



Review Article

A CRITICAL REVIEW OF ALTMAN Z'-SCORE MODEL AS A PREDICTOR OF CORPORATE FAILURE

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ARTICLE INFO

Article History:

Received 12th November, 2017

Received in revised form 13th

December, 2017

Accepted 3rd January, 2018

Published online 28th February, 2018

Key words:

Financial Distress, Bankruptcy, Corporate failure, Z-Score model

ABSTRACT

During the past few decades corporate failure prediction has become a significant concern for all stakeholders. The accuracy and validity of the failure prediction models are advantageous to varied economic agents, such as prospective investors, managers, customers, lenders, creditors, suppliers and others. Consequently, there has been a constant interest paid to corporate failure prediction modelling in financial and accounting studies. The primary objective of this research is to examine the accuracy and validity of the revised Altman Z'-score model in predicting corporate bankruptcy. Existing models in this regard have been studied in length. Literature suggests availability of varied techniques and models for corporate failure prediction such as the multiple discriminate analysis (MDA) approach, the logit regression analysis (LRA) and the artificial neural networks (ANN) model. This study concludes that Altman Z-Score model is the best predictor of corporate failure, which is based on the MDA approach, due to its wide use among researchers, academicians and practitioners in various countries.

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INTRODUCTION

The concept of corporate failure is a condition in which a business has to shut down because of its inability to continue its work effectively. However, the concept of business failure may be defined in different ways. Altman and Narayanan (2007) suggest some examples of business failure as default in debt payment, insolvency, bankruptcy, the delisting of a firm, liquidation and government interference through special financing. If we take a broader definition, Wu (2010) has defined business failures as the situations in which a company cannot fulfill its obligations to lenders, preferred stockholders, suppliers or where a firm is bankrupt according to law.

Financial distress is a term that is often utilized in the financial studies available. Levratto (2013) outlines it as whenever a company's liabilities exceed its book value of assets, principally it leads to financial distress. Johnsen and Melicher (1994) argued that an increase in fixed expenditures in a company might lead to elevation in the risk of financial distress. Further, bankruptcy and insolvency are another two terms, which are used commonly in the literature as proxy for a situation consequent of financial distress. The bankruptcy process begins when a business is incapable of meeting up its obligations due either to banks, suppliers, tax authorities or employees.

Kee (2003) says that when aggregate liabilities of a firm supersede the face value of the company's assets, this leads to bankruptcy, where upon the assets are employed to repay a portion of outstanding debt. In contrast, insolvency is a case in which the company is no longer able to meet its financial obligations when debts become payable. However, Ahn (2001) says insolvency happens when current assets are less than current liabilities.

According to Argenti (1986), there are two types of failures. Firstly, economic failure, where a firm fails to achieve minimum required return on capital invested. Secondly, financial failure, when a company is unable to meet up its financial obligations means financial insolvency. In these cases, a firm may be liquidated and this leads the firm to bankruptcy (Meeks and Meeks, 2009). Levratto (2013) proposes that both internal and external conditions have a significant impact upon business failure. The internal factors include administrative flaws, decline in customer base, location disadvantage, and difficulties in raising commercial credit. On the other hand, external factors comprise of increased competition amongst firms, increased insurance cost, political and economic instability, natural calamity. Bradley and Rubach, (2002) also suggested that natural disasters and accidents may also be amongst the reasons that lead to business failure. Many economists point financial distress as the biggest reason for the failure of a company, which predominantly occurs as a result of inefficiency of administration and lack of experience to ensure proper utilization of resources. Furthermore, economic recession and

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high interest rates may cause a situation of shrinking profits and substantial debt burdens for businesses. In addition, the nature of business and government policies might contribute to a company's financial distress (Mbat and Eyo, 2013). Thus, It can be argued that there are many factors inside and outside to the company that could be responsible for corporate failure.

