

DETERMINANTS OF CORPORATE CREDIT RATINGS: AN EMPIRICAL ANALYSIS OF INDIAN COMPANIES IN THE MANUFACTURING SECTOR

Rachan Sareen¹ and Madhu Vij²

The credit ratings that are assigned by credit rating agencies are based on publicly available data and confidential information relating to the company's business strategy, management quality, succession planning, industry characteristics and so on. Such information is not freely available to the public. The rating agencies claim that they make an overall assessment of the company by analyzing both financial information and non-financial or "subjective" factors. However, they are not perfectly transparent with respect to the factors that are considered for assigning the credit ratings. Thus, an exhaustive study of all the variables that are considered by the credit rating agencies is not possible. The academic literature on credit ratings focuses on the information available in the public domain. Keeping in view the limitation of the earlier studies, a primary survey was done to obtain information on qualitative factors like market position, commitment to the environment and business growth potential. These have been included in the present study as explanatory variables. Ordinal logit regression is conducted on a sample of 102 companies and commitment to the environment has been found to have a significant impact on the credit ratings of a company.

Key words: Credit Ratings, Ordinal Logit regression, Qualitative Factors

INTRODUCTION

The Credit Rating Agencies are able to provide independent assessments of the probability of default by companies, governments and the providers of a wide range of financial instruments. They not only specialize in accumulating information but, they also have access to non-public information. Even if they merely collate existing data, they offer service in summarizing the existing disjointed information, and giving an assessment. An investor has neither the means nor the capability to evaluate the creditworthiness of an issuer. These rating symbols instill confidence in him for taking

¹ Associate Professor, Sri Guru Tegh Bahadur Khalsa College, University of Delhi, Delhi

² Professor, Faculty of Management Studies, University of Delhi, Delhi

investment decisions. Thus, the credit rating agencies play a vital role in effective and efficient functioning of the financial markets

Credit rating agencies have been condemned for failing to anticipate major credit events worldwide. Big corporations like the international insurance giant A.I.G (American International Group), Enron and WorldCom were assigned high investment-grade ratings just months before their collapse. They also face criticism on account of lack of transparency, accountability and conflict of interest. The global crisis of 2007-08 and the ongoing Euro crisis have put the credit rating agencies under severe criticism. These crises have not seriously affected India. This has been due to strict and conservative standards followed by Indian banks. Nevertheless, there have been other incidents in India that have brought rating agencies under public scrutiny like CR Bansali's empire collapsed in mid-1990s, fall of Satyam and so on. This raises questions on the quality and objectivity of the methodologies, procedures, practices and processes adopted by credit rating agencies. There is an increasing pressure on the credit rating agencies by the regulatory authorities like International Organization of Securities Commission, (IOSCO), the United States Securities and Exchange Commission, and the European Commission Committee of European Securities Regulations, to make their methods and communication with investors and regulators more transparent.

According to Standard and Poor's Rating Services¹, a credit rating is a symbolic indicator of the current view of the relative capacity of the issuer to service its debt obligation in a timely manner, with specific reference to the instrument being rated. Credit ratings are not based on mathematical formulas. Instead, credit rating agencies use their judgment and experience in determining what public and private information should be considered in giving a rating to a particular company or government. However, they are not perfectly transparent with respect to the factors that are considered for assigning the credit ratings. Thus, an exhaustive treatment of all the variables that are considered by the credit rating agencies is not possible. The academic literature on credit ratings focuses on the information available in the public domain.

Keeping in view the limitation of the earlier studies, a primary survey was done to obtain information on qualitative factors like market position, commitment to the environment and business growth potential. These have been included in the present study as

¹ Credit ratings <http://www.standardandpoors.com/ratings> retrieved on September 13, 2013

explanatory variables. The study focuses on long term credit ratings assigned to three industries (textile, paper and steel) in the Indian manufacturing sector as on July 1, 2012 by any of the five rating agencies recognized by the Securities and Exchange Board of India (SEBI) and the Reserve Bank of India (RBI). The credit ratings of three industries (textile, paper and steel) in the Indian manufacturing sector have been studied as a function of qualitative factors. These three industries are the oldest and most prominent industries in India and also play an important role in the economy. On the basis of the annual growth rate data for the industrial sub-sectors by Central Statistical Organization published in the eleventh five year plan (Planning Commission in Of India, Government Of India, 2008), textile, paper and steel were among the few manufacturing industries that showed substantial increases in the rate of growth as compared to the previous plan. The Compound Annual Growth Rate for the period 2002-07 for textile industry was 4.7% (0.29% in 1997-2002), paper industry was 7.95%(4.29% in 1997-2002) and steel industry was 12.32% (2.16% in 1997-2002). In the approach paper of the twelfth five year plan published by Planning Commission Of India, Government Of India in October, 2011, priority sectors for India were identified and these were placed in four categories in the Twelfth Five Year Plan. These sectors are considered to be critical in achieving the overall manufacturing goals. These are -Sector of Strategic Importance, Sectors for Basic Inputs, Sectors for Depth and Value Addition and Sectors for Employment Generation. The three industries that have been selected for the study belong to the sector for basic inputs, sector for depth and value addition and sector for employment generation respectively. The sector of strategic importance has been excluded as data collection issues were anticipated due to the sensitive nature of the sector.

