

Using Altman Z-Score Model in Comparing Firms' Financial Performance Applied Research on Egyptian Stock Market

Heba Srour*

Heba.srour@fue.edu.eg

Marwa El Maghawry†

Marwa.elmaghawry@fue.edu.eg

Abstract

Financial performance has been of concern to management and other stakeholders since the 2008 financial crisis. The impact of financial distress and bankruptcy on firms cannot be taken for granted. Financial distress is detrimental to big organizations and the small organizations alike. This study was conducted with the purpose testing if Altman's failure prediction model is good indicator in predicting financial distress of firm working in Egyptian stock market. The study took a sample of seven companies from firms working in Egyptian stock market during the period from 2016 to 2020. Data was extracted from secondary sources for a period of five years. Data extracted included working capital, total assets, retained earnings, market capitalization total liabilities and sales. The collected data was then analyzed using Microsoft excel software. The study established that the Altman's Z-score model was good indicator for predicting financial distress of firm working in Egyptian stock market. The study recommends the adoption of Altman's failure prediction model in predicting financial distress of firm working in Egyptian stock market by not only investors but also all other stakeholders.

Keywords: Altman Z-score - Financial Distress - Prediction Models - Egyptian Stock Markets

* Assistance Professor, Faculty of Commerce and Business Administration - Future University in Egypt

† Assistance Professor, Faculty of Commerce and Business Administration - Future University in Egypt

Introduction

When companies fail to meet their financial responsibilities due to high fixed costs, economic variations that influence revenues and don't take actions regarding this situation this will eventually lead to bankruptcy and insolvency which will negatively affect the reputation of the firm causing the investors to avoid it. The previous situation is called financial distress, and that's why it is considered a crucial topic and has been heavily examined to figure out its drivers and ways to combat it. To be able to combat financial distress, many research developed models to predict financial distress, such as the most popular model created by Altman which is called Z-score and its mission is to classify firms into financially distressed and non-financially distressed ones before the bankruptcy occurs.

The 2008 popular financial crisis resulted from changes in macro-economic factors such as high interest rates, fluctuating exchange rates, high inflation rates and changes in Gross Domestic Product which have negatively affected businesses. The previous information shows the importance of predicting financial distress, therefore using an early warning system model is critically important to make a reliable measure of any company's financial health since companies that are strong today may not be strong tomorrow. This is the need that motivated us to carry out the study. This is the gap the study has sought to address by attempting to answer the research question.

Is z-score a sufficient model to predict financial distress of firm working in Egyptian stock market?

Literature Review

(Kordestani et al., 2011) provided a model that predicts company's financial distress on the based on the operational, investment and financing components of its cash flow statement. to apply this model he choose Tehran stock exchange as a sample within the years from 1995 to 2008. Considering the information that is reflected in the cash flow statement, the viability of financial distress prediction was examined. Cash flow statement contains three parts, which are operational, investment, and financial activities. Based on the counting principle. The continuation of activity of enterprises depends on various factors, such as liquidity and cash flow which are of essential importance in all companies. In this research he investigated the ability of cash flow composition to predict future financial distress in Tehran stock exchange companies. The result of chi-square test showed that there is significant relationship between first, third, sixth and seventh cash flow compositions and future financial distress. Despite the ability of cash flow to predict the financial distress, the

reason for lack of precision in analysis is the several years of difference between the time of submission of tax proposal and the time of its payment. In other words, based on Iranian accounting standards the tax figure in cash flow statement corresponds to tax number of two years before. However, practically in many cases the tax figure relates to more than two years before. (Mu-Yen Chen, 2014) collected 100 listed companies as the initial samples, Moreover, they added the empirical experiment with a total of 37 ratios which composed of financial and other non-financial ratios and used principal component analysis (PCA) to extract suitable variables. The decision tree (DT) classification methods and logistic regression (LR) techniques were used to implement the financial distress prediction model. The result of the experiment was the more principal component analysis we use the less accuracy we obtained by the decision tree classification approach. However the logistic regression has no significant impact on principle component approach the closer we get to the actual occurrence of financial distress, the higher the accuracy we obtain in DT classification approach, with an 97.01% correct percentage for 2 seasons prior to the occurrence of financial distress their empirical result show that PCA increases the error of classifying companies that are in a financial crisis as normal companies and the DT classification approach obtains better prediction accuracy than the LR approach in short run (less one year). On the contrary, the LR approach gets better prediction accuracy in long run (above one and half year). Therefore, this paper proposes that the artificial intelligence (AI) approach could be a more suitable methodology than traditional statistics for predicting the potential financial distress of a company in short run (Hua et al., 2011), With the enforcement of the removal system for “distress firms” in China’s securities market in 2001, the development of the bankruptcy process for firms in China did create huge impacts to the community. Therefore, identification of potential business failures and offering early warnings for the impending financial crises became very important to analysts, practitioners, and regulators. In our research, we developed a model called ZChina-Score to support the identification of potential distress firms. We applied the model to China’s securities market for distress diagnosis. The study achieved 98.8 percent accuracy in classifying distress firms for the original samples and 94 percent accuracy for holdout samples. Over the past twenty years, China has achieved great success in the economic development that the annual GDP growth maintained above an astonishing average of eight percent. Studying the soundness of the traded companies in China’s stock market, we made a broad study across to 1001 traded companies that classified into 11 sectors (exclude banking, finance and

real estate). Before doing so, a slight adjustment was made to the zero cutoff point that assigned by the computer. By observing the ZChina-score distribution of both initial and holdout samples, we found that there were only two distress firms and four non-distress firms misclassified. The overlap zone is between -0.5 and 0.71 , which can be defined as the “gray area” because of the existence of misclassifications. (Habib et al., 2013), Examining empirically the managerial earnings management practices of financially distressed firms, and to consider whether these practices changed during the recent global financial crisis. Although corporate distress has been a topic of research interest for many years, earnings manipulation by distressed firms has received relatively little attention. Three measures of distress, and discretionary accruals, a popular proxy for earnings management, to investigate the impact of distress on earnings management. The managers of distressed firms engage more in income-decreasing earnings management practices compared to their healthy firm counterparts. It finds an evidence of the effect of the global financial crisis on the association between financial distress and earnings management. Finally, shows some evidence of positive market pricing of discretionary accruals in the non-crisis period, but a substantial reduction in pricing coefficients during the global financial crisis period. Financial distress experienced by firms provides incentives to managers for earnings manipulation. However, the direction of the earnings management could be income-increasing or income-decreasing. Allow investors to take a better investment decision for their firm that's experiencing financial difficulties. Recently, New Zealand experienced a spate of finance company collapses that somewhat contributes, indirectly, to financial distress experienced by firms. The New Zealand reporting environment is characterized by concentrated ownership, relaxed monitoring by regulatory authorities, and a very low litigation threat that provides an interesting setting to examine the research question (Edward Altman, 2012), the original Z''-Score Model performs well in an international context. It is possible to extract a more efficient country model for most European countries and also for non-European countries using the four original variables, accompanied with a set of additional background variables. Considering practical applications, it is obvious that while a general international model works reasonably well, for most countries the classification accuracy may be somewhat improved with country-specific estimation. In a country model, the information provided even by simple additional variables may help boost the classification accuracy to a much higher level. Also, the original Z''-Score Model and its re-estimated version, containing the four Altman study variables with coefficients re-estimated using a large European

