Available online at http://www.iorajournal.org/index.php/ijgor/index

International Journal of Global Operations Research

e-ISSN: 2722-1016
p-ISSN: 2723-1739

Vol. 5, No. 4, pp. 256-262, 2024

Bankruptcy Prediction Analysis of Life Insurance Companies Using Altman Z-Score dan Ohlson O-Score Methods

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Abstract

Life insurance is one of the non-bank industries that offers guarantees to overcome risks. In its implementation, life insurance companies need to maintain the survival of the company in the midst of increasing economic competition so that they don't face the threat of bankruptcy. Bankruptcy itself is a legal status of a certain entity or company that cannot pay its debts to creditors and the company's operations cannot be continued due to lack of funds. This study aims to compare the accuracy of the Altman Z-Score and Ohlson O-Score methods in predicting the bankruptcy of life insurance companies in Indonesia, such as PT Axa Financial Indonesia, PT Taspen Life, Asuransi Jiwa Bersama (AJB) Bumiputera 1912, PT Avrist Assurance, and PT Reliance Life Insurance Indonesia. The data used in this study is secondary data in the form of financial statements of life insurance companies taken from the official website of the relevant company. The results showed that the comparison between the two models revealed that the Altman method is better in predicting company bankruptcy. This is because the Altman method has a more detailed classification of conditions compared to the Ohlson method.

Keywords: bankruptcy prediction, altman z-score, ohlson o-score, life insurance.

1. Introduction

The life insurance industry is one of the non-bank industries that is a pillar of the economy in Indonesia. Life insurance companies offer guarantees to overcome risks that will occur in the future with an agreement agreed upon by the insurer and the insured (Yuliadi, 2024). The guarantee given is usually a sum of money to compensate for the losses received. Like any other company, life insurance companies aim to maximize profits and also maintain the company's survival in the midst of increasing economic competition. Moreover, in recent decades, the sector has faced increasingly complex challenges, such as fluctuations in global financial markets, tight regulation, and pressure on profitability due to high claims and low interest rates. This makes life insurance companies suffer from unfavorable financial conditions and are threatened by bankruptcy.

According to Karamzadeh (2013), bankruptcy is a legal status of a person or company that cannot pay its debts to creditors. The company's existence cannot be continued due to lack of funds. Life insurance companies that experience bankruptcy will have a negative impact on several stakeholders, such as the company itself, policyholders, investors, and the entire economy. When an insurance company goes bankrupt, not only is public trust compromised, but there is also a risk of loss of expected policy benefits. This can worsen financial system instability and lead to greater uncertainty in the market. Therefore, early identification of potential insolvency is crucial to maintain the stability of the insurance sector and protect stakeholders.

In terms of predicting bankruptcy, there are several methods that can be used. Based on the literature, among the existing methods, ratio analysis and market risk analysis are considered more valid. Market risk analysis uses market risk fluctuations to estimate the probability of bankruptcy of a company. On the other hand, ratio analysis estimates the probability of bankruptcy using several financial ratios that have been selected by experts.

Two frequently used models are the Altman Z-Score and the Ohlson O-Score model. The Altman Z-Score model was developed by Edward Altman in 1968. This model combines several important financial ratios to determine whether a company is in the safe zone, gray zone, or bankruptcy risk zone. The superiority of Altman Z-Score lies in its simplicity and efficiency in processing financial data to produce accurate predictions (Bellovary, 2007).

On the other hand, the Ohlson O-Score model, developed by James Ohlson in 1980 uses logit analysis to develop a bankruptcy prediction model. Unlike the Altman Z-Score which is based on a linear combination of financial ratios, the Ohlson model utilizes various independent variables that are thought to influence the probability of bankruptcy. The logit model is a further development of the linear probability model which explains that logit model analysis is

used to estimate the probability of a phenomenon by reducing the weaknesses contained in linear probability (Irawan et al., 2017).

In Karamzadeh (2013), the Altman Z-Score and Ohlson O-Score models were used to predict bankruptcy in Iranian listed companies. A comparison of the prediction accuracy of the two models over a period of one, two, and three years before bankruptcy was conducted. It was found that the Altman model provided more predictive results than the Ohlson model, especially in the previous one year with 74.4% accuracy. The type I and type II error rates were also calculated for both models, showing their effectiveness in distinguishing between bankrupt and non-bankrupt companies. The prediction results obtained state that there are no companies in the grey area.

