
Application of Z-Score and Z-3 Score Models to Evaluate the Financial Situation of the Modern Sewing Company: A Case Study

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Abstract:

The Purpose of this research work is to examine the financial position of the company studied using Altman's Z-score and Z-3 score models. We are interested in identifying the financial position of the Modern Sewing Company (MSC) working in Iraq. The study focused on the importance, causes, symptoms of financial failure and distress. When the question deals with the potential effects on the wealth of creditors, stockholders, and society as a whole, researchers consider a company's distress and bankruptcy to be the most important issue to be studied. The Altman Z-score and Altman Z-3 Score models were applied on the financial data of the MSC to investigate and to predict the financial position of MSC between 2016 - 2022. The analysis conducted in this research work was based on the secondary data extracted from the financial statement of the company available on the listed companies at the Iraqi Securities Commission (isc.org.iq). According to the Altman Z-Score the MSC faced financial failure in 2016 and 2020, while according to Altman Z-3 score it was far away from financial failure during 2016-2022. This research is important because it provides investors and the MSC with information to guide their investments. The value and importance of research related to the study of financial failure prediction models in the industrial sector in Iraq are somewhat rare and requires more deep analysis due to the instability in the Iraqi economy. The research also seeks to explain financial failure models and the extent to which investors benefit from these models.

Keywords: Altman, Financial Failure, MSC, Prediction, Economy.

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1.Introduction:

The business environment, nowadays, is complex and rapidly changing, with economic, political, social, technical and competitive forces significantly changing. This has led researchers to use some financial ratios individually to predict financial failure. The interest in this topic has increased in the United States since the last century. From that date the number of researchers conducting studies in this field for identifying indicators that could inform the prediction of possible bankruptcies following incidents of bankruptcy in a number of U.S. organizations especially after the crisis of 2008 which was the most serious financial crises after the great depression of 1930's. It is evident that such incidents are increasingly causing significant damage to shareholders, lenders and investors. Yet by adopting financial models, management may predict ahead of time financial crisis and prepare for them before the crisis takes place. The efficiency of financial activity is one of the most important determinants of companies' ability to achieve their goals of survival and continuity. The company's poor management of the financial side may expose it to what is known as financial distress. This applies to all types of companies regardless of their legal form or the nature of their activity, not to mention the negative effects on the economy as a whole. Financial failure is one of the most important challenges facing companies, because of its impact on decision makers, such as investors, creditors and others. Although companies are obliged to prepare financial statements, in accordance with the requirements of the accounting standards, the information provided by the financial statements remain insufficient to provide them with a full and clear picture of the enterprise, especially regarding its future. Therefore, it is necessary to rely on other ways to assess the financial situation of companies and the risks surrounding them, thereby predicting their potential failure. Increasing the predictability and sustainability of the company's future would be in the

interest of stakeholders and would enhance its governance aspects especially after the bankruptcy of giant companies in the USA. Therefore, a number of financial models are now available in the financial literature such as the Altman model, Sherrod model, Kida model, Beaver models and others. These models are used to anticipate companies' financial future and viability. Such models have shown remarkable success in predicting the future of companies in terms of continuity, through studies carried out and applied to companies from different countries. The models provided by the literature are based on a set of ratios that are developed based on the information contained in the financial statements. Iraq suffers from political and economic problems that have a negative impact on corporate performance and increase its challenges. In addition, to the increased competition from foreign goods that are sold at competitive prices. Therefore, Iraqi companies' exposure to financial distress problems is not unlikely, and it is likely to have a catastrophic effect compared to any other market without such challenges. Therefore, the importance of predicting financial distress increases in the Iraqi environment compared to any other environment, as this contributes to enhancing the situation of Iraqi companies and thus addressing political and economic challenges. Hence, the objective of this study is to measure both the Altman's Z-Score and Z-3 models ability to predict the financial position of the MSC. On the other hand, the study seeks to examine the compatibility of the results of the two models.

2.Research Methodology

2.1. Research Problem

In view of the significant losses of corporate bankruptcy to the economy and investors, it has become necessary not to rely on financial ratios only to assess a company financial situation, but to rely on financial models, which are a set of financial ratios embedded in a single model, such as the Altman model, to

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predict corporate financial failures, hence the research problem shall address the following questions:

1. How effective are the Z-score and Z-3 models in predicting the researched company's financial position?
2. Is the researched company faces success or failure according to the Altman models?
3. Is there a significant difference between the results of the two models?
4. Can a statistical model be derived to estimate the value of Z-score?

2.2. Research Objectives:

Based on the foregoing research problem and its questions, a set of goals and objectives have been formed that can contribute to the research problems:

1. Measuring the success or failure of the company in question using the Altman models.
2. Comparison of the results of the company's success or failure indicators resulting from the application of the Altman model.
3. Analyse the company's financial statements to diagnose the most critical success factors that make the company successful or unsuccessful.
4. Derive a linear regression model to predict the failure or success of the company studied.

2.3. Research Significance

This research is significant because the results obtained will increase our awareness of the issue of measuring the financial failure of companies in general and the MSC in particular. In addition, this research is significant as it provides the company and investors with information that helps in making investment decisions in the company.

2.4. Research Method

A case study approach was used based on data derived from the researched company's financial statements and using quantitative methods and inferential statistics to achieve research objectives.

2.5. Research Sample

The research was conducted at the MSC, and the study sample consisted of the financial statements from 2016 – 2022 which were available on (isc.org.iq).

3.Theoretical Background

3.1. Definition of Financial Analysis

Financial analysis is the process of financially evaluating businesses, projects, and budgets. Its purpose is to determine the performance and suitability of the investments, and to extract semantic information that helps provide a clear vision of the financial situation and make sound decisions. Whether it is a financial analysis of companies with the aim of evaluating performance, conducting oversight and preparing plans, or it is an evaluation of an investments with the aim of identifying the most appropriate investment opportunities, or it is for the state and its government agencies or any other entity, in the end it is a very important means in guiding decision makers towards achieving better and more financial performance profitability (Ross & Westterfield,2013).