data set, work consistently well internationally and are easy to implement and interpret. (Alifiah, 2014) was predicting the financial distress companies in the trading and services sector in Malaysia using financial distress companies as the dependent variable and macroeconomic variables and financial ratios as the independent variables. Logit Analysis was used as the analysis procedure because financial ratios do not have to be normal if it is used. It is also suitable when the dependent variable is binary in nature. Furthermore, it can also provide the probability of a company being financially distress. In addition, it can also provide us with the sign of the independent variable(s). The independent variables that can be used to predict financial distress companies in the trading and services sector in Malaysia were debt ratio, total assets turnover ratio, working capital ratio, net income to total assets ratio and base lending rate. Future studies should be conducted on the prediction of financial distress companies in other individual sectors in Malaysia. In addition, cash-flow-based ratios should be considered as the independent variables in predicting financial distress companies in Malaysia (Onyiri, 2014) found that Altman's z-score model and the sustainable growth rate can be used together in the prediction of corporate financial distress. This will help firms develop better strategic financial plans contribute to a general understanding of how sustainable growth rate can better be. (Gunathilaka, 2014) collected a sample of 82 firms listed on Colombo Stock Exchange across different sectors, over a period of five years from 2008 to 2012. It analyzes company financials using independent sample t-tests and multivariate discriminant analysis. He found that the solvency test does not discriminate solvent and insolvent firms meaningfully. The Altman's Z-score models yield similar predictive power. In particular, Altman's Z-model shows a higher degree of discriminant power in identifying financially distressed firms, at least one year prior to the distress. The market value and book value contribute similarly between Z-models. This indicates the level of care required in solvency test-based decision making, he also compared between solvency test and Altman Z-score he found that Altman's Z-score models show a higher degree of accuracy in predicting the financial distress. In particular, it has the potential of minimizing the error of classifying a firm as safe when the firm is not safe.

(Sulub, 2014), investigated the predictive power of applying Altman's Z' model to the multinational companies, and taken a sample of 10 companies selected randomly and distributed equally to two groups failed and non-failed companies. Edward Altman's Z' model for financial distress prediction was found to be an accurate for the failed multinational companies at a predictive power of 70%, and for the non-failed at a predictive power of 55%. (Khaliq et

al., 2014) The unhealthy financial state can be a massive and can cause long term distress which can result to restrictions of investments activities, capital flows and performance of firms. Thus, it is vital for organizations to identify the reasoning that may lead to a corporate failure and take measures accordingly to refrain from such condition. Thus, addressing the financial distress measurement among 30 GLC's listed companies in Bursa Malaysia over the period of five years (2008 until 2012). Assessing the financial distress determinant measured by Z- score statistics model. Further on, determinant such as current ratio and debt ratio were identified. Results show that there is significant relationship between both variables and Z – Scores that determine financial distressed of the GLC. Results indicate that there is existence of significant relationship between both variables and Z – Scores that determine financial distressed of the GLC. Few GLCs do signpost their position falls under financially distress cluster. (Almamy et al., 2015) the extension of the Z-score model in predicting the health of UK companies using discriminant analysis, and performance ratios to test which ratios are statistically better in predicting the health of UK companies from 2000 to 2013. He contributed towards Altman's original Z score model by adding a new variable. He found that, cash flow when combined with the original Z-score variable is highly significant in predicting the health of UK companies. A J-UK model was developed to test the health of UK companies. Finally, he compared to the Z - score model, the predictive power of the model was 82.9%, which is consistent with (R. J. Taffler, 1982) UK model. Moreover, to test the predictive power of the model before, during and after the financial crisis period; results show that J-UK model had higher accuracy to predict the health of UK companies than the Z-score UK model. So, the extension of Altman Z score model leads to better results and assist users such as researchers, managers, regulators, and other practitioners to manage their risk profile more effectively. (Shahwan, 2015), This paper aims to empirically examine the quality of corporate governance (CG) practices in Egyptian-listed companies and their impact on firm performance and financial distress in the context of an emerging market such as that of Egypt. Based on a sample of 86 non-financial firms listed on the Egyptian Exchange 2010, the effects of CG on performance and financial distress are assessed. Tobin's Q is used to assess corporate performance. At the same time, the Altman Z-score is used as a financial distress indicator, as it measures financial distress inversely. The bigger the Z-score, the smaller the risk of financial distress. There is an insignificant negative relationship between CG practices and the likelihood of financial distress. The current study also provides evidence that firm-specific characteristics could be useful as a

first-pass screen in determining firm performance and the likelihood of financial distress examine the relationship between CG practices and a firm's financial distress. Company with a Z-score over 2.67 is considered to be healthy, whereas a Z-score below 1.81 implies a predicted bankruptcy. Z-scores between 1.81 and 2.67 indicate potential bankruptcy or a gray area. The firm financial distress status was regressed on the CGI and eight control variables. There are three points to notice. First, regarding the CG practices as measured by the CGI, we find insignificant negative association between CG practices and the probability of financial distress. Such a result might be expected due to the low quality of the CG practices within our sample. Thus, there is a need for Egyptian corporations to raise the level of their CG practices. (Zhang et al., 2014) investigate determinants of financial distress in large financial institutions based on the Distance-to-Default and Z-Scores measures. Using data of U.S. bank holding companies (BHCs), we find that the housing price index is a consistently significant factor across all BHCs and the non-performing loan ratio is the most powerful indicator for financial distress. Short-term wholesale funding is also a reliable default risk indicator. We additionally find that all the three regulatory capital requirements are very important for controlling default risk, particularly in the post-crisis period. (JEL C53, G14, G21, G28), we use a sample of 629 BHCs in the United States to probe the impact of various factors on the financial distress of BHCs, before, during, and after the recent financial crisis. Our main findings are: First, the HPI is consistently significant and is positively associated with the DD and the Z-Score measures. Second, the NPLR is the most powerful indicator predicting financial distress, and STWF can also be considered a reliable default risk indicator. Third, although existing studies have shown that the two alternative measures of BHC activity diversification are very important factors affecting default risk, in this study no conclusive findings have been reached regarding their role as determinants of default risk. Fourth, all three measures of regulatory capital requirements have a directly positive impact on both DD and Z-Score from 2010Q1 to 2013Q4, showing their importance in the post-crisis period. (Kihooto et al., 2016) assessing the financial distress amongst commercial and services companies listed at the Nairobi Securities Exchange, Kenya with an objective of determining whether the companies in this sector were prone to bankruptcy. Utilized secondary data collected from the Nairobi Securities Exchange over a five-year period (year 2009 to year 2013). Using Altman's Z score model, indicating that the companies' Z scores (on average) lay between -1.88 to 3.5. This is an indication that the companies are relatively not in danger of bankruptcy. The Z score for Express Kenya limited was below

