

**التنبؤ بالفشل المالي في ظل النماذج التقليدية ومؤشرات
السلامة المالية (انموذج مقترح) – بحث تحليلي لعينة من
البنوك المدرجة في سوق الأوراق المالية العراقية**

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Predicting financial failure under traditional models and financial safety indicators (Proposed model) - analytical research for a sample of Banks listed on Iraqi stock exchange

التنبؤ بالفشل المالي في ظل النماذج التقليدية ومؤشرات السلامة المالية (النموذج مقترح) - بحث تحليلي لعينة من البنوك المدرجة في سوق الأوراق المالية العراقية

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المستخلص:

بعد الفشل المالي ظاهرة غاية في الخطورة تواجه العديد من منظمات الاعمال نتيجة العديد من العوامل سواء على مستوى وحدات الاعمال ام على مستوى الاقتصاد ، و تتفاقم الحالة خطورة مع قطاع المصارف و ذلك ناشئ من طبيعة العمل المصرفي الذي يؤثر و يتاثر بالعديد من الجهات سواء الرقابية ام اصحاب المصالح المختلفين ، إذ يعاني القطاع المصرفي من خضوعه للعديد من الجهات الرقابية سواء على المستوى المحلي متمثلا بالبنك المركزي ام عالميا بفعل اتفاقية بازل ، و على مستوى اصحاب المصالح فهو مطالب تجاه المودعين باستثمار ايداعهم و تميمتها و تجاه الملاك بتقديم مستويات من الربح المقبول ، كل ذلك دفع نحو تبني العديد من المؤشرات التي تضمن حماية المصرف من اية مخاطر مرتبطة بعدم قدرته على سداد التزاماته ، و عليه قدم البحث الحالي النموذج مقترحا يلتقي مقبولية علمية و المعروف بالسلامة المالية و الذي تم توظيفه بمؤشراته الاربعة لملاءة راس المال و جودة الموجودات و الربحية و السيولة مع اعطاء اوزان تعتمد على مخرجات الخوارزمية الوراثية للفترة من 2017-2022 بالنسبة لمصرف الشرق الاوسط كمصرف ناجح ومصرف دار السلام للفترة 2012-2014 كمصرف اعلن افلاسه ، و بعد اختبار النموذج المقترح و مقارنة نتائجه بنماذج Altman, sheered, Kida توصل البحث إلى اتفاق النتائج للنموذج المقترح مع نموذجي Altman, sheered .

الكلمات المفتاحية: الفشل المالي ، السلامة المالية

Abstract

Financial failure is an extremely dangerous phenomenon that many organizations face as a result of many factors, whether at the level of business units or at the level of economy. The situation becomes more serious with the banking sector, and this arises from the nature of banking work, which affects and is affected by many bodies, whether supervisory or Different stakeholders, as the banking sector suffers from its subjection to many regulatory bodies, whether at the local level represented by Central Bank or globally due to the Basel Agreement, and at the level of stakeholders it is required towards depositors to invest and develop their deposits and towards owners to provide levels of acceptable profit, All of this prompted the adoption of many indicators that guarantee the bank's protection from any risks associated with its inability to pay its obligations. Accordingly, the current research presented a proposed

model that has universal acceptance, known as financial soundness, which was employed with its four indicators: capital adequacy, asset quality, profitability, and liquidity. Giving weights based on the outputs of the genetic algorithm for the period from 2017-2022 for the Middle East Bank as a successful bank and for the Dar es Salaam Bank for the period 2012-2014 as a failed bank, and after testing the proposed model and comparing its results with the models of Altman, Sheerod, Kida, the research reached agreement on the results for the proposed model with typical Altman, sheerod.

