


**USING ALTMAN AND SHERROD Z- SCORE MODELS TO DETECT FINANCIAL FAILURE FOR THE BANKS LISTED ON THE IRAQI STOCK EXCHANGE (ISE) BETWEEN 2009 – 2013**

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ARTICLE INFO	ABSTRACT
<p><b>Article history:</b></p> <p><b>Received</b> 31 January 2023</p> <p><b>Accepted</b> 27 March 2023</p>	<p><b>Purpose:</b> The Purpose of the study was to examine the validity of the Altman Z- Score and Sherrod Z- Score models in financial failure prediction. To achieve the study's goal, references from various authors who have reviewed this topic were used.</p>
<p><b>Keywords:</b></p> <p>Business Failure; Financial Forecast; Financial Analysis; Altman's Z-score; Sherrod's Z-score.</p>	<p><b>Theoretical framework:</b> The study highlights the importance of analyzing and delving into the various notions of financial failure and distress. When it comes to potential effects on the wealth of creditors, stockholders, and society as a whole, academics and researchers consider a company's distress and bankruptcy to be the most important issue to be studied. In order to maintain the goal of company survival and continuity before the disaster happens, many academics started looking for a method to identify and forecast distress and failure.</p>
	<p><b>Design/methodology/approach:</b> Altman Z-score and Sherrod Z- score employed a multi-discriminant model to predict the financial position of ten ISE banks between 2009 - 2013. Z- Score models from Altman and Sherrod were used to determine whether the banks listed on the ISE are exposed to failing financially. Ten banks out of the forty - six banks listed on the ISE were selected. The study only used secondary data obtained from the chosen banks' financial statements in ISE.</p>
	<p><b>Findings:</b> Based on Altman's Z- score model, the study examines that certain banks are particularly exposed to failure. In contrast, the Sherrod Z- Score model indicates that the chosen banks have some issues, but they are minor, and the risk of bankruptcy is low.</p>
	<p><b>Research, scientific and social implications:</b> By using a failure prediction model, it is possible to determine the likelihood that banks will experience financial failure in the future. Investors could use this information to guide their decision-making going forward.</p>
	<p><b>Originality/value:</b> The value and importance of research related to the study of financial failure prediction models in Iraqi commercial banks. The research also seeks to explain financial failure models and the extent to which investors benefit from these models.</p>
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## UTILIZAÇÃO DE MODELOS DE PONTUAÇÃO ALTMAN E SHERROD Z- PARA DETECTAR FALHAS FINANCEIRAS PARA OS BANCOS LISTADOS NA BOLSA DE VALORES DO IRAQUE (ISE) ENTRE 2009 - 2013

### RESUMO

**Objetivo:** O objetivo do estudo era examinar a validade dos modelos Altman Z- Score e Sherrod Z- Score na previsão de falhas financeiras. Para atingir o objetivo do estudo, foram utilizadas referências de vários autores que revisaram este tópico.

**Estrutura teórica:** O estudo destaca a importância de analisar e aprofundar as várias noções de fracasso e angústia financeira. Quando se trata de efeitos potenciais sobre a riqueza dos credores, acionistas e a sociedade como um todo, os acadêmicos e pesquisadores consideram a angústia e a falência de uma empresa como a questão mais importante a ser estudada. A fim de manter o objetivo de sobrevivência e continuidade da empresa antes que o desastre aconteça, muitos acadêmicos começaram a procurar um método para identificar e prever a angústia e o fracasso.

**Projeto/método/abordagem:** Altman Z-score e Sherrod Z-score empregaram um modelo multi-discriminatório para prever a posição financeira de dez bancos ISE entre 2009 - 2013. Os modelos Z-score da Altman e Sherrod foram usados para determinar se os bancos listados no ISE estão expostos a falhas financeiras. Dez bancos dos quarenta - seis bancos listados no ISE foram selecionados. O estudo utilizou apenas dados secundários obtidos dos demonstrativos financeiros dos bancos escolhidos no ISE.

**Conclusões:** Com base no modelo de pontuação Z da Altman, o estudo examina que certos bancos estão particularmente expostos ao insucesso. Em contraste, o modelo de pontuação Z de Sherrod indica que os bancos escolhidos têm alguns problemas, mas eles são menores, e o risco de falência é baixo.

**Pesquisa, implicações científicas e sociais:** Usando um modelo de previsão de falência, é possível determinar a probabilidade de os bancos experimentarem falhas financeiras no futuro. Os investidores poderiam usar estas informações para orientar suas decisões no futuro.

**Originalidade/valor:** O valor e a importância da pesquisa relacionada ao estudo de modelos de previsão de falhas financeiras em bancos comerciais iraquianos. A pesquisa também procura explicar os modelos de insucesso financeiro e até que ponto os investidores se beneficiam desses modelos.

**Palavras-chave:** Insucesso Empresarial, Previsão Financeira, Análise Financeira, Z-score da Altman, Z-score da Sherrod.

## UTILIZACIÓN DE LOS MODELOS DE PUNTUACIÓN Z DE ALTMAN Y SHERROD PARA DETECTAR EL FRACASO FINANCIERO DE LOS BANCOS QUE COTIZAN EN LA BOLSA DE VALORES DE IRAQ (ISE) ENTRE 2009 Y 2013

### RESUMEN

**Propósito:** El propósito del estudio fue examinar la validez de los modelos Altman Z- Score y Sherrod Z- Score en la predicción del fracaso financiero. Para lograr el objetivo del estudio, se utilizaron referencias de diversos autores que han revisado este tema.