1.81 which may be treated like a company in financial distress for all the years investigated. The Kenya Airways had a relatively strong Z score which reduces as time goes by. This is correct finding because the company has been making substantial losses in recent years and facing financial difficulties up to the extent of experiencing government intervention. Longhorn Kenya limited is having a high Z score on average thus interpreted not to be in financial distress. Nation Media Group, Scangroup Limited and TPS East Africa Serena and Uchumi have shown a relatively high Z score on average thus not considered to be on verge of financial distress. However, interpretation of the ratios is not to be taken on the face value only. Uchumi limited has been experiencing financial difficulties and have been engaged in creative accounting where they dispose off their assets for cash which is in turn used to settle short term obligations. May be that is the reason their Z score is relatively safe and does not raise any queries. (Vosoughi et al., 2016) investigating the relationship between financial distress and investment efficiency of companies listed in the Tehran Stock Exchange. To calculate investment efficiency, the Richardson's model 2006 (Richardson, 2006). The aim of the present study is applied, and its method is correlational- ex post facto. Using the exclusion sampling method and by applying the conditions of selecting the sample, 94 companies were selected from 2008 to 2013. To test the research hypotheses, multiple regression was used. Findings of the research indicate that there was a correlation between financial distress and investment efficiency in companies listed in the Tehran Stock Exchange, and institutional ownership had positive effects on the relationship between financial distress and investment efficiency of companies listed in the Tehran Stock Exchange. That the company which faces with financial distress, avoids doing investment in projects with positive NPV. The results indicate that from among control variables entered the model, leverage has a negative correlation with investment efficiency. It means that companies with a lot of debts avoid investment in projects with positive NPV. (Liao & Mehdian, 2016), Comparing between two approaches to indicate which is more accurate in predicting financial distress and they are aggregate bankruptcy index (ABI) and Z-score, the study found out that (ABI) is more accurate in predicting insolvency than Z-score. Also (ABI) is more powerful when you apply it with other parametric and non-parametric models to predict financial distress in corporations. Edward I. (Altman et al., 2017) Assessing the classification performance of the Z-Score model in predicting bankruptcy and other types of firm distress, with the goal of examining the model's usefulness for all parties, We analyze the performance of the Z-Score model for firms from 31 European and three non-European countries using different modifications

of the original model. We use the original Z00-Score model developed by Altman, Corporate Financial Distress: A Complete Guide to Predicting, Avoiding, and Dealing with Bankruptcy (1983) for private and public manufacturing and non-manufacturing firms. While there is some evidence that Z-Score models of bankruptcy prediction have been outperformed by competing market-based or hazard models, in other studies, Z-Score models perform very well. Without a comprehensive international comparison, however, the results of competing models are difficult to generalize. This study offers evidence that the general Z-Score model works reasonably well for most countries and classification accuracy can be improved by using country-specific estimation that incorporates additional variables. The purpose of this study was to assess the classification performance of the Z''-Score model originally introduced by (R. Taffler, 1983) using a very large international dataset. The analyses for all data show that the original Z''-Score model performs very satisfactorily in an international context.

(Ul Hassan et al., 2017) found out that the logit regression model (LRM) is much more accurate than multivariate discriminant analysis (MDA) for better prediction of financial bankruptcy. However, accurate prediction of bankruptcy is beneficial to improve the regulation of companies, to form policies for companies and to take any precautionary measures if any crisis is about to come in future. (Imelda & Alodia, 2017) The Multiple Discriminant Analysis is derived from the Altman Model While the Logit Analysis is derived from the Ohlson Model, at the end they found that the O-Score is much more accurate than the Z-Score in finding the financial distress. The examination Population is all organizations that are recorded on the Indonesian Stock Exchange. The example of the exploration is 40 assembling organizations recorded on the Indonesian Stock Exchange in the time of 2010-2014 that are partitioned into Companies with budgetary pain and those without money related trouble. (Restianti & Agustina, 2018) analyzing the influence of financial ratios proxied by the current ratio, the retained earnings to total assets, earnings before interest and tax to total assets, return on equity, debt to assets ratio, and total assets turnover against Financial distress. The population is a sub company of various industry listed in Indonesia Stock Exchange (IDX) in the period from 2013 to 2015 with the number of 40 companies. The sampling technique used purposive sampling technique and acquired 35 companies with 105 units of analysis. Data were analyzed with descriptive statistics and logistic regression. These results indicate that earnings before interest tax to total assets and return on equity have an impact on financial distress. While the current ratio, the retained earnings to total assets, debt to assets ratio, and total assets turnover

has no influence on the financial company's distress. The conclusion is that the company's financial distress condition can be avoided by reducing the financing coming from debt. In addition, increasing sales and maximizing the use of assets and equities that companies have can also reduce and avoid the company from financial distress. Descriptive analysis is used to provide an overview or description of a data. Descriptive statistical analysis is used to explain the frequency and percentage of companies which are experiencing financial distress and non-financial distress. The results of descriptive statistical analysis describe the minimum, maximum, average, and standard deviation values of independent variables and dependent variable. (Manaseer & Al-Oshaibat, 2018) examining the validity of Altman Z-score model used to predict financial distress in insurance companies in Jordan listed on Amman stock exchange (ASE) from 2011 to 2016. And the study outcome found that Z-score model have high predictive power, as well as ability to maintain and monitor firms' risk, and it also showed how Z-score model can be a valuable instrumental indicator for a lot of users of financial statement. But Z-score model is not the only measurement used to predict firm financial distress as the research advices use of other measurements in predicting financial distress in firms. (Mohd Ali & Mohd Nasir, 2018) comparing the relationship of between corporate governance mechanisms and financially distressed companies in Malaysia. They collected data from 2010 till 2016 they thing that the board activity has a significant relationship with financially distressed companies. They aim to improve corporate governance mechanisms among financially distressed companies and improve shareholders value. As far as the connection between leading body of chief's credits and monetarily troubled organizations, the outcomes from the double calculated relapse examination show that there is a critical positive connection between board movement and monetarily upset organizations. The outcomes give proof that more top managerial staff gatherings are held when the organizations are monetarily upset. Notwithstanding, board size, board freedom, and CEO duality have no critical relationship with monetarily troubled organizations. It is recommended that more continuous load up movement during money related pain can be a decent procedure for those chiefs with restricted communication time to sit together and examine the best techniques to end the organization's monetary trouble. This likewise gives proof that board movement will in general be more responsive as opposed to proactive. (Waqas & Md-Rus, 2018) comparing between the most admired financial distress prediction O-score, logit model and multiple discriminant Analysis model (MDA), and the result of this study is that the use of logit model is more accurate in predicting financial distress than