3.2. The Importance of Financial Analysis

In the age of information and investment in which we live, financial analysis is crucial, for it contributes to achieving the financial and administrative success of institutions and

individuals. According to Wang & Zhou (2016) and Mohammed & Amear (2017) the importance of financial analysis lies in its ability to:

- a. Determining the company's financial efficiency by determining its liquidity ratios.
- b. Determining financing plans and the amount based on the company's financial efficiency indicators.
- c. Provide accurate information about investment success through indicators of profitability ratios.
- d. Supporting the future planning process to enhance the strengths and confront the weaknesses.
- e. Determining the degree of investment risk in the company through indicators of debt ratios.

Giving accurate indicators of the extent of success of the relevant departments, such as finance and sales, through indicators of activity ratios.

3.3. The Goals of Financial Analysis

Al-Showishin (2021) and Al-Najjar (2022) stated that financial analysis has many purposes that vary according to the diversity of the objective of conducting the analysis. The most important of these objectives are:

- a. Providing the necessary information for preparing future plans. Giving clear indicators of the success of the activity practiced by the company.
- b. Identifying financial problems and negative courses of practices to correct them.
- c. Finding out the true financial position of the institution and its financial efficiency.
- d. Highlighting the strengths to maintain it and the weaknesses to avoid.
- e. Help discover investment opportunities available in the business market.
- f. Supporting the financial department and top management in defining their short and long term goals.
- g. Evaluate the extent to which the financial management and senior management have succeeded in maintaining a stable financial position.
- h. Determining the financial position in terms of the company's ability to obtain financing and loans and to fulfil their repayments.

3.4. Types of Financial Analysis

Peddyreddy (2014) and Mohammed & Amear (2017) state that financial analysis has several types that differ according to a set of criteria such as:

- a. According to the Motion Factor: includes vertical and horizontal analysis.
- b. According to the Time Horizon: which could be short term, or long term
- c. According to the Execution Entity: This could be internal financial analysis or external financial analysis.
- d. Financial Ratio Analysis: which includes several ratios such as: Liquidity ratios, Activity ratios, Profitability ratios, Indebtedness ratios, market percentages ratios and growth ratios. These ratios are embedded in some models to predict the failure or success of the company.

We shall first turn to some aspects of the financial failure, then we present the financial prediction models.

3.5. The Concept of Financial Failure

According to Mohammed and Amear (2017) and Al-Najjar (2022) financial failure is defined as inability to pay short-term liabilities on maturity date, and is also defined as the discontinuation of the payments of interest on loans or bonds. Moreover, it is defined as the company's inability to pay its financial obligations when it was due.

Financial failure can be seen from two angles:

The first - financial failure can occur for purely economic reasons and without resulting in financial hardship affecting the external parties dealing with the company when it yields less investment returns than the opportunity cost of capital sources and in this case it is called economic failure.

Financial failure may occur due to financial hardship affecting external parties dealing with the company, in which case the company is unable to meet its outstanding obligations. This concept takes two directions:

- a. First direction: The company's inability to meet its outstanding obligations even though its assets exceed its obligations, called technical hardship.
- b. Second direction: When a company fails to meet its outstanding liabilities, the value of its assets is less than the value of its liabilities and is called financial impairment.

3.6. Symptoms of Financial Failure

Financial failure is accompanied by different symptoms. Financial failure does not come with abnormality. It is accompanied by different symptoms indicating that the company faces a lack of liquidity and that identifying those causes helps the company take the necessary action to remedy and correct it in a timely manner. According to (Abbad & Abdullah, 2022) the most important symptoms of financial failure are:

- Dividend profits to shareholders through loans.
- Financing fixed assets with short-term loans.
- Disproportionate equity of funds invested in the company.
- Defer payment of due financial payment papers.
- Defer payment of medium-term loan instalments.
- Payment of interest on medium-term loans through short-term borrowing.
- Low rate of return on invested funds.
- Undervaluation of working capital, as a result of undervaluation of inventory, without being offset by a shortfall in the value of short-term liabilities.
- Absence of advertising the company's products.
- Lack of adequate allocations for doubtful debts.
- Lack of adequate allocations and reserves for replacement and replenishment of fixed assets.

3.7. Methods of Addressing Financial Failure

Al-Najjar (2022) mentions that there are many methods used to remedy financial failure that we will briefly address:

I. Restructuring: This is intended for the company to adopt new strategies that will help to remedy the financial imbalance and sustain the company. The restructuring should not be limited to financial aspects, but should extend to administrative restructuring and sometimes the financial and administrative structure must be undertaken simultaneously.

I: Financial restructuring: Takes several forms, including:

- a. Asset revaluation: All or some of the assets can be re-valued to reflect their market value because an increase in market value over book value improves the indebtedness ratio in relation to equity, allowing the company a wider area of borrowing.
- b. Debt restructuring: This means negotiations with creditors on several aspects such as: converting short-term debt into long-term debt, delay debt repayment, investment in favor of the company, temporarily suspending debt repayment or obtaining a longer repayment period to benefit from such debt, reducing or waiving interest rates.
- c. Debt-to-property swap: a portion or all of the debt is converted into equity contributions through the issuance of equity shares equal to the value of the debt. This measure is criticized for being useful in the event of temporary financial failure or disruption. Shares and new bonds may not be accepted by the assembly, and finally, new shareholders constitute a new constraint on management in terms of their willingness to participate in the management of the company and their influence on the decisions of the company's general assembly.
- d. Increased cash inflows: This can be achieved by adopting some strategies that positively affect the company's cash flow. These strategies include: making greater efforts to increase sales and achieve higher incomes, changing the company's debt collection strategies by granting discounts to accelerate repayment, selling stagnant inventory or exchange it with inventory that the company needs, selling some useless assets to the company, and finally selling and renting some of the assets that the company does not need.
- e. Reduction in cash outflows: the company is able to reduce cash outflows (payments) in a number of ways, such as: agreeing with creditors to defer payment of certain debts or interest, purchasing by instalment from raw material suppliers or parts or paying the value of consumed raw materials and parts in production only, rationalizing direct and indirect spending, searching for less expensive alternative materials, searching for production methods such as agile production to reduce costs and reduce defects and waste of production.