**Marco teórico:** El estudio resalta la importancia de analizar y profundizar en las diversas nociones de fracaso financiero y distress. Cuando se trata de los efectos potenciales sobre la riqueza de los acreedores, los accionistas y la sociedad en su conjunto, los académicos e investigadores consideran que el distress y la quiebra de una empresa es el tema más importante a estudiar. Para mantener el objetivo de supervivencia y continuidad de la empresa antes de que se produzca la catástrofe, muchos académicos empezaron a buscar un método para identificar y prever el distress y la quiebra.

**Diseño/metodología/enfoque:** Altman Z-score y Sherrod Z- score emplearon un modelo multidiscriminante para predecir la posición financiera de diez bancos de la ISE entre 2009 - 2013. Los modelos de puntuación Z de Altman y Sherrod se utilizaron para determinar si los bancos que cotizan en el ISE están expuestos a fracasar financieramente. Se seleccionaron diez de los cuarenta y seis bancos que cotizan en el ISE. El estudio sólo utilizó datos secundarios obtenidos de los estados financieros de los bancos elegidos en el ISE.

**Resultados:** Basándose en el modelo de puntuación Z de Altman, el estudio examina que determinados bancos están especialmente expuestos a la quiebra. Por el contrario, el modelo Z- Score de Sherrod indica que los bancos elegidos tienen algunos problemas, pero son menores, y el riesgo de quiebra es bajo.

**Investigación e implicaciones científicas y sociales:** Mediante el uso de un modelo de predicción de quiebras, es posible determinar la probabilidad de que los bancos experimenten quiebras financieras en el futuro. Los inversores podrían utilizar esta información para orientar su toma de decisiones en el futuro.

**Originalidad/valor:** El valor y la importancia de la investigación relacionada con el estudio de los modelos de predicción de quiebra financiera en los bancos comerciales iraquíes. La investigación también trata de explicar los modelos de quiebra financiera y la medida en que los inversores se benefician de estos modelos.

**Palabras clave:** Fracaso Empresarial, Previsión Financiera, Análisis Financiero, Puntuación Z de Altman, Puntuación Z de Sherrod.

## INTRODUCTION

Financial disaster Forecasting is employed to assess the concept of the firm's stability in economic life, as well as the degree to which the company's future ability to carry out its activity. The financial sector's security and stability can and should be taken into consideration as important factors in ensuring the finances (Novak, et. al. 2022). The need for financial indicators emerged and developed as the significance of financial statements increased in order to extract significant measures and relationships that are helpful in decision-making. By comparing the financial indicator of specific enterprises or similar institutions or periods and identifying trends in their performance, these ratios and indicators could be used to predict the performance and financial position of the enterprise over time. one of the most notable benefits of financial analysis and indicators is the ability to forecast potential distress through the development or construction of models and tools that provide early warning of failure. As a result, when businesses engage in its activities, they face difficulties that could increase the likelihood of financial failure, then businesses may be unable to continue operations. Controlling the failed firms, (Uchenna and Okelue, 2012) states that, is critical to a country's economic growth sustainability.

Financial failure is regarded to be the riskiest thing that a company may face as it may be sign of future financial issues. There may be an impact on numerous firms, both in developed and developing economies (Hamid et. al., 2022). This means that predicting and evaluating the failure of a business can assist businesses in taking the necessary safety measures and actions to prevent financial failure. As a result, over the previous few decades, experts in the field of corporate finance have regarded business failure as one of the most contentious issues (Arkan, 2015, 233). Numerous models have been proposed and empirically tested over the past 40 years. The performance and adequacy of these models, however, are in question (Gharaibeh and colleagues, 2013). To investigate businesses that are the most likely to experience difficulties in their finances, practitioners use business failure, prediction models. Financial institutions use such models to assess the risk of loan default; investors use them to evaluate their current and potential investment choices, and creditors use them to determine whether to do business with

a particular corporation. Failure of a corporation hurts these stakeholders, claims (Arkan, 2015, 234). To achieve this, we use models for predicting business failure. It will allow the company to prevent a situation that would otherwise require bankruptcy (Baran, Pastyr & Baranova, 2016, 73). The study's importance lies in identifying the risks connected to the financial failure of specific banks that are listed on the ISE. Making predictions of financial failures and trying to distinguish between efficient and inefficient banks can help businesses and organizations with an interest. As a result, banks will find it simpler to forecast their future, and investors, lenders, and other decision-makers will be able to make the best decisions possible. Commercial banks were chosen because commercial banks' role is to accelerate economic growth and investment (Wendy and Colin (2003) cited in Saud, Neamah, and Sabbar, (2022)).

Therefore, the objective and focus of this paper is to evaluate the efficiency of representative commercial banks that are listed in the ISE and to find a dependable method for estimating the likelihood that banks will experience financial failure using two of the most significant Z-score models for doing so (Altman Z-score and Sherrod Z-score). Along with assisting businesses in predicting their future, financial institutions and investors are also helped in protecting their funds and investments by identifying successful from unsuccessful businesses the and making right choices. To present accurate information, this study concentrates on the economy of Iraq as a developing nation. Furthermore, the models used and the sample size in earlier published research in Iraq are restricted. In addition, the majority of earlier studies that employed models for predicting business failure concentrated on developed nations.