(MDA) and O-score, Because prediction model provided more precise results with overall accuracy of 91.7 and 93.3 percent for the estimation sample while they found that the percentage of accuracy of O-score model is 61%. (MDA) proved its insufficiency in predicting financial distress in many studies in developed countries. This study was held in Pakistan with a sample of 290 firms divided into 45 distressed and 245 healthy firms for the period 2006-2016 and covered all sectors of Pakistan Stock Exchange. (Altameemi, 2021) investigating the effect of some of the firm level variables on the relation between financial distress and capital structure decisions The manufacturing firms listed in Turkish market between 2007 and 2017 are analyzed. Fixed effect panel regressions are used in the analyses. Financial distress level increases as leverage and short-term debt maturity usage increase. Firm size, return on equity, asset tangibility variables are reported as effective on the association between leverage and financial distress. Return on equity and asset tangibility have impacts on the relation between financial distress and debt maturity. The findings show that increased debt level results in higher level of financial distress which is in line with Trade-Off Theory. As the debt level of more profitable firms increases, the financial distress level of those firms increases. Moreover, increasing debt among large firms causes higher level of financial distress. Asset tangibility is also effective in reducing negative impact of debt on financial success. Increasing long term debt among firms with higher ROE, results in increased financial distress levels. Finally, increasing long-term debt ratio among firms with higher tangibility causes higher financial distress level. Altman Z Score and Springate S-Score are used to measure financial distress and negative relation is found between financial distress variables and capital structure variables. (Assagaf et al., 2019) overcoming weaknesses of using the logistic model used in previous studies to measure financial distress by using marginal approach because it provided evidence by mathematics and accounting calculations, And by using marginal approach this can also have a huge impact in evaluating the financial condition of SOEs, the study also showed the factors that have huge effect on financial distress, and this factors will help assist in developing strategies and management policies to raise marginal level scores. (Kashyap & Bansal, 2019) in India they started to predict the companies that may get bankrupt or “Financial Distress” so they started to collect some data from some of the companies and put them in a modeling and see if they will fall in a financial distress in the future or not and at the end they predicted 95% of the cases accurately prior to distress. The exploration was done to develop a factual model utilizing bookkeeping proportions to conjecture monetary misery among Indian listed organizations

enlisted under new indebtedness and insolvency code. The model was created utilizing distinctive money related proportions for both monetarily trouble just as sound organizations. Numerous discriminant investigations were utilized to segregate the organizations with between monetarily troubles from solid ones. As indicated by results, monetary proportions are very powerful for separating between conceivably trouble and non-trouble firms. The outcome found that money related proportions can exactly anticipate the trouble among Indian firms both two years just as three years ahead of time adequately. So, the proposed models can be utilized to discover the recorded organizations in India which can confront trouble in future well ahead of time. (Indriyanti, 2019) comparing the financial distress of technology companies, they got the data of world's 25 biggest tech companies from 2015-2016 and compared them, the total was 30 companies in the comparison and they started calculating. In this examination, each organization will be seen by their last exchange. Last exchanging demonstrates that the organization is as yet dynamic and not delisted on the stock trade. Furthermore, the organization will likewise be seen following a time of forecast whether the organization has consolidated or gained with another organization or not. It means to investigate and look at the prescient consequences of every expectation model with the current genuine state of the organization. The hour of perception of the organization's keeps going exchanging is done on August 5, 2018 on each stock trade which is where the organization is posting. The stock trades incorporate Nasdaq, New York Stock Exchange, Korea Stock Exchange, London Stock Exchange, India Stock Exchange, and National Stock Exchange of India. Likewise, to seeing the truth of the organization's condition, ICR was likewise determined for Robustness check investigation. In this investigation, each organization will be seen by their last exchange. Last exchanging demonstrates the assurance of the exactness of the expectation model in this investigation depends on the high-rate level of every forecast model. The level of results is acquired from the correlation of the consequences of the expectations of each model contrasted with the truth of the organization after the year anticipates. The model with a rate level drawing closer 100% is the most precise model in foreseeing the monetary trouble of an organization that can possibly bankrupt later on. The outcome shows that the expectation models which are the most exact to anticipate truth of the organization is Grover models. Grover models can anticipate with exact until 96,6%, and it is near 100%. After Grover model, Altman model can foresee with exact until 86,6%, and afterward Taffler model 85%, Zmijewski model 85%, Springate model 70%, Ohlson model 46,6%, and the last Fulmer model 40%. Table 2 show the consequence of Robustness

Check which depend on looks at count models with interest inclusion proportion. Furthermore, the outcomes demonstrate that the Grover model which is the most noteworthy precision model is right and still exact. In spite of the fact that the rate diminished from 96.6% to 95%, the Grover model remains the forecast model of monetary misery with the most elevated exactness contrasted with the Altman, Zmijewski, and Taffler models with an exactness pace of 83.3%, the Springate model with 71,6% precision rate, Ohlson's model with a 46.6% precision rate, just as the forecast model with the least exactness rate is the Fulmer model with a precision pace of 45%. (Elviani et al., 2020) determined the most accurate model among (Elviani et al., 2020) with binary logistic regression as analysis technique. A sample of 53 trade sector companies in Indonesia. it proved that the most appropriate and accurate model in predicting bankruptcy of trade sector companies in Indonesia is the Springate model and the Altman model. (Tanjung, 2020), Comparing between Altman Z-Score, Springate, Zmijewski and Ohlson models to determine which is the most accurate in predicting financial distress it's shown that The Altman model is the most accurate prediction model in predicting financial distress. And there is a huge difference between them. The sampling method used purposive sampling with 45 data from 9 pharmaceutical companies listed in IDX. This paper is conducted to examine the prediction model of financial distress, few researches were done in different industries and different time periods to unfold the puzzled phenomena and they used different variables to predict the financial distress so the effect of firm performance is still ambiguous. The paper has shown the prediction models of financial distress during the period 2011 to 2020. Through this study we predicted the financial distress by applying Z-score model on firms that have had financial problems and those that didn't face problems. However, most of the studies in developed countries have highlighted some models in predicting the financial distress, although all these models have the same ability to predict the probability of the firm facing financial distress. We found a high predictive power for Z-score model and that revealed that Z-score model could be valuable, but the problem still which model is the best to best predict financial distress. All the authors found positive relation between Z-score and financial distress so we will examine if there is a negative relation between Z-score and financial distress and the new measurement used to predict financial distress. Z-score model was developed in 1968 and it was the most appropriate for public firms (Altman, 1968). Edward Altman was considered to be the first one to start working on a model to assess a predictor of financial distress for companies. Altman was New York University Finance Professor; he developed the model widely