There are several stages to be endured by a company before revealing the failure of its commercial activity. According to Ooghe and De Prijcker (2008), the oldest and most prominent failure processes were explored by Argenti (1976). Argenti indicates that there are three different failure processes experienced by a firm, which starts with successful processes and ends with a case of insolvency. A fault is considered to be the primary indication of failing firms, which may include skills shortages or personal mistakes, for example administrative flaws like failures in accounting procedures, such as budgetary monitors, debt collection, credit payments. Mistakes are the second course of company failure explained by Argenti (1976). They happen with the passage of time as a consequence of the faults of the first phase of failing companies; for instance, high leverage, the company's inability to continue or failure in large projects, and over-trading. Other extreme symptoms of dysfunction are considered to be the last stage that leads to fully visible causes of failure, such as creative accounting or deteriorating ratios.

According to Laitinen (1993), generally the path of failure may vary from company to company according to its age of existence (Bercovitz and Mitchell, 2007), or in reference to failure to the industry it belongs to, (Ooghe and De Prijcker, 2006) or to its size as well. Eventually, it can be seen that failure does not occur suddenly. On the contrary, it begins when the company is going through a bad phase and there fore getting worse even up to the conditions of failure.

Next question is why is revelation about the forecasts for the corporate failures crucial? A revelation likelihood study of a company's failure is imperative to all stakeholders both at external and internal level such as managers, investors, creditors, employers, government, customers and others. Business failure may cause substantial damages and massive costs to the whole economy and society (Ahn, Cho & Kim, 2000). Ropega (2011) suggests that it is important to address the financial and non-financial symptoms that lead to the deteriorating financial situation of a company. The deteriorating conditions of the firm may lead to the following: a reduction in sales, profit and a decrease in liquidity (Oghe & De Prijcker, 2006; Koksai & Arditi, 2004; McKee, 2003; Korol & Prusak, 2005; Bednarski, 2001 and Sharma & Mahajan, 1980); a high level of debt (Korol & Prusak, 2005; Koksai and Arditi, 2004; Argenti, 1976); a decrease in market share (Zepek, 2003; Crutzen & Van Caillie, 2007). Further, there are two key reasons for detecting business failure. Firstly, accessing the root cause of failure through a study of it so to correct and address the fundamental reasons for future references. Secondly, combining causes, consequences and symptoms in an analytical way so to reach the origins of failure and address them opportunely (Ropega, 2011). The accuracy and validity of the failure prediction models would certainly be useful to varied economic agents, such as prospective investors, managers, customers, lenders, creditors, suppliers and others. Consequently, there has been a constant interest paid to failure prediction modelling in financial and

accounting studies ever since the ground breaking work first published by William Beaver in 1966.

According to Neophytou and Molinero (2004), over the past four decades studies on the ability to predict the failure of corporations have been undertaken extensively by academics, researchers and practitioners. Therefore, predicting the financial distress of corporations by applying financial ratios is a subject that has been explored in different ways over the last few decades and the present economic environment demands that these models need to be more accurate than ever before. Therefore, in order to find out the most accurate model for prediction of financial distress, a variety of financial ratios and failure prediction models have been explored in many studies.

Prima facie, it is evident that predicting financial distress effectively is of paramount importance to all stakeholders. Varied techniques and models are available for bankruptcy prediction such as the multiple discriminate analysis (MDA) approach, the logit regression analysis (LRA) and the artificial neural networks (ANN) models. Nevertheless, this still remains an open area for research to establish which model is most effective to predict financial distress. Hence, need for this work. Rest of the paper has been organized in four sections. Section II talks about literature review followed by section III, which underlines problem statement and section IV talks about the objectives of this research. Section V reviews most prominent existing models and Section VI discusses Altman's Z-score model and last section VII concludes the study.

LITERATURE REVIEW

Several studies were performed in the late 1960s to develop the failure prediction and financial distress models which continues until this day. The need for developing bankruptcy prediction models has been felt more than ever before especially after the financial crisis of 2008. There has been constant efforts by researchers to examine different models in order to identify their ability to predict corporate failure. Examples of studies in this regard are: Beaver (1966), Altman (1968), Deakin (1972), Kida (1980), Ohlson (1980), Taffler (1983) and Shirata (1998). In addition, the accuracy of these models still remains questionable. Therefore, advanced economies, such as those of the US, UK, Canada and China, have been used as case studies (Mohammed *et al.*, 2012).

