

## **ORIGINAL ARTICLE**

# **A SURVEY ON MEASURING FINANCIAL DISTRESS PREDICTION USING ALTMAN Z-SCORE MODEL FOR LIFE AND PENSION COMPANIES IN TÜRKİYE**

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### **Abstract**

The insurance market is crucial for both the national economy and the financial market. It contributes to the country's economy by ensuring the healthy operation of the financial industry and protecting it from risk. There are non-life, life, pension, and reinsurance companies operating in the insurance market. This study's financial failure evaluations were conducted using financial ratios obtained from the financial statements of 17 life and pension insurance companies operating in Turkey between 2019 and 2023. In this context, the Altman Z-Score model is used to assess bankruptcy risk. The Altman Z-Score results for the relevant periods have been calculated using the model established with a total of 4 commonly used ratios, and it has been determined that insurance companies generally fall into the risky zone.

### **Keywords**

Insurance market, Financial market, Distress risk, Altman Z-score, Life and pension companies

### **JEL Classification**

G21, G32, H12, G18.

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## 1. INTRODUCTION

While it's unknown when and where humans will encounter risks, it's also uncertain what types of risks companies providing coverage against these risks may face. Although the timing and nature of risks may be unpredictable, the types of risks are generally identifiable. In general, the types of risks for companies stem from bankruptcy, insufficient capital, failure to adopt effective management principles, and internal mismanagement practices.

Insurance companies are significant both in Türkiye and globally, representing a distinct market type. In Türkiye, according to the Insurance Law no: 5684, the insurance market is primarily divided into two main groups: life and non-life insurance.

Additionally, there are individual pension companies operating under the scope of Law No. 4632. The private pension system (PPS), initiated with legislation in 2001, was designed as a savings instrument to help individuals maintain their welfare levels during retirement. This method enables people to save and invest the money they earn throughout their working years for their retirement. PPS functions primarily as a voluntary system that supplements the public sector's required retirement systems, with pension corporations functioning in this field (Law No. 4632, 2001).

Non-life insurance undertakes to cover damages occurring to the properties of individuals or legal entities, whereas life insurance concerns individuals' lives. Life insurance is made based on the possibility of individuals living or dying. In the type of insurance made against the possibility of survival, if the insured individual does not experience death within the specified period stated in the insurance contract, they receive compensation payment. In the type of life insurance made against the possibility of death, when the individual passes away, the risk occurs, and compensation payment is based on the beneficiaries or legally designated heirs specified in the contract. These types of insurance are also divided into specific subgroups, each providing coverage against certain risks.

This type of assurance, in the form of compensation payments, is known to provide individuals with both financial and emotional relief. It should be noted that for compensation to be paid, the individual with the status of insured or policyholder must fulfill their obligations before or after the occurrence of the risk covered by the insurance contract. It is important not to assume that these obligations only belong to the insured or policyholder. The individual or legal entity establishing the insurance contract with the status of insurer also has certain duties and obligations. Both parties are responsible for fulfilling their duties and obligations before, during, or after the establishment of the contract (Sayın, 2019, s.682).

Insurance companies, besides being institutions that assume risk for a certain premium, also function as risk transfer centers. It is expected that insurance companies that assume risks also have a strong financial structure. In this context, it is important to know the financial status of insurance companies or, in other words, their risk of bankruptcy. Companies at risk of bankruptcy may have the opportunity to reduce this risk through the concept known as reinsurance in the insurance industry, which is a method of transferring risk (Yaman ve Şakar, 2022, s.29). As a result of all these, measuring the risks of insurance companies enables them to decide on measures they can take against potential risks and contributes to increasing the sense of trust they provide to insured/policyholder individuals.

The purpose of this study is to analyze the bankruptcy risk of a total of 17 insurance companies operating in Life and Pension activities in Türkiye using the Altman model with the end-of-period data from 2019 to 2023 and to enable comparison of these companies with this model. The study is divided into three parts, the first of which includes a brief introduction. The second part involves a literature review related to the subject and the analysis method used. The third and final part focuses on financial analysis, utilizing important financial ratios in the insurance sector, and analyzing the bankruptcy risk of insurance companies using the Altman Z-Score model.

## 2. LITERATURE REVIEW

This section contains a literature review based on the relevant study's findings. In their study, Akın and Ece (2013) examined 7 insurance companies in Türkiye and conducted a financial performance analysis. The analysis conducted using financial ratios revealed a decrease in the performance of insurance companies over the years.

Bülbül and Köse's (2016) study examined the financial performance of non-life insurance companies operating in Turkey using the Promethee method. The analysis revealed that more than half of the companies had negative performance over the years.