known as Z-score through using a statistical tool named as "Multiple Discriminant Analysis" (Calandro, 2007). Multiple discriminant analysis or MDA identifies well the distressed firms from the non-distressed ones through the ratios of Z-score. Z-score is based on five financial ratios; these ratios were chosen after analyzing various financial ratios (Calandro, 2007) , (Khurshid, 2013) and (Sandin & Porporato, 2007) The five ratio classifications included are: Liquidity, Profitability, Leverage, Solvency, and Activity ratios (Altman, 1968) and (Sandin & Porporato, 2007) Certain weights are given to each ratio (al Zaabi, 2011). This model has high predictive power ability 2 years before financial distress (Altman, 1968). This model has 2 modifications which are Z' and Z" models which will be discussed later in this section. Z-score is calculated as follows:

$$Z = 1.2 X1 + 1.4 X2 + 3.3 X3 + 0.6 X4 + 1.0 X5$$

X1: Working Capital/Total Assets

X2: Retained Earnings/ Total Assets

X3: Earnings before interest and taxes/Total Assets

X4: Market Value Equity/Book Value of Total Liabilities

X5: Sales/Total Assets

If Z is greater than 2.99, then the firm is not having any financial distress risk or it is financially solid. If Z is lower than 1.81, then the firm is identified as financially distressed. If Z is between 1.81 and 2.99, then the firm is falling in the grey zone (Altman, 1968). X1 shows the working capital which is the difference between firm's current assets and its current liabilities (Khurshid, 2013). This ratio tests the net liquid assets of a company with respect to total assets. Also, it measures the firm's ability in controlling its liquidity or the net liquidity of its assets (Al Zaabi, 2011). Thus, a financially distressed firm experiences deterioration in working capital or if the firm is having continuous operating losses, the current assets will decrease compared to total assets. Liquidity and size attributes are clearly considered. This ratio is the most relevant ratio (Altman, 1968). Also, (Khurshid, 2013) agreed that working capital is the blood of any company since it meets the daily business obligations. Also, he claimed that this ratio has been used frequently in common finance. It reflects how much part of assets is allocated for meeting business needs. So, (Al Zaabi, 2011) concluded that a financially distressed firm suffers from low working capital. X2 analyzes the retained earnings compared to total assets as it shows to what extent retained earnings are expressed by total assets needed (Al Zaabi, 2011). It measures the cumulative profitability of the firm (Altman, 1968). Correspondingly, (Khurshid, 2013) agreed that it is one of the most critical ratios in standard finance. Since the

firm's age is very crucial, therefore, a new firm has a relatively low retained earnings ratio and an old firm has a relatively high retained earnings ratio. Firms employ their high retained earnings as a source of capital financing thus using debt as a source of financing declines, so if the firm is having low retained earnings it will be highly leveraged. X3 is calculated by dividing earnings before interest and taxes (EBIT) by total assets (Al Zaabi, 2011). It is used to calculate return on total assets for examining the company's ability to earn profits from its assets. This ratio is used in evaluating the firm's going concern and measuring the firm's profitability since the firm's success or bankruptcy depends on its earning capability (Altman, 1968) and (Khurshid, 2013). This ratio measures the firm's productivity without considering leverage indicators, and taxes. Since the main reason for existence of any firm is based on its assets earnings, then this ratio is the most appealing one for measuring corporate failure (Altman, 1968). This ratio indicates to what extent EBIT is reflected by total assets or how much of total assets are being a part of EBIT (Khurshid, 2013). Also, it highlights the company's productivity resulting from its borrowed funds (Al Zaabi, 2011). X4 examines the shareholders' equity relative to total liabilities. Equity is assessed by the market value of all types of stocks. This ratio indicates how much the assets can decrease in value before liabilities get higher than assets and the firm becomes distressed (Altman, 1968). The higher this ratio, the lower the possibility that the company will be distressed (Al Zaabi, 2011). Accordingly, it reflects the firm's value over its total duties. This ratio is sometimes calculated by dividing net worth by total liabilities. Net worth is the amount by which assets exceed liabilities. So, the ratio evaluates the net worth of the company at the market as was mentioned by (Calandro, 2007) and (Khurshid, 2013). This ratio measures financial stability on the long-run. The increased gearing resulting from equity trading leads to insolvency and distress (Al Zaabi, 2011). X5 indicates how much the company is growing. Firms have to exploit their assets in an efficient way to achieve sales growth. Firms that are well-performing have high sales to total assets ratio (Khurshid, 2013). This ratio is known as capital-turnover ratio, it reflects the capability of assets in generating sales. Moreover, it shows how managers are effective in market competitions (Altman, 1968). This ratio shows the management ability to deal with competitive conditions. Also, it ranks second in terms of the model's ability to identify financial distress (Altman, 2000). However, Altman modified his original Z-score into two new models known as Z'-score model and Z''-score model.

Data Analyzed



Figure 1: Juhayna Z-SCORE

Validity of Altman Z-Score Model to Predict Financial Distress Page 7 of Number Pages 55

Juhayana z-score fluctuates through the years but most of the time it's in grey zone, in 2016 the company z-score was decreasing that it went from grey zone to becoming financial distressed and the big reason for this is decreasing in the value of X4 (Market Value Equity/Book Value of Total Liabilities) because it measures the financial stability of the company on the long-run but starting from 2017 Juhayna started improving till it came out of the financial distress and back to the grey zone and that due to the increase in the value of X4 (Market Value Equity/Book Value of Total Liabilities), furthermore the company entered the safe zone in end of 2018 but again in 2019 it went to the grey zone and small fluctuation over the year but in 2020 second quarter decreased because of the pandemic, but then the company began to progress again.

