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Bankruptcy Predictions of OCL India Ltd. Applying Altman & Springate Models

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Abstract

The study has attempted to predict the bankruptcy of OCL India Ltd. for the period 2012-13 to 2016-17 by applying Altman (1968) & Springate (1978) models. Reviewing literature it has framed four hypotheses which have been tested applying statistical tools along with the bankruptcy prediction models. Z scores and inferential statistics have supported likely to reject three null hypotheses and it has concluded there had no tendency for immediate bankruptcy under Springate model while Altman model has pointed out that the firm had been in distressed zone for the financial years 2012-13 & 2016-17 and in between these for three consecutive years had been lying in the grey area. Altman model has been identified more powerful in bankruptcy predictions than Springate model; limitations have acknowledged, practical implications and future research directions have also been indicated.

Keywords: Bankruptcy, Altman Z Scores, Springate Z Scores, Inferential Statistics

Introduction

Financial distress or bankruptcy has come into academic limelight way back in 1930s (see Smith, 1930; Ramser & Foster, 1931; Wall, 1936) and in 1960s univariate and multivariate statistical tools have been developed (Beaver, 1966; Altman, 1968); which have studied extensively across the industries globally (see Deakin 1972; Altman, Haldeman, & Narayanan, 1977; Ohlson, 1980; Mossman, 1998; Altman, 2000; Pompe & Bilderbeek, 2005; Kumar & Ravi, 2007; Hung & Chen, 2009; Cihak & Hesse, 2010; Sharma, 2013; Kyriazopoulos Georgios, 2014; Jan & Marimuthu, 2015). The term 'failure' has been defined as the inability of a firm to pay off its liabilities and in operational sense the symptoms include bankruptcy, default in bond re-payments and preference dividend, high leverage, recent losses, low and volatile returns, low liquidity as well as over drawings (see Beaver, 1966; Purnanandam, 2008; Campbell, Hilscher, & Szilagyi, 2011; Berk & DeMarzo, 2014; Zhou, Lu, & Fujita, 2015; Kim, Jo, & Shin, 2016; Jiang et al., 2017). 'Financial distress' has coined as a phenomenon about firms inability to honor their financial obligations (Altman et al., 2017; Li, Crook, & Andreeva, 2017) Aliakbari, 2009; John, 1993), fair valued liabilities have exceeded the values of assets (Ijaz et al. 2013); major customers have deferred their payments causing cash shortfalls (Sudarsanam & Lai, 2001) which, in turn, likely have leaded to bankruptcy (Barboza, Kimura, & Altman, 2017; Ouenniche & Tone, 2017) or closure or delisting (e.g., Mohamed, 2013; Kipruto, 2013; Kariuki, 2013). Further, it has been categorized as mild and serious distress-the former arisen due to temporary shortfall in cash positions while the latter has occurred due to corporate failure or bankruptcy (see Li et al. 2014).

Literature has documented in delve studies have applied multiple bankruptcy models in predicting corporate distress e.g., Altman's model (see Altman et al. 2016; Mohammed, 2016; Celli, 2015; Thai, Goh, & The, 2014; Civan & Dayı, 2014; Alareeni & Branson, 2013; Ray, 2011; Agarwal & Taffler, 2008, 2005; Grice & Ingram, 2001; Dichev, 1998; Moyer, 1977; Taffler & Tishaw, 1977), Ohlson O-score Model (see Ohlson, 1980; Dichev, 1998; Griffin & Lemmon, 2002; Moghadam et

