THE PREDICTION OF FINANCIAL FAILURE RISK IN INSURANCE COMPANIES LISTED IN THE AMMAN STOCK EXCHANGE USING THE ALTMAN MODEL

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Abstract

This study aimed to evaluate the ability of the Altman model to predict financial failure risk in insurance companies listed on the Amman Stock Exchange (ASE) and to assess the accuracy rate of the model's predictability. The study population and sample consisted of all Jordanian insurance companies listed on the ASE during the period from 2018 to 2022, totaling 23 companies. These were divided into 19 non-failed companies and four failed companies. The study adopted a descriptive analytical approach, utilizing Statistical Package for the Social Sciences (SPSS) to analyze the data and the Mann-Whitney U test to examine the study hypotheses. The findings revealed that the Altman model is capable of distinguishing between failed and non-failed insurance companies, with an overall accuracy rate of 56.7 percent for the study period, which is consistent with the results of Dolinšek and Kovač (2024) and Cindik and Armutlulu's (2021) studies. However, this accuracy rate decreases as the year of analysis moves further from the year in which the failure occurred. The study recommends using additional predictive models alongside the Altman model to enhance the quality of the decision-making process.

Keywords: Insurance Companies, Financial Failure, Amman Stock Exchange, Altman Model

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1. INTRODUCTION

Throughout history, people have sought to avoid risks and have developed various methods to achieve this objective. These methods include refraining from participating in uncertain or dangerous activities, sharing risks with other parties, or attempting to predict the probability of risks (Romney & Steinbart, 2017). Insurance companies play a fundamental role in minimizing risks by distributing them among insured parties. They provide protection against a wide range of risks (Yun, 2023). Risk is defined as the possibility of a challenging or unfavorable event occurring and the resulting financial impact.

The primary role of insurance companies in the economic system is to reduce risks and compensate insured parties, thereby fostering economic development and stability. From this perspective, countries have focused on regulating the insurance sector in accordance with the best professional standards and practices. This regulation aims to mitigate the adverse effects of financial failure risk in insurance companies and to safeguard the interests of both the insured parties and society as a whole (Fan & Song, 2024).

In their efforts to minimize the risk of financial failure for individuals, companies, the economic system, and society, researchers have developed various predictive models. Among these, the Altman model, with its different versions, has emerged as the most prominent and widely used model (Hamid et al., 2023). Insurance operations represent one of the most commonly utilized areas of financial services, and the failure of an insurance company can severely impact all individuals and groups associated with it, including clients, brokers, and agencies (Elewa, 2022). Financial failure risk is also a significant concern for accountants, investors, employees, managers, and creditors due to its profound effects on their interests (Pulawska, 2021).

According to data from Jordanian authorities — such as the Jordan Insurance Federation (JIF), the Central Bank of Jordan (CBJ), and the Amman Stock Exchange (ASE) — out of the 23 insurance companies operating in Jordan, four have experienced financial failure risk within the last five years. Specifically, two companies have declared liquidation, one has been suspended from the ASE, and one has merged with another company due to financial difficulties. These cases represent 17.3% of the Jordanian insurance sector, highlighting the importance of assessing the probability of financial failure risk in insurance companies.

Thus, this study aims to evaluate the ability of one of the most common and widely used predictive models — the Altman model — to predict financial failure in insurance companies. The research questions include:

RQ1: What is the predicted accuracy rate for the Altman model?

RQ2: How effectively can the Altman model discriminate between the failed and non-failed insurance companies listed on the Amman Stock Exchange?

The insurance sector, in general, is the sector that bears all types of risks faced by other entities and individuals. Specifically, in Jordan, the insurance sector has encountered significant financial difficulties, leading some companies to cease operations. Out of 23 insurance companies, eight have either declared bankruptcy or merged with other companies.

According to data provided by the JIF[1], 28% of the insurance companies listed on the ASE are currently experiencing financial challenges. Furthermore, 17.3% of these companies have faced financial failure within the past five years. These statistics underscore the importance of predicting the likelihood of insurance company failures using one of the established failure risk prediction models.

The research aimed to assess the effectiveness of the Altman model to predict the financial failure risk of insurance companies listed on the ASE, so it can be used by all parties interested in Jordanian insurance companies, as well as insurance companies in general.

The research is limited to Jordanian insurance listed on the ASE during the period (2018–2022), and the following terms have the corresponding meanings:

- Insurance companies: Jordanian insurance company licensed to provide insurance services according to Article 2 of Insurance Law No. 33 of 1999.
- Altman model: The Altman Z"-score model is remarkable, as it was specifically designed to predict failure in a non-manufacturing environment (Altman, 1993).
- Financial failure risk: For the purposes of this research, financial failure risk is defined as a company's inability to meet its debt obligations by the due date (Özsungur et al., 2023). A company is considered financially failed if it has declared liquidation, been suspended from the ASE due to a merger or other reasons, or had its operations suspended by government authorities.
- Accuracy rate: It is computed as (the number of effectively classified cases / total of cases studied) x 100%.

