

## **Prediction Analysis of Company Bankruptcy Using Comparison of the Altman Method (Z-score) and Grover Method (G-score) as an Early Warning System in Pharmaceutical Subsector Companies**

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**Abstract.** Pharmaceutical companies are part of the manufacturing sub-sector of the health sector, at the end of 2019 the outbreak of the Covid-19 virus weakened the country's economic sector, so this was also felt by pharmaceutical companies. The outbreak of the Covid-19 virus has created high market demand for medicines and medical devices, this has increased raw materials because 90% of pharmaceutical raw materials in Indonesia are still imported, as a result, if company management does not act immediately, this will lead to bankruptcy. The research objective is to predict the bankruptcy of pharmaceutical companies listed on the Indonesia Stock Exchange in 2019-2021 by using a comparison of the Altman method (Z-Score) and the Grover method (G-Score). Using a type of quantitative research using secondary data from the annual financial reports of pharmaceutical companies listed on the Indonesia Stock Exchange for 2019-2021. The data collection technique uses a saturated sample technique using data analysis, namely the Altman method (Z-Score) and the Grover method (G-Score). The results show that from the annual calculations using the Altman method, there are 6 companies in healthy condition and 3 companies in distress and gray areas, while the Grover method calculates that all companies, namely 9 companies, are declared to be in financially healthy condition with 27 samples of data for 2019-2021. In calculating the level of accuracy, the Altman method obtains an accuracy of 77.7%, while the Grover method obtains an accuracy of 100% by looking at the number of correct predictions and the entire sample.

**Keywords:** Altman; Grover; Bankruptcy; Level of accuracy; Prediction.

*Abstrak.* Perusahaan farmasi merupakan bagian dari subsektor manufaktur sektor kesehatan, di penghujung tahun 2019 merebaknya virus Covid-19 melemahkan sektor pereko-

*nomian negara sehingga hal ini juga dirasakan oleh perusahaan farmasi. Mewabahnya virus Covid-19 membuat permintaan pasar akan obat dan alat kesehatan tinggi, hal ini menyebabkan bahan baku meningkat karena 90% bahan baku farmasi di Indonesia masih impor, akibatnya jika manajemen perusahaan tidak segera bertindak, hal ini akan menyebabkan kebangkrutan. Tujuan penelitian adalah memprediksi kebangkrutan perusahaan farmasi yang terdaftar di Bursa Efek Indonesia tahun 2019-2021 dengan menggunakan perbandingan metode Altman (Z-Score) dan metode Grover (G-Score). Menggunakan jenis penelitian kuantitatif dengan menggunakan data sekunder dari laporan keuangan tahunan perusahaan farmasi yang terdaftar di Bursa Efek Indonesia tahun 2019-2021. Teknik pengumpulan data menggunakan teknik sampel jenuh dengan menggunakan analisis data yaitu metode Altman (Z-Score) dan metode Grover (G-Score). Hasil perhitungan menunjukkan bahwa dari perhitungan tahunan dengan metode Altman terdapat 6 perusahaan dalam kondisi sehat dan 3 perusahaan dalam kondisi distress dan grey area, sedangkan metode Grover menghitung seluruh perusahaan yaitu 9 perusahaan dinyatakan dalam kondisi sehat secara finansial, dengan 27 sampel data tahun 2019-2021. Dalam menghitung tingkat akurasi, metode Altman memperoleh akurasi sebesar 77,7%, sedangkan metode Grover memperoleh akurasi sebesar 100% dengan melihat jumlah prediksi yang benar dan keseluruhan sampel.*

**Kata Kunci:** *Altman; Grover; Kebangkrutan; Tingkat akurasi; Prediksi.*

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## BACKGROUND

The purpose of establishing a company is to obtain profits for the company, it can also be an increase both in the value of the company's shares or the welfare of shareholders. If someone wants to know whether the company is considered good as a whole, then the main thing to know is in terms of financial health. The existence of a healthy financial condition can be possible that the company's condition is also in a stable category and can also be seen from the profits obtained by a company. For this reason, the need for special supervision regarding financial conditions can be carried out by the company as early as possible, with the aim of minimizing whether the company's financial condition is in the category of healthy or not so that this will be used as a benchmark for the potential for bankruptcy.

Covid-19 pandemic has clearly paralyzed many business sectors due to limited space for community movement. This is also felt from economic factors, because many residents infected with the Covid-19 virus make demand for drugs, medical devices, vaccines also increase. Not only that, the increasing market of masks at that time also made several mask producers increase the selling price of their products, so that it was also felt by the impact by the community.