The rest of the paper is organized as follows:

Section 2 discusses the related literature. Section 3 presents the research methodology. It briefly discusses the variables and method of investigation used in the study. The analysis and interpretation of results is presented in Section 4. The last section presents the conclusion and policy implications.

REVIEW OF LITERATURE

The academic literature on credit ratings (To name a few- Sareen & Vij, 2015, Degos et al, 2010, Blume et al, 1998; Gentry et al, 1988; Kaplan & Urwitz, 1979; Pogue & Soldosky, 1969) focuses on the information available in the public domain. This is mostly in the form financial ratios or quantifiable non financial factors like age, volume

of debt and so on. Most of the researchers focused on empirically examining financial variables with respect to credit ratings. They have considered different sets of financial variables and arrived at significant determinants that were not necessarily same. The exclusion of the qualitative information has been considered as a limitation in these studies. The present study aims to examine the relationship between the credit ratings and predictors like market position, commitment to the environment and business growth potential. The information on these variables has been collated for the three industries by means of a questionnaire for each industry. The questionnaires have been constructed with the help of research methodology for the three industries given on the respective websites of credit rating agencies like Standard & Poor's, Moody's, CRISIL (Credit Rating and Information Services of India Limited), ICRA (Investment Information and Credit Rating Agency of India Limited) and CARE (Credit Analysis & Research Ltd.). Apart from this, various reports like the Annual Report (2011-12, 2012-13) of the Ministry of Textiles, the Annual Report (2011-12, 2012-13) of the Ministry of Steel were consulted to get an insight of these industries. Some of the articles that have been used in constructing the questionnaires are as follows:

Doshi G (2006) examines the strengths and weaknesses of the Indian textile industry. He also discussed threats from countries like Bangladesh, Turkey and Pakistan in the international market and opportunities after quota restrictions and other trade barriers have been removed. This helped in designing questions for assessing the growth potential of the companies in the textile industry.

Mathur RM., Thapliyal B. P. and Singh K. (2009) discuss the challenges faced by the Indian Paper industry like obsolescence of technology, high cost of inputs, environment issues and competition in the global market. It also examines initiatives taken up by the government of India to support the industry. The initiatives mainly relate to adoption of modern technology, innovation and research and development support to the industry.

Burange, L. G., & Yamini, S. (2010) examined the performance of Indian iron and steel industry in the pre and post-liberalization periods in terms of production, consumption, foreign trade, capacity utilization, prices and employment.

Raghuveer, S.(2011) discussed the future prospects of paper industry. According to him, the main challenges before the Indian Paper Industry are the shortage of fibrous raw material, the energy and its cost. He emphasized the need to balance the projected supply and demand gap.

Todi (2013) discussed the future of Indian textile industry. He discussed the role of the government, importance of technology and significant policy support in further growth of the industry.

Besides the various reports and articles, the Management Discussion and Analysis² that accompanies corporate governance report also proved useful in designing the questionnaire.

RESEARCH METHODOLOGY

This section describes the dependent and the independent variables. This is followed by the discussion on statistical and econometric techniques used in the study.

(a) Dependent Variable

The *dependent variable* (Y) in the present study is long term rating of a company assigned by credit rating agencies in India as on July 1, 2012. The long term ratings for the selected companies have been obtained from CMIE (Centre for Monitoring Indian Economy) database. The long term credit ratings are issued in alphabetic form and are categorized in six investment grades and four non-investment grades. The ratings are further classified into sub categories by attaching a suffix '-' or '+' to indicate the relative position of the issuer within the same category. The ratings are converted to a numerical score for the purpose of statistical analysis. The present study focuses on broad categories. Therefore, positive or negative signs suffixed to ratings have been ignored while assigning numerical values. As there were a few observations in the highest (AA, AAA) and the lowest categories (D, C, CC and CCC), they have been merged with the nearest category. Therefore, the present study considers 6 categories of credit ratings ranging from 1 to 6, where 1 denotes the lowest rating and 6 denotes the highest rating.