The structure of this paper is as follows. Section 2 reviews the relevant literature. Section 3 details the research methodology. Section 4 presents the results. Section 5 discusses the findings. Section 6 concludes the paper with implications, limitations, and future research directions.

2. LITERATURE REVIEW

2.1. Financial failure

Many organizations in both developed and developing economies face the significant challenge of financial failure risk due to substantial risks arising from internal and external factors. To mitigate the effects of financial failure risk, interested parties often use quantitative models to predict the likelihood of a company's financial collapse. Financial failure risk is an inherent risk in sectors such as banking, investment, and insurance. It typically begins with insolvency and often culminates in bankruptcy. According to Acosta-González et al. (2019), financial failure risk occurs when a company is unable to cover its daily expenses and operational requirements. Some studies define business failure risk as the act of filing for bankruptcy, while others use specific criteria. For example, Beaver (1966) defines failure as defaulting on a loan, having an overdrawn bank account, or failing to pay preferred stock dividends. Alternatively, Deakin (1972) defines failure from a legal perspective, including only entities that have experienced bankruptcy, insolvency, or liquidation for the benefit of creditors.

[1] https://www.jif.jo/en

Altman (1968) defines bankruptcy as filing for Chapter 11 bankruptcy, a concept particularly relevant in the USA, where corporations use Chapter 11 of the federal Bankruptcy Code to continue operations while reorganizing. This aligns with Gilbert et al. (1990), who suggest that the financial dimensions distinguishing bankrupt from non-bankrupt companies differ from those separating bankrupt from distressed firms. Similarly, Beaver (1966) limits failure to cases of loan default, overdrawn bank accounts, and non-payment of preferred stock dividends. Bhaskar and Flower (2019) describe financial failure as a situation where a company becomes unable to cover its costs, including the cost of capital, and management fails to generate a return on invested capital commensurate with the risks involved.

Researchers distinguish between economic failure and financial failure. Economic failure occurs when a company cannot generate a satisfactory return on investment, while financial failure risk occurs when a company is unable to meet its liabilities by the due date (Tung, 2020). García-Quevedo et al. (2018) emphasize that financial failure occurs when a company cannot pay its lenders on time.

Financial difficulty typically progresses through several stages, culminating in bankruptcy, which represents the final and most critical stage. These stages include:

1. *Blind stage*: Financial management becomes unable to identify and assess internal and external issues that threaten the company's long-term survival.
2. *Inaction stage*: Clear signs of declining financial performance are ignored.
3. *Faulty stage*: Management fails to halt the financial decline that began during the inaction stage.
4. *Crisis stage*: Disputes within top management lead to the departure of competent managers, and suppliers cease dealings with the company.
5. *Dissolution stage*: The company can no longer be salvaged as shareholder support dwindles and its ability to secure resources diminishes (Wietzel & Johnson, 1989).

From the researcher's perspective, if stakeholders can identify early signs of financial failure, bankruptcy can often be avoided. Early detection allows stakeholders to address problem areas and take corrective actions before the situation escalates to bankruptcy.

Financial distress, financial failure, insolvency, and bankruptcy are interrelated but represent distinct concepts. Financial distress refers to a situation where individuals or companies cannot generate sufficient revenue to meet short-term obligations. Insolvency occurs when a company's liabilities exceed its assets, rendering it unable to fulfill its financial commitments. Bankruptcy is a legal process initiated by individuals or companies unable to repay outstanding debts, often resulting in voluntary or mandatory liquidation (Karavar & Yaman, 2024; Nurcan & Köksal, 2021).

2.2. Reasons for financial failure risk

Financial failure risk can be attributed to two primary reasons: economic reasons and legal reasons. Economic reasons occur when the return on capital is lower than the average cost of capital or when the return on equity is negative. Legal reasons arise when a company faces legal consequences due to violations of rules, laws, or contracts (García-Quevedo et al., 2018).

Financial failure risk can stem from external factors such as technological obsolescence, economic recession, intense competition, lack of industry regulations, and fluctuations in interest rates (Keasey & Watson, 2000). Hubbard (2020) adds inefficient marketing of local products in international markets, regional conflicts, crises, and negative investor and analyst expectations for local markets as additional external reasons.

Internal factors contributing to financial failure risk include a lack of market awareness, weak investment and financial structures, and poor financial management (Sironi, 2018). Additionally, management's lack of flexibility, inability to adapt to external changes, and failure to modify plans in response to unforeseen circumstances are significant internal reasons (Appadurai, 2015). In Jordan, Alkhazaleh et al. (2023) argue that mandatory car insurance is a primary factor contributing to the financial difficulties faced by insurance companies.