The problem with the study is that there are numerous indications. The banks find it challenging to engage in credit activities such as lending and investing. Because of that, they were unable to keep up with the development, and they were forced into bankruptcy. The returns obtained do not support them to continue to grow.

In light of this, the problem of the study can be stated as follows: Do Altman and Sherrod Z- score models assist in preventing the financial failure of businesses and distinguishing between successful and unsuccessful banks? The Z-score models of Altman and Sherrod employed the MDR model to predict the financial position of some ISE banks from 2009 to 2013.

The following parts of the study are organized as follows: namely, the second part is an explanation of the Literature review; the third part is the research methodology; the fourth part

is about the research findings and analysis and the fifth part is the conclusion of the findings and suggestions.

## **LITERATURE REVIEW**

### **Financial Analysis**

The foundation of the business's economic performance review is an analysis of its financial situation, which typically focuses on key areas and outcomes such as utilizing capacity, managing production and supplements, and other similar actions. The fiscal analysis identifies a firm's strengths as well as weaknesses serves as a tool for "safety" tests and provides critical information to the management team and the company's owners (Vlachynsk, 2009, 369 cited in Hamid et al., 2022, 10).

Financial analytics, such as management, is indeed the art of requesting crucial requests and offering proper responses, regardless of whether the results are totally observable (Helfert, 2001). Financial statement analysis is a significant part of the larger field of business evaluation. Business analysis is a tool for assessing a firm's economic risks and opportunities. It entails investigating a firm's surroundings, policies, financial situation, and consequences (Wild and Subramanyam, 2009, 3).

### **Financial Analysis's Objectives**

The key objectives of financial analysis are to provide relevant data to decision-makers regarding a firm so they can make informed decisions. management of the business's overall or individual divisional operational and financial performance; Investors, lenders, and creditors make investment and portfolio decisions to determine credit value and credit position; decisions made by employees and trade unions to determine the company's economic status and to adopt a sound theory of financial statements.

However, the objectives of financial analysis are typically regarded as: (Ravinder and Anitha, 2013, 10-11).

1. To assess the company's strength and financial stability.
2. To evaluate and quantify the revenue of the business.
3. To evaluate and quantify fixed assets, stock, and some other issues.
4. To evaluate and decide the prospect of growth strategies in the future.
5. To assess the corporation's ability to re-pay long-term and short-term loans.
6. To assess the management effectiveness of the business enterprise.

## **Financial Ratio**

When conducting the financial analysis process, numerous various financial indicators may be employed during the economic data analysis. These ratios can include supporting data and indicators from the company's operating statement (FABOZZL, 2009, 58). These ratios are employed to anticipate and avoid financial failure (Gibson, 2009). Financial ratios are divided into the following groups:

### **Firstly: Liquidity**

It is the sum of all potential surplus money that the company has to fulfill its financial commitments. Solvency is therefore described in academic papers as an enterprise's readiness subject to their debts being paid at the time of their repayment and thus is one of the fundamental requirements for the enterprises successful. (Sedláek, 2009).

### **Secondly: profitability**

This ratio is also known as return and benefit ratios. This indicator is calculated as a percentage of the overall result of a company's operations (output) to some other relative base (input), which could be on the assets or liabilities of the ledger on another basis. Such indicators demonstrate the impact on asset management, topic funding, and profitability liquidity, whether favorable or unfavorable. (Kislingerová, 2007).

### **Thirdly: Activity**

This ratio is used in asset management because they assess how effectively an enterprise manages its resources. A corporation evaluates the contribution of individual capital objects to various asset types. If the company's aim has more assets than it requires, it will incur additional expenses and its earnings will be reduced. In comparison, if the business subject has fewer assets, it is possible to lose cash and earnings (Baran, 2014).

## **Financial Failure**

Financial failure is a critical challenge that many businesses face in addition, there are numerous causes for financial failure, which usually results in financial collapse and liquidation. The situation of the firm where it is incapable of fully fulfilling its contractual agreements with its creditors. This has been formally declared bankrupt and is typically being liquidated as a result. (Berryman, 1983, 49). Lipi (2014, 2) claims that a company's failure can



be demonstrated as either bankruptcy or illiquidity, with the latter referring to the situation in which a company fails because its short-term obligations can indeed be satisfied and declared bankrupt. When the firm's current liabilities are more than its current assets, or when the firm seems to have negative capital for operating and the loss of a signal appears after the decreasing trend in operating capital, this situation arises. While insolvency, which means a firm's legal position, is involved whenever the total liabilities of the firm are more than the fair value of its assets, financial statements should normally be compiled and used for management to assess the company's financial position and performance.

Others consider a business to be insolvent if it is incapable of consciously reversing the decrease by acquiring additional debt and equity; leaving the current assets and management unable to carry on. Failure is the point at which disruption ends, and when it does, operations end, and legal action is initiated (Fatoki 2014, 296).

The reasons why businesses fail is subject to different points of view. Business analysts have different beliefs from business owners, traders, and official receivers. Brough, 1970, claims that there are 12 different explanations for the main causes of business failure. The following are arranged according to their category: 1) lack of management, 2) Inadequate equity, 3) Inadequate operation capital, 4) Directors who take excessive business income, 5) insufficient finance and accounting program, 6) Lack of experience, 7) mismanagement at its worst, 8) Bad debts, 9) underestimating the strong points and weaknesses of the organization, 10) Pillaging or theft, 11) Over-trading and over-extending too rapidly; and 12) growing the overhead (cited in Ashour & Farra-el, 2002)

Pratten, 1991 argues that companies may fail because of the following general reasons: 1) Failure of the business could result from competition from a newly emerging large firm with low costs the production, 2) financial uncertainty, 3) failure in financial, and 4) failure of administration).