The ratings have been considered for all bonds, non convertible debentures, and other debt instruments (excluding public deposits) with original maturity exceeding one year. Different rating agencies may distinguish their ratings by adding a different prefix (e.g. AAA is given as LAAA by ICRA, CARE AAA by CARE and BWR AAA by Brickworks) but categories remain the same

² Management discussion and analysis (MDA) is an unaudited part of an annual report in which the management discusses the company's financial performance for the current and the past period and provides insight into the company's future prospects in light of its strategy.

(b) Independent Variables

A structured questionnaire has been developed to understand the competitive position, operating efficiencies and future prospects of the companies in the textile, steel and paper industries. A company with a strong market position, adequate commitment to environment and a good growth potential is viewed favorably by the credit rating agency. An adequate questionnaire construction is critical to the success of a survey. The important parameters in questionnaire designing are its content, phrasing, sequencing and layout. Keeping in view these factors, an in-depth analysis of rating criteria of all the five rating agencies has been done. Each rating agency gives a detailed rating methodology for different sectors. The rating agencies give general criteria for the manufacturing sector and specific criteria for the selected industries. In order to get a better insight into their rating methodology, rationales provided for 200 individual long term ratings assigned by these agencies have been thoroughly inspected. The annual reports (with special focus on Management Discussion and Analysis) have also been examined to understand the challenges and opportunities faced by different industries. The useful information thus obtained along with the articles and reports (Yildirak K and Süer O, 2011, Ministry of Steel, 2011, Raghuvver, S., 2011, Ministry of Textile, 2011, Burange, L. G., & Yamini, S., 2010, Competition Commission of India, Indicus Analytics, 2009) on issues and challenges of relevant industries helped in making the basic structure of the questionnaire. The research methodology used by international rating agencies i.e. Standard & Poor's and Moody's has been very helpful in designing the questionnaire. It has been found that Moody's Investor Service³ gives a free access to its members to research methodology grid which gives their approach to assessing risk. There are publications for various industries that can be referred to evaluate credit profiles. Although these publications do not give an exhaustive treatment of all factors but it helps issuers, investors, and other interested parties in understanding the qualitative considerations and financial ratios that are usually most important for ratings in a particular industry⁴. A thorough study of these publications provided an insight to key qualitative and quantitative risk characteristics for the industries selected for the present research.

The information sought in the questionnaire had to be obtained from the top

³ Moody's investor services. Moody's Approach to Rating the corporates December (1999). Retrieved on June 20, 2012 from www.kisrating.com/include/pdf

⁴ <http://www.moody.com/researchandratings/rating-methodologies>

management which made the task all the more difficult. There was another challenge of asking for relevant but not confidential information. The length of the questionnaire was also of prime importance. Given these considerations, three questionnaires for textile, steel and paper industry were designed. As all the three industries belong to the manufacturing sector, there were some common questions and some that were specific to the selected industry. These were sent out to 516 companies. On an average, 6-7 reminders were sent to most respondents. On the basis of the first thirty responses received, changes were made with respect to framing of some questions, scale of measurement and directions given to the respondents. The effort resulted in a total of 102 responses (Textile (64), Steel (25) and Paper (13)). The responses have been used to study the influence of market position, commitment to environment and growth potential of a company on its credit ratings. It has been obtained over a period of six months (July-December) in the year 2011-12. An attempt has been made to design the questions in such a way that the respondents' perception reflects companies' competitiveness and growth potential in general.

The questionnaire has been divided into four parts:

A. Company's/Respondent's Details: It includes questions on the gender, educational qualifications, level of management, age of the company and the respondent. It focuses on demographic information of the rated company and the person responding to the questionnaire. The demographic questions are important as they help in profiling the respondents. They also help in cross-tabulating and comparing subgroups to see how responses vary between these groups.

B. Market position: Market Position refers to the place an entity occupies relative to its competitors. This depends on the ability of the firm to control costs, diversity in terms of product health, markets served, geography and operations. Operational diversity reduces dependence on a single product or end market. This helps an entity to face adverse situations during business cycles. This is because one product or end market may perform better than another at different times. Therefore, a company that has a range of products or serves a range of markets can display more stability in terms of revenue and profits. This section attempts to ascertain the competitive position of the company. It attempts to find out how a company is placed in the market with respect to self sufficiency, product and geographic diversification, client concentration, and assured customer base. In order to understand the market status of the companies, nine questions have been framed for the companies in the paper and textile industry and

twelve questions have been framed for companies in the steel industry. Each question has been given four choices. A nominal value of one has been assigned to the least favorable option and a value of four has been assigned to the most favorable option. The market position variable has been found by calculating the mean of the values that have been assigned to the responses in this part.