In the study by Wulandari and Septiarini (2018), the financial failures of Sharia life insurance companies in Indonesia and Malaysia were measured. It was revealed that companies in Indonesia had a better financial condition compared to those in Malaysia.

AlKulaib and AlAi (2019) examined the relationship between Altman score and stock price of insurance companies listed on the Kuwait Stock Exchange. As a result, it was found that there is no significant relationship between Altman score and stock price, and the analysis results obtained with the Altman model for the companies studied over the years were found to be declining.

In their study, Nustini and Amiruddin (2019) compared the financial failures of Islamic and conventional insurance companies. They found that the financial success of Islamic insurance companies was higher.

In Zelig's study (2019), conducted to determine the factors influencing the financial success of insurance companies in Ethiopia, it was found that profitability and liquidity ratios have a positive effect on financial success, while leverage ratios have a negative effect.

In their study, Karadeniz and Öcek (2019) used 13 specific ratios for tourism businesses listed on BIST (Borsa Istanbul). They found that out of 11 companies, 5 were classified as unsuccessful, 1 was in the gray zone, and 5 companies were in the safe zone.

In the study conducted by Maulidya and Filianti (2020), 11 Islamic insurance companies were examined, and their financial failures were predicted. According to the results, it was determined that 5 out of 11 life insurance companies were financially unsuccessful.

In the study conducted by Eka, Diah, and Herawaty (2021), the financial failures of state-owned insurance companies in Indonesia were measured. Analyzing the data from 2014 to 2016, it was observed that the companies overall were unsuccessful.

In the study by Yaman and Şakar (2022), which focused on companies listed on the BIST (Borsa Istanbul), a total of 6 companies were examined. It was found that 2 of these companies were at risk of bankruptcy, 3 were in the safe zone, and 1 was in the gray zone.

In the study by Karavar and Yaman (2024), focusing on private health insurance companies operating in Türkiye, a total of 7 companies were examined. It was found that 1 of these companies was at risk of bankruptcy, 3 were in the safe zone, and 3 were in the gray zone.

Apart from the studies mentioned in the literature, no similar study conducted with this model has been encountered, making this study the first of its kind using this method. In terms of literature, this study represents a pioneering effort for life and retirement insurance companies.

## 3. RESEARCH AND METHODOLOGY

### 3.1. Objective and Scope

The primary objective of this article is to determine the level of financial success of insurance companies operating in the life and pension branches in Türkiye and to create a prediction model with the highest accuracy rate. The study included 17 insurance companies operating in the life and pension branches. In 2023, there were 72 insurance companies in Türkiye (Insurance Association of Türkiye, 2024). 55 companies that do not operate in life and pension activities were excluded from the calcula-

tions. Financial failure analysis was conducted using the financial statement data of the 17 insurance companies operating between 2019 and 2023. The insurance companies and their codes forming the scope of the study are shown in Table 1.

**Table 1**

*Insurance Companies Whose Financial Performance Was Measured*

Serial Number	Company Code	Company Name
1	BNPH	BNP Paribas Cardif Hayat Sigorta AŞ
2	DEMIR	Demir Sağlık ve Hayat Sigorta AŞ
3	MAPFRE	Mapfre Yaşam Sigorta AŞ
4	VIENLIFE	Viennialife Emeklilik ve Hayat AŞ
5	ALLIANZHYT	Allianz Hayat ve Emeklilik AŞ
6	ALLIANZYSM	Allianz Yaşam ve Emeklilik AŞ
7	ANADOLU	Anadolu Hayat Emeklilik AŞ
8	BEREKET	Bereket Emeklilik ve Hayat AŞ
9	AGESA	AgeSA Emeklilik ve Hayat AŞ
10	AXA	Axa Hayat ve Emeklilik AŞ
11	BNPE	BNP Paribas Cardif Emeklilik AŞ
12	QNB	QNB Sağlık Hayat Sigorta ve Emeklilik AŞ
13	FIBA	Fiba Emeklilik ve Hayat AŞ
14	GARANTI	Garanti Emeklilik ve Hayat AŞ
15	NN	NN Hayat ve Emeklilik AŞ
16	KATILIM	Katılım Emeklilik ve Hayat AŞ
17	METLIFE	Metlife Emeklilik ve Hayat AŞ

The financial analysis of the insurance companies listed in Table 1 has been conducted. The data pertaining to the results of the model are provided in Table 2. In the relevant Table, companies are compared based on their Z-score results over the years.