1980s and 1990s have witnessed increase in the number of corporate failure prediction models significantly, most likely due to increased data availability and the improvement and development of econometric methods. Univariate Analysis (UA). Fitzpatrick's (1932) was possibly the oldest study to predict corporate failure. Thus, he is the first person to have analysed the financial ratio in order to distinguish between active and inactive companies. The Univariate Analysis (UA) model has been used in his study, which includes 13 financial ratios to identify failure. However, Patrick's model has not demonstrated a considerable association with failure (Bellovary *et al.*, 2007). Fitzpatrick's work was subsequently followed by studies that carried out by William Beaver. Beaver (1966) was a pioneer of corporate failure prediction models, applying a univariate model on 30 financial ratios in order to classify corporations as solvent or bankrupt at that time. In the period 1954-1964, Beaver chose a sample of 79 listed failed firms, which tried to match every non-failed company with failed companies from the same industry and of the same size. Eventually, he illustrated the particular financial ratios that

were crucial in predicting failure. Financial ratios can correctly recognise failure with a proportion of 78% for five years before bankruptcy (www.accaglobal.com, 2015). In addition, Balcaen and Ooghe (2006) suggest that the main point of either criterion is contrasted in this predicting model.

Thus, the majority of work in this direction has been heavily influenced by a number of early studies, such as Altman (1968), Ohlson (1980), Zavgren (1985) and Dewaelheyns *et al.* (2006). According to Wang and Campbell (2010), US corporations' data have been used by many researchers who have provided different techniques to help identify bankruptcy. It is reported that the Altman Z-score model (1968) and Ohlson's model (1980) are two models that are well accepted and commonly used at present. After the spread of the Altman Z-score model, studies on this model increased widely. Examples of studies include: Deakin (1972); Edmister (1972); Taffler (1982, 1983); Goudie (1987); Grice and Ingram (2001); Agarwal and Taffler (2007); Boritz, Kennedy and Sun (2007); and Sandin and Porporato (2007).

The Altman Z-score model consists of five financial ratios based on the multivariate approach, Multiple Discriminate Analysis (MDA) instead of Univariate Analysis (UA) (Galvão *et al.*, 2004). Moreover, the prediction of corporate bankruptcy has been well-researched by other researchers using the MDA. For instance, Deakin (1972) has used the MDA technique in order to predict bankruptcy. He developed the failure prediction model by randomly choosing 23 non-failed firms and 11 failed firms; therefore this has led some to be vague about Altman's 1968 model. In addition, Kida (1980) and Taffler (1983) have used MDA approach to predict corporate bankruptcies (Wang and Campbell, 2010).

On the other hand, in terms of forecasting corporate bankruptcies, there are some other studies which have used logistic regression model as a standard to predict firm's failure. For example, logistic regression analysis has been utilized by Ohlson (1980) to predict company bankruptcy. His study has been adapted to United States companies to estimate and determine the probability of failure for each firm separately. He believes that the logistic regression model faces less criticism than the MDA approach.

Multiple Discriminate Analyses (MDA) Altman (1968) extended Beaver's work in his study of corporate failure prediction models by employing the MDA model to the failure classification model (www.accaglobal.com, 2015). Thus, in the 1970s and 1980s (Altman, 1968; Altman & Lavalley, 1981; 1982; Izan, 1984), it was stated that the discriminant analysis MDA technique was extensively used for corporate bankruptcy studies. As well, according to Altman (2000), the MDA approach is considered to be a more familiar statistical mechanism, which was utilised to classify and to forecast corporate failure. In a study of Jo and Han (1996), Laitinen and Kankaanpaa (1999) have found that there are three phases to the MDA approach. The first phase is to predict the coefficient of the variations. The second stage is measure the discriminant of every situation in regard to the sample score and in the final phase the cases have been classified that rely on pieces in the result. Altman (1968) has drawn attention to the fact that the variables in the MDA approach provide considerable information. In contrast, the variables in the univariate method do not give much information. Moreover, it is clear that in the MDA model, whenever the discriminant

score of the company decreases the probability of company's fail will increase, in contrast to the companies that have a high percentage of discriminant score; thus, its failure rate reduces (Balcaen and Ooghe, 2006).