C. Commitment to Environment: It is crucial to combine economic success with environmentally friendly processes that sustains life for all future generations. The corporate sector should strive to achieve a zero environmental footprint throughout the life cycle of their products and business activities. This section examines the company's sensitivity towards the environment and its management. Four questions have been framed to assess the company's commitment towards its environment. They relate to certifications (and their renewal) with respect to environment management, quality, health and safety standards. These certifications confirm that the company meets the statutory and regulatory requirements. Apart from this, the questionnaire sought information about any litigation risk with respect to product liability, environment or labor issues the company faced. This section ends with a question on how the respondent's company is contributing towards improving the environment.

The questions require the respondents to rate (in the increasing order of importance) the different options on a five point likert scale. Thereafter, weights have been computed by finding out the mean of scale chosen by all the respondents for each option. The environment commitment variable is found by computing a weighted sum of the scale chosen by the respondent for different options.

D. Business Growth Prospects: Growth potential is an organization's future ability to generate larger profits and expand its production and workforce. A company's growth potential can be gauged from a company's planned movement into new markets, the development of new product lines and the employment of advanced techniques. Three questions have been framed to assess a company's competitive advantages, challenges and plans. The questions require the respondents to rate (in the increasing order of importance) the different options using a five point likert scale. Thereafter, weights have been computed by finding out the mean of scale chosen by all the respondents for each option. The growth potential variable is found by computing a weighted sum of the scale chosen by the respondent for different options.

The three independent variables (market position, environment commitment and

business growth prospects) have been given a dichotomous form on the basis of their mean values. A nominal value of "0" implies presence of an unfavorable attribute and a value of "1" implies presence of a favorable attribute. The favorable attributes have an affirmative influence on the credit ratings. The empirical research hypothesis is that credit ratings are directly related to the presence of favorable attributes. This is followed by preliminary examination of data using correlation statistics and descriptive statistics. The inferences are drawn on the basis of results of bivariate analysis and ordinal logit analysis

(c) Ordinal Logit Regression

This is one of the techniques recommended for the analysis of ordered, categorical, non-quantitative choices, outcomes and responses. (Agresti, 2002; Greene, 2009, O Connel 2006). It is used when there is dependence of a polytomous⁵ ordinal response on a set of predictors, which may be categorical or continuous. Ordinal Logit Regression generalizes basic linear regression such that it can be used for dependent variable that may not have a normal distribution.

The dependent variable is credit rating assigned by rating agencies in India as on July 1, 2012. The credit rating, Y_i , takes the following values:

$$Y_i = \begin{cases} 1 & \text{if rating} = D, C, CC, CCC \\ 2 & \text{if rating} = B \\ 3 & \text{if rating} = B \\ 4 & \text{if rating} = BBB \\ 5 & \text{if rating} = A \\ 6 & \text{if rating} = AA, AAA \end{cases}$$

The credit rating is a latent variable and is related to independent variables (X_i) through an unobserved linking variable (Y_i^*) (Agresti, 2002, Greene, 2009, Long, 1997, Wooldridge, 2001) as follows:

$$Y_i^* = \alpha_i + X_i \beta_j$$

Where X_i is a vector of independent variables, β_j is the vector of estimated coefficients. The linear model is related to the dependent variable (Y_i) by a link function (Y_i^*). This is

⁵ Polytomous ordinal responses can be categorized into more than two classes.

referred to as the logit link.

Ordinal logit model is presented as a function of the probabilities is as under:

$$Y_i^* = \ln\left(\frac{\text{prob}(\text{event})}{1-\text{prob}(\text{event})}\right) = \alpha_i + X_j\beta_j$$

$\ln\left(\frac{\text{prob}(\text{event})}{1-\text{prob}(\text{event})}\right)$ is called a logit. It's the log of the odds that an event occurs. The coefficients in the logistic regression model indicate the logit changes based on the values of the predictor variables. By exponentiation of the pooled estimate relative to a given predictor, i.e. taking e^{β_j} , we obtain an estimate of the common odds ratio that describes the relative odds for being in a certain category for values of X_j differing by 1 unit (O'Connell, 2005). In the context of present study, it can be presented as follows:

$$Y_i^* = \left[\log \left[\frac{\text{Prob}(Y \leq Y_i^*)}{\text{Prob}(Y > Y_i^*)} \right] \right] = \alpha_i + X_j\beta_j$$

Where $i=1, 2 \dots k-1$ and i indexes the cut-off points for all categories of the outcome variable. The expression $\left[\frac{\text{Prob}(Y \leq Y_i^*)}{\text{Prob}(Y > Y_i^*)} \right]$ defines the probability of falling in a say, category 4 or lower as compared to falling in higher categories. Solving for $\text{Prob}(Y \leq Y_i^*)$, the ordinal logit regression model can be written as:

$$\text{Prob}(Y_i \leq Y_i^*) = \frac{\exp(\alpha_i + X_j\beta_j)}{1 + \exp(\alpha_i + X_j\beta_j)} = \frac{1}{1 + \exp -(\alpha_i + X_j\beta_j)}$$

Ordinal logit regression calculates changes in the log odds of the dependent, not changes in the dependent itself as ordinary least squares (OLS) regression does (Long, (1997). Menard, (2002)). The statistical package that has been used in the present study is SPSS20 (Statistical Package for Social Sciences Version 20).