Suganda & Kim (2023) utilized Altman Z-Score, k-score, and distance to default (DTD) in investigating the relationship between corporate social responsibility (CSR) and default risk. The z-score is used to standardize the data to minimize the impact of outliers and ensure the statistical analysis results are not biased towards extreme values. A least-square dummy variable (LSDV) regression model was also used to analyze the impact of CSR on default risk. The results of this study confirm that there is a negative relationship between CSR and default risk, indicating that firms with higher levels of CSR involvement tend to have lower default risk.

In measuring the level of financial distress in the insurance sector in Ethiopia, Ayinaddis & Tegegne (2023) used the revised Altman Z-Score model. Financial data of insurance companies from 2010 to 2020 were collected to classify the companies based on their financial health. In addition, the revised Altman Z-Score model was collaborated with ordinary least-square (OLS) panel data regression to obtain the analysis. Based on the z-score results, it is found that the financial distress condition of Ethiopian insurance companies has variability. Some companies fall into the grey area category, and some other companies are in the safe category.

The application of the Altman Z-Score model as a predictive model in assessing company performance on the Hong Kong stock exchange is used by Fung (2023) for the purpose of teaching students, teachers, and investors. The object of focus in this study is the manufacturing companies whose ratios are more relevant for the z-score model. The stock return in two time periods is used as data, and the results show that the z-score model remains valid in various time periods. The simplicity of this model makes it easy to teach students. However, in the context of real-life investment decisions, it is recommended to add the use of other models for better results.

Similar to Ayinaddis & Tegegne (2023), Kebede el al. (2024) also examined the financial distress of insurance companies in Ethiopia. In addition to using the Altman Z-Score to categorize firms based on their financial distress, multiple linear regression models were applied to evaluate the effects of firm-specific and macroeconomic factors on financial distress. Profitability, liquidity, firm size, revenue growth, claims ratio, and inflation rate were identified as the main determinants of financial distress in the Ethiopian insurance business, and it was found that insurance companies in Ethiopia have financial health conditions that are not in the safe zone.

Table 1: Research Gap

Authors	Variables	Methods	Using Altman Z-Score	Using Ohlson O-Score	Insurance Companies
Karamzadeh, 2013	Profitability, liquiduty, solvency ratio, leverage	Altman and Ohlson	Yes	Yes	No
Suganda & Kim, 2023	Corporate social responsibility (CSR), default risk	Regression analysis, Altman, and Ohlson	Yes	Yes	No
Ayinaddis & Tegegne, 2023	Leverage, profitability ratio, gross domestic product (GDP)	Altman and regression analysis	Yes	No	Yes
Fung, 2023	Profitability, liquidity, solvency ratio, leverage	Altman	Yes	No	No
Kebede et al., 2024	Profitability, claim, liquidity ratio, leverage	Altman, Pearson Correlation Analysis	Yes	No	Yes
This Research	Profitability, liquidity, solvency ratio, leverage	Altman and Ohlson	No	Yes	Yes

Based on the results of the research above, this research was conducted to compare the accuracy of the Altman Z-Score and Ohlson O-Score methods in predicting the bankruptcy of life insurance companies in Indonesia, such as PT Axa Financial Indonesia, PT Taspen Life, Asuransi Jiwa Bersama (AJB) Bumiputera 1912, PT Avrist Assurance, and PT Reliance Life Insurance Indonesia. By using historical financial data from life insurance companies, this study will

look at the analysis. of the two models in predicting bankruptcy over a three-year time period. The results of this study are expected to contribute to the bankruptcy prediction literature in the insurance sector, as well as provide insight for company management and investors in strategic decision making.

2. Literature Review

Financial Statements

Financial statements are statements that provide information about the financial condition of a company to show the performance of a company's finances. This financial statement has a very important role to determine the extent to which the company has achieved its goals and to measure the results and development of the company over time (Hidayat, 2018).

The purpose of the financial statements of a company according to Kasmir (2008) as cited by Fatihudin (2018) are:

a). Provides information about the number and type of assets owned by the company
b). Provides information about the amount and type of liabilities and capital owned by the company.
c). Provides information about the amount and type of income earned by the company in a certain period.
d). Provides information about the amount and type of company costs incurred in a certain period.
e). Provides information about changes in the company's assets, liabilities and capital.
f). Provides information about company management.
g). Provides information about the notes to the financial statements.
h). Provides other financial information

According to Prihadi (2019) in general, financial statements are divided into four types, including the statement of financial position (balance sheet), income statement, cash flow statement and statement of changes in equity. This statement can be used for the financial analysis of the company.