II. Management Restructuring

Management restructuring is complementary to financial restructuring. Management restructuring can take place in one or more of the following methods: adopting production strategies that reduce costs, re-examining marketing strategies to

reduce costs, increase marketing effectiveness, reduce workforce costs by cutting out unproductive human resources.

III. **Merger:**

Merger means the fusion of two or more companies into one entity, which is the opposite of the union where each company maintains its identity when they unite. The merger is used to confront financial failure or to face intense competition or to cut taxes. Merger can be to achieve evolutionary goals such as expanding production to reach large volumes to reduce single unit production costs, or to control a large market share to counter competitors.

IV. **Changing company's legal form**

Changing the legal form is an effective way of remedying some companies' financial imbalances or failures. This is meant to transform from a less flexible form into a more flexible form where the management of the company has freedom of movement and freedom to make many decisions and reap the benefits of this process.

V. **Liquidation**

Is one of the last remedies for financial failure where legal action is taken to pay the company's obligations to others. Liquidation is either optional or compulsory, the optional liquidation is done by the owner or the owners of the company. Compulsory liquidation means the company's inability to fulfill its obligations to third parties and lack of access to solutions with creditors. One of the most important priorities for payment is: payment of costs of bankruptcy and liquidation proceedings, payment of taxes due to the State, payment of secured and unsecured debts, payment of preference shareholders' rights, and finally payment of ordinary shareholders' rights.

3.8. Types of Corporate Failure

Corporate failure takes several overlapping forms (Al-Najjar, 2022) (Abbadi & Abdullah, 2022):

- a. **Financial Failure:** refers to a company's lack of sufficient liquidity to meet its obligations on maturity. Financial failure occurs due to financial hardship affecting external parties dealing with the company, in which case the company is unable to meet its outstanding obligations. This concept takes two directions: The first tendency: means the company's inability to meet its outstanding obligations even though its assets exceed its obligations, called technical hardship, and the second tendency: occurs when a company is unable to meet its outstanding liabilities and the value of its assets is less than the

value of its liabilities and is called cash deficit.

- b. **Economic failure:** indicates that the rate of return on capital is much lower compared to similar investments, or that the rate of return on capital is less than the cost of the capital invested in the company, in which case the company continues to operate until the company's revenue is sufficient to cover its expenses. Economic failure occurs for purely economic reasons and without resulting in financial distress affecting the external parties dealing with the company when it yields less investment returns than the opportunity cost of capital sources.
- c. **Legal Failure:** It occurs when the company is declared bankrupt by the court, i.e. the company's bankruptcy means its failure, either to liquidate or restructure the company.

3.9. Stages of Financial Failure

According to Mohammed and Ameer (2017) the financial failure goes through several phases, as follows:

Phase I: This stage is called the birth phase, where there are signs of failure, such as low company sales, low liquidity, low cash flows and changing demand for the company's products. As long as the failure is undergoing its first phase, the company can remedy it with one or more of the methods, mentioned above, before the problem grows and moves to the next stage.

Phase II: This phase is called the cash deficit phase, as the company is unable to meet its current obligations. At this stage, the company's net assets are greater than its obligations. To address this failure, the company is able to borrow at this stage to guarantee its assets. If the company does not find a remedy at this stage, the failure phenomenon will worsen and become more dangerous by moving to phase III.

Phase III: At this stage, the company undergoes so-called financial insolvency and the company's revenues do not strengthen the fulfillment of its obligations. The company may issue bonds with higher interest than the prevailing interest in the market. If the company does not receive the necessary funds, then the phenomenon of financial failure will worsen further and further and move to phase IV.

Phase IV: This stage is called the stage of bankruptcy or total failure, considering that the company has exhausted all available means to obtain the necessary funds. At this stage, the company's net assets are less than its obligations, leading creditors to take legal action against the company, and the company enters the most dangerous phase, phase V.

Phase V: This is the stage of declaring the company bankruptcy and exiting the market.

3.10. Causes of Financial Failure

The financial failures do not occur suddenly but are the result of one or more reasons that can vary from one environment to another as a result of differences in capital structure, accounting practices and the political, economic and social environment. According to Al-Hileawi & Alsharif (2017) the causes of financial failures can be limited to internal and external causes.

3.10.1. Internal Causes

These are the reasons that arise from within the company, including:

- Lack of sound financial planning, resulting in increased productive capacity, with additional investments, without adequate studies and excessive forward sales.
- Wrong choice of employees in the company and the conflicts among managerial leaders in decision-making centers.
- Low profits, low sales, high operating expenses, insufficient capital and high corporate indebtedness.
- Lack of management expertise, resulting in a lack of proper financial policy planning within the company and a lack of an accurate internal control system.
- Weak company management, lack of interest in cost analysis and reduction, and lack of interest in market studies and research.
- Marketing reasons such as the company's failure to conduct marketing research to recognize consumers' tastes and desires, especially when the company operates in a competitive environment.
- Production-related reasons such as: not benefiting from economies of scale, production interrupted by maintenance, high proportion of defects and waste in materials entering production and laggard production techniques to accommodate modern developments.