### **Business Failure Prediction Models**

Numerous approaches have been used since the 1960s to forecast business failure. Most likely, the idea of a company failing was first floated earlier. On the other hand, the first advanced statistical approach for forecasting business failures was already published (Gepp & Kumar, 2012, 4). Arens, 2014 said that financial failure models have been criticized for their inability to accurately predict failure due to a lack of knowledge of the root causes. Holt 2013,

claims that the vast of these revisions concentrated on company assessment with less attention paid to the reasons why longevity predictions often failed.

The fact that most of the literature on these models uses data from developing economies has led to criticism of their suitability and performance. These models were also produced in the late 1960s. Since then, a number of business-related factors have changed (Boritz et. al., 2007, 142). Nevertheless, numerous articles have demonstrated that these models can frequently forecast failure in finance. A response to earlier critiques is given by the fact that the majority of these model types predict accidents in advance from two to approximately five years, offering recovery enough time (Arens, 2014, 23).

The MDA, which employs predictor representations, has become the methodology of choice for research on bankruptcies, financial distress, and financial failure (Ohlson, 1980, 112). In this study, the Altman Z-score and Sherrod Z-score models were used to measuring financial failure in banks. These models are mostly used for predicting financial failure.

## Research models

### Altman model

Altman calculated the Z-Score using five ratios. These various ratios were combined into a single measure called Z-Score Analysis (Panigrahi, 2019, 68). Altman was the first person to use Multiple Discriminant Analysis \_ MDA. As a result, Z-score was able to predict a company's potential bankruptcy in a continuous and general way. Altman developed the first bankruptcy model after researching specific variables and samples. A bankruptcy equation aimed at predicting the failure of such a publicly traded manufacturing business (Tanjung, 2020, 127).

Altman's formula for assessing the Z-Score analysis is as follows: (Panigrahi, 2019, 68)

$$z = 1.2 X_1 + 1.4 X_2 + 3.3 X_3 + 0.6 X_4 + 1 X_5$$

where:

$X_1 = \text{Working Capital} \div \text{Total Assets}$ .

$X_2 = \text{Retained Earnings} \div \text{Total Assets}$

$X_3 = \text{EBIT} \div \text{Total Assets}$

$X_4 = \text{Market Value of Equity} \div \text{Book Value of Total Debt}$ , and

$X_5 = \text{Sales} \div \text{Total Assets}$

The author also established the parameters for the bands used to forecast the future (Siekelova et al. 2019, 92).



Table 1: Degree of risk level and ability assessment according to the Altman Model

	Z	Degree of Risk
1	$Z > 2.99$	The firm's financial position is good
2	$1.81 < Z \leq 2.99$	Non matched results area (grey zone), bankruptcy is possible
3	$Z < 1.81$	The financial position is critical, bankruptcy is very likely.

Source: SIEKELOVA, A., KOVALOVA, E., CIURLĂU, C.F. (2019). Prediction financial stability of Romanian production companies through Altman Z-score, *Ekonomicko-manazerske spektrum*, 13(2), 89-97.

### Sherrod model

This model, one of the latest popular models for financial failure detection, includes corresponding weights of the variable feature coefficients for these variables, as well as six independent indicators of financial offered by the formula given (Arkan, 2015):

$$z = 17 X_1 + 9 X_2 + 3.5 X_3 + 20 X_4 + 1.2 X_5 + 0.1 X_6$$

where:

$X_1$  – anetaoperationacapital ÷ atotalaassets,

$X_2$  – acurrentaliquidaassets ÷ atotalaassets,

$X_3$  – atotalaequity ÷ atotalaassets,

$X_4$  – anetaincomebeforeincomeatax ÷ atotalaassets,

$X_5$  – atotalaassets ÷ atotalaliabilities,

$X_6$  – atotalaequity ÷ atotalafixedaassets.

Banks were divided into five groups based on the degree of risk and the capacity to proceed, as shown in table (2) (Abu Orabi, 2014, 33):

Table 2: Categories of risk level and ability assessment according to the Sherrod Model

	Z- Value	Risk Degree
1	$Z > 25$	The bank is not at risk of going bankrupt.
2	$25 \geq Z > 20$	There is little opportunity of exposure to the risk of bankruptcy.
3	$20 \geq Z > 5$	It is difficult to forecast the risk of bankruptcy.
4	$5 \geq Z > -5$	The Company is significantly exposed to the possibility of bankruptcy.
5	$Z \leq -5$	The company is at risk of bankruptcy.

Source: Abu Orabi, M. M. (2014). Empirical tests on financial failure prediction models. *Interdisciplinary journal of contemporary research in business*, 5(9), 29-43.

The value of risk, bankruptcy, and failure depend on the (Z) value, as shown in the above table.

1. A rising valuation (Z) indicates a strong financial position and minimal risk for the company.
2. If the (Z) value decreases, the company will have difficulty managing high risks going forward.

## MATERIAL AND METHODOLOGY

The multi-discriminant research model was used by Altman and Sherrod Z-score to predict the financial position of ten ISE banks from 2009 to 2013 in order to achieve the study's objectives. To extract the Z-score data, only two numbers were taken from the excel files of each bank after the decimal point.