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al., 2009; Kumar & Kumar, 2012; Karamzadeh, 2013), Springate model (Huo, 2006; Sevil, Başar, & Coşkun, 2013), Zmijewski J score (Zmijewski, 1984; Imanzadeh, Jouri, & Sepehri, 2011; Kumar & Kumar, 2012), Fulmer F score and Toffler T score (Rahimipoor, 2013) and S score model (Terzi, 2011). Other models applied include Logit, Probit & Linear probability models (see Gujarati, 1998; Theodossiou, 1991; Morris, 1998; Maddala, 1983), Partial adjustment processes (e.g., Gujarati, 1998; Laitinen & Laitinen, 1998), Recursively partitioned decision trees (see Pompe & Feelders, 1997; Friedman, 1977), Cumulative sums procedures (e.g., Kahya & Theodossiou, 1999; Healy, 1987; Page, 1954) and Neural networks (see Mukhopadhyay et al. 2013; Yang, Platt, & Platt, 1999; Coats & Fant, 1993). Scholars also have reported newly developed and first growing bankruptcy prediction models based on accounting, financial market and hazards (see Bauer & Agarwal, 2014; Agarwal & Taffler, 2008; Bharath & Shumway, 2008; Campbell et al. 2006; Shumway, 2001). Moreover, statistical and operational research techniques (see Ouenniche & Tone 2017; Li et al. 2017; Avkiran & Cai, 2014; Li et al. 2014; Premachandra et al. 2011) and artificial intelligence (e.g., Chen, Ribeiro, & Chen, 2016; Fethi & Pasiouras 2010; Bahrammirzaee 2010) have been documented. The practical applications of Altman model in addressing accounting and financial facets have been extensively studied, e.g., in assaying going concern status (see Louwers, 1998; Mutchler, Hopwood, & McKeown, 1997; Citron & Taffler, 1992), pricing of credit risk (Kao, 2000), capital structure determination (Molina, 2005; Allayannis, Brown, & Klapper, 2003), bond ratings and portfolios (Caouette, Altman, & Narayanan, 1998; Altman, 1993), merger & divestment activity (Lasfer, Sudarsanam, & Taffler, 1996; Shrieves & Stevens, 1979), asset pricing and market efficiency (Ferguson & Shockley, 2003; Griffin & Lemmon, 2002; Altman & Brenner, 1981), vulnerability of companies (Permatasari, 2006) and for evaluating distressed securities (Marchesini Perdue & Bryan, 2004).

Scholars have studied bankruptcy model in different parameters encompassing range of Indian industries such as business bankruptcy predictions (e.g., Anjum, 2012; Karels & Prakash, 1987), telecommunications (Permatasari, 2006), wood industry (Muhammad, 2008), pharmaceuticals (Ambarsari, 2009), a group of industries (Mukhopadhyay et al. 2013), NIFTY50 companies (Sanesh, 2016), steel industry (Singla & Singh, 2017), civil aviation (see Vasantha, Dhanaraj, & Thiayalnayaki, 2013; Kumar & Anand, 2013), banking (Pradhan, 2014; Jayadev, 2006; Krishna Chaitanya, 2005), cement (e.g., Ramana, Azash, & Ramakrishnaiah, 2012; Selvam, Vanitha, & Babu, 2004), metals and minerals (Kumari, 2013), logistic industry (Tyagi, 2014), electrical (Khannadhasan, 2007), water heater industry (Satish & Janakiram, 2011), ONGC (Aditya, 2016) and BSE-Greenex companies (see Swalih, 2017; Divya & Shirisha, 2014; Bhattacharya, 2013). Moreover, sector-specific studies like automobiles, BSE listed companies (see Sulphey & Nisa, 2013; Bhatt, 2012; Ray, 2011; Ramaratnam & Jayaraman, 2010), secondary and tertiary sectors (e.g., Sajjan, 2016; Dheenadhyalan, 2008) have also been attempted. The consequences of bankruptcy and its preventive mechanisms have also been indicated in literature (see Vuran, 2009). Review of those studies have indicated bankruptcy predictions of multiple industries and companies have attempted mostly applying Altman's model but no such studies unlikely have conducted to predict the bankruptcy of selected cement company in a comparative manner applying Altman & Springate models. Moreover, the private sector companies like the sample company has arranged a substantial portion of its finance from borrowing hence the prediction of bankruptcy has gained momentum, accessing accounting data rather market data (share prices). The current study has motivated to close this identified gap in literature based on empirical evidence from OCL India Ltd, a cement manufacturing Indian company. Further, the Altman model (1968) was first applied in manufacturing firms.