3.10.2. External Causes

These are reasons that are beyond the company's control and that it cannot control such as internal causes, sometimes called sudden failures, as opposed to internal failures, which are also called progressive failures. These include:

- Lower demand for the company's products and consequently lower cash inflows resulting in a reduction in the company's ability to meet its obligations to others.
- Inflation, which means a general rise in the price level and a decrease in the purchasing power of the monetary unit, which results in lower demand and higher production costs in the company.
- Changes in the exchange rates resulting in lower local currency against foreign currencies dealt with by the company resulting in increased cash outflows and thus higher costs and lower profits.
- Technological changes, mean that the company is unable to keep pace with technological developments in the business environment that can lead to a decline in the company's sales due to the entry of alternative goods or services.
- Some dangers, such as fire and theft, strikes and acts of vandalism.
- Natural disasters occur, such as earthquakes, floods, and wars.
- Change in society's political, social and economic conditions.

4. Literature Review

Many previous studies have been interested in testing prediction models that have been prepared in different environments, and based on data from different periods. For instance, Roque and Carrero (2023), claim that there is no agreement on the factors that determine the behavior or outcome of the Z-Score. Therefore, they conducted a study to analyze the factors that determine the behavior of the Z-Score in Colombian companies. The research seeks to measure the association between the Altman Z-Score and the financial indicators that determine its outcome; the sample study consisted of 2,684 companies of the Colombian commercial

sector that reported financial information on a systematic basis during the period 2016-2020. The results of the statistical tests carried out reveal that there is a direct relationship between the indicator that measures the financial structure (equity/liabilities) and the Altman Z-Score. This leads to the conclusion that, from the point of view of Altman's model, a company that seeks to capitalize profits and keep debt levels under control will be a company with financial stability and a low probability of financial insolvency. Elewa (2022) conducted a study in Egypt in which she attempted to identify the impact of applying Altman Z-Score models on the quality of financial distress predictability in the Egyptian registered non-financial institutions. A sample of 44 institutions is selected from the EGX 70 index during 2016-2020, The test tools used to forecast financial distress were the original Altman Z-Score model (1968) and the modified Altman Z-Score model (1993). The dependent variable is the firm financial distress represented by the sum of Z-Score. The independent variables are the ratios that are applied to the Altman Z-Score models. The logistic regression analysis was applied to examine the influence of the ratios used in the models. The Findings indicate that applying Altman Z-Score models have a significant impact on the quality of financial distress predictability. The Findings also indicate that the modified Altman Z-score (1993) model presents better results than the Altman Z-Score (1968) model for the prediction of the future financial distress of firms and the probable causes that might influence investor decisions and firm financial performance. Elia et al. (2021) conducted a research to prove the validity of the Altman Z''-score model to expect the financial distress in the Lebanese Alpha banks over the period 2009 - 2018 The authors calculated the Altman Z''-score for non-manufacturing companies and emerging markets. The authors validated the Altman Z''-score Model using the four independent variables. In addition to that, the correlation of the variables indicated that there is a strong positive correlation between X1 and Z'', a weak negative correlation between X2 and Z'' and a weak positive correlation between X3 and X4 and Z''. Above all, based on the calculated values for the Z'' for nonmanufacturing companies and emerging markets, the majority of the ten Alpha Banks had values below the cutoff of 1.1 which showed evidence that they were distressed over the period 2009 - 2018. Kablan (2020) performed a study to assess the financial distress risk of the metropolitan municipalities in Turkey from 2012 to 2017 using Altman's Z''-Score, an accounting-based financial distress prediction model. The Altman Z''-Score model was applied to the data from 2012 to 2017 for 30 metropolitan municipalities in Turkey. Microsoft Excel Program was used to calculate the four financial ratios. The results showed that four of the metropolitan municipalities gradually moved to the red zone based on the 2012-2017 data. However, only two of these municipalities were placed in the red zone based on the mean. Similarly, ten of the municipalities moved to the grey zone over time, but only one of these municipalities were in the grey zone with respect to the mean whereas all the other metropolitan municipalities were in the safe zone. The results of the study show that the fiscal performance of the metropolitan municipalities in Turkey seems to be better than expected. Baber et al. (2019) attempted to measure the accuracy of the Altman model in predicting the future of companies. The study found that models' effectiveness in forecasting is lower during financial crises. A number of

studies attempted to predict financial faltering through financial ratios. For instance, Bunyaminu et al. (2019) used financial ratios for forecasting and determining financial distress in companies listed in Ghana's financial market. The study found that profitability ratios, especially return on assets, and solvency ratios are the most accurate determinants of financial distress. Al Janabi (2018) concluded that Iraq's commercial banks have good financial conditions and will not be exposed to financial distress in the following three years. In their study, Al-Manaseer and Al-Oshaibat (2018) attempted to investigate the validity of Altman z-score model to predict financial failure in insurance companies listed on Amman Stock Exchange (ASE) over the period 2011-2016. To achieve the goal of the study, the authors depended on the different statistics analytical method and Multiple Linear Regression to measure the effect of the independent variables on the dependent variable related to the subject of the study. The result of the study revealed a high predictive power for Z-score model and that Z-Score model could be valuable instrumental indicators for many users of financial statement such as financial managers, auditors, lenders, investors, to make right decisions in the face of financial failure. Al-Mushidi (2018) also tried to predict financial distress in Iraqi commercial banks, using the Sherrod model, which is based on testing a number of financial ratios that measure banks' ability to maintain a certain amount of liquidity required to pay short-term liabilities, as well as to achieve the returns needed as a basis for predicting financial failure and knowing the company's sustainability. The study found that predicting financial failure helps management take the necessary corrective and control action to address failure before it occurs. Elsewhere a series of studies tested these models, Al-Farra (2017), for example, tested the predictability of financial failure in Saudi cement companies listed on the financial market. The researcher used the models of Altman and Springate, the results showed a convergence between the results of the two models in predicting financial failure. Manousaridis (2017) conducted a study to examine the effectiveness and accuracy of Altman's Z-score model for measuring the financial health of the banking sector organizations in Europe, and to answer the research question whether Altman's specialized formula, for firms from emerging markets, could be used for banking sector organizations too. The findings of the empirical study, allows someone to claim that the accuracy and predictability of the tested Altman Z-score model, specialized for firms from emerging markets, is questionable as regards predictions for private firms operating with high leverage. Al-Refai (2017) also found that the Altman model is able to predict financial failure two years before it occurs. The study showed a statistically significant correlation between all components of the Altman model equation as an independent variable and the return on the stock as a dependent variable. Al-Amar and Qusayri (2015) sought to determine the effectiveness of financial ratios predicting financial failure using financial ratios in Syria. The results of the study showed that the "sample size" criterion is the most credible and relevant in models and is available in the Shirata 2002 model. Khaliq, et. al. (2014) found that there is a statistically significant correlation between the components of the Z-Score model and financial faltering in a sample of companies in Malaysia. Samkin's study (2012) also demonstrated the ability of the Altman model to predict the future status of financial companies in New Zealand. The study