Keywords: financial failure, financial soundness

Section one /theoretical aspect

First: The cognitive framework of financial failure

Banking financial failure takes complex forms that do not necessarily apply to all banks. Although all banks operating in developing countries are subject to a single system of laws and instructions, the individual characteristics of each bank remain, causing some confusion that is reflected in cases of financial failure, and the origin of this is to Three considerations: the first is macroeconomic crises, the second is deficiencies in management and microeconomics, and finally, banking crises as a result of excessive government intervention (Honohan, 1997: 8-13), The first studies of financial failure date back as a reaction during the Great Depression, most notably the study of Charles Merwin in 1942, where he analyzed 900 organizations that were divided into successful and failed organizations during the period 1926 - 1936 (MAMMADLI & HELHEL, 2022:163), followed by (FitzPatrick, 1930; Beaver, 1966; Tamari, 1966; Altman, 1968) (MAMMADLI & HELHEL, 2022:163), then came the contribution of (Altman, 1968) to expand the scope of the results reached by (Beaver, 1966), which He employed multivariate discriminant analysis, which was represented by working capital/total assets and retained earnings/total assets and profit before interest and tax/total assets and market value of shares/total debts and sales/total assets (de Oliveira, 2015:5), Then came the contribution of Myer and Pifer, in 1970, who used the linear probability model, then the contribution of Martin in 1977, who employed the logit model, then the contribution of Zmijewski, who made use of the probit model in 1984 (Andekina & Rakhmetova, 2013:50), as Martin's contribution is considered the first to Complex mathematical methods were employed to determine the distinctive model of financial failure, as the logarithmic model was used, which proved its ability to predict financial failure (de Oliveira, 2015:5), His contribution was followed by an increase in the trend of scientific research towards employing more complex statistical and mathematical methods, as (Lennox, 1999) reused the logarithm and probit regression models to obtain more accurate results with regard to the study of financial failure, as well as the contribution of (McDonald, 1999), who used In addition to the previous two models, the EGB2, lomit, burrit models (Keener & 2013:374), in related context, researchers have recently turned to using genetic algorithms to obtain predictions related to financial failure, including the contribution of (Poorzamani & Kalantari, 2012) to distinguish between failed and non-failed organizations, By using 23 variables representing financial ratios that were pruned in light of the results of the genetic algorithm, (González & Rodríguez, 2014) used the genetic

algorithm to determine those appropriate financial ratios from a large number of ratios that actually contribute to predicting financial failure, and in light of the above The current research presents a test of the financial safety model applied by the Central Bank of Iraq, through its four indicators: capital adequacy, liquidity, profitability, and asset quality, for which the weights were estimated based on the outstanding results of banks operating in Iraq, and a proposed model was presented consisting of these ratios. The four financial indicators are weighted with weights that give importance rates for each indicator.

Second: Conceptual framework for financial safety

The financial turmoil at the end of the nineties presented the need for methods that could control the issue of exposing a number of organizations, regardless of their activities, to failure and then bankruptcy. The need is precisely focused on capital fluctuations, in addition to the violent shocks that the world's economies were exposed to, which created a state of credit crisis and Liquidity All of this has led to the need to develop a financial safety system (Jose & Georgiou, IFC Bulletin No. 31, 2008:271), and thus the state, represented by the central bank, takes a number of strategies to hedge against the risks to which its banks may be exposed, which are represented by a set of measures (Alshaikhli, 2024:75), as it is a set of indicators that measure the health of the financial system, and therefore it is an indicator that identifies weaknesses in a specific financial sector (IMF, 2013:3), Despite the widespread concepts of monetary and financial policies, financial crises They still exist and will continue to exist (Ali, 2024: 70), and as a result of these violent financial shocks, there has become an urgent need for technologies that can manage risks, called financial safety indicators, with which the work of banks can be tracked, which reflects the financial health of the banking sector and prevents the collapse of the system Financial and banking (Kemal & Emina, 2014: 159-160), the Central Bank of Iraq presented financial safety indicators in the financial stability report, which is published on an annual report, as it specified safety indicators according to the Iraqi banking reality as follows (Financial Stability Report, 2023: 48-63):

1. **Capital adequacy:** This indicator aims to ensure financial stability at the banking sector level in a way that increases capital adequacy and achieves the ability to reduce losses. This is achieved by increasing banking capital, as it is considered the first line of defense against potential risks and within this context. The Basel international standard, which specifies a ratio of 8%, is considered an acceptable value for determining capital adequacy, knowing that the Central Bank of Iraq was not satisfied with the aforementioned ratio, but rather raised it to 12%.
2. **Liquidity:** Banking liquidity is considered an element that must be verified on an ongoing basis, and this is based on the fact that the bank works with the money of others and is responsible for returning that money to depositors at any time upon request or at a predetermined future date. The main challenge facing the banking sector is balancing the amount of liquidity that must be maintained to face withdrawals and the amount that must be invested in a way that maximizes the bank's profitability. Here, the role of the Basel III standard emerged to establish a new regulation for monitoring banking liquidity by focusing on high-quality capital, which means maintaining appropriate quantities of liquid assets.

3. **Quality of assets:** The quality of banking assets expresses those assets whose quality is translated by the bank's ability to convert them into liquidity quickly, within this indicator, overdue debts compared to total assets, capital, or total cash credit are considered an indicator of the quality of liquidation of assets without losses.
4. **Profitability:** The opposite of liquidity is profitability, The inverse relationship between the two indicators gives a clear indication of the level of banking safety, In light of the previous assumption that banks operate with the money of others, the bank is obligated not to use all the deposits available to it towards achieving large profits, as it, that is, the bank, is governed by the necessity of retaining amounts, It helps it face withdrawals, and on the other hand, it is committed to the necessity of achieving profits in order to meet its existence and the ambitions of its stakeholders, Thus, this indicator is extremely important and must be monitored to ensure banking safety.

