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DEVELOPMENT OF CREDIT RISK MODEL FOR BANK LOAN RATINGS

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ABSTRACT

Credit rating is an opinion about future ability and obligation of the issuer to make timely Payments of principal and interest on a specific fixed income security. Traditionally the scope of rating was limited up to fixed income securities. Today, the credit rating agencies started rating of almost all types of instruments. The bank loan market is much larger than the bond market. Banks lend to various entities, many of whom have not felt the need for or do not have the ability to pay, therefore BLR is essential. Now, however, with the advent of Basel II regulations, which encourage banks to better calibrate the credit risk on their books, BLR's are more important. The bank loan rating can be at the request of the borrower or the lender. The ratings strengthen the banks' confidence in their borrowers. The present study aims to develop model for reliable bank loan ratings after investigate the relationship between financial ratios and rating scales. The model is developed for long-term bank loan ratings with the help of multiple regression. The model is developed with the help of financial data and rating information of 32- sample companies. The developed model will serve the banking sector to evaluate the credit-worthiness of the borrowers.

KEYWORDS

Credit Risk, Bank Loan, Finance, Credit Rating.

INTRODUCTION

REDIT RISK

Credit risk associated with each rating, or "risk bucket," is a probability of default that is derived from historical observations of the default behavior of companies within each ratings class. As such published ratings clearly contain significant information concerning the quality and marketability of various fixed income issues; it is of little surprise that credit ratings are considered a primary source of investor information in investment decision-making.

In India, four primary rating agencies namely Credit Rating Information Services of India, Ltd ("CRISIL"), Investment Information and Credit Rating Agency ("ICRA"), Credit Analysis and Research ("CARE") and FITCH provides such credit ratings to the public. The importance of the services of these agencies in the Indian debt market cannot be under estimated. Their role becomes doubly important in Indian financial market, where information relevant to determining creditworthiness may not be publicly available.

The basic problem of the Indian credit rating agencies may lie within the rating process itself, where different opinion is given by two rating agencies for same class of rating instruments. Past research has also shown that the ratings provided by the two bond rating agencies, are becoming extremely variable over time[i]. The consistency of determinant financial ratios between rating classes also points to probable weakness in rating methodologies. To avoid such variability it is extremely important to have a model, which avoids such complexities. Here models are developed targeting Bank-Loan Rating (BLR) segment.

BANK -LOAN RATING (BLR): AN INTRODUCTION

The bank loan market is much larger than the bond market. Banks lend to various entities, many of whom have not felt the need for or do not have the ability to pay, therefore BLR is essential. Now, however, with the advent of Basel II regulations, which encourage banks to better calibrate the credit risk on their books, BLR's are more important. The bank loan rating can be at the request of the borrower or the lender. The ratings strengthen the banks' confidence in their borrowers. Such rating gives an opinion of the timely payment of principal and interest, it also give an opinion on the extent of recoverability of the loan post-default. The bank loan rating provides a uniform benchmark for credit and pricing decisions in the bank loan market. Loan ratings focus on both the risk of default, and the likelihood of ultimate recovery in the event of default. Bank loan ratings are widely accepted and extensively used globally. Standard and Poor's rated 1,350 company bank loans aggregating $982 billion[ii]. BLR supports Indian banks in the implementation of the Basel II accord, by providing an independent opinion on loan-specific risk. This is used by banks for risk pricing, capital allocation and portfolio management.

The bank loan rating methodology is broadly divided in to two parts: long-term rating and short-term rating. Under long-term rating agencies use various symbols like, AAA, AA, A, BBB, BB, B, C and D grades are assigned based on credit quality of ratee, while grades like $P_1/PR_1/F_1/A_1$, $P_2/PR_2/F_2/A_2$, $P_3/PR_3/F_3/A_3$, $P_4/PR_4/F_4/A_4$ and $P_5/PR_5/F_5/A_5$ are assigned for short-term ratings. Apart from above ratings grades plus (+) and minus (-) signs are used to determine sub-grading.