The study has attempted to predict the bankruptcy of OCL India Ltd. for the period 2012-13 to 2016-17 applying Altman & Springate Z scores.

The study has the following contributions in literature; *firstly*, it has reported comprehensive bankruptcy predictions about OCL Limited applying twin MDA models, which probably the first of this kind addressing a cement producing firm. *Secondly*, it has validated the supremacy of Altman model over the Springate model in bankruptcy predictions (e.g., Hermawan, Tirok, & Dawis, 2010) but, has contradicted with few scholars who have concluded with opposite findings (see Kanapickiene & Marcinkevicius, 2014). *Thirdly*, it has partially correlated with prior studies attempted on Indian cement studies (see

Ramana et al., 2012) which have concluded with mixed results in bankruptcy predictions, e.g., average sound financial health of KCP Ltd and Kesoram Industries Ltd. while that of Dalmia Bharat Ltd has been indicated as poor. *Finally*, in tune with literature it has validated the efficiency of Altman model in bankruptcy predictions at least in Indian companies, as indicated in literature (see Sulphey & Nisa, 2013) which has concluded 53.18 percent BSE small-cap companies have been lying in grey area while around 11 percent companies have been adjudicated as distressed.

The reminder of the paper has been designed as in Section 2 the review of related literature and hypotheses have set, research methodology has explained in Section 3, the findings and discussion of those findings have been presented in Section 4 and finally in Section 5 it has reached in conclusion.

Settings

Altman Model (1968)

Originally, Beaver's (1966) Ratio analysis has set the platform for conducting Multiple Discriminant Analysis (MDA). The present study has used Altman's original bankruptcy model developed in 1968. The original model has been applied in several studies globally [e.g., Brazil (Altman, Baidya, & Dias, 1979), Mexico (Altman, 1995), Indonesia (Agustine & Chrestinawati, 2003), Kenya (Mamo, 2011), Turkey (Zeytinoğlu & Akarım, 2013), Italy (Altman, Danovi, & Falini, 2013), France (Lepetit & Strobel, 2013)]. The model has subsequently being revised several times (in 1983, 1993, 1995, 2002, 2005) but has been criticized for few causes like [non-consideration of asset volatility (Hillegeist et al. 2004) and macro variables (see Demsetz & Lehn, 1985); excessive broadness of 'grey area' (see Johnson, 1970; Joy & Tollefson, 1975; Guatri, 1995) and exclusion of tax (Oz & Yelkenc, 2017)] even though, it has being extensively applied worldwide studies and practices for almost five decades, e.g., in Italy (Altman et al., 2013). Interestingly, few scholars have indicated the model has also being used for assessing financial soundness and in taking investment decisions (see Hauschild, 2013). The function of the model has presented as:

$$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 0.999X_5$$

Where, the Z-score has represented the synthetic indicator which has predicted the bankruptcy of the studied organization within one or two years (Žager et al. 2008). If the score remained in between 1.81 and 2.99 the possibility of bankruptcy in the next financial year even though partially ruled out but the firm required to be given serious attention on its financial health (Bragg, 2007). The ratios (co-efficient) of the model have been nicely explained by Eidleman (1995) which include:

X_1= Working Capital / Total Assets (Liquidity)

The ratio has been identified as a measure of the firms' liquidity relative to their total assets where working capital has been computed as the difference between current assets and current liabilities. Literature has reported the firms having pre-distressed high leverage have the higher possibility if cash flows insufficient to pay off the financial obligation (see Kahl, 2002). The liquidity and firm size has also been considered.