From the researcher's perspective, financial failure risk is a broad term that encompasses the financial difficulties a company faces, beginning with financial distress and potentially ending in bankruptcy. Preventive and corrective measures for financial failure risk vary depending on a country's legal requirements, which are generally designed to protect the interests of stakeholders.

Saida (2021) outlines several procedures to address financial failure risk:

1. *Restructuring*: Implementing new strategies to resolve financial problems.
2. *Mergers*: Reducing competition and lowering tax expenses.
3. *Changing legal form*: Transitioning to a more flexible legal structure.
4. *Leasing*: Selling assets and leasing them back to generate funds for debt repayment.
5. *Sale of the company*: Transferring ownership to a new entity capable of operating more effectively.
6. *Liquidation*: Filing for bankruptcy, selling assets, and distributing proceeds to creditors according to legal priorities.

2.3. Prediction of financial failure risk

Predicting financial failure probability is a critical focus for both academics and professionals, as it enables timely decision-making, such as reallocating resources and taking necessary actions. Keasey and Watson (2000) highlight that testing creditworthiness and insolvency indicators can help anticipate a company's future position and its likelihood of survival or liquidation. Regression analysis and mathematical models are often used to forecast financial conditions and evaluate performance.

Mselmi et al. (2017) note that creditworthiness indicators reflect a company's current performance, while insolvency indicators assess its ability to meet future financial obligations. Financial analysts rely on their expertise and judgment to predict financial failure, often grappling with the variety of financial ratios and the challenges of interpreting them (Bookstaber, 2017).

Consequently, most financial failure prediction analyses use quantitative models that incorporate ratios and financial indicators (Altman et al., 2017). These models fall into two categories:

1. Models using weighted averages of various financial measures.
2. Models relying on a single financial ratio (Ashraf et al., 2019).

Quantitative models are valuable tools for auditors to assess a company's current financial health and predict its future stability, enabling preventive measures to avoid financial difficulties (Ashraf et al., 2019).

2.4. Financial failure risk prediction models

Research into financial failure prediction models began in the late 1960s. One of the most prominent models is Altman's (1968) Z-score model. Initially designed for publicly traded manufacturing companies, the model was later adapted for use in other industries, and the Altman Z-score is a numerical indicator that predicts a company's risk of bankruptcy within the next two years (Caporale et al., 2017).

The importance of the Altman's (1993) model stems from its ability to enhance judgment and analysis, improve the assessment of a company's solvency and creditworthiness, and support stock market analysis, It is particularly beneficial for investors, as it strengthens the decision-making process, the model ability to predict financial failure was assessed in many studied in different economics environments. The study of AL-Lahlah et al. (2024) examined the model's ability to predict financial failure in companies listed in the Iraqi Stock Exchange and found that it is able to predict financial failure with a moderate rate. Medjdoub and Guembour Mohamed (2020) examined the model's ability to predict financial performance in companies listed in ASE and found that it can be relied upon to judge the financial position of companies, but not at a high rate. Al-Amoudi and Al-Harbi (2024) studied the model's ability to predict financial failure in the Saudi banking sector and found that it is able to predict financial failure in banks. However, the model has some disadvantages, including the need for sample data to compute its scores. Since these situations may not always yield precise and clear data, the validity of the Altman Z-score could be questioned. Additionally, the financial and commercial worlds are constantly evolving, and companies are often exposed to various types of risks, which can affect their profitability and challenge the model's accuracy.

2.5. Eligibility of the Altman (1993) model to predict financial failure risk in insurance companies

The eligibility of the Altman (1993) model to predict financial failure in insurance companies is generally based on its power or accuracy to achieve the goal it was built. To assess its suitability for this research, several practical studies that used the Altman model to predict financial failure in different countries and economic systems were reviewed. These studies support the use of the Altman model in this context.

Alareeni and Branson (2013) tested the generalizability of the Altman (1968) Z-score and the Altman (1993) Z"-score models in the Jordanian environment. They used a sample of 71 failed and 71 non-failed companies, selected based on the same industry, year of data, and comparable total asset size. They examined whether the models could predict failures in Jordan as effectively as they did in the USA and European countries. They found that the original Altman (1968) Z-score model still works effectively in the Jordanian context for assessing failed industrial companies. However, for service companies, the Altman models did not provide strong indicators to differentiate between failed and non-failed companies.

Kebede et al. (2024) investigated financial failure risk determinants using the Altman Z" model for 11 listed companies in Ethiopia from 2010 to 2021. The study found that the Altman Z" model classified all insurance companies in the "gray zone". It also identified that earnings growth, firm size, profitability, and liquidity levels positively impacted the financial position of insurance companies, while claim ratios, leverage, inflation, and asset tangibility had negative effects. The study recommended using the Altman model to predict financial failure in Ethiopian companies.