METHODOLOGY ADOPTED FOR DEVELOPMENT OF RATING MODELS

The models are developed to determine the creditworthiness of corporate. It is developed purely based on financial information (Financial ratios). The models development is broadly divided in to two parts. The first section of the study examines the extent of the association between the ratings published by credit ratings agencies and the sample financial ratios of companies. The purpose of such an investigation is to determine which ratios, if any, are closely correlated with the ratings of the credit agencies' so that they can subsequently be used in the development of a new ratings model.

Second section discusses about development of rating model through multiple regressions. Here, ratings assigned by rating agencies are taken as independent variable, while ratios selected after correlation analysis in first parts are dependent variables. To have uniformity in rating models, the rating data are taken for all four rating agencies' bank loan ratings. The researcher had selected at least one company from each rating class rated by each rating agency. 32 -sample companies are considered for total eight rating scales of all four rating agencies. Here sub-gradings like AAA-,AA-,A-,BBB- etc. are not considered to avoid the complexities in the model. The General form of multiple-regression model is discussed below:

Equation: Multiple regressions equationiii...1

$$Y^ = a + b_1X_1 + b_2X_2 + ... +.....+ b_kX_k$$

Where : $Y^$ =   Estimated value corresponding to dependent variables

      a = $Y^$- Intercept value (Constant value)

      b_1, b_1, b_k =   Slopes associated with dependent variable like X_1, X_2, X_k

      X_1, X_2, X_k =   Value of dependent variable.

Where' is the predicted score, X_1 is the score on the first predictor variable, X_2 is the score on the second, X_k is the score for k variables etc. The Y intercept is a (Constant value). The regression coefficient b_1, b_2, b_k etc. are analogous to the slope in simple regression.

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DATA COLLECTION

The long-term ratings published after 31st March, 2008 for samples companies are considered for this model. The Five years financial information is collected form leading financial software like; Capitaline, Ace analyzer and Prowess.

SAMPLE COMPANIES

A list detailing the sample for this study, along with the long-term and short-term rating of the companies' and the name of concerned rating agency is shown below:

TABLE 1: LIST SAMPLE COMPANIES FOR RATING MODELS			
Name of company	Long- Term Rating Scale	Short-term Rating Scale	Rating Agency
20 Microns Ltd.	BBB	PR3	CARE
ACC Ltd.	AAA	P1+	CRISIL
Arvind Ltd.	D	P5	CRISIL
Asian Granito India Ltd.	A	PR1+	CARE
B H E L	AAA	F1	FITCH
Bharat Electronics Ltd.	LAAA	A1+	ICRA
Bharat Gears Ltd.	BBB	P2	CRISIL
Cipla Ltd.	AAA	PR1+	CARE
Compton Greaves Ltd.	AA	F1+	FITCH
DCM Ltd.	LD	---	ICRA
Duncan Industries Ltd.	LC	A5	ICRA
Dynamic Industries Ltd.	BB	P3+	CRISIL
Escorts Ltd.	BB	F4	FITCH
Ginni Filaments Ltd.	D	F5	FITCH
Godrej Consumers Products Ltd.	LAA	A1+	ICRA
Hester Biosciences Ltd.	C	P4	CRISIL
Hind Industries Ltd.	LBB	A4	ICRA
Hindalco Industries Ltd.	AA	P1+	CRISIL
Balmer Lawrie & Company Ltd.	LAA	A1+	ICRA
JP Hydropower Ltd.	A	F1	FITCH
KLG Systel Ltd.	A	P1	CRISIL
MMTC Ltd.	AA	PR1+	CARE
CCS InfoTech Ltd.	BB	P4	CRISIL
Nagarjun Fertilizers & Chemicals Ltd.	BB	PR4	CARE
Nitin Spinners Ltd.	C	PR4	CARE
NKG Infrastructure Ltd.	LBBB	A2	ICRA
Quintgra Solution Ltd.	LB	A4	ICRA
Soma Textiles & Industries Ltd.	D	PR5	CARE
TV 18 India	BBB	F2	FITCH
Unitech Ltd.	B	F4	FITCH
Wockhardt Ltd.	C	F5	FITCH
XL Telecom & Energy Ltd.	B	PR4	CARE

The data is collected from the Rating Scan (Monthly journal on credit quality, published by CRISIL), BLR Connect (Monthly update on bank loan rating) and rating updates on websites of each rating agency. For the shake of uniformity in the models, the companies rated by each rating agency are incorporated in the data base.