Retained Earnings / Total Assets (Cumulative Profitability)

The ratio has indicated the amount of past profit ploughed back in the business which has been cumulated during the life of the firm and age of the firm has a significant role in the accumulation (see Caouette et al. 1998). Higher the ratio it likely to has indicated the firm has used a substantial portion of its financing of total assets using the past profits rather borrowings, resulting lower leverage.

X3=Earnings before Interest and Taxes / Total Assets (Profitability)

The ratio has measured the productivity of the firms' assets before computing tax and interest obligations. It has indicated the earning potential of the firms and for potential sick firms the ratio is vital one (e.g., Anderson & Reeb, 2003; Caouette et al. 1998).

X_4=Market Value of Equity / Book Value of Total Liabilities (Capital Structure)

It has indicated the current market value of equity of the firms towards their total book value of debt, including current liabilities. In other words, it has been identified as the reciprocal of debt-equity ratio i.e. capital gearing ratio. Scholars have reported significant positive associations

between these which, in turn, indicate past performance; price earning and overall predictions about the financial health (see Fama & Franch, 1992).

X_5=Sales / Total Assets (Capital Turnover Rate/ Measure of Management's Ability to Compete)

It has explained the sales potentials of the firms by investing per unit of money measurement in total assets i.e., sales generating ability and management efficiency of the firm. Significant association between firm performance and capital turnover of total productive assets has been indicated in the literature (see Anderson & Reeb, 2003).

Springate Model (1978)

Gordon Springate (Springate, 1978) has developed a bankruptcy model using ratios by accessing financial data of 40 Canadian companies (Haseley, 2012) and Z score below .862 has indicated a probable bankruptcy (Aghajani & Jouzbarkand, 2012). Accordingly, firms likely to be classified in twin ways- those in the risk of bankruptcy (distress zone) and rest which are not in the risk of bankruptcy (safe zone) (Boritz, Kennedy, & Sun, 2007). Studies have documented the model whenever applied has yielded with accurate predictions in the range of 83 to 92.5 percent (see Dolejsova, 2015; Ghodrati & Moghaddam, 2012; Kasilingam & Ramasundaram, 2012; Asgari, 2008; Kidane, 2004; Sands, 1980; Botheras, 1979). Literature has documented the wide application of the model in bankruptcy prediction studies across the industries globally [e.g., Iran (see Aminian, Mousazade, & Khoshkho, 2016; Talebnia, Karmozi, & Rahiminia, 2016; Imanzadeh, Jouri, & Sepehri, 2011), India (see Muthukumar & Sekar, 2014; Srinivasan & Tripura Sundari, 2011), Indonesia (see Sinarti & Sembiring, 2015; Husein & Pambekti, 2014; Qureshi, Rasli, & Zaman, 2014), USA (Huo, 2006), Romania (Oniga, 2016), Lithuania (e.g., Kanapickiene & Marcinkevicius, 2014; Jurevičienė & Bercevič, 2013; Grigaliūnienė & Cibulskienė, 2004)] and in Taiwan (Putera, Swandari, & Dewi, 2017). As per the model, if the Z score falls below 0.862 the possibility of bankruptcy would be high, and the firm would likely be considered unstable and dangerous. On the other hand, if the score slipped down to 0.9 or below, the management should put serious attention to the firm's financial condition. The functions of the model have been presented as:

$$Z = 1.3X_1 + 3.07X_2 + 0.66X_3 + 0.4X_4$$

X_1 = Working Capital / Total Assets

Like the Altman model this ratio has also indicated the liquidity position of the firms computed as a proportion of net current assets on total assets of the firms.

X_2 = Earnings before Interest and Taxes / Total Assets

The ratio has indicated the earning potential of the firms computed before paying taxes and financial fixed costs, a significant measure of profitability for probable distressed firms.

X_3= Net Sales / Total Assets

The capital turnover ratio has indicated the firms' sales generating capability and management efficiency i.e. how the assets have been yielding revenues from top line.

X_4= Earnings before Taxes / Total Liabilities

The ratio has indicated the proportion of earnings before taxes against the firms' total liabilities.