Elewa (2022) examined the prediction capability of the Altman Z-score for 44 companies listed on the Egyptian Exchange using available and published financial statements from 2016 to 2020. The study found that the Altman (1993) Z" model had a higher prediction ability than the original Altman Z model. It recommended using the Altman Z" model to predict financial failure in Egyptian firms and encouraged management and decision-makers to adopt financial failure prediction models.

Dolinšek and Kovač (2024) studied the prediction capability of the Altman Z-score for two Algerian companies using available and published financial statements from 2010 to 2019. They found that the Altman model had a high prediction ability to differentiate between failed and non-failed companies. They encouraged the use of the Altman model in the Algerian environment, citing its accuracy and ease of implementation in assessing financial positions and the probability of company failure.

Cindik and Armutlulu (2021) studied the prediction ability of the Altman model alongside three other prediction models to evaluate its effectiveness in the Turkish environment. The study sample included 80 companies from 2013 to 2018. The findings confirmed the effectiveness of the Altman model and its predictive power, encouraging its use in the Turkish environment, especially for private companies.

Medjdoub and Guembour Mohamed (2020) examined the efficiency of the Altman Z" model for predicting financial failure risk in non-industrial companies. The study sample included eight companies listed on the Qatar Stock Exchange from 2018 to 2019. The author concluded that the Altman model effectively categorized organizations as either failed or non-failed companies and recommended its use in service companies due to its strong ability to forecast financial failure. The authors also emphasized that companies should rely on prediction models as early warning systems for financial failure.

Munira et al. (2021) investigated the prediction capability of the Altman and Springate models and found that the Altman model had a higher predictive ability than the Springate model, with a total

accuracy rate of 66.49%. They concluded that the Altman model could be used as an indicator for the sustainability of the mining sector.

Elia et al. (2021) examined the predictive capability of the Altman model in determining the financial failure risk of Algerian insurance companies. They found that the Altman Z" model demonstrated a substantial capacity to forecast financial difficulties, further supporting its use in this context.

Based on the above review of the financial failure risk concepts, the previous literature, and the financial failure risk prediction models, the study developed the following hypotheses:

H1: The Altman (1993) model does not achieve high accuracy rates in evaluating the financial position of insurance companies in Jordan.

H2: There is no statistically significant difference at $\alpha \leq 0.05$ between Altman (1993) model Z-scores for financially failed and not-failed insurance companies listed on the Amman Stock Exchange.

3. RESEARCH METHODOLOGY

3.1. The study variables and procedures

The study procedures: The study used the descriptive analytical approach as it is the most efficient method for achieving its objectives, and was conducted through the following steps:

1) Obtaining the financial statements for the companies in the study sample.

2) Computing the financial ratios used in the Altman model.

3) Applying the model to the study sample companies over the study period to calculate the Z-score values for each company and year.

4) Comparing the model's prediction results with the actual financial status of each company.

5) Calculating the accuracy rate for each year and for the entire study period.

The study variables: The original formula for Altman's Z-score was developed in 1968. It used the following financial ratios to compute the Z-score values, and it used the cut-off limits shown in Table 1 to judge the financial status of the study sample (Altman, 1968):

- working capital / total assets (liquidity ratio);
- retained earnings / total assets (profitability ratio);
- earnings before interest and taxes / total assets (profitability ratio);
- market value of equity / total liabilities (market value);
- sales / total assets (asset turnover).

Table 1. Altman (1968) Z-score cut-off limits

Values	*Definitions*
Z < 1.8	Financial distress and a high likelihood of bankruptcy
1.8 < Z < 2.99	The company is in a "gray zone", meaning it has a moderate possibility of bankruptcy in the near future.
Z > 2.99	The company is in the "safe zone", which means that the company has a strong financial position.

Source: Altman (1968).

The study used the Altman (1993) model, which was developed in 1993 and proposed to be used for industrial and non-industrial companies as well as private and public companies. The following equation represents this model:

$$Z'' = 6.56\,x_1 + 3.26\,x_2 + 6.72\,x_3 + 1.05\,x_4 \qquad (1)$$

where,

- Z'' = the cumulative score value;
- x_1 = working capital / total assets (liquidity ratio);
- x_2 = retained earnings / total assets (profitability ratio);
- x_3 = earnings before interest and taxes / total assets (profitability ratio);
- x_4 = book value of equity / total liabilities (book value).

The model used the cut-off limits shown in Table 2 below to discriminate between failed and unfailed companies (Altman, 1993).