Third: Models of financial failure

1. The Altman (Z) score :In 1968, Altman presented his original model to evaluate the possibility of industrial companies being exposed to financial problems that threaten the future of the company and ultimately lead to bankruptcy. According to this model, companies were classified into three categories: the first is risky, the second is safe, and the third is gray. Whenever the company achieves a value of $z < 1.80$, it will be exposed to bankruptcy and $z > 2.99$ the company will be far from the risk of bankruptcy and $1.80 < z < 2.99$ represents the gray area and equation (1) shows the components of the original equation (Manjunath & Kumari2022:3-4):

$$Z = 0.012 Z_1 + 0.014 Z_2 + 0.033 Z_3 + 0.006 Z_4 + 0.999 Z_5 \dots\dots (1)$$

The components of the equation were represented by the following indicators:

- Z1 = Net working capital / Total assets
- Z2 = Retained Earnings / Total Assets
- Z3 = Earnings before interest and tax / total assets
- Z4 = book value of shareholders' equity / total liabilities
- Z5 = Sales / Total Assets

Altman (1983) made an amendment to the acceptable z ranges as an evaluation of the proposed indicator. A value of $z < 1.23$ would be at risk of bankruptcy, $z > 2.9$ would make the company far from the risk of bankruptcy, and $1.23 < z < 2.9$ represents the gray area. The second amendment was made in 1993 when it was deleted. Z5 and adjusting the values of the remaining four indicators to suit the banking sector, and accordingly the Z equation became as shown in:(2)

$$Z = 6.56 Z_1 + 3.26 Z_2 + 6.72 Z_3 + 1.05 Z_4 \dots\dots (2)$$

A value of $z < 1.10$ will be at risk of bankruptcy, $z > 2.60$ will make the company far from the risk of bankruptcy, and $1.10 < z < 2.60$ represents the gray area (Elewa, 2022:10)

2. **Sherrod Model** :This model was presented in 1987 to predict financial failure, as this model was presented according to equation (3) (MEDJOUB & HOUAS,2020:96):

$$Z = 17X_1 + 9X_2 + 3.5X_3 + 20X_4 + 1.2X_5 + 0.1X_6 \dots\dots (3)$$

The model indicators are as follows:

X1 = Net working capital / Total assets

X2 = Current assets / Total assets

X3 = Total Equity / Total Assets

X4 = Net income before tax / Total assets

X5 = Total Assets / Total Liabilities

X6 = Total equity / Total fixed assets

Table (1) shows the Z-scores classified according to the model (Hamid et al., 2022:12):

Table 1 Z-scores

case	Degree of risk	Z
The first	The company is far from the risk of bankruptcy	$Z > 25$
the second	Low risk of bankruptcy	$25 \geq Z > 20$
Third	Gray area	$20 \geq Z > 5$
Fourth	There is a high probability that the company will go bankrupt	$5 \geq Z > -5$
Fifth	Bankruptcy for sure	$Z \leq -5$

3. Kida model: The Kida model provides a set of indicators used to predict failure using five indicators shown in equation (4) (Babela & Mohammed, 2016:36), as it was presented in 1980 as one of the important quantitative models that used discriminant analysis to choose five financial ratios that constitute indicators of failure and as explained by equation (4) (Zinal, 2023:175):

$$Z = 1.042X1 + 0.42X2 + 0.461X3 + 0.463X4 + 0.271X5 \dots \dots \dots (4)$$

X1 = Net profit after tax / Total assets

X2 = shareholders' equity / total liabilities

X3 = Current Assets / Current Liabilities

X4 = Returns / Total Assets

X5 = Cash / Total Assets

Accordingly, companies were classified according to this model on two levels of Z:

Successful company: $Z > 0.38$

Failed company: $Z < 0.38$

According to these two scores, companies are classified as either a successful company capable of continuing work or vice versa, based on the criterion of 0.38 (Alkhatib, 2011: 209-210).

Section tow / research methodology

First: the importance

The banking sector is characterized by a set of characteristics that distinguish it from other business organizations. It is an institution that is subject to the supervision of many bodies, led by the Central Bank, and this at the local and global levels, It is subject to a set of agreements in which the Central Bank participates, which is reflected in the nature of the activity of banks operating in a particular country, In addition, the unique feature of banks is working with the money of others, and this is the reason for the emergence of these restrictions on banks. Despite this, many banks are exposed from time to time to failure and then bankruptcy. Thus, the current research contributes by adding knowledge by presenting a model that suits the Iraqi environment according to the financial safety indicators imposed under Instructions of the Central Bank of Iraq.

Second: the problem

Researchers have been seeking for decades to provide many models that help reduce the failure of the banking sector. Indeed, despite the existence of many standards that govern banking work, the failure and bankruptcy of many banks still exists until now. Thus, the current research sought to provide an addition to knowledge represented by the financial safety model to predict the failure of banks within the Iraqi environment, especially with the shift of banks towards comprehensive banking and the resulting increase in costs depending on the multiple types of services provided, which affected the profitability of those banks.