recommended that companies calculate the likelihood of stumbling over their financial lists as part of published annual reports, as this would increase users' confidence in financial lists. Xu and Wang (2007) measured the effect of variable effectiveness on some models of financial failure prediction to increase accuracy in forecasting. The study demonstrated that the presence of an effective variable in the models' equations used in the analysis added the appropriate accuracy to predict financial failure. Altman (2000) sought to know the most important financial ratios that contribute to detecting potential financial failures, and to know the conditional weights of each percentage of ratios to determine the amount of financial failures, and how to determine these weights. To arrive at the results of the research, the author used financial analysis to find financial ratios for five consecutive years for non-industrial companies in America, and then statistical analysis through MDA that is based on dividing views into affiliate groups based on their individual characteristics, the author, then, used five metrics combined to reach the last model, the ZETA Score, which is built on a Z-Score basis. as it became the basis for dividing companies into successful or financially unsuccessful groups. This model was able to predict financial failure a year before it occurred by 93%. The study showed that this developed model from a range of older models is suitable for use by all types of companies.

The area of measuring financial performance is so interesting that other researchers have conducted different studies. In their work Ali and Ma'eani (2021) attempted to measure the effect of financial solvency of the National Insurance Company on its investment activity. The authors assumed the existence of a significant statistical relationship between financial solvency and investments. The study revealed a decline of the return on its financial investment, and that despite the large investments of the company the rate of return on the investments to the total income does not exceed 9%. The study found that the majority of the company's income comes from the insurance installments and not from its investments. The study recommended the use of financial indices to evaluate the financial solvency of the company. Elsewhere, Lafta and Kadim (2016) performed a study on some local municipalities in Iraq. The authors mention that there is an absence of the evaluation of financial performance, and also an absence of financial standards to evaluate the financial performance of such organizations. The study revealed that such organization have no financial standards to identify its true financial performance. The authors recommended the establishment of financial standards to be used in the municipalities. Mohammed (2013) suggested in her study that the financial position of a company should be evaluated continuously. In her research applied on the Iraqi Insurance company, she used different tools to evaluate the financial performance of the company. The study revealed that there is a need for additional financial analysis tools beside the reports provided by the external accounting editors.

5. Predicting Financial Failure Models

The risk of financial failure is the ghost that haunts companies that are oblivious to the reality of their financial situation, such that if one company fails, it gradually goes to the end point, that is to say, publish its bankruptcy and eradicate their lives, hence there is a need for a means of reducing and preventing this threat to the survival of companies. Undoubtedly, predicting financial failure brings many positive advantages to the

management of companies when they make the right prediction process. The financial failure prediction process enables companies to take action to address failure at early stages and avoiding access to bankruptcy and liquidation.

Extensive efforts have been made by researchers in the USA and other countries to develop financial models that can be adopted to predict the likelihood of financial failure such as the models of Beaver 1968, Altman 1968, 1982 and 1992, Deakin 1972, Kida 1980, Ohlson 1980, and Zmijewski 1984 to mention some. According to the objectives of this research work, we shall direct our attention to the Altman's Z-score and Z-3 score models.

5.1. Altman's Z-Score Model

This model was developed in 1968 which to predict financial faltering with the aim of developing an expectation about the company's sustainability. This model can be expressed by the following formula:

$$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 0.999X_5 \dots (1)$$

Where:

- X₁ = Working capital ÷ total assets.
- X₂ = Retained profits ÷ total assets.
- X₃ = Earnings before interest and tax ÷ total assets.
- X₄ = Market Value of Shareholders' Equity ÷ Total Liabilities.
- X₅ = Net sales ÷ total assets.
- Z = index of financial failure.

The more positive the Z value is, the better the financial position of the company. Financial distress according to this Z value model is classified into three classes:

Class A: Where Z is greater than 2.99, the company is far away from financial failure.

Class B: Where Z is less than 2.99 and greater than 1.8, the company situation is difficult to determine and deeper analysis is needed, so that the company's situation is questionable.

Class C: Where Z value is less than 1.8, the company situation is very difficult and will go bankrupt at any moment and the probability of stumbling is very high.

The original Altman model is used as a tool to evaluate investments, as it helps investors know the correct financial position of the company. The model contains a set of related ratios and relies on a multi-differentiation analysis method to separate distressed and non-struggling companies (Altman, 1968).

In 1983, Altman (Altman, 1983) reviewed his original model which was developed in 1968, he claimed that the new model is applicable for financial institutions, but later the Altman's model proved to be useful to predict financial failures in the industrial and service sectors. The new model is represented by the following equation (Karaca, 2017, 16):

$$Z = 0.717X_1 + 0.847X_2 + 3.107X_3 + 0.420X_4 + 0.998X_5 \dots (2)$$

Where

- X₁ = Working capital ÷ total assets.
- X₂ = Retained profits ÷ total assets.
- X₃ = Earnings before interest and tax ÷ total assets
- X₄ = Market Value of Shareholders' Equity ÷ Total Liabilities.
- X₅ = Net sales ÷ total assets
- Z = index of financial failure.