**Data source:** Because of the nature of the study, only data from secondary sources were used which are publicly accessible bank financial statements were used in the analysis. The ISE website, which can be accessed at <http://www.isx-iq.net>, provided the data.

**Sample size and population:** Between 2009 and 2013, Altman Z-score and Sherrod Z-score estimated the financial status of ten ISE banks out of a total of 46 banks. Banks without reports about financial statements from 2009 to 2015 were removed from the list.

**Research Hypothesis:** The following hypothesis has been developed as a result of the issue and the study's goal: The financial failure of the banks could be predicted using the Altman and Sherrod Z-score models.

Table 3: Study sample

N.	NAME OF BANKS	Establishment of Banks
1	Kurdistan International bank	2005
2	Babylon Bank	1993
3	Investment Bank of Iraq	1993
4	Elaf Islamic Bank	2007
5	Ashur International Bank	2005
6	Al-Mansour Bank for Investment	2005
7	Bank of Baghdad	1992
8	Commercial Bank of Iraq	1992
9	Gulf Commercial Bank	1999
10	Sumer Commercial Bank	1999

Source: Prepared by the authors (2022)

## RESULTS AND DISCUSSION

The results of the data processing are as follows:

### Kurdistan International Bank

Table 4: The outcomes of the Altman and Sherrod models

Model Years		Altman Model					Z Score	
		X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>		
2009		0.20	0.01	0.14	0.21	0.07	0.63	
2010		0.27	0.01	0.07	0.25	0.05	0.65	
2011		0.33	0.02	0.14	0.61	0.08	1.17	
2012		0.42	0.01	0.13	0.09	0.06	0.71	
2013		0.43	0.04	0.13	0.63	0.06	1.30	
Model Years		Sherrod Model					Z Score	
		X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>		X <sub>6</sub>
2009		2.81	6.17	0.77	0.88	1.59	0.41	13
2010		3.81	6.52	0.94	0.44	1.71	0.59	14
2011		4.65	6.85	1.09	0.86	2.16	0.81	16
2012		5.91	7.80	1.32	0.78	2.06	1.24	19
2013		6.14	7.11	1.39	0.79	2.15	1.13	19

Source: Prepared by the authors (2022)

As shown in table (4), the Z-score of Altman models for Kurdistan International Bank reached its highest value of 1.30 in 2013. This is a good sign when compared to previous years because the Z-score is less than 1.8 for all years, indicating that the financial situation is critical; according to Altman, bankruptcy is most likely.

However, the results of the Sherrod Z-score model for Kurdistan International Bank from 2009 to 2013 were 13, 14, 16, 19, and 19, indicating that the results are in the third category, which makes it difficult to predict the likelihood of bankruptcy.

### Babylon Bank

Table 5: The outcomes of the Altman and Sherrod models

Model Years		Altman Model					Z Score
		X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>	
2009		0.29	0.03	0.08	0.48	0.08	0.96
2010		0.24	0.03	0.08	0.19	0.07	0.61
2011		0.35	0.02	0.07	0.30	0.07	0.81
2012		0.33	0.02	0.07	0.25	0.06	0.73
2013		0.44	0.01	0.05	0.38	0.07	0.95

Model \ Years	Sherrod Model						
	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>	X <sub>6</sub>	Z Score
2009	4.14	6.32	1.15	0.51	1.83	0.39	14
2010	3.42	6.28	1.04	0.50	1.73	0.31	13
2011	5.03	4.90	1.38	0.43	2.01	0.40	14
2012	4.62	6.37	1.29	0.45	1.92	0.38	15
2013	6.18	2.47	1.72	0.30	2.37	0.39	13

Source: Prepared by the authors (2022)

Babylon Banks' financial situation for all years is critical, and bankruptcy is highly likely, as shown in Table (5). because the results are all below 1.8 based on the Altman Z-score model.

Furthermore, the results of Sherrod's Z-score model for Bank of Babylon from 2009 to 2013 ranged from 13 to 15, revealing that the outcomes fell into the third category, which indicates that the possibility of bankruptcy is difficult to forecast.

### Investment Bank of Iraq

Table 6: The outcomes of the Altman and Sherrod models

Model \ Years	Altman Model						
	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>	Z Score	
2009	0.34	0.03	0.09	0.37	0.07	0.92	
2010	0.39	0.05	0.14	0.35	0.09	1.02	
2011	0.38	0.04	0.12	0.27	0.07	0.88	
2012	0.33	0.00	0.03	0.24	0.08	0.67	
2013	0.39	0.07	0.20	0.27	0.10	1.03	
Model \ Years	Sherrod Model						
	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>	X <sub>6</sub>	Z Score
2009	4.85	7.25	1.14	0.57	1.78	0.79	16
2010	5.55	5.47	1.26	0.85	1.87	1.08	16
2011	5.37	4.28	1.25	0.71	1.87	0.86	14
2012	4.63	3.78	1.10	0.18	1.77	0.76	12
2013	5.59	4.00	1.25	1.21	1.90	1.23	15

Source: Prepared by the authors (2022)

According to the above table, the Investment Bank of Iraq has a weak financial position and is subject to the possibility of financial collapse during the study period based on Altman's Z-score. A  $Z < 1.8$  indicates that the financial situation is critical, and bankruptcy is highly likely.