Problem Statement

Corporate failure is considered to be the most significant challenge faced by numerous businesses in various industries around the world. As a result, the problem of corporate failure continues in contemporary economies. A rigorous and reliable method for predicting bankruptcy status has not yet been discovered and so research attention is most likely to continue. It is clear that the failure of corporations does not happen suddenly and that there are many factors that lead businesses to fail. The majority of economists agree that the high proportion of interest rates, high debt burdens, the nature of businesses operations, government regulations and bad economic times, such as a recession, might contribute to the failure of businesses.

Objectives of The Research

The primary objectives of this research are:

- To review existing models for predicting corporate failure.
- To examine the accuracy and validity of the revised Altman Z'-score model in predicting corporate bankruptcy through literature support.

Review of Alternative Models

This research relies upon studying the most prominent models adopted in the field of detecting the probabilities of corporate bankruptcy. Thus the method used for achieving objectives of the study is through extensive literature review.

Logit Regression Analysis (LRA)

Logit Analysis technique has recently been widely used in many areas of the social science for the modeling of discrete outcomes. It is reported that discrete choice theory was used for the developing of this technique. The theory of discrete choice describes the discrete behavioral responses of persons to the governments and business market actions when there are two or more potential incomes. Thereby, the theoretical foundations of this model are found to be based with microeconomic theory of customer character. After Lo (1986) had conducted study to recognize the superior technique between discriminant and logit analysis, he found that the two techniques are significantly related (Balcaen and Ooghe, 2006). As Balcaen and Ooghe (2006) indicate that failing corporates and nonfailing corporates are categorized in the logit analysis depended on their logit score as well a certain cutoff score for the technique. Then, the cutoff point and the logit score are compared; and the company will more likely fail, if the cutoff point is lower than the logit score. However, if the cutoff is higher than the score, the corporate is more likely to be non-failing.

Artificial neural networks Model (ANN)

Artificial Neural Networks The idea behind the artificial neural networks is based on the newly understanding of the physiology of the nervous system. There are billions neuron cells in the human brain which interact to for processing information in humans. It is known that each neuron sends inhibitory or excitatory signals to other neurons. This

technique is used to emulate the way human neurons work. Artificial Neural Networks solved many problems and is widely used in expert system, modeling, signal processing and forecasting. Generalization is the predicting method which is used by neural networks. This technique has been used in different fields and for solving complex issues. ANN has reported to be better than MDA analysis in the business environment especially in cases like stock price and bond price performance. Artificial neural networks have been used to many different fields and have illustrated its capacities in solving complex problems (Yoon, Swales and Margavio, 1993; Yoa and Lui, 1997; Dutta, Shekhar and Wong, 1994).

Altman's Z-score (1968) model (MDA)