Financial Statement Analysis

Purnama, (2020) state that financial statement analysis is the process of studying financial data with the aim of gaining an understanding of the financial position, operating results, and progress of a company. In this way, financial statement analysis can be used as a basis for decision making for interested parties and also for conducting their analysis. The purpose of financial statement analysis is to identify what is needed or obtained from the resulting analysis. With the existence of goals, further analysis can be organized, have limits, and achieve the desired results (Fatihudin, 2018).

One of the tools for analyzing financial statements is using financial ratios. There are 4 types of financial ratios including liquidity ratios, solvency ratios, activity ratios, and profitability ratios.

Bankruptcy

According to Toto (2011) as cited by Abdin (2022) bankruptcy is a condition of a company that is unable to run its business because it is unable to pay its debts or obligations. Early indications of a company experiencing bankruptcy can be identified through an analysis of the company's financial ratios.

Bankruptcy makes the company no longer carry out business activities, so it is unable to generate financial benefits. In addition, bankruptcy also has an impact on the losses experienced by the company, such as the inability to pay off debts or costs incurred due to claims from parties who have rights to the company (Abdin, 2022).

3. Materials dan Methods

3.1. Materials

In this research, bankruptcy prediction is done on life insurance companies in Indonesia, such as PT Axa Financial Indonesia, PT Taspen Life, Asuransi Jiwa Bersama (AJB) Bumiputera 1912, PT Asuransi Avrist Assurance, and PT Asuransi Jiwa Reliance Indonesia. The analysis was carried out using software assistance, namely Microsoft Excel to calculate the values needed in the two methods used, namely Altman z-score and Ohlson o-score.

3.2. Methods

There are several methods in predicting bankruptcy. The most effective methods are ratio analysis and market risk analysis. Market risk analysis calculates market risk fluctuations to estimate the probability of bankruptcy of a company. Meanwhile, ratio analysis uses financial ratios that have been selected by experts to estimate the probability of bankruptcy of a company.

Two frequently used models are the Altman Z-Score and the Ohlson O-Score model. In the Altman model, important financial ratios are used to determine whether a business is in the safe zone, gray zone, or bankruptcy risk zone. The advantage of Altman Z-Score lies in its ease and efficiency of processing to produce accurate predictions

from financial data. Meanwhile, the Ohlson O-Score model uses logit analysis which is an evolution of the linear probability model used to estimate the likelihood of a phenomenon by reducing the shortcomings of linear probability.

3.2.1. Altman Z-Score

In 1968, Edward I Altman introduced the z-score formula which is used to predict the probability that a company will go bankrupt within 2 years (Karamzadeh, 2013). This Altman model uses MDA (Multivariate Discriminant Analysis). Altman has developed over time. This is done with the aim that it can be applied to many companies, one of which is a life insurance company (Maulana,, 2024).

The first model introduced by Altman had five variables in the form of company financial ratios. The equation used in this model is:

$$Z = 1.21X_1 + 1.42X_2 + 3.3X_3 + 0.64X_4 + 0.999X_5$$

Meanwhile, the modified model has four variables with the following equation:

$$Z = 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4$$

where,

X_1= Working Capital to Total Assets
X_2= Retained Earning to Total Assets
X_3= Earning Before Interest and Taxes to Total Assets
X_4= Total Equity to Total Debt Ratio

The equation will produce a cut off value. This value is used to predict the potential bankruptcy of a company. The criteria for the cut off value are as follows.

Bankrupt : $Z < 1.23$
Grey area : $1.23 < Z < 2.9$
Non-bankrupt : $Z > 2.9$

3.2.2. Ohlson O-Score

James Ohlson invented the o-score model in 1980 to predict corporate bankruptcy using logit analysis in the development of a model that has nine independent variables. The equation of this model is:

$$O = -1.32 - 0.407Y_1 - 6.03Y_2 - 1.43Y_3 - 0.0757Y_4 - 2.37Y_5 - 1.72Y_6 - 0.285Y_7 - 1.72Y_8 - 0.521Y_9$$

Where,

Y_1 = Log (total assets to GNP price-level index)
Y_2 = Total liabilities to total assets
Y_3 = Working capital to total assets
Y_4 = Current liabilities to current assets
Y_5 = 1 if total liabilities exceeds total assets, 0 otherwise
Y_6 = Net income to total assets
Y_7 = Funds provided by operations to total liabilities
Y_8 = 1 if net income was negative for the last two years, 0 otherwise
$Y_9 = \frac{(NI_t - NI_{t-1})}{(|NI_t| + |NI_{t-1}|)}$, where $\mathrm{NI_t}$ is net income for the most recent period