Table 2. The Altman (1993) model cut-off limits

Cut-off limits (Z" values)	*Prediction status*
Z" < 1.10	The company is in financial distress and has a high likelihood of bankruptcy.
1.10 < Z" < 2.6	The company is in the gray zone, which means it has a moderate possibility of bankruptcy in the near future.
Z" > 2.6	The company is in a safe zone, which means it has a strong financial position.

Source: Altman (1993).

3.2. The study sample

The study sample consists of all insurance companies operating in Jordan during the study period, which includes the years 2018–2022. The insurance companies (the sample) were divided into two sub-samples, failed companies include those companies declared bankrupted or there shares are suspended from trading in ASE or merged with other companies, this sub-sample include two the companies that have declared liquidation, one company has been suspended from the ASE, and one company has undergone merge with a total of four companies, the second sub-sample is the un-failed insurance companies, include those listed on ASE with total of 19 companies, Table 3 below shows the non-failed Jordanian insurance companies. Table 4 includes the insurance companies declared financially failed by the government.

Table 3. Non-failed insurance companies list

No.	*Registration No.*	*Company name*	*Established year*
1	121002	Middle East Insurance Company	1962
2	121003	AL-Nisr Al-Arabi Insurance Company	1976
3	121004	Jordan Insurance Company	1951
4	121005	Arabia Insurance Company — Jordan	1975
5	121006	Delta Insurance Company	1976
6	121007	Jerusalem Insurance Company	1975
7	121008	United Insurance Company	1972
8	121009	Jordan French Insurance Company	1976
9	121013	AL Manara Islamic Insurance Company	1973
10	121014	Gulf Insurance Group — Jordan	1996
11	121020	Arab Union International Insurance Company	1976
12	121021	National Insurance Company	1965
13	121022	Jordan International Insurance Company (Newton)	1996
14	121023	Euro Arab Insurance Group	1996
15	121025	Islamic Insurance Company	1996
16	121026	The Arab Assurers Company	1996
17	121027	Arab Jordanian Insurance Group	1996
18	121032	The Mediterranean & Gulf Insurance Company	2007
19	121034	Solidarity-First Insurance Company	2008

Source: https://www.jif.jo/en

Table 4. Failed insurance companies list (2018–2022)

No.	*Registration No.*	*Company name*	*Year of suspension or liquidation*
1	121010	The Holy Land Insurance Company	2022 liquidation
2	121015	ALSafwa Insurance Company	2023 liquidation
3	121017	Arab Life and Accident Insurance	2021 merge
4	121018	Philadelphia Insurance Company	2020 suspended

Source: https://www.ase.com.jo/ar

3.3. Statistical approaches

The research used the Statistical Package for the Social Sciences (SPSS) to perform the following statistical analyses and tests.

- Descriptive statistics help get information from samples, including median, upper and lower values, standard deviation, and Z-scores for each model.
- Normal distribution test (Shapiro-Wilk): To test whether the study data follows a normal distribution or not.
- Mann-Whitney analysis: To test the study hypotheses, since the data do not follow a normal distribution, the study utilized a non-parametric test.

3.4. Source of data collection

The primary sources for research data are the website of the CBJ, the Jordan Federation of Insurance, and ASE. The secondary source of data is books, articles from journals, and the relevant information available on the internet.

3.5. Statistical analysis and hypothesis testing

This chapter summarizes the findings of statistical analysis tests performed on the research data. The first part examines the predictive ability tests of both Altman and the model for predicting financial failure in Jordanian insurance companies. The second part shows the descriptive analysis, and the third contains the validity of the study's data for statistical analysis, while the fourth part includes the hypothesis testing using the Mann-Whitney U test.

3.6. Descriptive statistics for study sample data

Table 5 shows the descriptive characteristics. The table above presents the descriptive analysis of the sample data. For financially non-failed companies, the mean Z-score is 1.571, with the lowest value being -4.37 and the highest value 9.31. For financially failed companies, the mean Z-score is -1.078, with the lowest value at -4.92 and the highest value at 2.56. The variation in the Z-score values indicates that the Altman model is capable of predicting financial failure in insurance companies.

Table 5. Descriptive analysis of the study data

Model		*Minimum*	*Maximum*	*Mean*	*Std. deviation*
Altman model Z-score	Financially non-failed companies	-4.37	9.31	1.571	2.66081
	Financially failed companies	-4.92	2.56	-1.078	2.01191

Source: Authors' elaboration.

3.7. Testing the validity of the data for a normal distribution

The study used the Shapiro-Wilk test to test the normal distribution of the sample data. Table 6 below shows the results of the normal distribution test.

Table 6 shows the result of the Shapiro-Wilk test for normal distribution for the study sample data. Since the Sig. value is less than 0.05, which indicates that the study data is not normally distributed. Therefore, the research should use a non-parametric statistical test to test the research hypotheses (Razali & Wah, 2011).