However, Sherrod's Z-score, which falls into the third category  $20 \geq Z > 5$ , it is challenging to predict whether the Investment Bank of Iraq will go bankrupt during the study period.

### Elaf Islamic Bank

Table 7: The outcomes of the Altman and Sherrod models

Model \ Years	Altman Model						
	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>	Z Score	
2009	0.36	0.15	0.59	0.31	0.22	1.63	
2010	0.27	0.08	0.24	0.20	0.10	0.89	
2011	0.32	0.08	0.23	0.26	0.09	0.98	
2012	0.32	0.04	0.11	0.22	0.05	0.73	
2013	0.53	0.03	0.10	0.52	0.06	1.24	
Model \ Years	Sherrod Model						
	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>	X <sub>6</sub>	Z Score
2009	5.08	3.26	1.27	3.56	2.05	0.38	16
2010	3.81	6.31	1.13	1.48	1.80	0.09	15
2011	4.59	5.64	1.22	1.40	1.89	0.44	15
2012	4.46	5.66	1.23	0.67	1.86	0.40	14
2013	7.53	3.97	1.93	0.60	2.76	0.50	17

Source: Prepared by the authors (2022)

The results of Altman's Z-score model make it clear that Z scores below 1.8 for all years as shown in table (7) indicate that the company is likely to file for bankruptcy, reflecting the likelihood that it will struggle to meet its financial obligations and serving as a clear indicator of that failure.

Although the Sherrod Z-score model's findings presented that it is difficult to forecast the bankruptcy of the Elaf Islamic Bank, the Z-score ranged between 14 and 17 for all of the selected years from 2009 to 2013. The Z-score is not a clear indicator of the bank's financial situation as long as it is located in the third category of risk.

### Ashur International Bank

Table 8: The outcomes of the Altman and Sherrod models

Model \ Years	Altman Model						
	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>	Z Score	
2009	0.47	0.08	0.24	0.44	0.11	1.34	
2010	0.60	0.07	0.21	0.61	0.11	1.60	
2011	0.50	0.06	0.20	0.54	0.12	1.42	
2012	0.69	0.08	0.24	1.05	0.10	2.17	
2013	0.70	0.06	0.18	0.89	0.09	1.91	
Model \ Years	Sherrod Model						
	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>	X <sub>6</sub>	Z Score
2009	6.67	2.60	1.51	1.45	2.23	0.98	15
2010	8.47	3.70	1.92	1.28	2.92	1.07	19
2011	7.11	5.52	1.75	1.18	2.79	0.61	19
2012	9.71	2.82	2.23	1.48	4.05	0.97	21

2013	9.87	5.52	2.27	1.08	4.06	0.95	24
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Source: Prepared by the authors (2022)

According to the results presented in table (8) for Ashur International Bank, the Altman Z value during 2012 and 2013, was 2.17 and 1.91, indicating that it is located in the second category, which means that bankruptcy is possible these years. While other years from 2009 to 2011 had Z- scores of 1.34, 1.60, and 1.42, respectively, the finding result indicates that bankruptcy is very likely. The Ashur International Bank's financial performance has slightly improved throughout the study period, with the Z value moving up to the second category in 2012 and 2013.

The Sherrod Z-score model for Bank of Ashur in 2012 and 2013 was located in the second category of risk which its value was 21 and 24, respectively, implying that the financial position of the bank is not in risk. The 2009 results were 15, and the 2010 and 2011 results were 19, indicating the difficulty in predicting the bankruptcy risk because it is located in the third category.

### Al-Mansour Bank for Investment

Table 9: The outcomes of the Altman and Sherrod models

Model Years	Altman Model						Z Score
	$X_1$	$X_2$	$X_3$	$X_4$	$X_5$	Z Score	
2009	0.68	0.04	0.13	1.04	0.08	1.97	
2010	0.56	0.03	0.09	0.73	0.06	1.47	
2011	0.45	0.04	0.12	0.48	0.07	1.15	
2012	0.71	0.04	0.11	1.12	0.05	2.03	
2013	0.45	0.04	0.13	0.51	0.05	1.18	
Model Years	Sherrod Model						
	$X_1$	$X_2$	$X_3$	$X_4$	$X_5$	$X_6$	Z Score
2009	9.64	3.17	2.01	0.77	3.02	8.65	27
2010	7.99	2.33	1.72	0.53	2.41	2.28	17
2011	6.40	3.17	1.41	0.70	2.02	1.55	15
2012	10.07	2.04	2.15	0.68	3.14	2.81	21
2013	6.40	2.42	1.24	0.76	1.87	2.76	15

Source: Prepared by the authors (2022)

The above table shows the Sherrod Z-score model results for Al-Mansour Bank for Investment in 2010, 2011, and 2013, which were 17, 15, and 15, respectively, implying that the score is in the third group of risk, even though estimating the bankruptcy risk is complicated. With a score of 21 in 2012, the bank's financial statue is safe. Furthermore, it is not in danger of going bankrupt because its score in 2009 was higher than 25.



Even so, data for Altman's Z-score model for 2009 and 2012 are found in the second category ( $1.81 < Z \leq 2.99$ ). While the results of the Z- score model in 2010, 2011, and 2013 were 1,47, 1,15, and 1,18 respectively, this suggests that the possibility of bankruptcy is high in addition, the bank has a precarious financial situation, which will likely fail soon.