### 3.2. Methodology

Altman's weighted formula for non-manufacturing enterprises is the modified Z-Score equation (Altman, 1995), often known as the Altman (Z-Score) modification. The following is also employed in our study (Altman, 2000):

$$Z = 6,56 X1 + 3,26 X2 + 6,72 X3 + 1,05 X4$$

$X1$  = Working Capital (Current Assets - Current Liabilities) / Total Assets

$X2$  = Retained Earnings / Total Assets

$X3$  = Earnings Before Interest and Taxes (EBIT) / Total Assets

$X4$  = Total Equity Value / Total Liabilities

The evaluation of Z-score results involves reference range values. Based on these values, the results obtained can be interpreted regarding the insurance companies, as provided in Table 2.

**Table 2**  
*Comparison of Altman Z-Score Model Score Ranges*

Z-score Ranges for Publicly Traded Manufacturing Sector Companies (Altman, 1968)	Altman Z-Score Ranges for Private Manufacturing Companies (Altman, 2000)	Altman Z-Score Ranges for Private Sector Service Companies (Altman, 2000)
Z-score > 2.99 indicates the safe zone.	Z-score > 2,90 indicates the safe zone.	Z-score > 2,60 indicates the safe zone.
$1.8 \leq Z\text{-score} \leq 2.99$ indicates the gray zone.	$1,23 \leq Z\text{-score} \leq 2,90$ indicates the gray zone.	$1,10 \leq Z\text{-score} \leq 2,60$ indicates the gray zone.
Z-score < 1.8 indicates the risky zone.	Z-score < 1,23 indicates the risky zone.	Z-score < 1,10 indicates the risky zone.

**Source:** Yaman ve Şakar, 2022, s.37

According to Table 2, the reference range values for Altman Z-score ranges for private sector service companies should be selected. The analysis will be interpreted based on this reference range.

### 3.3. Findings

Table 3 shows the Altman Z-score results applied to the financial statements of the 17 life and pension insurance companies operating in Turkey between 2019 and 2023.

**Table 3**  
*Altman Z-Score Results for Life and Pension Insurance Companies*

	2019	2020	2021	2022	2023
<b>BNPH</b>	3,26	2,67	2,08	2,10	2,46
<b>DEMIR</b>	2,13	2,54	2,65	2,04	2,46
<b>MAPFRE</b>	4,26	5,20	5,06	5,33	6,00
<b>VIENLIFE</b>	5,57	5,79	6,23	6,26	6,15
<b>ALLIANZHYT</b>	0,69	0,49	0,41	0,42	0,51
<b>ALLIANZYSM</b>	0,81	0,58	0,85	0,87	0,79
<b>ANADOLU</b>	0,45	0,43	0,41	0,48	0,51
<b>BEREKET</b>	0,81	7,72	1,17	1,69	1,67
<b>AGESA</b>	0,54	0,52	0,81	0,84	0,85
<b>AXA</b>	0,98	4,02	0,64	0,36	0,87
<b>BNPE</b>	1,00	0,56	0,74	0,62	0,72
<b>QNB</b>	2,70	2,17	3,28	2,74	4,00
<b>FIBA</b>	0,53	0,90	0,40	0,47	0,53
<b>GARANTI</b>	0,94	0,44	0,66	0,58	0,63
<b>NN</b>	0,19	0,15	0,13	0,10	0,17
<b>KATILIM</b>	0,36	0,36	0,36	0,36	0,42
<b>METLIFE</b>	2,32	2,30	2,41	1,72	1,59

Table 3 provides the Z-scores of the companies. According to the Altman Z model applied to all insurance companies examined in the study, companies with a Z-score below 1.10 are at risk of financial distress. The comparative risk zones of companies based on their Z-scores over the years are provided in Table 4.

**Table 4***Risk Zones of Insurance Companies by Year*

	2019	2020	2021	2022	2023
<b>BNPH</b>	Safe	Safe	Gray	Gray	Gray
<b>DEMIR</b>	Gray	Gray	Safe	Gray	Gray
<b>MAPFRE</b>	Safe	Safe	Safe	Safe	Safe
<b>VIENLIFE</b>	Safe	Safe	Safe	Safe	Safe
<b>ALLIANZHYT</b>	Risky	Risky	Risky	Risky	Risky
<b>ALLIANZYSM</b>	Risky	Risky	Risky	Risky	Risky
<b>ANADOLU</b>	Risky	Risky	Risky	Risky	Risky
<b>BEREKET</b>	Risky	Safe	Gray	Gray	Gray
<b>AGESA</b>	Risky	Risky	Risky	Risky	Risky
<b>AXA</b>	Risky	Safe	Risky	Risky	Risky
<b>BNPE</b>	Risky	Risky	Risky	Risky	Risky
<b>QNB</b>	Safe	Gray	Safe	Safe	Safe
<b>FIBA</b>	Risky	Risky	Risky	Risky	Risky
<b>GARANTI</b>	Risky	Risky	Risky	Risky	Risky
<b>NN</b>	Risky	Risky	Risky	Risky	Risky
<b>KATILIM</b>	Risky	Risky	Risky	Risky	Risky
<b>METLIFE</b>	Gray	Gray	Gray	Gray	Gray
<b>Number of Companies</b>					
<b>Safe Zone</b>	4	5	4	3	3
<b>Gray Zone</b>	2	3	3	4	4
<b>Risky Zone</b>	11	9	10	10	10