Literature has reported studies have been attempted for comparing the different financial distress prediction models (see Mousavi, Ouenniche, & Xu, 2015; Bauer & Agarwal, 2014; Wu, Gaunt, & Gray, 2010; Reisz & Perlich, 2007) and applied sampling techniques (Zhou, 2013; Neves & Vieira, 2006). Based on above it has framed the following hypotheses:

H_1: Altman model has significant influence in predicting bankruptcy of OCL India Ltd.

H_2: Springate model has significant influence in predicting bankruptcy of OCL India Ltd.

H_3: Altman model has to predict financial distress better than Springate model.

H_4: Springate model has to predict financial distress better than Altman model.

Methodology

Research Design

Historical research has been applied since data for the five financial years (2012-13 to 2016-17) of OCL India Ltd has been considered. Non-parametric statistical approach

which need not be true representative of the studied population and matched by its normal distribution has been followed.

Methods

Sampling Technique

The study population consisted of all the cement manufacturing companies listed in the Bombay Stock Exchange (BSE) having accessible financial statements for the stated study period of which OLC India Ltd. has been chosen applying non-probability sampling technique (purposive sampling). The rationale for sample selection has been justified as a general criterion all the required financial statements such as Balance Sheet, Statement of Profit & Loss and Cash Flow Statement have accessible and specific criterion include non-inclusion of any banking and non-banking finance companies (see Sugiyono, 2008).

Data Collection Design

Secondary Data

- **Primary Sources**

  The published annual reports have been accessed from Capital line data base subscribed by a central university. Moreover, around 255 original research papers published by few international (e.g., Sage, Wily, Emerald, Springer and Elsevier) and few Indian publishers (accessed from J-Gate) have been reviewed.

- **Secondary Sources**

  Selective review papers, dissertations and theses have also been reviewed.

- **Tertiary Sources**

  Academic papers have also been accessed from Google Scholar, Social Science Research Network (SSRN), Indian Citation Index (ICI) and Scopus.

Data Analysis Strategy

Microsoft Office Excel, 2007 has run for analyzing the data.

Variables

The parameters of the study have been divided into two ways-predictor and outcome. The predictor has been taken as a dummy variable having two attributes 0 and 1; where the former has indicated financial year experiencing financial distress and the latter for not facing any distress. The each of the prediction scores have been identified as the outcome.

Criteria of Hypothesis Testing

Table 1: Decision Zone of Hypothesis Testing

Probability Values	*Classification*
P<1%	Strong Significant
1%>p<5%	Moderate Significant
5%>p<10%	Weak Significant
p>10%	Not Significant

Statistical Tests

Logistic Regression has been applied to assess the impact of predictor on the outcome in the form of dichotomous or binary variable. The following model has applied:

$$Y = a + bX + \varepsilon \quad (1)$$

[Where, Y=Dummy variable, 1: distressed firm and 0: non-distressed firm

a, b=constants; X=Score models; ε = Error]

Results & Discussion

Distress Predictions

Table 2: Altman Model Z Scores from 2016-17 to 2012-13

Years / *Coefficients*		*2016-17*	*2015-16*	*2014-15*	*2013-14*	*2012-13*
X_1	**WC/TA**	0.312	0.366	0.346	0.140	0.146
X_2	**RE/TA**	0.493	0.404	0.361	0.441	0.437
X_3	**EBIT/TA**	0.140	0.122	0.071	0.081	0.129
X_4	**MV of equity / TL**	0.005	0.006	0.005	0.008	0.009
X_5	**Sales / TA**	0.687	0.722	0.675	0.745	0.773
Z score		**1.590**	**2.220**	**2.184**	**1.832**	**1.802**

From Table 2, the Z scores for the stated 5 years have indicated the firm had been lying in distress zone (Z<1.81) in 2012-13 and then had moved to grey area (1.81 < Z

<2.99) for three consecutive financial years i.e., 2013-14 to 2015-16 and then again slipped down to distress zone in the financial year 2016-17 (z<1.81).