EMPIRICAL FINDINGS

The total number of responses received is 102 (Textile (64), Steel (25) and Paper (13)). Most of the respondents are males (96%) and belong to upper management (63%) followed by middle management (37%). There is a fair representation of all age groups – less than 35 years (33%), 35-45 years (27%), 45-55 years (22%) and more than 55 years (21%). The respondents are mostly postgraduates (76%) followed by graduates (22%) and doctorates (1%).

The preliminary investigation of the explanatory variables and their relationship with credit ratings included correlation statistics and descriptive statistics (Table 1 and 2 in

endnotes). There were no issues of multicollinearity. The descriptive statistics of commitment to the environment variable show proximity between the mean and the median values. This implies that the distribution of commitment to the environment variable is symmetrical around its mean. With regard to market position and growth potential, the sample is slightly skewed towards the left. This indicates that there are more respondents in the sample who perceive the market position and growth prospects of their respective companies to be above average. The coefficient of variation (standard deviation/mean) of market position, commitment to the environment and growth potential is 17.8%, 30.8% and 24.04% respectively. This shows that there is higher dispersion around the mean of commitment to the environment variable as compared to the other two predictors- market position and growth potential.

A bivariate analysis (cross tabulation) of credit ratings has been done with market position, commitment towards the environment and growth prospects respectively. This helps to understand the patterns in the given sample and study the odds of getting a certain rating (conditional on the three predictors). The bivariate data analyses have discussed the nature, extent, and direction of relation between the dependent variable and independent variables. In the results not shown here, the responses to the questionnaire indicate that a company with a favorable market position, commitment to environment and growth prospect is more likely to get higher ratings.

This has been followed by an empirical investigation of the corporate credit ratings using ordered logit regression methodology. The dependent variable, credit ratings is regressed on the independent variables: market position, environmental commitment and business growth prospects. Given the three independent variables in this section, the model has been presented below:

$$Y_i^* = \left[\log \left[\frac{\text{Prob}(Y \leq Y_i^*)}{\text{Prob}(Y > Y_i^*)} \right] \right] = \alpha_i + \beta_1(\text{Market position}) + \beta_2(\text{Environment commitment}) + \beta_3(\text{Growth Prospects})$$

(i varies from category 1 to category 6)

The cumulative probabilities have been used rather than probabilities for discrete categories i.e. SPSS models the probability of companies achieving level 5 (rating AAA, AA, A) or below, 4 (rating BBB) or below and so on.

The statistical fittings of the independent variables have been summarized in the following table:

Table 3 : Statistical fittings of the independent variables

Parameter Estimates		Coefficients			
Thresholds	α_1	-3.174			
(intercepts)	α_2	-2.028			
	α_3	-.651			
	α_4	1.090			
	α_5	1.916			
Explanatory Variables		β coefficient	Std. error	Wald	p-value
Market Position		-.494	.381	1.682	.195
Environment Commitment		-1.361	.388	12.319	0.000
Growth Prospects		.425	.381	1.244	0.265
Overall model fit					
Log Likelihood test		Chi Square Statistic(p-value)		16.46 (0.001)	
Equal Slope Assumption		Chi Square Statistic(p-value)		18.374 (0.105)	
Pearson coefficient				30.237(0.556)	
Pseudo R-Square				0.16	

Source: On the basis of SPSS output

On the basis of likelihood ratio test, the model with the three selected explanatory variables depicts significant relationship between the credit ratings and the selected predictors. Pearson's chi-square statistic for the model also confirms that the observed data is consistent with the fitted model. In case of Pearson's chi-square statistic, if p-value is large ($>.05$), it is concluded that the data and the model predictions are similar. The given model satisfies the equal slope assumption (as $p > .05$) underlying the ordinal model. This implies that the same sets of coefficients are appropriate for all categories of credit ratings in the sample considered for the present study. The low pseudo R^2 is understandable since there are many other variables considered by the rating agencies for assigning the credit ratings. The inclusion of financial variables is bound to improve the pseudo R-square as it was 72% in a model that included only financial determinants (Sareen & Vij, 2015).