5.2. Altman's Z-3 Model

According to Altman, the previous model is applicable only for financial organizations, however, in 1995 Altman cooperated with Hartzell and Peck to develop a new model that is applicable for the service organizations. The new model does

not contain assets turnover to reduce the effect of mechanization, since the asset turnover in the service companies is higher than that of the industrial companies. But later the model was used for service and industrial organizations. The new model is referred to as Altman Z-3 model. The Z-3 formula is:

$$Z = 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4 \dots (3)$$

Where:

- X₁ = Working capital ÷ total assets.
- X₂ = Retained profits ÷ total assets.
- X₃ = Earnings before interest and tax + total assets
- X₄ = Book Value of Shareholders' Equity ÷ Total Liabilities.
- Z = index of financial failure.

Altman developed two classes to measure financial stress:

Class A: if $Z \geq 2.6$ then the company is far away from financial stress.

Class B: if $Z \leq 1.1$ then the company is facing financial stress.

6. Application of Z-score Model

To predict the financial position of the MSC, appropriate secondary data were obtained from the financial statements of the company available on the (isc.org.iq). Table (1) presents the data required to apply the Altman's Z-score model.

Table (1): Data for Calculating Altman's Model Ratios (millions IQD)

Year Item	2016	2017	2018	2019	2020	2021	2022
Net Working Capital	827	1207	1736	1928	1976	1283	2382
Total Assets	1637	1880	2797	2732	3122	4000	5000
Retained Profits	1187	3460	4786	3158	3116	2026	993
EBIT	163	441	603	394	397	262	1240
Market Value of Shareholders' Equity	2160	3400	5600	6700	7300	16800	19200
Total Liabilities	1637	1880	2797	2732	3122	4000	5000
Net Sales	90	218	103	118	78	30	18

Source: Extracted from the financial statements of the company

By substituting the relative values appearing in Table (1) in equation (1), the Z- score value is computed for 2016 as follows:

$$\begin{aligned} Z\text{- Score} &= (1.2 \times 0.505) + (1.4 \times 0.072) + (3.3 \times 0.101) + \\ &+ (0.6 \times 1.32) + (0.999 \times 0.055) \\ &= 1.883 \end{aligned}$$

Table (2) provides detailed calculations of the Z- score for 2016. Table (2): Computations of Altman's Z-Score for the Company for the Year of 2016

Code	Financial Ratio	Value	Weight	Z-Score
X1	Net Working Capital/Total Asset	827/1637=0.505	1.2	0.606
X2	Retained Earnings/Total Assets	1187/1637=0.072	1.4	0.101
X3	EBIT/Total Assets	165/1637=0.101	3.3	0.333
X4	Market Value of Shareholders' Equity/Total Liability	2160/1637=1.32	0.6	0.792
X5	Net Sales/Total Asset	90/1637=0.055	0.999	0.054
	Total			1.883

Since 1.883 < 2.99, then the company suffered financial failure in 2016 and is classified as B, the position of the company is questionable according to Altman's model.

Similarly, the Z-Score for the years 2017-2022 were calculated using equation (1) and Microsoft Excel, the results are presented in Table (2). From this table we notice that the

company faced financial failure in 2016 and 2020. The reason for failure in 2016 is due to the significant decline in the EBIT and the decline in sales, the failure for 2020 was due to COVID-19 which hit all the economies worldwide. The company was able to exit from its failure position in 2017 because it managed to increase its net working capital, total assets, retained profits, EBIT, the market value of shareholder's equity, and net sales.

Table (2): Computations of Altman's Z-Score for the Company for the Years 2016-2022

Year Code	2016	2017	2018	2019	2020	2021	2022
X1	0.606	0.770	0.745	0.847	0.760	0.385	0.572
X2	0.101	0.258	0.239	0.161	0.139	0.071	0.278
X3	0.333	0.774	0.711	0.476	0.420	0.216	0.818
X4	0.792	1.085	1.201	1.471	1.403	2.520	2.304
X5	0.054	0.116	0.037	0.043	0.025	0.007	0.004
Z-SCOR	1.883	3.003	2.934	2.999	2.747	3.199	3.976
Position	failure	success	success	success	failure	success	success

7. Application of Altman's Z-3 Model

To apply Altman's Z-3 model the appropriate data were, similarly, collected from the financial statements of the company as presented in Table (3).

Table (3): Data for Calculating Altman's Z-3 Model Ratios (millions IQD)

Year Item	2016	2017	2018	2019	2020	2021	2022
Net Working Capital	827	1207	1736	1928	1976	1283	1382
Total Assets	1637	1887	2797	2732	3122	4000	5000
Retained Profits	118	346	478	315	311	202	993
EBIT	163	441	603	394	397	262	1240
Book Value of Shareholders' Equity	1000	1000	1000	1000	1000	2000	2000
Total Liabilities	1637	1887	2797	2732	3122	4000	5000

Source: Extracted from the financial statements of the company

By substituting the relative values appearing in table (3) in equation (3), the Z-3 score value for 2016 is computed as follows:

$$Z-3 \text{ Score} = (6.56 \times 0.5) + (3.2 \times 0.07208) + (6.72 \times 0.101) + (1.05 \times 0.61) = 4.23$$

Table (4) provides detailed calculations of the Z-3 score for 2016

Table (4): Calculation of Altman's Z-3 Score for the Company for the Year of 2016

Code	Financial Ratio	Value	Weight	Z-Score
X ₁	Net Working Capital/Total Assets	827/1637=0.5	6.56	3.28
X ₂	Retained Earnings/Total Assets	118/1637=0.0721	3.2	0.2307
X ₃	EBIT/Total Assets	163/1637= 0.1	6.72	0.672
X ₄	Book Value of Shareholders' Equity/Total Liability	1000/1637=0.61	1.05	0.641
Total				4.23

Since z-3 >2.6, then the company was far away from financial failure and is classified as A according to Altman's Z-3 model

Similarly, the Altman's Z-3 Score for the years 2017-2022 were calculated using equation (3) and Microsoft Excel, the results are presented in Table (5).