Second: objectives

1. Testing models based on the Middle East Bank as a successful bank and the Dar es Salaam Bank as a failed bank.
2. Proposing a financial safety model based on the financial safety indicators used by Central Bank of Iraq as indicators of the proposed financial safety model for financial failure, which was built based on the weights emerging from the genetic algorithm.
3. Comparing the results between the proposed model and Altman, Sheer Third: The procedural plan for the research

Third: The procedural chart presents the steps taken to obtain a safety model for financial failure as followed:

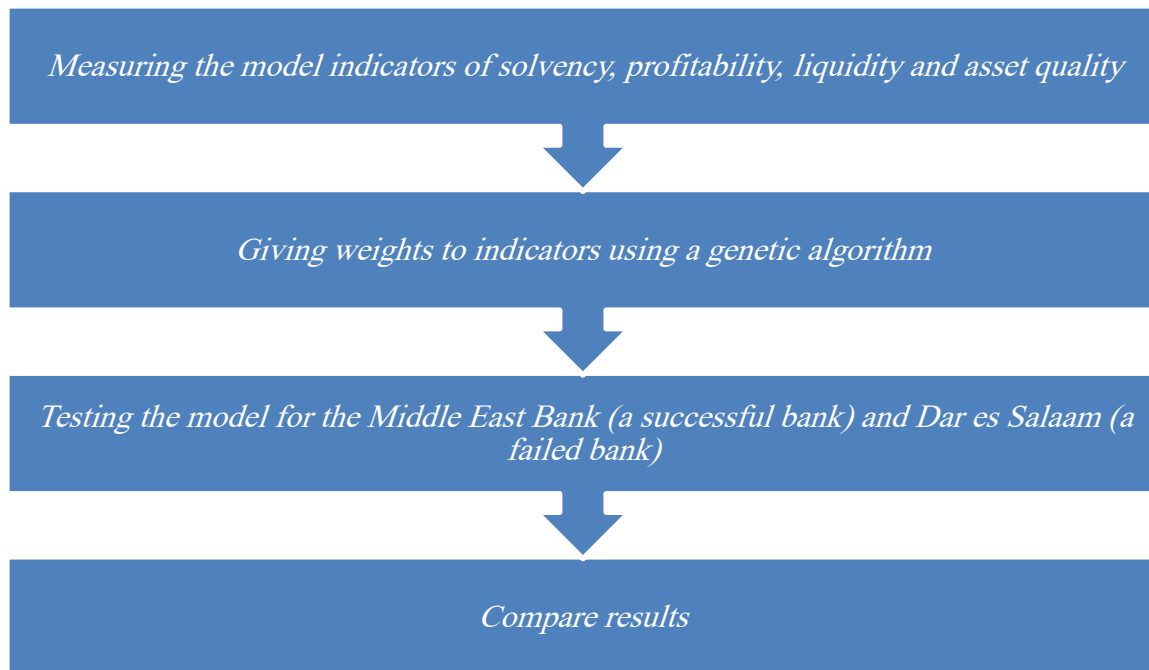


Figure (1) procedural diagram of the study

Fourth: The population, sample and sampling method

The study population represented Iraqi banking sector, especially the private sector, while the sample consisted of the Middle East Bank as a successful bank and the Dar ea Salam Bank as a failed bank that went bankrupt in the year 2015. Due to the difficulty of obtaining data from the records of lists published on official websites such as Iraqi Securities commission, therefore, the method of intentional inspection was adopted for the two aforementioned banks.

Fifth: Quantitative tools

Financial safety model: Based on the financial stability report and the four indicators of financial safety that it presents, and because these indicators represent those actually implemented by Central Bank of Iraq and because they periodically present the state of the financial safety of the Iraqi banking sector, the idea of research was crystallized using the same indicators while working to provide weights. For each indicator using a genetic algorithm, work was done to build a proposed model that simulates the results that stem from the Altman, Sheered, and Kida models, relying on financial safety indicators as quantitative variables through which the proposed model is formed. As for the weights, it was left to the genetic algorithm to determine those weights based on the nature of the indicators. The results it reflects express the reality of the bank, and equation (5) explains the formation of the proposed model:

$$Z=X1 0.205 + X2 0.016 + X3 0.200 + X4 0.579 \dots\dots (5)$$

Based on the proposed model and the results of the genetic algorithm and what it presented through the preference function, the dividing line between the weights presented was 0.536, and accordingly the scale was Whenever we exceed this divided into two dividing points and the value of this dividing point was 0.536 Whenever the bank is able to exceed the .threshold, the bank's situation is farther away from bankruptcy threshold, it moves toward stability and vice versa. Figure (2) shows the aforementioned measure:

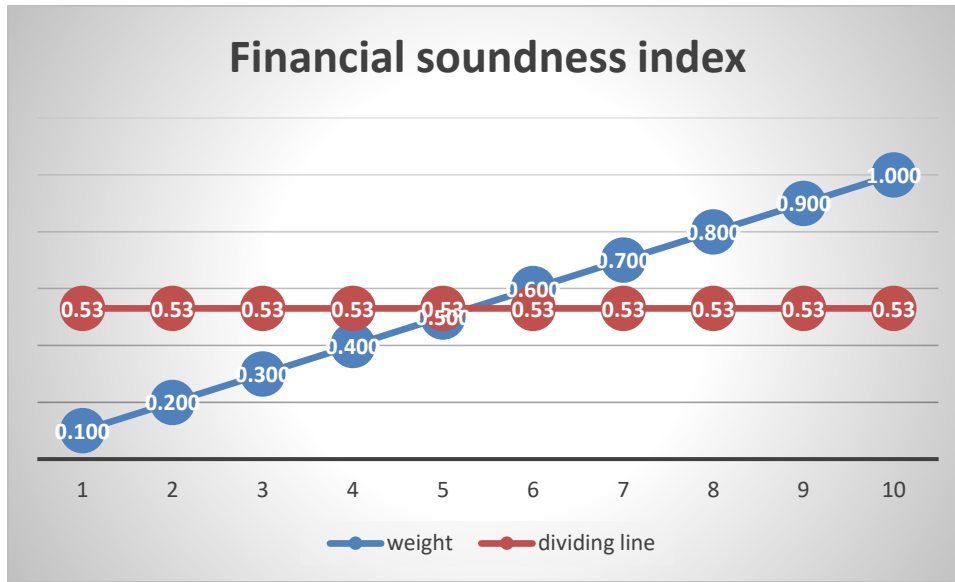


Figure (2) financial safety Index

According to the model shown in Figure (2), Degrees can be divided into three levels:

- a) First degree (financial failure): achieved at a score of <0.536 .
- b) The second degree (gray): is achieved at $<0.536 \leq Z < 0.7$.
- c) Grade 3 (Financial Soundness): achieved at $Z \geq 0.7$.

Section third / the practical aspe

The current section presents the mechanism adopted to achieve the practical aspect of the research, as the Altomn, Sheerod and Kida models were used to determine the level of risk to which the banks in the research sample may be exposed, known as financial failure. In addition to these models, a model was proposed that relies on financial safety indicators, Applied by Central Bank of Iraq and published in the Financial Stability Report, the financial safety indicators were reweighted using a genetic algorithm to obtain those optimal weights that can provide a new, reliable model to detect cases of financial failure before they occur.

First: Middle East Bank: The Middle East Bank was chosen because it is one of the oldest banks that has been operating since 1993 until now. The three models known as the Altomn, Sheerod and Kida models were applied in addition to the proposed financial safety model, as follows:

1. **Sherrod model:** Table (3) presents an examination of the status of the Middle East Bank and its ability to operate properly or whether it may be exposed to bankruptcy in the future that may lead it to financial failure based on the indicators of the Sheered model.

Table (3) Sherrod model outputs

index	2017	2018	2019	2020	2021	2022
x1	4.14266	3.77521	-9.9333	4.59363	-0.4307	-0.3164
x2	7.89615	7.94596	0.00772	7.6622	0.02949	0.02391
x3	1.26735	1.16907	1.42126	1.43103	0.52453	0.38993
x4	0.01547	-0.0496	0.00589	-0.0521	1.1E-05	-2E-05
x5	1.88117	1.80186	2.02045	2.02999	3.20953	2.70361
x6	0.29523	0.28521	0.28599	0.27506	0.72953	0.73098
Z	15.498	14.9277	-6.192	15.9398	4.0624	3.53199
result	Difficulty predicting bankruptcy	Difficulty predicting bankruptcy	bankruptcy	Difficulty predicting bankruptcy	Exposed to bankruptcy	Exposed to bankruptcy

Observing the results shown in Table (3), it is clear that the Middle East Bank, according to the Sherrod model, suffers from three situations:

- a) The difficulty of predicting bankruptcy for the years 2017, 2018, and 2020.
- b) It may go bankrupt in 2021 and 2022.
- c) Bankruptcy for the year 2019.

2. **Altman model:** Table (4) presents the calculation of the Altman model indicators for the Middle East Bank as follows:

- a) The years 2017, 2018, and 2020 are gray, and the bank's position on whether it will go bankrupt or not is not clear.
- b) In the years 2019, 2021, and 2022, the bank may go bankrupt.