Ordinal regression uses maximum likelihood estimation after transforming the dependent into a logit variable (the natural log of the odds of the dependent occurring or not). And thus, estimates the probability of a certain event occurring. The beta coefficients of the significant variable indicate the strength and the direction of the relationship between independent and dependent variables in terms of logits. Logit coefficients correspond to the beta coefficients in ordinary least squares (OLS) regression. Logit is the natural log of odds. They are used in the ordinal logit regression

equation to estimate the log odds that the dependent equals its highest or last value. The coefficients of explanatory variable for which Wald chi-square statistics is significant at 95% confidence level is used to calculate the odds of being at (or below) a certain category : odds of being at (or below) category 5 versus category 6. On the basis of Wald test, only one independent variable is found to have a significant relationship with credit ratings –Commitment towards the environment. The results indicate that companies with low level of commitment are less likely to get higher credit rating as compared to the companies with high level of environment commitment. The other predictors that have been considered in the model namely, market position and growth potential are found to be relevant but not significant in determining the credit ratings.

The intercepts and the beta coefficient of environmental commitment variable can be used to estimate the cumulative odds: the odds of being at or below a given category with the given commitment to the environment. These can also be used to estimate the Odds Ratios (OR). For inadequate commitment towards environment (i.e. when environment commitment is coded 0) the intercepts for each cumulative category ($\alpha_1, \alpha_2, \alpha_3, \alpha_4$ and α_5) are the cumulative logits i.e. log odds of getting a rating at or below category i . This can be exponentiated to get the odds for a company with inadequate commitment of being assigned a rating at or below category i . Similarly, cumulative logits for companies with adequate environmental commitment can be found by $\ln(Y_i^*) = \alpha_i + -1.361$ (1) (Adequate environmental commitment has been coded 1). For instance, for the logit representing $Y_i^* \leq 1$, the predicted logit for inadequate environmental commitment is -3.174 (the value of α_1); for adequate environmental commitment, the predicted logit is $-3.174 - 1.361(1) = -4.535$. The cumulative odds of being in category 1 (since there is nothing below the category 1) for a company with inadequate environmental commitment can be found by computing the exponential form of -3.174 as 0.0418 ($e^{-3.174}$). The cumulative odds of being in category 1 for a company with adequate environmental commitment can be found by computing the exponential form of -4.535 as 0.0107 ($e^{-4.535}$). The ratio of the two cumulative odds is the odds ratio ($0.0418/0.0107=3.9$). This odd ratio indicates that the odds of a company with inadequate commitment towards the environment being at or below category 1 are 3.9 times higher than a company with adequate commitment towards the environment. Likewise, odds ratio can also be found for other cumulative categories. Also, the estimated cumulative odds can be transformed into the estimated cumulative probabilities using the formula (odds= $p/1-p$), which yields $P(Y \leq \text{category } i)$. The results have been shown in the following table:

Table 4 : Estimates of cumulative odds, probabilities and Odds ratios for Environment commitment variable.

Environment Commitment	$Y_i^* \leq 1$ (being at (or below) cat. 1 vs cat. 2, 3, 4, 5 or 6)	$Y_i^* \leq 2$ (being at (or below) cat. 2 vs cat. 3, 4, 5 or 6)	$Y_i^* \leq 3$ (being at (or below) cat. 3 vs cat. 4, 5 or 6)	$Y_i^* \leq 4$ (being at (or below) cat. 4 vs cat. 5 or 6)	$Y_i^* \leq 5$ (being at (or below) cat. 5 vs cat. 6)
Inadequate(coded 0)					
Cumulative logit (α_i)	-3.174	-2.028	-0.651	1.090	1.916
Cumulative odds (co)(=exp ^{Cumulative logit})	0.0418	0.1315	0.521	2.974	6.790
Cumulative probability (=co/(1+co))	0.04	0.11	0.34	0.74	0.87
Adequate(coded 1)					
Cumulative logit ($\alpha_i + \beta$ (1))	-4.535	-3.389	-2.012	-0.271	0.555
Cumulative odds (=exp ^{Cumulative logit})	0.0107	0.0337	0.1337	0.7626	1.741
Cumulative probability (=co/(1+co))	0.01	0.03	0.11	0.43	0.63
Odds Ratio (adequate/inadequate)	0.25 (=0.0107/0.0418)	0.25 (=0.0337/0.1315)	0.25 (=0.1337/0.521)	0.25 (=0.7626/2.974)	0.25 (1.741/6.790)

Source: Author

Table 4 shows that odds ratio remains constant at 0.25 across all cumulative categories. This is in line with equal slope assumption that has been satisfied in the ordinal logit model (Table 3). Alternatively, in ordinal logit regression, the beta coefficient of the significant independent variable can be exponentiated to get the odds ratio for that predictor. In Table 3, β coefficient for environment variable is -1.361. The value of \exp^β is 0.25 ($\exp^{-1.361}$) which is same as the odds ratio in Table 4.