Table 6. Results of the Shapiro-Wilk test for normal distribution

Titles	*Statistic*	*Df.*	*Sig.*
Results	0.933	104	0.000

4. RESULTS

The first hypothesis (*H1*) was tested by computing the model's accuracy rate for all companies for each year of the study period, as well as the overall accuracy rate for all companies across the entire study period. For the second hypothesis (*H2*), and based on the results of the normality test, the research utilized the Mann-Whitney U-test, a non-parametric test, to measure the difference between the Altman Z-scores of failed and non-failed companies. The decision rule was to reject the null hypothesis (H_0) if the probability value (Sig. U) was less than 0.05 and to accept H_0 if the probability value (Sig. U) was greater than 0.05 (Hair et al., 2017).

4.1. Result of testing the first hypothesis (*H1*)

To determine the predictive ability and accuracy rate of the Altman model, the research compared the results of the study data analysis using the Altman model with the actual status of the companies in the study sample. This comparison was used to assess the model's effectiveness in classifying each company as either failed or non-failed. Based on this, the model's accuracy rate was computed. Table 7 below presents the predictive accuracy of the Altman model in forecasting financial failure risk alongside the actual status of the companies in the study sample.

Table 7. Results of Altman model accuracy testing (Part 1)

No.	*Company name*	*Year*	*Z" score*	*Zone*	*Result*
1	Middle East Insurance Company	2018	0.298	Bankruptcy	Not effective
		2019	0.366	Bankruptcy	Not effective
		2020	0.928	Bankruptcy	Not effective
		2021	1.244	Gray	Effective
		2022	1.336	Gray	Effective
2	AL-Nisr Al-Arabi Insurance Company	2018	2.751	Bankruptcy	Not effective
		2019	2.889	Bankruptcy	Not effective
		2020	3.137	Bankruptcy	Not effective
		2021	3.385	Bankruptcy	Not effective
		2022	3.756	Bankruptcy	Not effective
3	Jordan Insurance Company	2018	0.180	Bankruptcy	Not effective
		2019	0.746	Bankruptcy	Not effective
		2020	1.425	Gray	Effective
		2021	1.325	Gray	Effective
		2022	1.035	Bankruptcy	Not effective
4	Arabia Insurance Company — Jordan	2018	0.180	Bankruptcy	Not effective
		2019	0.746	Bankruptcy	Not effective
		2020	1.425	Gray	Effective
		2021	1.325	Gray	Effective
		2022	1.035	Bankruptcy	Not effective
5	Delta Insurance Company	2018	0.594	Bankruptcy	Not effective
		2019	0.726	Bankruptcy	Not effective
		2020	1.051	Bankruptcy	Not effective
		2021	0.815	Bankruptcy	Not effective
		2022	1.192	Gray	Effective
6	Jerusalem Insurance Company	2018	2.440	Gray	Effective
		2019	2.444	Gray	Effective
		2020	2.256	Gray	Effective
		2021	2.163	Gray	Effective
		2022	2.206	Gray	Effective
7	United Insurance Company	2018	0.413	Bankruptcy	Not effective
		2019	0.846	Bankruptcy	Not effective
		2020	0.924	Bankruptcy	Not effective
		2021	0.908	Bankruptcy	Not effective
		2022	1.173	Gray	Effective
8	Jordan French Insurance Company	2018	4.662	Safe	Effective
		2019	4.935	Safe	Effective
		2020	5.307	Safe	Effective
		2021	5.037	Safe	Effective
		2022	4.515	Safe	Effective
9	AL Manara Islamic Insurance Company	2018	1.896	Gray	Effective
		2019	2.382	Gray	Effective
		2020	4.463	Safe	Effective
		2021	2.739	Safe	Effective
		2022	2.360	Gray	Effective
10	Gulf Insurance Group — Jordan	2018	0.904	Bankruptcy	Not effective
		2019	1.671	Gray	Effective
		2020	1.681	Gray	Effective
		2021	1.491	Gray	Effective
		2022	1.995	Gray	Effective
11	Arab Union International Insurance Company	2018	0.306	Bankruptcy	Not effective
		2019	0.751	Bankruptcy	Not effective
		2020	1.005	Bankruptcy	Not effective
		2021	4.372	Bankruptcy	Not effective
		2022	3.493	Bankruptcy	Not effective
12	National Insurance Company	2018	0.565	Bankruptcy	Not effective
		2019	0.540	Bankruptcy	Not effective
		2020	0.715	Bankruptcy	Not effective
		2021	1.194	Gray	Effective
		2022	1.056	Bankruptcy	Not effective

Table 7. Results of Altman model accuracy testing (Part 2)