A study by Wu (2010) shows that Altman's Z-score model (1968) is the first, pioneering approach to use financial ratios to identify or predict company bankruptcy. Since that time, it has been considered that the evaluation and apply of financial ratios has become a vital component for failure prediction techniques. In addition, Edward Altman's Z-score model (1968) is commonly utilised to assess company insolvency. His model composed of five linear combinations of business ratios, which used a multivariate approach, MDA, in order to measure the business performance or competence of a firm. For instance, financial ratios can be calculated as a criterion of company performance; those involving profitability, liquidity, capital structure and efficiency (Altman, 1968). Moreover, Altman (1968) has drawn attention to the fact that the MDA approach has a marked preference compared to the traditional univariate ratio analysis. The first advantage is that the statistical MDA approach has the possibility of analysing an entire set of explanatory variables with their interaction in the same instant. The second advantage is that the MDA technique decreases the number of explanatory variables that are being considered. The Altman analysis is concerned with two categories of companies which are active and inactive companies and thus converts this analysis to its simplest form. Altman's study consists of 66 manufacturing companies with 33 bankrupt and 33 non-bankrupt. Thus, his study consists of a list of 22 financial variables (ratios) which had been compiled for evaluation. However, only five financial variables (ratios) have been chosen from this list based on their capacity to predict company bankruptcy such as liquidity, profitability, leverage, solvency and activity. Altman's original Z-score model (1968) equation was: $Z = 0.012X1 + 0.014X2 + 0.033X3 + 0.006X4 + 0.999X5$ Cumulative values based upon Altman's formula, the firms were classified into three categories according to the company's sustainability. For instance, if the firm is in the distress area then there is a strong probability of failures when the Z-score index of the company is below 1.8. On the other hand, when the Z-score index exceeds 2.99, it is considered that the enterprise is in the safe zone, with a low percentage of company failure. Moreover, when the value of the Z-score index is greater than 1.80 and less than 2.99, there is no strong evidence to specify the financial condition of the company; that is, the results cannot precisely ascertain whether the company is in the safe or distressed zone (Altman, 1968). $Z < 1.80 \rightarrow$ Distress Zone $Z > 2.99 \rightarrow$ Safe Zone $1.8 < Z < 2.99 \rightarrow$ Grey Zone

Altman's revised Z'-score (1968) model

It is obvious that the original Altman Z-score (1968) model was utilized discriminant analysis as a first phase and depends upon on data for publicly held manufacturers companies. Subsequently, Z-score technique was extended by its author (Altman, 1983) to be used for other industrial sectors such as private manufacturing companies. Thus, revised Altman Z'-score (1983) was published as an exceptional model for those sectors. As a result of that, original Z-score formula was changed by Altman to replace book value of equity for market value in X4 in order to match them with different parameters. This leads to change in the classification standards and Z-score results. Finally, the revised Altman Z'-score formula is shown as follows:

$$Z' = 0.717X1 + 0.847X2 + 3.107X3 + 0.420X4 + 0.998X5$$

Where:

X1= Working Capital/ Total Assets

X2= Retained Earnings/ Total Assets

X3= Earnings Before Interest and Taxes/ Total Assets

X4= Market Value of Equity/ Book Value of Total Liabilities

X5= Sales/ Total Assets, Altman (1983).

$Z' < 1.23 \rightarrow$ Distress Zone (High Risk of Bankrupt) $1.23 < Z' < 2.9 \rightarrow$ Grey Zone (Uncertain Results) $Z' > 2.9 \rightarrow$ Safe Zone (Low Risk Area (Healthy))

Altman's revised Z'-score (1993) model after original Altman Z-score model was extended and revised Altman Z'-score model of 1983. In that year Altman continued with research and produced a further revised model that employed for predicting corporate failure. This model called Z'-score, which is utilised for other industrial sectors such as non-manufacturing companies and for emerging market companies. Moreover, in the Altman Z'-score model the variables X5 was excluded, sales/total assets, thus solely four ratios kept in this new model. Ultimately, the revised Altman Z'-score formula was presented as follows (Altman, 1993).

$$Z = 6.56 (X1) + 3.26 (X2) + 6.72 (X3) + 1.05 (X4)$$

The new Z-score model ratios are listed such as:

X1= Working capital/total assets

X2= Retained earnings/total assets

X3= Earnings before interest and taxes /total assets and

X4= Book value/total liabilities.

Therefore, the cut-off scores are also adjusted so that index scores of $Z' < 1.10$ indicate bankrupt companies. However, index scores of $Z' > 2.60$ are indicators of healthy companies. Moreover, companies with Z'-score index between 1.10 and 2.60 are determined to exist in the grey zone, Altman (1993).