It implies that the odds for a company with adequate environment commitment being at or below any category i are only .25 times the odds a company with adequate environment commitment. In other words, a company with adequate environment commitment is 4 times (1/.25) more likely to be in the higher categories of credit ratings.

The findings substantiate the increasing emphasis on environment sustainability by regulatory authorities. The three industries that have been included in the study are a source of immense water, air and soil pollution-The *textile industry* uses huge quantities of water for all its activities. The untreated waste water usually contains chlorine, lead, and many other chemicals that pose various health hazards. Apart from this, boilers, thermo pack, and diesel generators that are used in textile industries produce extremely toxic gases. The environmental problems of *paper industry* also include high water consumption, wastewater generation, solid wastes including sludge generating from wastewater treatment plants and air emissions like volatile organic carbons. The paper mills generate toxic solid wastes such as lime mud, lime slake grits, green liquor dregs, boiler and furnace ash, scrubber sludge and wood processing residuals. These solid wastes have chlorinated organics, pathogens, ash and traces of heavy metal content. In the *steel industry*, the process of steel manufacture is energy and fossil fuel intensive and many green house gases are emitted in the process. The major pollutants present in untreated wastewater include carbon, cyanide, fluoride, zinc and so on. The furnace slag, dust and effluents with high temperatures generated in the process of steel making have an adverse impact on the environment.

As the industries that have been considered in the sample belong to the list of most polluting industries in India (www.dnaindia.com), their commitment towards reducing environmental footprint of their operations is viewed favorably while assigning credit ratings.

CONCLUSION

Ordinal logit regression is conducted on a sample of 102 companies to predict credit rating of a company using the predictor variables-market position, commitment towards the environment and growth prospects. A test of the full model against a constant only model is statistically significant, indicating that the set of predictors reliably distinguished between favorable and unfavorable attributes of a firm. (Chi square =16.46, $p = .001$ with degree of freedom=1). A low pseudo R-square resulted in an overall prediction success of 40%. There are 36% of the total ratings that have been misclassified by only one category.

The Wald criterion demonstrated that only environment commitment made a significant contribution to the classification ($p = .000$). The exponential value of beta coefficient

(\exp^B) of the environment variable is 0.25. This indicates that a company with adequate environment commitment is 4 times ($1/.25$) more likely to be in the higher categories of credit ratings. It is further observed that the model has been able to predict in only two categories- BB and BBB. This could be due to the conservative nature of the respondents who generally avoid giving extreme answers.

The findings support the hypothesis that commitment of the company to the environment is positively related to the credit ratings. The findings substantiate the increasing emphasis being laid on environment sustainability by regulatory authorities. There is a message for the corporate sector to set high standards in the area of environmental responsibility to get favorable ratings.

Endnotes

Table 1. Correlation Statistics

	Market Position	Environmental Commitment	Growth Prospects
	Pearson Correlation Coefficient (Sig.)		
Market Position	1		
Environmental Commitment	.270*(.006)	1	
Growth Prospects	.274*(.005)	.123(.218)	1

* Correlation is significant at the 0.01 level (2-tailed).

Source: SPSS output

Table 2. Descriptive Statistics

	Market Position	Environmental commitment	Growth potential
Mean	2.5993	136.51	179.48
Median	2.6667	137.38	188.18
Standard deviation	.46273	42.161	43.147
Minimum	1.25	20	60
Maximum	3.82	255	297
N	102	102	102