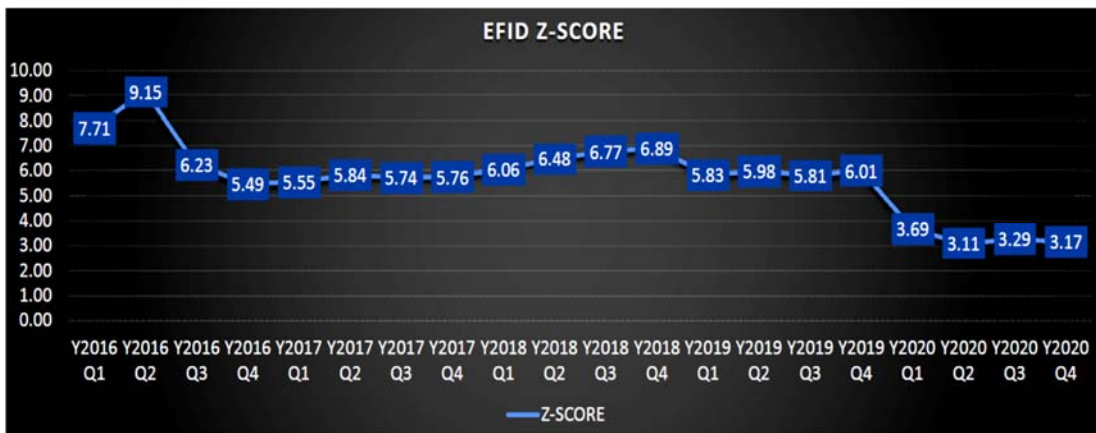


Figure 2: Edita Food Industries Z-SCORE
 Validity of Altman Z-Score Model to Predict Financial Distress Page 7 of Number Pages 55

The company past 5 years was in (Safe Zone) where the Z score was higher than 1.81 even higher than 2.99 so this means that the company is in the safe zone.

The company working capital has been decreasing the past years but this is a good indicator that the company is not keeping a working capital and its investing all its money but the last two years 2019-2020 they started increasing the working capital, They kept dealing with the total asset and year by year it has been increasing gently and this is a sign that the company is growing, the Retained earnings kept its growth and this is one of the major signs that company is staying consistently profitable From 2016 till 2020 the Z-Score decreased from 9.14 to 3.11 the big reason that the company decreased its total Z score is the EBIT. The company faces unstable amount of Increasing EBIT it may be due to marketing campaigns or taxes the total amount of EBIT/Market value Decreased in 2020 and this caused that the Z-score decrease to 3.1 and also the Market value compared with the other years, in 2020 it decreased, in the past 5 years the book value of this company has been increasing hugely this mean that the company stock price has increased too and it's a good indicator for the purchasing or investing in this company.



Figure 3: Telecom Egypt Z-SCORE
 Validity of Altman Z-Score Model to Predict Financial Distress Page 7 of Number Pages 55

Telecom Egypt Company was in the distressed zone in the past 5 years (2016-2017-2018-2019-2020) as the z score in the 4 quarters of the 4 year was less

than 1.81 except quarter 2 in 2016 the company was in the grey zone which means that the company is headed for bankruptcy as the X1 (working capital/Total Assets) increased in Q2 2016 and began to increase negatively from Q3 2016 to Q4 2020 which indicates that the company current liabilities exceeded its current assets. And the liabilities that need to be paid within one year exceed the current assets over the same period.

Also, there is a moderate fluctuation in all the other variables as they gradually increased where X2 (Retained Earnings/ Total Assets) went from 0.18 to 0.26, X3 (Earnings before interest and taxes/Total Assets) from 0.01 to 0.02, X4 (Market Value Equity/Book Value of Total Liabilities) from 1.53 to 0.45, X5 (Sales/Total Assets) from 0.09 to 0.11 despite this increasing all of the variables still below 1.81 which indicates that the company still in the distressed zone.



Figure 4: Lecico Egypt Z-SCORE

Validity of Altman Z-Score Model to Predict Financial Distress Page 7 of Number Pages 55

Lecico suffered from financial distress from the start of 2016 to the end of 2020 as it's z-score in the past 5 years never were higher than 1.81 as shown the highest z-score Lecico had in 2018 fourth quarter was 1.32 and that was due to the increase in the value of X5 (Sales/Total Assets) or in other words increase capital-turnover ratio which shows the increase in the capability of assets in generating sales. Moreover, it shows improve in the management ability to deal with competitive conditions.

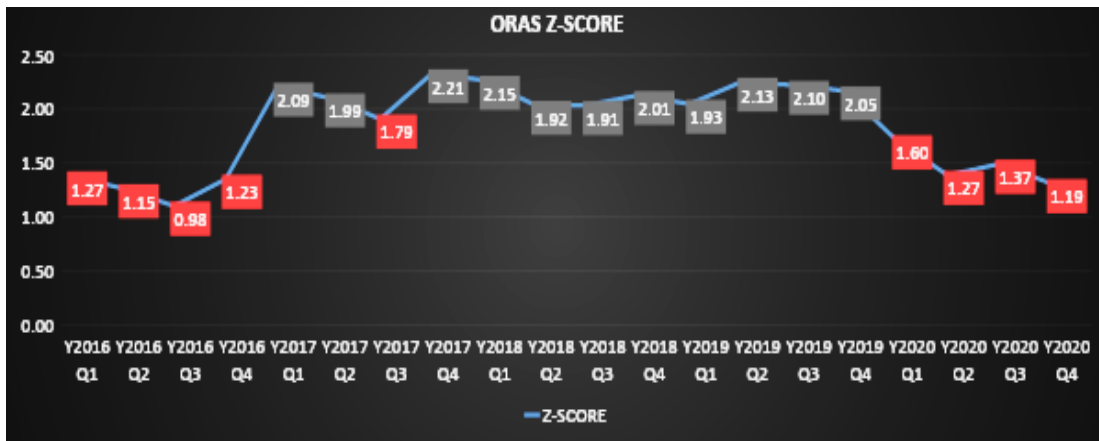


Figure 5: Orascom Construction Z-SCORE

Validity of Altman Z-Score Model to Predict Financial Distress Page 7 of Number Pages 55

ORASCOM company in 2016 faced financial distress because appreciation of US dollar relative to Egyptian pound and the inflection in Egypt so all construction sector in Egypt face problem, the company have problem in Asset turnover, Average collection period and stock of company fall in stock market. But in 2017 to 2019 the company moved from distress zone to grey zone, so the ORASCOM company didn't face any distress due to the company decrease in the expenses and collect Account receivable faster to convert Account receivable into cash, turnover asset in sales faster and the company become more efficient in shareholder return so the EPS increase. But in 2020 all construction sector in world faced problem because COVID-19.



Figure 6: Ezz Steel Z-SCORE

Validity of Altman Z-Score Model to Predict Financial Distress Page 7 of Number Pages

In 2016 and 2017 years Ezz steel company was in safe zone as their scores were above 3 which indicates that the company will not declare bankruptcy, as the company has good efficient retained earnings compared to their total assets for buying more income producing assets, higher future profitability. In those years in the last quarters the company was just facing a problem for weak sales and possibly excess inventory (overstocking). But it seems that they have improved those problems as in 2018, we can see that the company is not facing any distress due to their improvement with a z score 2.3 and above 3 indicating grey and safe zones. In 2019 and 2020 the company has fallen to the distress zone with a very low z score as the longer the company take to pay their creditors and bad inventory management and for the COVID-19 world pandemic.

