100% of the originally developed cases are correctly classified and this demonstrated = *s* that the discriminant developed can be considered as valid.

6. CONCLUSION

The standardized discriminant model clearly indicates that the predictor variable viz., Return on Assets is the primary one which discriminate between the two groups of banks and the correlation for Return on Assets is larger than the correlation coefficients viz. EXP/IN, AD/AS, LA/AS, RSA/RSL and CAR. The result of the study may help in formulating policies for effective determination of financial ratios by the management authorities of the banks.

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