Accorduing to Irawan et al. (2017), the cut-off value obtained from the equation is classified into two conditions, which is:

Bankrupt : $O > 0.50$
Non-bankrupt : $O < 0.50$

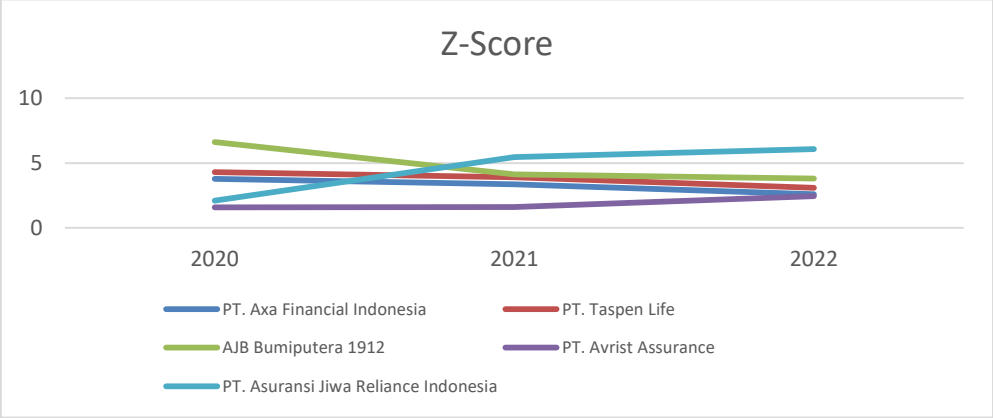
4. Results and Discussion

The result of this research is presented in the form of all ratios obtained from processing annual financial statement data at PT Axa Financial Indonesia, PT Taspen Life, Asuransi Jiwa Bersama (AJB) Bumiputera 1912, PT Avrist Assurance, PT Reliance Life Insurance Indonesia from 2020 to 2022. Two bankruptcy prediction methods are used, namely the Altman Z-Score method with four independent variables and the Ohlson O-Score method with nine independent variables.

Table 2: Altman Method Calculation

Company	Z-Score			Average	Category
	2020	2021	2022		
PT Axa Financial Indonesia	3.785	3.366	2.580	3.244	Non-Bankrupt
PT Taspen Life	4.298	3.899	3.091	3.763	Non-Bankrupt
Asuransi Jiwa Bersama (AJB) Bumiputera 1912	6.613	4.132	3.814	4.853	Non-Bankrupt
PT Avrist Assurance	1.591	1.594	2.444	1.876	Grey area
PT Asuransi Jiwa Reliance Indonesia	2.101	5.459	6.063	4.541	Non-Bankrupt

Figure 1: Z-Score Chart



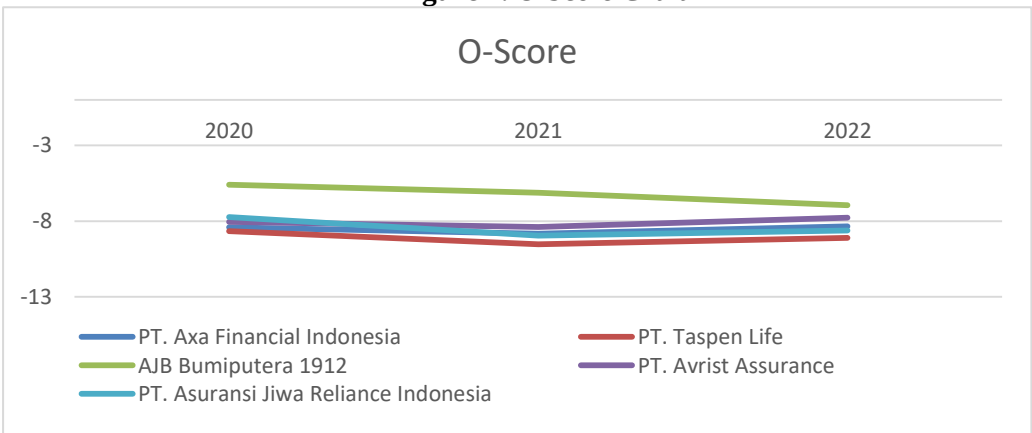
Based on the results of the calculation of the z-score value in table 1, it shows that the average z-score value of the Asuransi Jiwa Bersama (AJB) Bumiputera 1912 for 3 years has the highest value of 4.853, followed by PT Reliance Life Insurance Indonesia with an average z-score value of 4.541. While the lowest average z-score value is owned by PT Avrist Assurance of 1.876, then followed by PT Axa Financial Indonesia with an average z-score value of 3.244. In addition, there is PT Taspen Life with an average z-score value of 3.763.