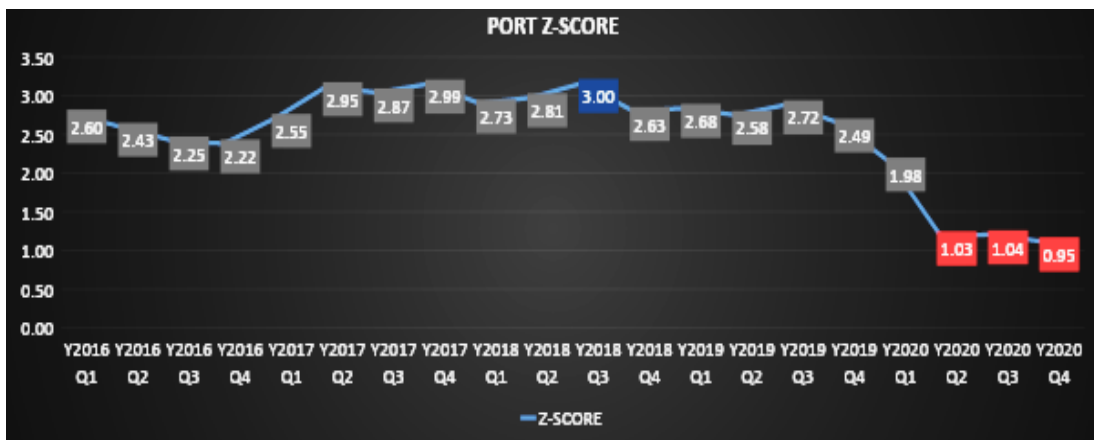


Figure 7: Porto Group Z-SCORE

Validity of Altman Z-Score Model to Predict Financial Distress Page 7 of Number Pages 55

Porto Group Company in 2016, 2017, 2018 and 2019 years are in grey zone as their z score is above 1.81 and below 2.99 which suggests there is a moderate chance of the company going bankrupt within the next two years of operations which indicates that the business was not bad, both in terms of sales performance and inventory management. While in 2020 as its shown the company has fallen to the distress zone with a z score below 1.81 which is leading to facing a problem of a difficulty in paying its bills and it meets difficulty in converting its inventories to sales and a bad average collection period, in addition to the COVID-19 world pandemic.

Result

After testing our hypothesis, we reached out that z-score is a good indicator to measure financial distress of a firm working in the Egyptian stock market, in a sample of 7 companies in the Egyptian stock market we calculated the z-score and we found out companies that have financial distress and in the danger zone and others that don't have financial distress and in the safe zone and we also found out the cause of the problems that are putting the companies in the danger zone. The Z-score model is a very practical tool that can be used to predict the insolvency of companies in Egypt. This tool also could be used by investors to decide if they would invest in any of those companies showing the company's financial position. The study showed that z-score is valid model in measuring financial distress as it differentiated distressed firms from safe and grey ones in the used sample. Also, in this study we used Altman Z score model as a tool on a sample of 7 companies in Egyptian stock market over the period 2016 – 2020 for predicting failure of companies and measuring the related risk of bankruptcy and we found out that financially distressed firm experiences deterioration in working capital, low **EBIT** (earnings before interest and taxes). Decreasing in sales which makes these companies fall in the distressed zone and also, we found out non distressed companies these experience effective noticeable increasing in all of the 5 variables which made them in the safe zone away from being financially distressed. And after analyzing the sample we found out that in the second quarter in 2020 all of the seven companies suffer from the pandemic and that cause decrease in the Z-score although the effect differs from one company to another obviously. The purpose of this study was to investigate the accuracy of Altman Z-score model in predicting corporate financial distress in Egypt. The Z score Altman's model may not be the only model to measure the financially distressed firms but Z-score is a valid model to determine the financial distressed firms. We recommend that further researches are conducted including companies in other sectors, increase the sample size and increase the number of years used in the sample. Also using other models to predict financial distress and compare it with z-score would be effective for future research. The study only relayed on financial data to predict financial distress, while there are other measures which can be used for financial distress detection Such as corporate governance, investment efficiency, equity return, cash flow. Capital structure, prevailing economic as well as political conditions. If such information is incorporated in financial distress prediction models, then the study can be conclusive. This study could have been conclusive if done for the whole population of the firms listed at the

Egyptian stock market. However due to inadequate data only 7 companies were analyzed. Critical sectors like insurance and banking were totally left out in the analysis due to disclosure requirements which minimize availability of data. The study covered only five years. This is due to time limitation and as such results may be different if the time frame covered was expanded.

References

- Al Zaabi, O. (2011). Potential for the Application of Emerging Market Z-Score in UAE Islamic Banks. *International Journal of Islamic and Middle Eastern Finance and Management*, 4(2), 158–173.
- Alifiah, M. N. (2014). Prediction of Financial Distress Companies in the Trading and Services Sector in Malaysia using Macroeconomic Variables. *Procedia-Social and Behavioral Sciences*, 129, 90–98.
- Almamy, J., Aston, J., & Ngwa, L. N. (2015). An Evaluation of Altman's Z-Score using Cash Flow Ratio to Predict Corporate Failure Amid the Recent Financial Crisis: Evidence from the UK. *Journal of Corporate Finance*, 36, 278–285.
- Altameemi, A. F. (2021). The Relationship Between Financial Flexibility and Market Value Added: The Mediation Effect Role of the Corporate Size (A Practical Study on a Sample of Jordanian Industry Sector Firms). *International Journal of Economics and Finance*, 13(1), 1–52. <https://ideas.repec.org/a/ibn/ijefaa/v13y2021i1p52.html>
- Altman, E. I. (1968). Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy. *Journal of Finance*, 23(4), 589–609.
- Altman, E. I. (2000). Predicting Financial Distress of Companies: Revisiting the Z-score and ZETA Models. In *Handbook of Research Methods and Applications in Empirical Finance*.
- Altman, E. I., Iwanicz-Drozdowska, M., Laitinen, E. K., & Suvas, A. (2017). Financial Distress Prediction in an International Context: A Review and Empirical Analysis of Altman's Z-Score Model. *Journal of International Financial Management & Accounting*, 28(2), 131–171. <https://doi.org/10.1111/JIFM.12053>
- Assagaf, A., Murwaningsari, E., Gunawan, J., & Mayangsari, S. (2019). Estimates Model of Factors Affecting Financial Distress: Evidence from Indonesian State-owned Enterprises. *Asian Journal of Economics, Business and Accounting*, 1–19.
- Calandro, J. (2007). Considering the Utility of Altman's Z-score as a Strategic Assessment and Performance Management Tool. *Strategy and Leadership*, 35(5), 37–43.
- Edward Altman. (2012). Enhancements to Assess Credit Risk in Global Environment--. Experience Stern. <https://www.stern.nyu.edu/experience-stern/faculty-research/altman-launches-zscore-plus>
- Elviani, S., Simbolon, R., Riana, Z., Khairani, F., Dewi, S. P., & Fauzi, F. (2020). The Accuracy of the Altman, Ohlson, Springate and Zmijewski Models in Bankruptcy Predicting Trade Sector Companies in Indonesia. In *Budapest*