No.	*Company name*	*Year*	*Z" score*	*Zone*	*Result*
13	Jordan International Insurance Company (Newton)	2018	3.181	Safe	Effective
		2019	3.160	Safe	Effective
		2020	2.749	Safe	Effective
		2021	2.234	Gray	Effective
		2022	1.226	Gray	Effective
14	Euro Arab Insurance Group	2018	1.798	Gray	Effective
		2019	1.914	Gray	Effective
		2020	1.898	Gray	Effective
		2021	0.751	Bankruptcy	Not effective
		2022	1.145	Gray	Effective
15	Islamic Insurance Company	2018	8.580	Safe	Effective
		2019	8.660	Safe	Effective
		2020	9.120	Safe	Effective
		2021	9.311	Safe	Effective
		2022	3.824	Safe	Effective
16	The Arab Assurers Company	2018	1.060	Bankruptcy	Not effective
		2019	0.881	Bankruptcy	Not effective
		2020	1.365	Gray	Effective
		2021	0.544	Bankruptcy	Not effective
		2022	2.247	Bankruptcy	Not effective
17	Arab Jordanian Insurance Group	2018	0.728	Bankruptcy	Not effective
		2019	1.109	Gray	Effective
		2020	1.364	Gray	Effective
		2021	0.606	Bankruptcy	Not effective
		2022	0.201	Bankruptcy	Not effective
18	The Mediterranean & Gulf Insurance Company	2018	1.114	Gray	Effective
		2019	0.734	Bankruptcy	Not effective
		2020	1.267	Bankruptcy	Not effective
		2021	1.017	Bankruptcy	Not effective
		2022	0.629	Bankruptcy	Not effective
19	Solidarity-First Insurance Company	2018	6.764	Safe	Effective
		2019	6.450	Safe	Effective
		2020	6.457	Safe	Effective
		2021	6.946	Safe	Effective
		2022	3.508	Safe	Effective
20	The Holy Land Insurance Company	2018	1.711	Bankruptcy	Effective
		2019	4.916	Bankruptcy	Effective
		2020	N/A	N/A	N/A
		2021	N/A	N/A	N/A
		2022	N/A	N/A	N/A
21	AL Safwa Insurance Company	2018	0.984	Bankruptcy	Effective
		2019	2.475	Bankruptcy	Effective
		2020	N/A	N/A	N/A
		2021	N/A	N/A	N/A
		2022	N/A	N/A	N/A
22	Arab Life and Accident Insurance	2018	1.188	Bankruptcy	Effective
		2019	0.135	Bankruptcy	Effective
		2020	N/A	N/A	N/A
		2021	N/A	N/A	N/A
		2022	N/A	N/A	N/A
23	Philadelphia Insurance Company	2018	2.564	Gray	Not effective
		2019	0.792	Bankruptcy	Effective
		2020	0.059	Bankruptcy	Effective
		2021	N/A	N/A	N/A
		2022	N/A	N/A	N/A

Source: Authors' elaboration.

The table above shows the model's accuracy rate for each year: 56.5% for 2019, 65% for 2020, 57.9% for 2021, and 75.9% for 2022. Overall, the Altman model was effective in 59 out of 104 cases, with an accuracy rate of 56.7%. As a result, the *H1* is rejected, as the data analysis reveals a moderate predictive accuracy rate. This finding is consistent with the results of the study by Alareeni and Branson (2013).

Additionally, the results of testing this hypothesis are supported by the descriptive analysis of the Altman model's predictive accuracy rate in Table 5. The table shows that the mean Z-score value for failed companies is -1.078, which falls within the range of companies expected to fail according to the cut-off points established by the Altman model. The model classifies companies with Z-score values below 1.1 as likely to fail. Similarly, the descriptive analysis in Table 5 shows that the mean Z-score value for non-failed companies is 1.571, which falls within the range of companies expected to remain solvent. The model classifies companies with Z-score values above 1.1 as unlikely to fail.

4.2. Result of the second hypothesis (*H2*) testing

Table 8 shows the result of the second hypothesis *H2* testing.

Table 8. Mann-Whitney test results for the first main hypothesis testing

Item	*N*	*Mean rank*	*Decision*
Financially non-failed	95	55.37	Reject *H1*
Financially failed	9	22.22	
Mann-Whitney U = 155		Sig. U = 0.002	

Table 8 above presents the results of the Mann-Whitney U test for the difference between the Altman model Z-scores of financially failed and non-failed insurance companies listed on the ASE. The Mann-

Whitney U value is 155, and the Sig. value is 0.002, which is lower than 0.05. This indicates a statistically significant difference between the Altman model Z-scores of financially failed and non-failed insurance companies at a significance level of less than 0.05.