In the Altman Z-Score model, the greater the z-score value, the better the company's performance, meaning that the company is healthy, meaning that it is less likely that the company will experience bankruptcy. The results of the bankruptcy prediction analysis on 5 insurance companies using the modified Altman Z-Score method, there are 4 companies that are in the "non-bankrupt" category, namely PT Axa Financial Indonesia, PT Taspen Life, Asuransi Jiwa Bersama (AJB) Bumiputera 1912 and PT Reliance Life Insurance Indonesia. This indicates that the four companies have good company performance so that the potential for the four companies to go bankrupt in the future can be said to be small. In addition, there is 1 company that is in the "grey area" category, namely PT Avrist Assurance. This grey area category indicates that the financial performance of the company needs to be monitored further because there is a potential risk of bankruptcy that needs to be watched out for.

Table 3: Ohlson Method Calculation

Company	O-Score			Average	Category
	2020	2021	2022		
PT Axa Financial Indonesia	-8.413	-8.834	-8.339	-8.529	Non-Bankrupt
PT Taspen Life	-8.672	-9.535	-9.106	-9.104	Non-Bankrupt
Asuransi Jiwa Bersama (AJB) Bumiputera 1912	-5.596	-6.135	-6.947	-6.226	Non-Bankrupt
PT Avrist Assurance	-8.057	-8.388	–7.786	-8.440	Non-Bankrupt
PT Asuransi Jiwa Reliance Indonesia	-7.738	-8.969	-8.612	-8.044	Non-Bankrupt

Figure 2. O-Score Chart



The calculation results in table 2 show the average o-score value of each company, with PT Axa Financial Indonesia of -8.529, PT Taspen Life of -9.104, PT AJB Bumiputera 1912 of -6.226, and PT Avrist Assurance of -8.440, and PT Reliance Life Insurance Indonesia of -8.044. In the Ohlson O-Score model, the smaller the o-score value, the better the company's performance. The best value is found in the company PT Axa Financial Indonesia and the worst value is found in AJB Bumiputera 1912. Nevertheless, all companies are in the non-bankrupt category

because they have an average o-score value of less than 0.50. The average o-score values of all companies are quite large negative values, which means that these companies generally have a fairly healthy financial condition and the risk of bankruptcy is quite low. In addition, the o-score value from year to year for each company does not experience significant fluctuations. This shows that the company's financial condition tends to be consistent.

From the two methods used, different prediction results were obtained, namely for the company PT Avrist Assurance which was predicted to be in the grey area category with the Altman Z-Score method, but with the Ohlson O-Score method in the non-bankrupt category. This is because the Altman Z-Score method has a more detailed classification of conditions into three categories, namely bankruptcy, grey area, and non-bankrupt. Meanwhile, the Ohlson O-Score method is only divided into two categories, namely bankrupt and non-bankrupt. Meanwhile, the other four companies obtained the same results in both methods used.

5. Conclusion

Based on the results of the analysis of the two methods for predicting bankruptcy, namely the Altman Z-Score and Ohlson O-Score methods, most companies from the five companies are in good condition and have a low risk of bankruptcy. Using the Altman Z-Score, four of the five companies, namely PT Axa Financial Indonesia, PT Taspen Life, Asuransi Jiwa Bersama (AJB) Bumiputera 1912, and PT Asuransi Jiwa Reliance Indonesia, are in the "non-bankrupt" category, which indicates that these companies have healthy financial performance. One company, PT Avrist Assurance, is in the "grey area", which indicates that this company needs further supervision because there is a potential risk of bankruptcy. Meanwhile, the Ohlson O-Score model shows that all of these companies generally have a fairly healthy financial condition and the risk of bankruptcy is quite low because they have a fairly high average negative o-score value. In addition, there is no significant fluctuation in the o-score value of each company from year to year.

From the two methods used, there are different prediction results for the company PT Avrist Assurance. In the Altman Z-Score method, this company is predicted to be in the grey area category, while with the Ohlson O-Score method it is still in the non-bankrupt category. Thus, the Altman method can be said to be more recommended than the Ohlson method because it has a more detailed classification of conditions.

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