Table (5): Computations of Altman's Z-3 Score for the Company

From 2016-2022							
Year Code	2016	2017	2018	2019	2020	2021	2022
X ₁	3.314	4.212	4.072	4.629	4.152	2.104	1.813
X ₂	0.231	0.589	0.547	0.369	0.319	0.162	0.636
X ₃	0.669	1.576	1.449	0.969	0.855	0.440	1.667
X ₄	0.641	0.559	0.375	0.384	0.336	0.525	0.420
Z-3 SCOR	4.855	6.935	6.443	6353	5.662	3.231	4.535

Since z >2.6, then the company was far away from financial failure during the study period according to Altman's Z-3 model.

Figure (1) provides a schematic representation of the z-score and the z-3 score values compared to the failure index. It is evident from this figure that all the values fall above the failure index for the z-3 model, while the z score for 2016 and 2020 fall below the z-score index for the Altman's z-score model. However, the coefficient of correlation between the scores of the two models was 0.05 which is very week indicating the preference of Z-3 model over Z- score model. This result coincides with the findings of Elewa (2022)

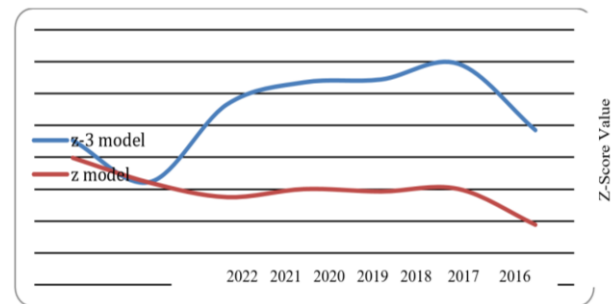


Figure (1): Schematic Representation of Altman's z-score and Z-3 score models

If we assume that the values of the net working capital, total assets, retained profits, EBIT, book value of shareholders' equity, and total liabilities will change at the same rate as between 2021 and 2022, then by applying the same logic for calculating Z-3 score, we could obtain a prediction of the success or failure of the company in 2023 as shown in Table (6). Table (6): Computations for Predicting Z-3 score for 2023

Item	2021	2022	%Change	2023	Ratios	Z-3 Weights	Z
N.W.C.	1283	1382	0.08	1489	1489/6250=0.238	6.5	1.548
Ttl. Assets	4000	5000	0.25	6250	4881/6250=0.781	3.2	2.494
Ret.Profits	202	993	3.90	4819	5869/6250=0.939	6.72	6.310
EBIT	262	1240	7.73	5869	2000/6250=1.050	1.05	0.336
B.V.Equity	2000	2000	0	2000		Z-3 Score	10.694
Ttl. Liab.	4000	5000	0.25	6250			

Since Z>2.66 the company is expected to be fare away from failure at the end of 2023.

8. Deriving a Regression Equation

In an effort to facilitate the estimation of the Z-score, we conducted some statistical analysis to derive a regression

equation to predict the z-score value using Microsoft Excel. The general shape of the equation is:

$$\hat{Y} = a + bx \dots\dots\dots (4)$$

Where: \hat{Y} = the estimated score

a= intercept

b = slop

x= independent variable (here the number of year)

The final shape of the regression equation derived from the z-3 model is:

$$\hat{Y} = 6.737 - 0.33x \dots\dots\dots (5)$$

By applying the regression equation to the same time series (i.e. year 1 to year 7) for z-3 model, we obtained the following data as shown in Table (7):

Table (7): Estimation of the Z-Score Using Regression Equation

Year	X	Z-3 Score	Estimated Z-Score
2016	1	4.855	6.407
2017	2	6.935	6.077
2018	3	6.443	5.747
2019	4	6.353	5.417
2020	5	5.662	5.087
2021	6	3.231	4.757
2022	7	4.535	4.427
Mean		5.43	5.417
Study.		1.3	0.712

Using equations (6) and (7), the means of the Z-3 Score and the Estimated Z-Score were tested for significance at $\sigma = 0.05$ (*two tails t test*) and 12 *d.f.* The statistical test revealed no significant difference between the two estimates. In addition the coefficient of correlation (r) for both estimates was 0.55 which is a good correlation. Therefore, we may conclude that it is possible to get a quick estimate of financial failure using regression analysis, however, we do not suggest it as a replacement of the Altman's model.

$$\hat{\sigma} x_1 - x_2 = \sqrt{\frac{s_1^2 n_1 - s_2^2 n_2}{n_1 - n_2 - 2}} \sqrt{\frac{n_1 + n_2}{n_1 n_2}} \dots\dots\dots (6)$$

$$t = \frac{x_1 - x_2}{\hat{\sigma} x_1 - x_2} \dots\dots\dots (7)$$

Through reviewing Tables (2) and (5) we can notice that one-two factors in each model contribute significantly to the value of the success or failure of the company. For instance, in 2016 the market value of shareholders' equity (X4) and the return on assets (X1) were 0.792 and 0.606 respectively, which totals 1.458. Dividing this value by the Z-score for 2016 we obtain 0.77 (1.458/1.883). In other words, these two factors contributed by 77% to the failure of the company in 2016. Tables (8) and (9) present the most effective factors that contributed to the success or failure of the company using the Z-score and the Z-3 models from 2016 to 2022. The frequency of the most effective factors in both models were 14, 9, and 8 for X1, X4, and X3 respectively.