- International Research and Critics Institute (BIRCI-Journal) (Vol. 3, pp. 334–347).
- Gunathilaka, C. (2014). Financial Distress Prediction: A Comparative Study of Solvency Test and Z-score Models with Reference to Sri Lanka. *The IUP Journal of Financial Risk Management*, 11(3), 39–51.
- Habib, A., Bhuiyan, B. U., & Islam, A. (2013). Financial Distress, Earnings Management and Market Pricing of Accruals during the Global Financial Crisis. *Managerial Finance*.
- Hua, Z., Wang, Y., Xu, X., Zhang, B., & Liang, L. (2011). Predicting Corporate Financial Distress Based on Integration of Support Vector Machine and Logistic Regression. *Expert Systems with Applications*, 33(2), 434–440.
- Imelda, E., & Alodia, I. (2017). The Analysis of Altman Model and Ohlson Model in Predicting Financial Distress of Manufacturing Companies in the Indonesia Stock Exchange. *Indian-Pacific Journal of Accounting and Finance*, 1(1), 51–63.
- Indriyanti, M. (2019). The Accuracy of Financial Distress Prediction Models: Empirical Study on the World's 25 Biggest Tech Companies in 2015–2016 Forbes's Version. *KnE Social Sciences*, 442–450.
- Kashyap, S., & Bansal, R. (2019). Modeling Financial Distress Prediction of Indian Companies. In *International Journal of Recent Technology and Engineering (IJRTE)* (Vol. 8, Issue 1C2).
- Khaliq, A., Altarturi, B. H. M., Thaker, H. M. T., Harun, M. Y., & Nahar, N. (2014). Identifying Financial Distress Firms: a Case Study of Malaysia's Government Linked Companies (GLC). *International Journal of Economics, Finance and Management*, 3(3).
- Khurshid, M. R. (2013). Determinants of Financial Distress Evidence from KSE 100 index. *Business Review*, 8(1), 7–19.
- Kihooto, E., Omagwa, J., Wachira, M., & Emojong, R. (2016). Financial Distress in Commercial and Services Companies listed at Nairobi Securities Exchange, Kenya. *European Journal of Business and Management*, 8(27), 86–89.
- Kordestani, G., Bakhtiari, M., & Biglari, V. (2011). Ability of Combinations of Cash Flow Components to Predict Financial Distress. *Business: Theory and Practice*, 12(3), 277–285.
- Liao, Q., & Mehdian, S. (2016). Measuring Financial Distress and Predicting Corporate Bankruptcy: An index approach. *Review of Economic and Business Studies*, 9(1), 33–51.
- Manaseer, S., & Al-Oshaibat, S. D. (2018). Validity of Altman Z-score Model to Predict Financial Failure: Evidence from Jordan. *International Journal of Economics and Finance*, 10(8).

- Mohd Ali, M., & Mohd Nasir, N. (2018). Corporate Governance and Financial Distress: Malaysian Perspective. *Asian Journal of Accounting Perspectives*, 11(1), 108–128. <https://doi.org/10.22452/AJAP.VOL11NO1.5>
- Mu-Yen Chen. (2014). A High-Order Fuzzy Time Series Forecasting Model for Internet Stock Trading. North-Holland, 37, 461–467.
- Onyiri, S. (2014). Predicting Financial Distress using Altman's Z-score and the Sustainable Growth Rate. In Northcentral University. ProQuest Dissertations Publishing.
- Restianti, T., & Agustina, L. (2018). The Effect of Financial Ratios on Financial Distress Conditions in Sub Industrial Sector Company. *Accounting Analysis Journal*, 7(1), 25–33. <https://doi.org/10.15294/AAJ.V7I1.18996>
- Richardson, S. (2006). Over-Investment of Free Cash Flow. *Review of Accounting Studies*, 11(2–3), 159–189. <https://doi.org/10.1007/S11142-006-9012-1>
- Sandin, A. R., & Porporato, M. (2007). Corporate Bankruptcy Prediction Models Applied to Emerging Economies Evidence from Argentina in the years 1991-1998. *International Journal of Commerce and Management*, 17(4), 295–311.
- Shahwan, T. M. (2015). The Effects of Corporate Governance on Financial Performance and Financial Distress: Evidence from Egypt. *Corporate Governance*, 15(5), 641–662. <https://doi.org/10.1108/CG-11-2014-0140>
- Sulub, S. A. (2014). Testing the Predictive Power of Altman's revised Z' model: The Case of 10 multinational companies. *Research Journal of Finance and Accounting*, 5(21), 174–184.
- Taffler, R. (1983). The Assessment of Company Solvency and Performance using a Statistical Model. *Accounting and Business Research*, 52. [https://www.research.manchester.ac.uk/portal/en/publications/the-assessment-of-company-solvency-and-performance-using-a-statistical-model\(734e4dee-5f31-4f80-85df-7e8eaa64389c\)/export.html](https://www.research.manchester.ac.uk/portal/en/publications/the-assessment-of-company-solvency-and-performance-using-a-statistical-model(734e4dee-5f31-4f80-85df-7e8eaa64389c)/export.html)
- Taffler, R. J. (1982). Forecasting Company Failure in the UK Using Discriminant Analysis and Financial Ratio Data. *Journal of the Royal Statistical Society. Series A (General)*, 145(3), 342. <https://doi.org/10.2307/2981867>
- Tanjung, P. R. S. (2020). Comparative Analysis Of Altman Z-Score, Springate, Zmijewski And Ohlson Models In Predicting Financial Distress. *EPR International Journal of Multidisciplinary Research (IJMR)*, 126.
- Ul Hassan, E., Zainuddin, Z., & Nordin, S. (2017). A Review of Financial Distress Prediction Models: Logistic Regression and Multivariate Discriminant Analysis. *Indian-Pacific Journal of Accounting and Finance*, 1(3), 13–23.
- Vosoughi, M., Derakhshan, H., & Alipour, M. (2016). Investigating the Relationship Between Financial Distress and Investment Efficiency of Companies listed on the Tehran Stock Exchange. *Accounting*, 2(4), 167–176.

- Waqas, H., & Md-Rus, R. (2018). Predicting financial distress: Applicability of O-score and logit model for Pakistani firms. *Business and Economic Horizons* (BEH, 14(1232-2019-760), 389-401.
- Zhang, Z., Xie, L., Lu, X., & Zhang, Z. (2014). Determinants of Financial Distress in U.S. Large Bank Holding Companies. *SSRN Electronic Journal*. <https://doi.org/10.2139/SSRN.2392892>