Table (4) Altman model outputs

index		2017	2018	2019	2020	2021	2022
	3.25	3.25	3.25	3.25	3.25	3.25	3.25
x1	6.56	1.598577628	1.4567885	-3.833103	1.772602	-0.682	-0.5498
x2	3.26	0	0	0.0140156	0	0.00514	0.0042
x3	6.72	0.005198292	-0.016661	0.0019784	-0.0175	0.00478	0.00337
x4	1.05	0.596023763	0.5266271	0.7178952	0.726246	0.74144	0.52548

Z	5.449799683	5.2167548	0.1507858	5.731346	3.31937	3.23322
result	gray	gray	bankruptcy	gray	bankruptcy	Bankruptcy

3. KIDA model

Table 5: KIDA model results

index	2017	2018	2019	2020	2021	2022
X1	-0.0008	-0.003	0.00012	-0.0034	0.00047	0.00002
X2	0.23841	0.21065	0.28716	0.2905	0.29658	0.21019
X3	0.63828	0.61592	0.00068	0.67535	0.01599	0.01598
X4	0.01217	0.00635	0.01633	0.02171	0.02021	0.01469
X5	0.10256	0.09903	0.13456	0	0.14297	0.12306
z	0.99061	0.92896	0.43885	0.98419	0.47621	0.36394
result	good	good	good	good	good	bankruptcy

By observing the results shown in Table (5), it is clear that the position of the Middle East Bank is described as follows:

- a) For the years 2017 - 2021, the bank's condition is good, and it does not qualify for the bank to go bankrupt.
- b) The bank is likely to go bankrupt in 2022.

4. The proposed model

The proposed model provides a measurement of the situation of the Middle East Bank using the proposed model, as the bank is still functioning properly. The purpose of the measurement is to determine the ability of the proposed model to reach results close to the three aforementioned models, Table (6) presents safety indicators Finance, its impact ratios and Z value:

Table (6) Outputs of the Financial Soundness Index of the Middle East Bank

index	القيمة	2017	2018	2019	2020	2021	2022
X1	0.2	0.260034	0.2256358	0.227683	0.2174457	0.259829	0.208846
X2	0.02	-0.0000122	-0.0000449	0.0000019	-0.0000507	0.0000071	0.0000003
X3	0.2	0.1755518	0.1766594	0.000172	0.1703507	0.000747	0.000602
X4	0.58	0.1494855	0.2088563	0.100138	0.4768573	0.472581	0.46945
z		0.5850591	0.6111065	0.327995	0.864603	0.733165	0.678899
result		Probability for bankruptcy	Probability for bankruptcy	bankruptcy	good	good	Probability for bankruptcy

Observing the results shown in Table (6) are:

- a) The possibility of the Middle East Bank going bankrupt for the years 2017, 2018, and 2022.
- b) Bankruptcy for 2019.
- c) The position of the Middle East Bank is good during the years 2020 and 2021.

Second: Comparing the results between the proposed model and the three models adopted in the study

Table (7) Comparison of results for Altman, Sheerod , Kida indicators and financial safety

year	Sheered		Altman		Kida		financial safety model	
2017	15.498	Difficulty predicting bankruptcy	5.4498	gray	0.99061	good	0.585059	probability of bankruptcy
2018	14.9277	Difficulty predicting bankruptcy	5.21675	gray	0.92896	good	0.611107	probability of bankruptcy
2019	-6.192	bankruptcy	0.15079	bankruptcy	0.43885	good	0.327995	bankruptcy
2020	15.9398	Difficulty predicting bankruptcy	5.73135	gray	0.98419	good	0.864603	Good
2021	4.0624	Exposed to bankruptcy	3.31937	bankruptcy	0.47621	good	0.733165	Good
2022	3.53199	Exposed to bankruptcy	3.23322	bankruptcy	0.36394	bankruptcy	0.678899	probability of bankruptcy

From the results shown in Table (7), the following are:

- a) Sheerod, Altman, and financial safety models agree on the bank’s bankruptcy for the year 2019.
- b) The Sheerod, Altman and financial safety models agree on the fuzzy for the years 2017 and 2018.
- c) Agreement of Sheerod and financial safety model in the probability of bankruptcy for the year 2022.
- d) Agreement of Kida and financial safety Model on the good position of the Middle East Bank for the years 2020 and 2021.

From what was presented above, it is clear that the proposed model can be adopted in practice, similar to the models presented, as the proposed model agreed with other models, as follows:

- a) Sheerod and Altman 2017-2020 models agreed.
- b) The financial safety model agreed with the previous two models for the years 2017-2019 and with the Sheerod model for the year 2022.
- c) The Kida and Altman models agreed for the year 2022 only, while the financial safety model agreed with the Kida model for the years 2020 and 2021.

Third: Retest the model on Dar es Salaam Bank, which went bankrupt in 2015

This test presents the effectiveness of the proposed model in predicting the failure of Dar es Salaam Bank before it reaches bankruptcy according to the three aforementioned models with the proposed model.