Sample companies for long-term rating includes at least one ratee from eight rating classes like AAA, AA, A, BBB, BB, B, C and D rated by all four rating agencies, while for short-term rating includes at least one ratee from five rating classes like; $P_1/PR_1/F_1/A_1$, $P_2/PR_2/F_2/A_2$, $P_3/PR_3/F_3/A_3$, $P_4/PR_4/F_4/A_4$ and $P_5/PR_5/F_5/A_5$ rated by all four rating agencies.

The thirty two companies are taken from each rating class. Here, each rating agency assigns one or more same rating symbol in case of long-term rating scale. In short-term rating, the different rating symbols are assigned to each rating class by each rating agency. Sample companies are selected from various industries like cement, cotton, textiles, pharmaceuticals, metal, television, power, consumer care, infrastructure, energy, bio-science etc.

SAMPLE FINANCIAL RATIOS

The financial information is collected from leading financial software namely Capitaline, Ace analyzer and Prowess[iv]. The financial ratios shown in **Table: 7.2** for last five years periods (Pre-rating period) are used to develop rating models. The correlation between these sample financial ratios and rating scales are measured to identify the contributory ratios in rating. The sample financial ratios considered in model are shown below;

TABLE 2: SAMPLE FINANCIAL RATIOS FOR RATING MODEL	
D/E = Debt-equity ratio	ROE = Return on equity
RONW = Return on networth	IT = Inventory turn over ratio
S/NA = Sales/Net Assets	DT = Debtors turnover ratio
IC = Interest coverage ratio	APATM = Avg. profit after tax margin (%)
LD/E = Long-term debt/equity	CPM = Cash profit margin (%)
PBDIT/S = Profit before depreciation, interest and tax /Sales	P/CE = Price/Cash EPS
CR = Current ratio	P/E = Price-earning ratio
ROCE = Return on capital employed (%)	P/B = Price-book value ratio
	MCAP/S = Market capitalization/Sales

The data of above mentioned financial ratios for the period of 2003-04,2004-05,2005-06, 2006-07, 2007-08 are considered for all sample companies for developing rating models. The five-year average of above financial ratios is considered for all sample companies to develop a long-term rating model.

CORRELATION BETEEN FINANCIAL RATIOS AND CURRENT RATINGS

The ratios available from financial statements are the most important source of information concerning the creditworthiness of a corporation. It is important to measure correlation between ratios of above sample companies to develop reliable rating models. The ratios which have significant correlation with the rating grades/scales are important predictors for ratings of a company.

CORRELATION: LONG-TERM RATING SCALES AND FINANCIAL RATIOS

The correlation is measured at 1% and 5% significant level. The ratios, having significant correlation at 5% level, means at 95% confidence levels are selected for developing rating models. The ratios, which are not having significant correlation with rating scales at 95% confidence levels, are excluded from the rating model.*(See Analysis: A)*

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For this model, the ratios are selected considering 95% confidence level. The ratios are which are significant at 5% level (p-value < 0.05) includes Debt-equity (D/E), Return on net worth(RONW), Interest coverage (IC), Long-term debt-equity (LD/E), Return on capital employed (ROCE), Return on equity (ROE) and Price-Book value (P/B). *(See Table: 3)*