Table 3: Springate Model Z Scores from 2016-17 to 2012-13

Years / Coefficients		2016-17	2015-16	2014-15	2013-14	2012-13
X_1	WC/TA	0.312	0.366	0.346	0.140	0.146
X_2	EBIT/TA	0.140	0.122	0.071	0.081	0.129
X_3	Net sales/TA	0.687	0.772	0.675	0.745	0.773
X_4	EBT/TL	0.221	0.142	0.052	0.096	0.172
Z score		**1.360**	**1.412**	**1.649**	**0.962**	**1.166**

Table 3 has shown the Z score computed by applying Springate model which has indicated the firm had been in safe zone (non-distress zone) being the scores have comfortably exceeded the cutoff point .862 for all the five financial years under consideration. Further, the Z scores for all the five financial years have been recorded even more than 0.9 which unlikely to attract any management attention as far as OCL India's financial conditions have concerned, sharply contradicting Altman model scores which have predicted financial distress for two financial years and probable bankruptcy for three financial years.

Descriptive Statistics

Table 4: Results of Descriptive Statistics

Descriptives	Altman Model	Springate Model
Mean	1.925	1.309
Median	1.832	1.360
Standard Deviation (SD)	.240	.231
Coefficient of variations (CV)	.124	.176
Kurtosis	1.7351	1.6819
Skewness	-1.229	-1.471
Range	0.63	0.450
Minimum	1.590	0.962
Maximum	2.220	1.649

It has reported the sample statistics of the two models applied for predicting bankruptcy of OCL India Ltd. As far as Altman model has concerned, the mean and median values have computed as 1.925 and 1.832 and that of for Springate model have stood at 1.309 and 1.360 respectively. SD has run to show how the data have deviated from the central point and smaller the value betters the data set, hence Springate model has less dispersed in compared to Altman model. The coefficient of variation (CV) has indicated the degree of risk of which Z-score has placed in OCL India Ltd and lower the value betters the model, has computed dividing SD by mean, in line with literature (see Keller, 2005). Further, for investing in a firm in the expectation of yielding standardized returns the associated risk should be properly accounted for hence CV likely to serve the purpose for both risk and return, as concluded by scholars (e.g., Brigham & Houston, 2007). Skewness (SK) has run to imply the degree of inclination of the distribution and larger the value more skewed the distribution. The SK values for both the models have computed negative results indicating greater variation towards the lower values of the variable. Further, SK value of Altman model has less asymmetrical in compared to that of Springate model. The fitness of the data has been

tested applying Kurtosis. The Kurtosis values for both of the models have computed <3, i.e., very blunt (platikurtic) Kurtosis which have indicated in both the models data likely to have homogeneous, in line with literature (see Hadi & Anggraeni, 2008). Further, for Springate model, it has reported less value of Kurtosis.

Inferential Statistics

The Test of Logistic Regression for Altman Model

Table 5: Test of Logistic Regression for Altman Model

Sig. F	3.0257E-25
Determinant coefficient	0.5325
Const	1.0351
P Value of Cons	0.0598
B	0.9802
P Value	3.0257E-25

From Table 5, the significance value (Sig. F) has calculated as 3.0257E-25 which has indicated an error model error model or the model error rate which need to be paid attention. The significant value has indicating significantly stronger relations (<1%). The coefficient of determination (i.e. R^2) has indicated the model has explained 53.25 percent of the distress prediction while remaining 46.75 percent likely to be explained by other models. Further, the significant constant value 1.0351 (<1%) has indicated a missing variable borne by the model and based on this it likely to reject H_{01}.