### Bank of Baghdad

Table 10: The outcomes of the Altman and Sherrod models

Model \ Years	Altman Model					
	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>	Z Score
2009	0.01	0.03	0.08	0.19	0.05	0.35
2010	0.11	0.02	0.06	0.13	0.04	0.36
2011	0.14	0.03	0.09	0.33	0.06	0.66
2012	0.15	0.03	0.08	0.18	0.05	0.48
2013	0.16	0.02	0.07	0.21	0.05	0.52

Model \ Years	Sherrod Model						
	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>	X <sub>6</sub>	Z Score
2009	0.20	5.36	0.48	0.46	1.43	0.75	9
2010	1.57	5.35	0.43	0.34	1.40	0.39	9
2011	2.05	4.70	0.56	0.57	1.47	0.41	10
2012	2.14	5.62	0.56	0.46	1.46	0.48	11
2013	2.26	5.17	0.58	0.44	1.46	0.51	10

Source: Prepared by the authors (2022)

Table (10) demonstrate that all of the records for Altman's Z-score model for the Bank of Baghdad fall into the third category  $Z < 1.81$ . Despite a minor increase in status, the probability of financial distress remains high.

The result of the model of Sherrod, on the other hand, include all figures have fallen to the third category (9,10, and 11) in other word ( $20 \geq Z > 5$ ), this illustrates how difficult it is to forecast that whether the Bank financial condition will fail or not.

### Commercial Bank of Iraq

Table 11: The outcomes of the Altman and Sherrod models

Model \ Years	Altman Model					
	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>	Z Score
2009	0.47	0.02	0.07	0.42	0.08	1.05
2010	0.55	0.07	0.23	0.46	0.08	1.38
2011	0.65	0.03	0.11	0.68	0.05	1.52
2012	0.58	0.05	0.16	0.51	0.06	1.35
2013	0.70	0.03	0.11	0.60	0.06	1.50

Model Years	Sherrod Model						Z Score
	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>	X <sub>6</sub>	
2009	6.64	1.00	1.41	0.41	2.01	2.98	14
2010	7.74	1.89	1.62	1.37	2.23	6.15	21
2011	9.18	3.96	1.91	0.64	2.65	8.72	27
2012	8.19	4.21	1.71	0.98	2.34	7.94	25
2013	9.90	5.16	2.05	0.64	2.91	12.30	33

Source: Prepared by the authors (2022)

The findings in table (11) show in 2009, the Sherrod model's Z- score was only 14, indicating that it was difficult to predict the failure of this bank. As long as the Z- value falls under the third category of risk, therefore, It is difficult to evaluate the bank's financial situation. The Z- score, on the other hand, has dramatically increased over the past few years to reach the highest rating 33 in 2013, indicating that the bank is not in danger of going bankrupt.

The data for Altman's Z- score, however, all fall into the third group of risk  $Z < 1.81$ , indicating that bankruptcy is very likely for all years in the study.

### Gulf Commercial Bank

Table 12: The outcomes of the Altman and Sherrod models

Model Years	Altman Model						Z Score
	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>	X <sub>6</sub>	
2009	0.20	0.04	0.10	0.29	0.08	0.71	
2010	0.20	0.02	0.07	0.16	0.08	0.53	
2011	0.34	0.04	0.12	0.28	0.08	0.85	
2012	0.36	0.10	0.28	0.25	0.14	1.13	
2013	0.40	0.08	0.24	0.37	0.11	1.20	
Model Years	Sherrod Model						Z Score
	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>	X <sub>6</sub>	
2009	2.89	2.02	0.82	0.62	1.64	0.37	8
2010	2.82	2.51	0.83	0.45	1.67	0.33	9
2011	4.77	2.46	1.18	0.70	1.91	0.59	12
2012	5.09	3.39	1.24	1.71	1.89	0.65	14
2013	5.73	4.25	1.37	1.43	2.01	0.73	16

Source: Prepared by the authors (2022)

Based on Sherrod's Z-score, the fiscal situation of Commercial Bank of Gulf for all years in the study is really difficult, as shown in Table (12). The findings fall into the third risk group, which is between 5 and 20.

According to the outcome of Altman's Z- score model, the bank faces financial failure in the coming years. Therefore, the bank must take precautionary measures against this threat.

### Sumer Commercial Bank

Table 13: The outcomes of the Altman and Sherrod models

Model Years	Altman Model						
	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>	Z Score	
2009	0.66	0.05	0.18	0.87	0.09	1.85	
2010	0.68	0.00	0.02	0.85	0.05	1.61	
2011	0.69	0.00	0.01	0.84	0.05	1.59	
2012	0.63	0.00	0.02	0.85	0.08	1.59	
2013	0.69	0.00	0.02	1.02	0.14	1.88	
Model Years	Sherrod Model						
	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>	X <sub>6</sub>	Z
2009	9.31	2.09	2.18	1.09	3.68	0.82	19
2010	9.67	4.16	2.21	0.10	3.62	1.00	20
2011	9.80	3.40	2.21	0.04	3.45	1.16	20
2012	8.93	4.94	2.06	0.10	2.99	0.94	20
2013	9.83	5.37	2.21	0.10	3.38	1.17	20

Source: Prepared by the authors (2022)

The data in table (13) demonstrates that Sumer Commercial Bank's rating score for the study period according to Altman's model is negative for all years in the study, suggesting that Sumer bank is at risk of failure in the coming year.