TABLE:3 : CORRELATION BETWEEN FINANCIAL RATIOS AND LONG-TERM RATING SCALES					
Financial Ratios	Prior sign of correlation	Correlation	p- Value	Significant at 1% level	Significant at 5% level
Debt-Equity Ratio (D/E)	-	-0.477	0.002	Yes	Yes
Return on Networth (RONW)	+	0.360	0.021		Yes
Sales/Net Assets (S/NA)	+	0.198	0.139		
Interest Coverage Ratio (IC)	+	0.542	0.001	Yes	Yes
Long-term Debt/Equity (LD/E)	-	-0.453	0.005	Yes	Yes
PBDIT/Sales	+	0.237	0.096		
Current Ratio (CR)	-	-0.131	0.238		
Return on Capital Employed (%)	+	0.472	0.003	Yes	Yes
Return on Equity (ROE)	+	0.359	0.022	Yes	Yes
Fixed Assets Turnover (FAT)	+	0.166	0.182		
Inventory Turnover Ratio (IT)	+	0.126	0.246		
Debtors Turnover Ratio (DT)	+	0.235	0.098		
Avg. PAT Margin (APATM%)	+	0.273	0.065		
Cash Profit Margin (CPM%)	+	0.255	0.079		
Price/Cash EPS	+	0.223	0.110		
Price- Earning ratio (P/E)	-	-0.041	0.411		
Price-Book Value Ratio (P/B)	+	0.357	0.022		Yes
Market Capitalization /Sales	+	0.188	0.152		

The ratios like; Sales/Net Assets (S/NA), PBDIT/Sales, Current Ratio (CR), Fixed Assets turnover (FAT), Inventory turnover (IT), Debtors turnover (DT), Average Profit after tax margin (APATM%), Cash Profit Margin (CPM%), Price/Cash EPS (P/CEPS), Price-earning ratio(P/E) and Market Capitalization /Sales (MCAP/S) are not significant at 5%. These ratios do not contribute in rating determination, therefore excluded while developing model. The table shows selected financial ratios for developing rating model for long-term rating scales;

TABLE: 4: SELECTED FINANCIAL RATIOS FOR LONG-TERM RATING MODEL[v]

D/E = Debt-equity ratio	ROCE = Return on capital employed (%)
RONW = Return on net worth	ROE = Return on equity
IC = Interest coverage ratio	P/B = Price-book value ratio
LD/E = Long-term debt/equity	

The debt-equity ratios has negative correlation with long-term rating scales, because when debt proportion is more, the ability to pay may adversely affects and it downgrades an organization. The RONW is having positive correlation with rating scales, which shows the return relationship with grading scales.

The interest coverage ratio has positive correlation with rating scales, which shows interest paying ability of an organization. Long-term debt/equity is also having negative correlation. The ROCE and other two valuation ratios namely ROE and P/B ratio are having positive correlation with rating scales.

SELECTION OF CONTRIBUTORY FINANCIAL RATIOS FOR MODELS

The final inclusion of financial ratios from the potential list of significant ratios is dependent on prediction power as proven in correlation analysis. The selected ratios are having prediction power for long-term rating scales.

As stated earlier, the ratios, which are significant at a 5% level for long –term ratings are Debt-equity (D/E), Return on net worth(RONW), Interest coverage (IC), Long-term debt-equity (LD/E), Return on capital employed (ROCE), Return on equity (ROE) and Price-Book value (P/B). The correlation matrices in *Analysis: A* ,shows ratios like; Debt-equity (D/E), Return on net worth(RONW), Interest coverage (IC), Long-term debt-equity (LD/E), Return on capital employed (ROCE), Return on equity (ROE) and Price-Book value (P/B) are all highly correlated with one another; nearly all of these correlations are significant at a 5% significance level. As a result, these ratios are well present the long-term rating scales.

DEVELOPMENT OF CREDIT RATING MODELS:

The model is developed based on multiple regression as stated in *Para:.2*. The ratings are taken as independent variables, while all contributory ratios selected after correlation analysis are dependent variables. The model provide numerical rating, which are converted in to symbolic rating scales by applying average grade difference between higher and lower values. The model is developed by applying multiple regression equation. The model development is divided in to various stages. At initial stage beta values (Slope) is calculated between long-term rating scales and all selected financial ratios. Analysis of Variance (ANOVA) is tested. Here F-calculated value is < F-Table value at (6, 25) degree of freedom, means F falls in acceptance region. It shows equality of population means with sample means, when population standard deviation is not known. *(See Analysis:.B)*.