Table (8): Most Effective Factors Contributed to the Success of the Company Using Z-score Model

2016	2017	2018	2019	2020	2021	2022
X4=0.792	X4=1.08 5	X4=1.20 1	X4=1.47 1	X4=1.40 3	X4=2.52	X4=2.30 4
X1=0.666	X3=0.77 4	X3=0.74 5	X1=0.84 7	X1=0.76 0	X1=0.38 5	X3=0.81 8
Total=1.458	1.859	1.946	2.318	2.163	2.905	3.122
z-score=1.883	3.003	2.934	2.999	2.747	3.199	3.976
effect= 77%	62%	66%	77%	79%	90%	79%

Table (9): Most Effective Factors Contributed to the Success of the Company Using Z-3 score Model

2016	2017	2018	2019	2020	2021	2022
X1=3.314	X1=4.2 12	X1=4.0 72	X1=4.6 29	X1=4.1 52	X1=2.1 0	X1=1.8 13
X3=0.669	X3=1.5 76	X3=1.4 49	X4=0.9 69	X3=0.8 55	X4=0.5 25	X3=1.6 7
Total= 3.983	5.788	5.521	5.598	5.007	2.625	3.483
z-3 score= 4.855	6.935	6.443	6.353	5.662	3.231	4.535
effect= 82%	83%	86%	88%	88%	81%	77%

Throughout the previous analysis and through reviewing the financial statements of the company we can derive some insights about this company. The company's production declined severely since 2003 for several reasons such as: declining of power supply (electricity and fuel), widely opened borders in front of imports, disabling the laws that protect local products, inability of local products to compete with imported goods due to its low cost, the dependence of government agencies in buying their needs from imported goods, decline in the quality of goods produced locally due to lack of knowledge in the Quality Management Systems. Despite all these obstacles the company could survive, continue, and make profits by diversifying itself in commercial activities and investments. Table (10) present the net profits (in millions IQD) of the company between 2016 and 2022, while Figure (2) depicts these profits along with growth rate of the profits. Although the profit growth rate declined in some years, the company could survive and continue. We can notice clearly the effect of COVID-19 on the growth rate of profits between 2019-2021.

Table (10): Profits and Growth Rate of the Studied Company

Year	2016	2017	2018	2019	2020	2021	2022
Profit	148	430	593	391	387	252	1231
Growth Rate %	-54	190	38	-34	-1	-38	390

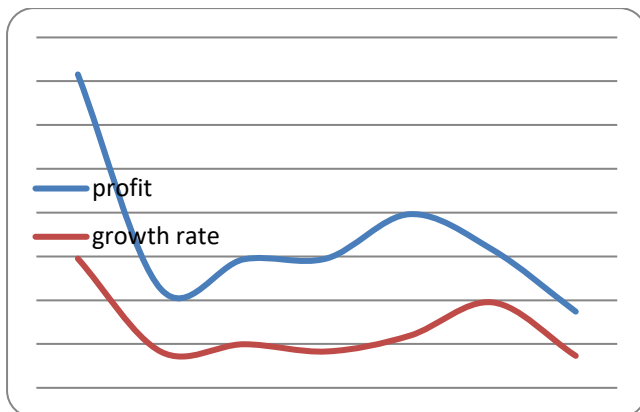


Figure (2): Schematic Representation of the MSC Profit and Profit Growth Rate for the Years 2016-2022

9. Conclusions

In accordance of the research objectives, we have come up with some conclusions:

1. Through reviewing the financial statements of the company and the accounting editor's report, we did not encounter any mention about any success or failure indices. We may conclude that such indices are not required from the accounting editor or the company is not aware of the financial failure prediction models.
2. The Altman's Z-score 1968 and the Z-3 score 1993 models proved their ability to measure the financial failure of success throughout the study period.
3. The Altman Z-Score 1968 model estimated the failure or success of the MSC using the five independent variables. While the modified version of the Z-3 1993 used 4 independent variables which resulted in improved predictions compared to the 1968 model.
4. The reason for the differences between the performance of the two models is the presence of the 5th variable in the original 1968 models and its absence in the 1993 model. Hence, the results of the second model were better than the first model, which might influence investor decisions and firm financial performance.
5. The Z-score model application revealed that the company was far from financial failure during the study period except for 2016 which was due to internal and external causes, and in 2020 due to COVID-19 pandemic. While the application of the Z-3 model revealed that the company was successful throughout the study period. This should encourage top management of the company and investors to make sound decisions about their investments.
6. The coefficient of correlation between the results of the Z-score and the Z-3 score models was 0.05 which indicates that there is a significant difference between the results of the two models.
7. The inferential statistical analysis revealed that it is possible to derive a regression equation between the z-3 scores (dependent variable and the independent variable, the study period) to estimate the financial failure or success in the future, the coefficient of correlation between the two estimates was 0.55 which is good. The statistical test of both estimates

revealed no significant difference between the two estimates.

8. The most dominant factor which contributed to the success of the company was (X1= Net Working Capital/Total Assets) which suggests that the company should increase its net working capital (among other things) to continue its success in the future.

9. Recommendations

1. Top management should pay more attention to the analysis of financial failure models to predict the company's position in the future.
2. Top management should educate the financial staff about these models to make better use of them.
3. Top management should, annually, demand from the accounting editors to measure and predict whether the company faces financial failure or success.
4. Although both models were able to measure the financial failure or success of the MSC, we recommend the use of the Altman's Z-3 models because it provides more accurate results compared to the Z-score model.
5. We also recommend the application of other financial failure prediction models such as Kida model, Beaver model, and Sherrod model to predict the company's position in the future and prepare for it ahead of time.
6. Top management should stress on the financial ratios that contribute significantly to its success or failure which are: (Net working capital/total assets), (EBIT/total assets), and (Value of Shareholders' equity/total liabilities).

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