The results of testing this hypothesis are further supported by the descriptive analysis of the Altman Z-score values in Table 5. The analysis shows that the difference between the mean Z-score values of non-failed and financially failed insurance companies is 2.649, which is significant, as confirmed by the hypothesis testing. This demonstrates that the Altman model is capable of discriminating between failed and non-failed insurance companies.

Based on these results, H_0 is rejected, and the alternative hypothesis, which states that there is a statistically significant difference at $\alpha \leq 0.05$ between the Altman model Z-scores of failed and non-failed insurance companies listed on the ASE, is accepted. Furthermore, by comparing the mean ranks, it is evident that this difference favors the financially non-failed companies.

5. DISCUSSION

5.1. The first hypothesis (*H1*)

The analysis of Table 7 reveals that the earlier the prediction (i.e., the farther away from the year in which financial failure occurred), the lower the accuracy rate of the prediction. The accuracy rates for the years 2018, 2019, 2020, 2021, and 2022 are 47.8%, 56.5%, 65%, 57.9%, and 75.9%, respectively, with an overall accuracy rate of 56.7%. This moderate prediction rate leads to the rejection of the *H1*.

Several studies support these findings. Ashraf et al. (2019) found that the Altman model had an accuracy rate of 66.3% in predicting financial failure risk, and Samkin et al. (2012) reported an accuracy rate of 69.8% for the Altman model in New Zealand. Al-Manaseer and Al-Qshaibat (2018) used the Altman model to examine the likelihood of financial failure risk in Saudi cement companies and found an accuracy rate of 60%. Salina et al. (2024) concluded that the Altman model could accurately forecast financial failure in Kazakh banks with an accuracy rate of 44.05%. Kebede et al. (2024) and Elewa (2022) both supported the capability of the Altman model to predict financial failure. Medjdoub and Guembour Mohamed (2020) and Elia et al. (2021) found that the Altman model is a reliable tool with significant predictive ability to detect financial failure risk. The researchers believe that the accuracy rate of 56.7% found in this study is reasonable and acceptable, as it aligns closely with the accuracy rates reported in the aforementioned studies. It is important to note that these studies were conducted across different economic sectors and under varying economic circumstances. Therefore, the Altman model can be considered a dependable tool for predicting financial failure in insurance companies.

5.2. The second hypothesis (*H2*)

The results of the current study indicate that the Altman model is effective in discriminating between failed and non-failed companies. This finding is consistent with several previous studies. Dolinšek and Kovač (2024) found that the Altman model can distinguish between financially failed and non-failed companies. Medjdoub and Guembour Mohamed (2020) concluded that the Altman model is effective in predicting the probability of companies' financial failure. AlQaisi (2016) demonstrated that the Altman model can discriminate between failed and non-failed companies up to three years before failure occurs.

However, the results of this study are not compatible with the findings of Alareeni and Branson (2013), who found that while the original Altman (1968) Z-score and the 1993 models are effective in assessing failed industrial companies in the Jordanian context, they do not provide strong indicators for differentiating between failed and non-failed service companies. Additionally, Sharma and Bolda (2022) noted that Altman's Z-score model is widely used globally, likely due to its simplicity compared to other models.

Based on the above discussion, the researchers believe that the results of this study align with the majority of previous studies that have examined the validity of the Altman (1993) model in distinguishing between companies expected to fail and those not expected to fail. At the same time, the model is widely recognized for its simplicity. Therefore, the researchers recommend relying on the Altman model to predict financial failure risk in insurance companies.

6. CONCLUSION

Based on the discussion of the results, the study concludes that the Altman model is capable of predicting financial failure in insurance companies. This conclusion is supported by the model's accuracy rate of 56.7%, which is consistent with the results of many other studies that have used the model to predict financial failure risk in various sectors, such as banks, industrial companies, and service companies. Additionally, the results of the hypothesis testing and the descriptive analysis of the study data further validate this conclusion. The descriptive analysis revealed a significant difference between the mean Z-score values of failed and non-failed companies. Specifically, the mean Z-score for non-failed companies was greater than 1.1, while the mean Z-score for failed companies was less than 1.1, both of which align with the classification ranges established by the Altman model's cut-off points. This supports the study's findings regarding the model's ability to predict financial failure risk in insurance companies, the findings of the study is supported by the findings of previous studies that assess the model ability to predict financial failure risk in different sectors and improve its ability predict financial failure risk and assess the financial position in one of the main economic sectors, enrich the theoretical literature in financial prediction subject, and the results of the study has a special important for the users of financial data of Jordanian insurance companies because it faces different financial difficulties, the study face a main limitation represented by the small size of the study sample, while it include all insurance companies operating in Jordan and listed on ASE during the study period.

Moreover, the Altman model is widely recognized for its simplicity and ease of use. However, given the moderate accuracy rate identified in this study, the researchers recommend using additional predictive models alongside the Altman model to enhance the quality and reliability of the decision-making process.

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