The Test of Logistic Regression for Springate Model

Table 6: Test of Logistic Regression for Springate Model

Sig. F	1.8752E-11
Determinant coefficient	0.4869
Const	1.6820
P Value of Cons	3.1257E-06
B	0.5705
P Value	1.8752E-11

From Table 6, the significance value has reported as 1.872E-11, indicating a stronger relations (<1%). The coefficient of determination (i.e. R^2) has indicated the model has explained 48.6 percent of the distress prediction while remaining 51.4 percent likely to be explained by other models. Further, the significant constant value 3.1257E-06 (<1%) has indicated a missing variable borne by the model. Moreover, the model has more significant p value compared with constants and based on this it likely to reject H_{02}.

The Accuracy Analysis of the Models for Financial Distress Prediction

Table 7: Comparative Summary of Regression Results

Values	*Altman Model*	*Springate Model*
Sig. F	3.0257E-25	1.8752E-11
Determinant coefficient	0.5325	0.4869
Const	1.0351	1.6820
P Value of Cons	0.0598	3.1257E-06
B	0.9802	0.5705
P Value	3.0257E-25	1.8752E-11

Based on comparative summary results of Regressions presented in Table 7, the significance level for Altman model has been indicated as powerful as Springate model with p value 3.0257E-25. Moreover, the determination coefficient or the ability of the model in explaining financial distress for Altman model has shown as 53.25 percent, higher than that of Springate model. Based on these twin factors i.e., the level of significance and determination of coefficient the study has likely to reject H_{03} but probably has failed to reject H_{04} and has concluded that Altman model likely has predicted financial distress better than Springate model. Further, it has also indicated that different accounting ratios such as liquidity, cumulative profitability and profitability have more power in predicting financial distress.

The findings have indicated the Altman Z scores for the study period have been lying in bankruptcy zone (z<1.81) during 2012-13 and 2016-17 and in the grey area (1.81 < Z <2.99) for three consecutive fiscals 2013-14 to 2015-16 hence the management have been expected to take corrective measures for turning around the situation, as Altman himself had suggested (see Altman, 1983). Different financial parameters such

as liquidity, profitability and solvency required to be properly assessed by the management for tracing out the reasons for such poor financial conditions which, in turn, resulted with bankruptcy as predicted in the study. The management should apply proactive tools rather reactive tool in the general approach for detecting and remedying the potential problem. Interestingly, the Springate model Z scores have indicated the firm during the stated period of five financial years never slipped to distressed zone even though the scores had registered fluctuations but, exceeding the cutoff point .862 as stipulated in the model.

Conclusion

The study has motivated to assess bankruptcy predictions by applying Altman Model (1968) and Springate Model (1978) of OCL India Ltd by accessing accounting data from published financial statements for the financial years 2012-13 to 2016-17. Adopting historical study design and framing four research hypotheses it has tested the z scores which have indicated bankruptcy for 2012-13 and 2016-17 while existence in grey area during three consecutive financial years i.e., 2013-14 to 2015-16 under Altman model whereas the Springate model has indicated the firm had been lying in the safe zone (non-distress zone) being the scores exceeded the cutoff point .862 for all the five financial years. Inferential statistics have supported to reject three null hypotheses while likely to accept one null hypothesis. Based on these it has probably to accept the corresponding research hypotheses that both Altman and Springate models have the ability of predicting the bankruptcy. Further, Altman model has been identified as more powerful than Springate model as far as predicting of the bankruptcies have concerned but, unlikely the reverse.