According to the indicators in Table 4, over the years, out of the 17 insurance companies, 3 or 4 are successful, 3 or 4 are in the gray zone, meaning they are at a normal level, while 10 companies are in the financially risky zone. Additionally, it is observed that companies located in the financially safe zone have consistently maintained their success over the years. In order to determine the reasons for classification as successful or unsuccessful, the average values of 4 financial ratios calculated for the companies between 2019 and 2023 were examined, and a Mann-Whitney U test was conducted to determine if there were any differences in terms of financial ratios during the analysis process (Karadeniz and Öcek, 2019: 200). The results of the Mann-Whitney U test analyzed with the SPSS Statistics 25 program are presented in Table 5.

**Table 5***Results of the Analysis of Differences in Financial Ratios Between Insurance Companies at Risk of Financial Failure and Those Not at Risk of Financial Failure*

<b>Ratios</b>	<b>Average of Failed Companies (n = 49)</b>	<b>Average of Successful Companies (n = 19)</b>	<b>Mann-Whitney U Value</b>	<b>Z Value</b>	<b>Probability</b>
<b>X1</b>	0,058	0,534	39,000	-5,829	0,000
<b>X2</b>	0,022	0,151	125,000	-4,654	0,000
<b>X3</b>	0,010	0,082	188,000	-3,797	0,000
<b>X4</b>	0,028	0,122	79,000	-5,283	0,000

Looking at the values provided in Table 5, it is evident that there is a statistically significant difference between the ratios of successful and unsuccessful companies. The highest difference is observed in variable X1, which represents the proportion of working capital to total assets. The variable with the least difference is X3, representing the ratio of pre-tax and interest income to total assets. Overall, successful companies tend to have higher ratios across all variables compared to unsuccessful companies.

## RESULTS AND RECOMMENDATIONS

Monitoring and overseeing the insurance market, which holds a key importance in the finance sector, both remotely and closely, is of paramount importance. This is because any issues within this market could potentially spillover to other sectors and lead to systemic risk.

Therefore, it is crucial for insurance and pension companies, as well as regulatory authorities, to continuously measure and monitor their financial risks.

The study utilized data from 17 insurance companies operating in the life and pension sector in Türkiye between 2019 and 2023, using the Altman Z-score model developed by Altman. According to the study aiming to measure the financial distress of companies, based on the data from the past two years, it was found that 3 companies had no risk of bankruptcy, 10 companies had a high risk of bankruptcy, and the risk of bankruptcy for the remaining 3 companies was uncertain. It was identified that the ratios contributing the most to the low Z-score of companies with high bankruptcy risk were the ratios of working capital to total assets, undistributed profits to total assets, and total equity value to total liabilities. The study, in terms of the literature reviewed and insurance companies considered, bears resemblance to the studies conducted by Akin and Ece (2013), Zelié (2019), Maulidya and Filianti (2020), Diah and Herawaty (2021), and Yaman and Şakar (2022).

When the results of the studies in the literature are evaluated, it is thought that the Z-score result obtained from the Altman Z-score model is a strong prediction in measuring financial failure. In the context of these evaluations, companies will be able to measure financial performance by applying this model to predict both their current conditions and their own financial failure. In addition, public authorities will evaluate companies better by making similar models and scoring and will have the opportunity to take precautions in advance. In this way, the trust in the insurance sector will be established for both the insured and the sector players. Companies with a high level of bankruptcy risk can also evaluate this study positively in order to take the necessary precautions and make various financial decisions. These decisions may be related to the assets, capital, profit amounts and equity of the business.

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**How to cite this article:** Akkurt, E., & Umut, M. (2024). A survey on measuring financial distress prediction using Altman Z-score model for life and pension companies in TÜRKİYE. *International Journal of Insurance and Finance*, 4(1), 1-8. <https://doi.org/10.52898/ijif.2024.1>