1. Sherrod model

Table 8 -Sherrod model outputs

index	2012	2013	2014
x1	4.14266	3.7752142	-9.933347
x2	7.89615	7.9459627	0.0077221
x3	1.26735	1.1690747	1.4212569
x4	0.01547	-0.049586	0.0058882
x5	1.88117	1.8018596	2.0204517
x6	0.29523	0.2852074	0.2859913
Z	15.498	14.927733	-6.192037
result	Difficulty predicting bankruptcy	Difficulty predicting bankruptcy	Bankruptcy

It is clear from Table (8) the outputs of the Sherrod model for the Dar es Salaam Bank, as the model indicated the bank’s crisis situation during the years 2012 and 2013, and it ended up with the possibility of bankruptcy for the year 2014, knowing that this prediction of the bank’s bankruptcy was fulfilled during the year 2015.

2. Altman model

Table 9- Altman model outputs

index		2012	2013	2014
3.25		3.25	3.25	3.25
x1	6.56	1.5985776	1.4567885	-3.833103
x2	3.26	0	0	0.014016
x3	6.72	0.0051983	-0.016661	0.001978
x4	1.05	0.5960238	0.5266271	0.717895
Z		5.4497997	5.2167548	0.150786
result		grey	grey	bankruptcy

It is clear from the results presented in Table (9) that the bank’s situation, according to the indicators of the Altman model, is gray and unclear for the years 2012 and 2013, and that it will certainly achieve bankruptcy in 2014, and this matches reality, as the bank was exposed to bankruptcy in 2015.

3. KIDA model

Table 10- KIDA model results

index	2012	2013	2014
X1	-0.0008	-0.002987	0.0001245
X2	0.23841	0.2106509	0.2871581
X3	0.63828	0.6159226	0.0006759
X4	0.01217	0.0063461	0.0163278
X5	0.10256	0.0990276	0.1345603
z	0.99061	0.9289604	0.4388467
result	good	good	good

It is clear from Table (10) that the Bank of Dar es Salaam, according to the indicators of the KIDA model, enjoys a good reality and is unlikely to go bankrupt. This is in contrast to the previous two models. Although we are not evaluating the eligibility of the KIDA model, applying this model in light of the banking sector of Iraqi does not give real inferences about the nature of the bank's work.

4. Financial safety model

Table -11 financial soundness indicators, their impact ratios, and the approved Z value

index	القيمة	2012	2013	2014
X1	0.2	0.260034	0.2256358	0.227683
X2	0.02	-1.22E-05	-4.49E-05	1.87E-06
X3	0.2	0.1755518	0.1766594	0.000172
X4	0.58	0.1494855	0.2088563	0.100138
z	0.536	0.5850591	0.6111065	0.327995
		Probability of bankruptcy	Probability of bankruptcy	bankruptcy

The proposed financial safety model shown in Table (11) matches the Sheerod and Altman models completely, as the proposed model predicted the possibility that the bank would go bankrupt for the years 2012 and 2013 and that it would go bankrupt in the year 2014, and this is what actually happened for the year 2015.

Section fourth: conclusions and recommendations

First: conclusions

1. The effectiveness of using the proposed model to predict financial failure after applying it in two cases of a successful bank, represented by the Middle East Bank, which is still operating until the date of completion of the research, and a bank that went bankrupt during the year 2015, represented by the Dar es Salaam Bank.
2. The effectiveness of financial safety indicators approved by Central Bank of Iraq to detect cases of financial failure in themselves.
3. The ineffectiveness of financial safety indicators in terms of the importance weights of those indicators, Despite the use of these indicators in the financial stability report issued by Central Bank of Iraq, it did not indicate the condition of some banks and their inability to fulfill their obligations, which may expose them to failure and then bankruptcy.
4. The proposed model is consistent with what was proposed by Altman and Sheerod as a measure for predicting financial failure, while the proposed model in addition to the Altman and Sheerod models did not agree with the results presented by the Kida model.
5. The effectiveness of using a genetic algorithm in determining the weights of the relative importance of financial safety indicators, which helps in using these indicators after adjusting their weights to be an effective indicator for predicting the financial failure of the Iraqi banking sector.

Second: Recommendations

1. Central Bank of Iraq can adopt the proposed model as a measure of financial safety after retesting it on a larger sample of Iraqi banks to give a more accurate picture of the reality of financial failure.
2. Central Bank of Iraq must reassign weights to the indicators adopted in measuring financial safety, because the current classification of the importance of indicators according to the applicable weights does not give an accurate picture of the reality of the Iraqi banking sector.
3. Iraqi banking sector must use the proposed model to determine its position in the event of financial failure by applying the proposed model periodically according to the data issued by it without waiting for financial health reports to indicate the bank's condition.