DISCUSSION & INTERPRETATION

This section carries discussion on components of financial ratios used by Altman Model followed by interpretation of the model. Also would try to establish why the Altman Z'-Score Model (revised) is probably the most effective available model for predicating financial distress or even future bankruptcy. Altman uses X1, Working Capital/Total Assets (WC/TA) ratio. The working capital/total assets ratio is one of the commonly found ratios in the research of firm issues. It is a measure of the net liquid assets of the corporate in comparison to the overall capitalisation. The differences between current liabilities and current assets are considered as working capital. Obviously, size and liquidity features should be taken into consideration. Generally speaking, current assets are found to be low in comparison to total assets, when a company

undergoing consistent operations fails. This one is found to be the most valuable ratio amongst the evaluated three liquidity ratios because the quick ratio and the current ratio were observed to be less hopeful (Altman, 1968).

The second variable in the model is X2, Retained Earnings/Total Assets (RE /TA). The overall amount of reinvested losses or/and earning of a corporate during its whole life can be obtained by retained earnings. This is also called earned surplus. It is worth noting that an earned surplus account is subject to manipulation by stock dividend announcements. This measure, which is the cumulative earning over time, was earlier considered to be a new ratio. This ratio is found to be implicitly affected by the age of a company and an old company might have higher retained earnings/total assets ratio than a young company. This is because the younger company has not had enough time to increase its cumulative profits. Therefore, this analysis is argued not to be appropriate for young companies because their chance of being classified as a failed company is higher compared to the chance of older company. It is reported that about 50% of the bankrupted companies in 1993 did so in their earlier years of existence. More over, the leverage of a company is also measured by this ratio. The companies with low TA compared to RE are reported to have not used as much debt and have depended on the retention of profits to finance their assets (Altman, 2000).

The third variable in the model is X3, Earnings before Interest and Taxes/Total Assets (EBIT/TA) The true productivity of a company's assets is measured by the EBIT/TA ratio without taking into consideration leverage or tax factors. This ratio is believed to be extremely appropriate for investigating firm bankruptcy because the ultimate existence of the company depends on earning power (Altman, 1968).

X4, Equity/Book Value of Total Liabilities (MVE/TL) Liabilities is the measuring of both the long and current term, while equity is found to be the market value of all the shares of common, preferred and stock. This measure demonstrates how much the firm's assets might decline in value before the assets become lower than liabilities and the company becomes bankrupt. X5, Sales/Total Assets (S/TA) Ratio is the well-known ratio showing the sales generating efficiency of the company's assets. It is widely used for dealing with competitive situations. This ratio is considered to be the least considerable ratio on an individual basis. Consequently, it is found to be quite an important ratio. It should be noted that, depending on the univariate statistical significance test, this ratio would have disappeared. Nevertheless, it is ranked as the second most important ratio for contributing to the total discriminate ability of the model. This is because it has a unique and quite significant association to other variables in the model (Altman, 2000).

Thus X1 to X3 relates total assets of a firm with its working capital, EBIT and retained earnings. Which primarily means liquidity, current earnings and accumulated retained earnings of the business with relation to its total assets. The first ratio proclaimed by Altman (1968) is X1 which measures the liquidity ratio of the company. X2 is the second ratio that measures the cumulative profitability of the company. The third ratio is X3, which measures the productivity of the company while ignoring tax effects and interest. X4 is the fourth ratio identified by Altman (1968). This ratio fundamentally illustrates a company's insolvency. It indicates how much the

company's assets can decrease before the company's liabilities exceed its assets. Finally, X5 is an activity ratio. This ratio is considered as a standard that shows the sales generating capability of the company's assets (Altman, 1968).