The academic audience should consider the following limitations before reaching in eventual conclusions. *Firstly*, instead of all the corporates under cement industry it has used financial data of only OCL India Ltd and even only for five financial years hence it unlikely to represent the firms of the cement industry listed in Indian Stock exchange. *Secondly*, the annual reports have been accessed from BSE listed companies hence cement companies listed in other Indian stock exchanges have not been considered. *Thirdly*, it has applied only two bankruptcy prediction MDA models rather other variant of models in the broader categories such as Logit, Probit, & Linear probability. *Fourthly*, the applied statistical tools along with the two models have their inherent limitations which likely have influences in the study outcomes (see Bethlehem, 2008; Guatri, 1995; Hillegeist et al. 2004). *Fifthly*, few savers' perceptions about expected high returns by assuming high risks as literature reported (see Hull, 2010; Fabozzi & Modigliani, 2009) have not been considered in the current study. *Finally*, the influence of bankruptcies on stock prices has kept beyond the scope of the present study while few studies have retained the proxy (see Syamni, Majid, & Siregar, 2018). Moreover, the positive significant impacts of Altman model (see Andriawan & Salean, 2016; Adrian & Khoiruddin, 2014) and negative impacts of Springate model (see Wulandari & Norita, 2014) on stock prices have also been reported.

The current study has few practical implications such as; *firstly*, the prospective savers before taking their saving decisions in the company or other companies in the industry may use the report. *Secondly*, the financiers of the firm may use the report in revisiting their extended loans in the firm by re-computing debt service coverage ratio. *Thirdly*, the analysts may use the report in forecasting the share price movements as well as recommending portfolio designs of retail investors. *Fourthly*, the management of the firm may chalk out strategies for promoting the performances in the light of the bankruptcy prediction score indicated in the study. *Fifthly*, the bankruptcy as well as its probability as predicated likely not exclusively dependent on financial indicators but also a number of non-financial parameters such as economic conjuncture, location and so on should be thoroughly reviewed to trace the leakages, if any, in the light of the study report. *Finally*, the findings have concluded with opposite results in bankruptcy prediction where Springate model has indicated sound financial health of the firm while Altman has reported conflicting results i.e., has predicted bankruptcy. The accuracy of Springate model has been reported in literature (e.g., Kanapickiene & Marcinkevicius, 2014).

Future research roadmap has been indicated such as; *firstly*, other excluded cement producing firms e.g., Birla Cement, Ambuja cement, ACC Limited, JK Cement may be incorporated for carrying out comparative bankruptcy prediction studies applying Altman & Springate models for assessing the compressive bankruptcy scenario, if any, in the cement sector. Moreover, longer period of

data should be used in future studies which likely to show clearer picture about the bankruptcy predictions. *Secondly*, the bankruptcy predictions may be tested applying different models such as Zmijewski (1984), Grover (2003), Taffler (1984) and Izan (1984). *Thirdly,* Indonesian scholars have validated amongst the applied models such as Altman, Springate, Zmijewski and Grover in bankruptcy predications, the Zmijewski model has most accuracy (see Fatmawati, 2012) which should be revalidated in Indian context. *Fourthly*, studies may be attempted for comparing the bankruptcy prediction accuracy, i.e., assaying the least probability of committing type I & type II errors applying any one of MDA, Logit, Probit or Neural prediction models in tune with literature (see Edmister, 1972; Dambolena & Shulman, 1988; Skogsvik, 1990; Messier & Hansen, 1988). *Fifthly*, different timelines before the probable bankruptcies such as two years (Deakin, 1972), three years (Dwyer, 1992) and even five years (EI Hennawy & Morris, 1983) may be replicated in Indian industries like cement manufacturing sector. *Sixthly*, even though the current study has run original versions of both the models with five (Altman) and four (Springate) variables and inclusion of higher number of models likely do not improve prediction accuracies (see Jo, Han, & Lee, 1997; Appetiti, 1984) but, future studies may apply those models in Indian industries in an era of Ind-AS (converged IFRSs) financial reporting for revisiting relevance of those models. *Seventhly*, in future studies may be attempted by adjusting the financial statements with current purchasing price and then applying the models for assaying the probable bankruptcies since traditional financial statements have been prepared under historical price, as scholars suggested (e.g., Zarei, Dadashi, & Akbari, 2012). *Finally*, further research may apply the Zeta Model by Altman, Haldeman & Nayanan (Caoutte et al. 2008) in the cement industries in general and in OCL India Ltd. in particular to assess the concurrent validity of the findings of the present study.

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