The third stage is all bout goodness of fit of the model. Under this stage R, R^2, adjusted R^2 and p-value are calculated. R shows multiple correlation coefficients. It is correlation between the observed and predicted values of the dependent variable. The values of R for model produced by the regression procedure range from 0 to 1. Here the value R is 0.9354. The R^2 Value helps us to determine which model is best. The values of R squared range from 0 to 1. Here value of R^2 is nearer to 1 i.e. 0.8749, so, we can say that independent variables are highly correlated with dependent variables. Adjusted R^2 attempts to correct R squared to more closely reflect the goodness of fit of the model in the population. Use of R^2 helps us to determine which model is best. Here value of R2 is 0.7231, means it shows the model best fits to determine rating *(See Analysis: C)*.

The p-value shows, whether significant relationship exist with independent variables or not. Here p-value is 0.0221< 0.05, means significant relationship exist between dependent and independent variables. The RONW is selected after correlation analysis, but it is rejected because of its low tolerance, which contributes little information to a model, and can cause computational problems. It means RONW is not fit for the model at each step. The figure below shows new developed model for long-term rating scales.

Equation: Developed Model to Determine Long-term Rating Scales (LRM)………………………………………………….. 2.

Rating Scale Y^ = 4.1040 -(0.4080 * D/E + (0.0265 *IC)- (0.0865 *LD/E) – (0.0424* ROCE) – (0.0257*ROE) +(0.0595 *P/B)

Where Y = Est. Numerical rating scales   D/E = Debt-equity ratio   ROE = Return on equity
ROCE = Return on capital employed   IC = Interest Coverage ratio   LD/E = Long-term debt/equity   P/B = Price-Book value ratio
(b_1 = - 0.4080, b_2 = 0.0265, b_3 = - 0.0865, b_4 = - 0.0424, b_5 = -0.0257, b_6 = 0.0595,are beta (Slope) for ratios considered significant for the model)

ASSUMPTIONS OF THE MODEL

1. Model considers only financial ratios (quantitative data). Here qualitative information like political situation, business environment, management qualities, economic conditions in which company is located etc. are ignored.

2. Model is based on five-year average financial performance of the sample companies. The long-term performance of an organization may not state the clear picture because of worst performance of an organization in past year due to poor economic condition.

3. Model provides only numerical rating scales like 1,2,3 etc., which are converted in to Lettered rating scales like AAA,A,A,BBB,BB,B,C,D.

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4. The sub-grading like AAA-, AA-,A-, BBB-, etc are ignored to avoid complexity. There is a further scope to develop new model with sub-grading.

5. The model is developed only for long-term rating scales, further model can be developed considering short-term rating scales also.

CONVERSION OF NUMERICAL RATINGS IN TO LETTERED RATINGS

The developed model provides ratings in numeric, therefore it is necessary to develop method to convert numerical rations in to alphabetical one. The ratios that contribute to Long-term rating model (LRM) tend to fall within a general range of possible values. At the initial stage the numerical values are calculated using new developed model, and higher and lower range is determined. The grade difference values are calculated by dividing total range difference by total number of grades. These grade difference values are subtracted from higher grade and determined the value of next grade and so on.