Source: On the basis of SPSS output

REFERENCES

- Agresti, A. (2002). *Categorical data analysis*. John Wiley & Sons, New York, 2nd edition.
- Blume, M.E., Lim, F., & MacKinlay, A.C. (1998). The declining credit quality of U.S. corporate debt: myth or reality? *Journal of Finance*, 53, 1389–1414.
- Burange, L. G., & Yamini, S. (2010) Competitiveness of the Firms in Indian Iron and Steel Industry. Retrieved May 2, 2012 from www.mu.ac.in/arts/social_science/eco/pdfs/depart/dwp54.pdf.
- Competition Commission of India, Indicus Analytics. (2009). *Public Enterprises, Government Policy and Impact on Competition Indian Steel Industry* Retrieved April 20, 2012 from www.cci.gov.in/images/presentations/pdfJune2009/12B.pdf
- Degos, J.G., Ben Hmiden, O., & Henchiri, J.E. (2010). Credit rating agencies: accounting adjustments and econometrical analysis. *International Journal of Economics and Accounting*, 1, 88–106.
- Doshi, G. (2006) An Outlook on Indian Textile sector. Retrieved on February, 10 2013 from http://EzineArticles.com/?expert=Gaurav_Doshi
- Gentry, J.A., Whitford, D.T., & Newbold, P. (1988). Predicting industrial bond ratings with a probit model and fund flow components. *The Financial Review*, 23, 269–286.
- Greene, W. H., & Hensher, D. A. (2009). Modeling ordered choices. *Unpublished manuscript*, 1-181.
- Kaplan, R.S., & Urwitz, G. (1979). Statistical models of bond ratings: a methodological inquiry. *Journal of Business*, 52, 231–261.
- Long, J.S. (1997). *Regression models for categorical and limited dependent variables*. Thousand Oaks, CA: Sage.
- Mathur RM., Thapliyal B. P. and Singh K. (2009) Challenges confronting Indian Paper Industry in changing scenario, IPPTA (Indian Pulp and Paper Technical Association) J., Vol.21, No. 3, 95-99. retrieved from November 6, 2013 http://smallb.in/sites/default/files/knowledge_base/IndianPaperIndustryinachangingScenario.pdf
- Menard, S. (2002). *Applied logistic regression analysis, 2nd Edition*. Thousand Oaks, CA: Sage Publications. Series: Quantitative Applications in the Social Sciences, No. 106. First ed., 1995.
- Ministry of Steel (2011). *Report Of The Working Group On Steel Industry For The Twelfth Five Year Plan (2012 – 2017)* Retrieved October 10, 2013 planningcommission.gov.in/aboutus/committee/.../wg_steel2212.pdf
- Ministry of Steel (2012) *2012 Annual report*. Retrieved October 26, 2013 from <http://steel.nic.in/ararchive.htm>
- Ministry of Steel (2013) *2013 Annual report*. Retrieved October March 7, 2014 from <http://steel.nic.in/ararchive.htm>
- Ministry of Textile (2012) *2012 Annual report*. Retrieved October 26, 2013 from <http://texmin.nic.in/annualrep/arep.htm>
- Ministry of Textile (2013) *2013 Annual report*. Retrieved March 7, 2014 from <http://texmin.nic.in/annualrep/arep.htm>
- Moody's investor services. (1999) *Moody's Approach to Rating the Steel Industry*. Retrieved on June 20, 2012 from www.kisrating.com/include/pdf
- Moody's Investor Service (1999) *Moody's Approach to Rating the corporates* Retrieved June 20, 2012 from <http://www.moody.com/researchandratings/rating-methodologies>
- Moody's Investor Service. (2003). *US and Canadian Corporate Governance Assessment*. Available at www.moody.com
- O'Connell, A. A. 2005. *Logistic Regression Models for Ordinal Response Variables* Thousand Oaks, CA: Sage Publications.
- Planning Commission. (2012). *Twelfth Five Year Plan (2012–2017): Faster, more inclusive and sustainable growth, vol. I (draft)*.
- Planning Commission. (2013). *Twelfth Five Year Plan (2012–2017): Economic Sectors, Volume II*

Available at http://planningcommission.gov.in/plans/planrel/fiveyr/12th/pdf/12fyp_vol2.pdf

Planning Commission. (2008). *Eleventh Five Year Plan (2007-2012) Agriculture, Rural Development, Industry, Services and Physical Infrastructure, Volume III*. Available at http://planningcommission.gov.in/plans/planrel/fiveyr/11th/11_v3/11th_vol3.pdf

Pogue, T.F., & Soldofsky, R.M. (1969). What's in a bond rating? *Journal of Financial and Quantitative Analysis*, 4, 201-228.

Raghuvver, S. (2011). Positioning of Indian Paper Industry to face the Ecological challenges of tomorrow. *IPPTAJ*. Vol.23, No. 3, 185-190. Retrieved August 17, 2013 from www.ipptaonline.org.

Saren R. & Vij, M. (2015). *Financial Determinants Of Corporate Credit Ratings In India*, *Business Analyst*, 35, 43-58.

Todi A.K (2013) Indian Textile Industry - The Road Ahead. Retrieved March 7, 2014 from <http://EzineArticles.com/8175746>

Yildirak K and Süer O (2011) *The Importance of Qualitative Factors in Firm Default: Evidences from Turkey*. Retrieved December 29, 2012 from www.efmaefm.org/0EFMAMEETINGS/2011-Braga/0157.pdf.

Wooldridge, J. (2002). *Econometric Analysis of Cross Section and Panel Data*. MIT Press.

Websites:

www.standardandpoors.com

www.arxaa.com

www.careratings.com

www.crisil.com

www.icra.in