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English References:

- Ali ,Saad Hasan (2024), The efficiency of monetary and financial policies tools in enhancing financial sustainability in the Iraqi economy-(2010-2021) analytical study, *ECONOMICS AND ADMINISTRATIVE STUDIES JOURNAL (EASJ)*, VOL.3 , NO.2 .
- Alkhatib, Khalid (2011), Predicting Corporate Bankruptcy of Jordanian Listed Companies: Using Altman and Kida Models, *International Journal of Business and Management* Vol. 6, No. 3 .
- Alshaikhli, Saja (2024), Hedging in light of the application of IFRS 9, *ECONOMICS AND ADMINISTRATIVE STUDIES JOURNAL (EASJ)*, Vol. 3, No. 1.
- Alkhatib, Khalid (2011), Predicting Corporate Bankruptcy of Jordanian Listed Companies: Using Altman and Kida Models, *International Journal of Business and Management* Vol. 6, No. 3.
- Andekina, Regina & Rakhmetova, Rakhila (2013), Financial Analysis and Diagnostics of the Company, *International Conference on Applied Economics, Procedia Economics and Finance* 5.
- Babela, Islam S. T. & Mohammed, Renas I. (2016), Business Failure Prediction using Sherrod and Kida Models: Evidence from Banks Listed on Iraqi Stock Exchange (2011 - 2014), *Humanities Journal of University of Zakho (HJUOZ)* ,Vol. 4, No. 2.
- de Oliveira, André Eduardo Paulo (2015), Bank Failure and the Financial Crisis: an Econometric Analysis of U.S. Banks, Master Thesis in Finance and Taxation, university DO PORTO.
- Elewa, May Mahmoud (2022), Using Altman Z-Score Models for Predicting Financial Distress for Companies – The Case of Egypt panel data analysis, *Alexandria Journal of Accounting Research*, Vol. 6.
- Financial Stability Report (2023), Central Bank of Iraq DEPARTMENT OF STATISTICS AND RESEARCH of Monetary & Department Financial Stability.
- González, Eduardo Acosta & Rodríguez, Fernando Fernández (2014), "Forecasting Financial Failure of Firms via Genetic Algorithms," *Computational Economics*, Springer;Society for Computational Economics, vol. 43(2).
- Hamid, Guleshan Mohsin & Mohammed, Gulizar Abdullah & Omar, Kurdistan M. Taher & Haji ,Shelan Mohammed Rasheed (2023), USING ALTMAN AND SHERROD Z- SCORE MODELS TO DETECT FINANCIAL FAILURE FOR THE BANKS LISTED ON THE IRAQI STOCK EXCHANGE (ISE) BETWEEN 2009 – 2013, *Intern. Journal of Profess. Bus. Review. | Miami*, v. 8 | n. 4 .
- Honohan, Patrick (1997), BANKING SYSTEM FAILURES IN DEVELOPING AND TRANSITION COUNTRIES: DIAGNOSIS AND PREDICTION, BANK FOR NTERNATIONAL SETTLEMENTS Monetary and Economic Department BASLE.
- IFC (2009), Measuring financial ,innovation and its impact, *Proceedings of the IFC Conference,Basel*, 26–27 .
- Jose, Armida San & Georgiou, Andreas (2013), Financial soundness indicators (FSIs):framework and implementation.
- Keener, Mary Hilston (2013), Predicting The Financial Failure Of Retail Companies In The United States, *Journal of Business & Economics Research*, Volume 11, Number 8.
- Kemal, Kozaric & Emina, Zunic (2014), Financial soundness indicators in Bosnia and Herzegovina banking sector, *UTMS Journal of Economics*.

- MAMMADLI, Aytakin & HELHEL, Yeşim (2022), FINANCIAL FAILURE in TOURISM ENTERPRISES REGISTERED in BORSA ISTANBUL (BIST), Journal of Süleyman Demirel University Institute of Social Sciences , Number: 43.
- Manjunath , Kumari Dr Sujatha Susanna (2022), The Analytical Study Of Altman's Z-Score Model On Family Controlled Companies Listed In Nifty 50, Journal of Pharmaceutical Negative Results | Volume 13 | Special Issue 10.
- MEDJOUR, Alaeddine & HOUAS, Abderrezzak (2020), A comparative study between Altman, Kida and Sherrod's model in predicting the financial failure of listed companies in Amman Stock Exchange, Economic and Management Research Journal, Vol:14, No:03 .
- Poorzamani, Zahra & Kalantari ,Hassan (2012), Investigating Financial Crisis Prediction Power using Neural Network and Non-Linear Genetic Algorithm, Int. J. Fin. Acco. Eco. Stu. Vol. 2 / No.1.
- Zinal, Wisam Sami Jabbar (2023), PREDICTING THE FINANCIAL FAILURE OF COMMERCIAL BANKS USING THE KIDA MODEL AND SHERROD MODEL. (AN ANALYTICAL STUDY IN A NUMBER OF IRAQI COMMERCIAL) (BANKS), World Economics & Finance Bulletin (WEFB),Vol. 20 .