The *Analysis: E,* shows the calculated numerical rating scales using new developed formula. The higher value of numerical rating is 6.9009, while lower value of numerical rating is -3.0611. The numerical rating falls within the range of -3.0611 to 6.9009, which shows the range of 9.9620   (-3.0611-6.9009). The total value difference between each grade is calculated 1.2453 (9.9620/ 8 grades). Grade difference 1.2453 shows the difference between each grade, say AAA-AA. The each grade is determined subtracting the grade difference value from its upper grade. The *Analysis-F,* shows the conversion of numerical rating in to lettered rating scales. The table given below shows the conversion of numerical values in to lettered rating scales:

TABLE 5: CONVERSION OF NUMERICAL RATING IN TO LONG-TERM LETTERED RATINGS

Rating Scales	Range of Numerical rating	The grade range is calculated by following:
AAA	5.6556 & Above	AAA = Higher num. rating i.e 6.9009 – Range difference i.e. 1.2453 = 5.6556 & above
AA	4.4103 TO 5.6555	AA = 5.6556 – 1.2453 = 4.4103 TO 5.6555
A	3.1650 TO 4.4102	A = 4.4103 – 1.2453 = 3.1650 TO 4.4102
BBB	1.9197 TO 3.1649	BBB = 3.1650 – 1.2453 = 1.9197 TO 3.1649
BB	0.6744 TO 1.9196	BB = 1.9197 – 1.2453 = 0.6744 TO 1.9196
B	-0.5709 TO 0.6743	B = 0.6744 – 1.2453 = - 0.5709 TO 0.6743
C	-1.8162 TO -0.5710	C = -0.5709 – 1.2453 = -1.8162 TO – 0.5710
D	-3.0615 & Below	D = -1.8162- 1.2453 = -3.0615 and Below

SUMMARY

The model will be useful to bank to determine creditworthiness of the clients and investors, brokers and professionals to determine the ratings of unrated entities. The 32 -sample companies are selected for these two models. The first section of this study examined the extent of the association between the ratings published by credit ratings agencies and the financial ratios of companies within a sample set. The second section is all about model development through multiple regressions. The model is developed to determine long-term rating scales based on selected financial ratios after correlation analysis. The third section of this chapter is all bout conversion of numerical ratings in to lettered rating scales.

As a result of this study, I find that these models are good means of determining credit scores for companies that are un-rated by any of the primary credit ratings agencies of India. The variables *(Financial ratios)* which are selected to develop these models are true measures for creditworthiness of rated company. The models exclude qualitative data like economic condition, political situation, management qualities etc. Model are developed without considering the sub-grading between two main grades like AAA⁻, AA⁻, BBB⁻, BB⁻, B⁻ etc. so; there is a further scope to develop a model with sub-grading.

ENDNOTES

[i] Article by: Sanjay Sehgal & Mamta Arora, "*Bond Rating Variability and Methodology: Evidence from the Indian Bond Market"*, IIMB Management review, Volume No: 16 , September 2004.

[ii] CRISL Begins Bank Loan Rating', "*The Hindu Business Line"*, Financial daily form The Hindu group of Publications, Tuesday, July 19,2005.

[iii] Richard I. Levin and David S. Rubin, "*Statistics for Management*", Seventh edition, New Delhi: Prentice-Hall of India, 1999, pp: 720-728.

[iv] Capitaline and Prowess are financial software developed by Capital Market Pvt. Ltd., Mumbai and Centre for Monitoring Indian Economy Pvt. Ltd, Mumbai respectively. While Ace analyzer is developed by Accord Fintech Pvt. Ltd. These software provides up-to-date database of around twelve thousands companies.

[v] The correlation is measured 1% and 5% significant level. The ratios which are having p-value < 0.05 are selected for rating model. The model ratios are selected considering 95% confidence level.

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DATA BASE SOFTWARE

- Capitaline Plus: Database software developed by Capital Market Limited, provides fundamental and market data on more than 20,000 Indian listed and unlisted companies. It provides the extensive data on every company profile, History and Financial details for more than 10-years (P&L, balance sheet, cash flow, consolidated financial data, segment data, forex data, R&D data, ratios, quarterly results etc).
- Prowess: Data base Software developed by Centre for Monitoring Indian Economy provides detailed information on over 23,000 firms in organized form.
- ACE Analyzer: Software developed by Accord Fintech Pvt. Limited, Provides financial and non-financial information of companies & sectors, Equity Markets**,** Commodities Markets and other Economic Data.

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