Based upon the revised Altman Z'-score (1983) model, the company has been classified into three categories. For example, if the firm is in the distress area there is a high probability of failure when the Z'-score index of the firm is below the proportion of 1.23. In contrast, if the firm is in the low risk area, which is called the safe zone, then it is considered that the enterprise is in the safe zone when the Z'-score index exceeds the proportion of 2.99. However, when the Z'-score is greater than 1.23 and less than 2.99 this leads to uncertain results being received and it's difficult to know exactly whether the company is in the safe or distress zone. Now, let's concentrate on some prominent studies which concluded that revised Altman Z-Score Model is most accurate in predicting bankruptcy. Hawar Abdulkareem (2015), concludes in his research that the predictive ability of the revised Altman Z'-score model was accurate in predicting bankruptcy in the UK. Therefore, concerned authorities can use this model to take corrective or preventive action. In his study, the FAME database was used in order to obtain the data available in the financial reports of each active and inactive company. The results of his thesis illustrate that the accuracy of the revised Altman Z'-score model for inactive companies was found to be 83.3% and 66.7% in years one and two before bankruptcy, respectively. However, the Z'-score accuracy for non-failed companies was found to be 91.7% at one year prior to failure and 81.3% at two years prior to bankruptcy. It was shown in this research that the predictive ability of the revised Altman Z'-score model was accurate in predicting bankruptcy in the UK.

There are significant number of studies that documented as an evidence of the effectiveness of Altman's Z-score in forecasting company bankruptcy and financial distress, for instance (Gerantonis, et. al (2009), Xu & Zhang (2009), Wang & Campbell (2010), Lugovskaya (2010) & Janakiram (2011), Al Zaabi (2011), Gutzeit & Yozzo (2011), Wang & Li & Rahgozar (2012)). According to Li (2012) however, Altman's model is not free from criticisms; there are numerous studies that have received criticism to this model. For example, Shumway (2001) develops a hazardous technique and draws criticism against Altman's Z-score technique. Moreover, another study demonstrated by Campbell, Hilscher, and Siglagyi (2011) follows the same approach of reasoning as Shumway. However, at the end, they agreed unanimously to orientate blame to the Altman's paper with respect to the modeling and the ratios applied (Li, 2012). Some other criticism is provided against the ratios that employed by Altman, for instance according to the Hillegeist *et al.* (2004) and Gharghori *et al.* (2006), Altman Z-score model includes numerous measures of accounting variables which drawn from the financial and income statements. It might be relied upon that the financial statements do not provide predictive value for firm's future. Also it depends solely on one of the five variables as $X4 = \text{Market value of equity} / \text{Total liabilities}$, as an assumption to identify the company's failure. Furthermore, another drawback of Altman's Z-Score is its inability to include a measure of asset volatility. This volatility is one of the significant matters that measure the value of the company's assets to meet its obligations Hillegeist *et al.* (2004). In

addition, Ingram and Grice (2001) believe that the Altman Z-score has the best performance in manufacturing firms than firms in other industries. Like wise, Begley *et al.* (1996) consider that Altman's Z-score model applies in more accurate for US firms for predicting corporate failure in certain periods than others.

It is clear that the most accurate and most reliable model for predicting corporate failure is the Altman Z-score model, which is based on the MDA approach, due to its wide use among researchers, academics and practitioners in various countries.

CONCLUSION

In conclusion, it is worth mentioning that corporate failure is a common phenomenon that may be encountered by small and large companies in different economies, both developed and developing. Therefore, a country's economy and society as a whole may face substantial damages and enormous costs as a result of the bankruptcy of its companies and financial organizations. As a consequence, predicting business failure is a crucial topic that has gained the attention of many researchers, academics and professionals who have long been interested in corporate failure. It could be argued that the Beaver (1966) and Altman (1968) models were the two most influential for predicting bankruptcy and financial distress. It is clear that the most accurate and most reliable model for predicting corporate failure is the Altman Z-score model, which is based on the MDA approach, due to its wide use among researchers, academics and practitioners in various countries. However, it must be admitted that these models do not devoid of the criticism that is faced by many researchers. Finally, more studies and attempts are proposed that should be carried out to expand the Altman Z-score model and discover a new technique for predicting corporate failure.

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How to cite this article:

Amarjeet Kaur Malhotra (2018) 'A Critical Review of Altman Z'-Score Model as a Predictor of Corporate Failure', *International Journal of Current Advanced Research*, 07(2), pp. 10118-10124.
DOI: <http://dx.doi.org/10.24327/ijcar.2018.10124.1701>