On the other hand, the Sherrod Z- score fell into the second category of risk in 2010 and 2013 ( $25 \geq Z > 20$ ), showing that the possibility of Sumer Commercial Bank's predicted bankruptcy is low. However, the Z value was 19, 20, and 20, respectively, in 2009, 2011, and 2012, indicating that it is challenging to foresee Sumer Commercial Bank's bankruptcy.

Table 14: Comparison of the Altman and Sherrod models' ability to predict bankruptcy

N.	NAME OF BANKS	Altman's Z-score MEAN	Sherrod's Z-score MEAN
1	Kurdistan International bank	0.90	16.2
2	Babylon Bank	0.812	13.8
3	Investment Bank of Iraq	0.904	14.6
4	Elaf Islamic Bank	1.094	15.4
5	Ashur International Bank	1.688	19.6
6	Al-Mansour Bank for Investment	1.56	19
7	Bank of Baghdad	0.474	9.8
8	Commercial Bank of Iraq	1.36	24
9	Gulf Commercial Bank	0.884	11.8
10	Sumer Commercial Bank	1.704	20.4
<b>Total</b>		<b>1.138</b>	<b>16.46</b>

Source: Prepared by the authors (2022)

Table (14) shows that a comparison of the two results reveals that the financial situation of all banks is critical, as they fall into the third category ( $Z < 1.81$ ) according to Altman's Z-score, indicating that bankruptcy is very likely. Altman's Z- score demonstrates that all banks' financial status is weak, and they may face some serious issues in future. The interpretation, on the other hand, shows that the majority of banks' ratings fall into the third category of risk, making it difficult to forecast their status using Sherrod's Z-score model, as there is only one bank in the second category, which has a Z-score of between 20 and 25, this bank has a very low exposure to bankruptcy. Furthermore, as shown in table (14), no bank in the study sample has a Z-score greater than 25, meaning that all banks are unable to continue and are thus at risk of failing.

Overall, the above findings in the table (14) show that Altman's Z- score of the banks included in the study fell into the third category of risk ( $Z < 1.81$ ), which is only (1.138). This means that all of the banks included in this research are in a critical financial situation, and bankruptcy is highly likely. In contrast, Sherrod's Z-score makes forecasting the bankruptcy risk of the banks in the current study challenging. This is since the average rating of these banks is only (16.46), and it is located between  $20 \geq Z > 5$ .

Sherrod's Z- score results demonstrate a number of the banks listed on ISE are successful, capable of satisfying their responsibilities, and are far from financial disaster, even though the probability that some banks are likely to fail financially is low.

Altman's Z- score model, on the other hand, produced the opposite outcome for similar banks. Therefore, it is essential to use more than one model to predict financial failure, as mentioned by (Al-Manaseer and Al-Oshaibat, 2018, 188) the researcher suggests using additional models in addition to Altman's model to identify financially distressed firms since it may not be the only model to measure them. In some Securities Exchanges, this could even raise the number of distressed companies.

Furthermore, according to the Altman model, these banks' financial positions are weak, and the possibility of financial difficulty is extremely high. This contrasts with how these banks operate, given that their financial statements illustrate their profitability, the actuality that their obligations are lower than their assets, and the fact that they remain in business. The study has supported Heaton's (2020) findings that Altman's model could not provide an accurate picture of a firm's financial position, concluding his study by saying that "The Altman Z-Score, however, is unreliable" (Heaton, 2020, 34). he also mentioned that Accounting and financial researchers recognized from the start that the Altman method did not accurately predict

bankruptcy. According to Johnson (1970) cited in (Heaton, 2020, 32), Altman Z-scores are "largely descriptive statements devoid of predictive content". As a result, the current study offers more proof that Altman's Z-Score model may not be reliable for forecasting financial failure. As a result, this study has brought up a significant issue regarding Altman's Z-score model's accuracy.

## CONCLUSION

To inform investors and researchers, this study examined the reliability of widely-used financial failure models. The most significant conclusion that can be drawn from this research is that businesses should use a financial failure model to assess the status of their finances. Both models have roughly the same predictability power for bankrupt banks. Based on the findings from Altman's Z- score, almost all of the banks in the study fell into the third group of risk. This means that all of the banks included in this study are in a difficult financial situation, and bankruptcy is highly likely. On the other hand, Sherrod's Z- score model indicated that the majority of the banks in the research, fall into the third category of risk, making the risk of bankruptcy difficult to predict, except Commercial Bank of Iraq and Sumer Commercial Bank, which fall into the second category of risk, indicating a slight risk of bankruptcy. Therefore, the study suggests using other predicting failure models with Altman Z- score to find the banks financially distressed as mentioned by Al-Manaseer and Al-Oshaibat's study in 2018. The findings of this and other studies, including those by Johnson in 1970 and Heaton in 2020, has been established that the Altman model is unreliable for identifying businesses that are in danger of bankruptcy. Although all banks are exposed to bankruptcy based on the current study, however, all businesses are operating normally and have not yet declared bankruptcy. The limitation of the research lies in the fact that the research sample was small due to a lack of data; thus, the research recommends using a larger sample for many years. It is recommended that banks assess their financial position on a regular basis in order to detect any financial distress issues and correct them before they worsen. In addition, banks must concentrate their attention on the accuracy of the financial statements and work to issue periodic, regular, and accurate financial statements. On the other hand, the Z score Altman and Sherrod models may not be the only models to measure banks' financial failure; therefore, research suggests using other models to determine banks' financial failure.

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