This was also felt by the pharmaceutical sector, at the time of Covid-19 pandemic national pharmaceutical industries were recorded significantly by 10.81%. Judging from the record of the national pharmaceutical industry, the sales indicator is approximately Rp. 90-95 trillion (Winarto, 2022). Because in Indonesia the supply of raw materials for the pharmaceutical sector is still 90% import, this is a concern of the company. In the midst of the limitations of the supply of raw materials, it turns out that in the Covid-19 pandemic era the demand for raw materials increased. If the company cannot stabilize the market demand with the selling price of the product in accordance with this will result in the financial distress conditions of the company (Fitra, 2020).

Financial distress or commonly called financial difficulties is a condition where the company experiences a condition that makes the company's financial statements experience difficulties. Usually this happens because of various factors, both internal terms, for example, a decrease in profit that is on an unnatural threshold and an external aspect can be seen from the state of the inflation of a country or the exchange rate of the exchange rate can also affect the company's financial distress conditions. For this reason, the need for Early Warning for companies in predicting whether their financial conditions are in the healthy category or preferably.

Bankruptcy is a condition in which the company is not possible to operate well and stable, which usually can be marked by the opportunity to obtain an opportunity to get a profit and fail in continuing the company's operational activities. Analysis of bankruptcy predictions is carried out to obtain an initial warning regarding the potential bankruptcy of the company (Masdiantini, 2020). For this reason, the bankruptcy of a company can be prevented by analyzing bankruptcy.

The method used to view the company's financial health is by using ratio analysis. This method is used to test the benefits of financial ratios in analyzing the level of financial health in a company. Financial ratios can assess the health condition of a company even in predicting company bankruptcy. The bankruptcy analysis method used in this study is to use 2 methods as a comparison in analyzing bankruptcy, namely the Altman Z-Score method and the Grover method.

Research conducted by Siswanto (2021) shows that the Altman method used in the bankruptcy prediction model in the pharmaceutical sector for the 2015-2020 period has the second highest level of accuracy after the Zmijewski model. The accuracy level of the Altman model in the results of this study obtained a value of 87.50%. This model is quite interesting for further research to see whether the Altman Z-Score method is accurate enough to predict bankruptcy in the pharmaceutical sector. In the current research, it will be compared with a model that is different from previous research, namely using the Grover model with the same sector with a different range of years.

Previous research was also conducted on the pharmaceutical sector listed on the IDX for the 2014-2018 period using the Altman Z-Score, Grover, Zmijewski bankruptcy prediction model, and using 6 companies listed on the IDX and KLSE (Kuala Lumpur Stock Exchange). In this study, of the three bankruptcy prediction models, the Grover and Zmijewski models obtained a draw with the highest accuracy rate of 100% for companies

listed on the IDX and KLSE, followed by Altman's accuracy of 86% for companies listed on the IDX and the results acquisition of 100% in companies registered in KLSE (Nisa K, 2022).

## **THEORETICAL REVIEW**

### **Bankruptcy**

According to Ghosh (Sudrajat, 2019), bankruptcy is a puzzle that the company is trying to avoid, analysts like to measure and find difficulties to predict in general. Potential danger lies in aspects such as poor quality assets and weak capitalization, as evidenced in other historical events. The bankruptcy of a company can occur because there are factors underlying, as for these factors can come from both internal such as the inability of the company in paying off the company's debt, or external such as inflation, interest rates, etc.

### **Altman Method (Z-Score)**

This method was developed by Edward I. Altman in 1968, as a result of his research after selecting 22 financial ratios, found 5 ratios that can be combined to see companies that are bankrupt and not bankrupt. Altman conducted several studies with different company objects, therefore Altman produced several different formulas to be used in several companies with different conditions. Altman formed 3 Z-Score formulas for 3 different company categories, namely for open manufacturing companies, for closed companies, for non-manufacturing companies/other general use, in this study using the Altman 1 formula (for open manufacturing companies). The formula [1] used is as follows (Sumarna, 2020):

$$Z = 1,2(X1) + 1,4(X2) + 3,3(X3) + 0,6(X4) + 1,0(X5) \text{ -----}[1]$$

Description:

- Z = Bankruptcy model score
- X1 = Working Capital/Total asset
- X2 = Retained Earning/Total asset
- X3 = Earning Before Interest and taxes/Total asset
- X4 = Market Value Equity/Book Value of Total Liabilities
- X5 = Sales / Total asset.

### **Grover Method (G-Score)**

The Grover Method is the abnormalities and development of the Altman method, in this Grover method there is a deleted ratio that is the company's market value ratio and the ratio of profit is held to the total assets and adding the ROA ratio. Researchers from this method namely Jeffrey S. Grover conducted research by taking a sample of 35 bankrupt companies and 35 companies did not go bankrupt in the period 1982-1996. The results of the study showed the accuracy of 97.7%, this indicates that the Grover method is suitable for detecting financial distress in the company (Fahma, 2019). The formula [2] formulated by Grover (Sumarna, 2020):

$$G = 1,650(X_1) + 3,404(X_2) + 0,016 ROA + 0,057 \text{ -----}[2]$$

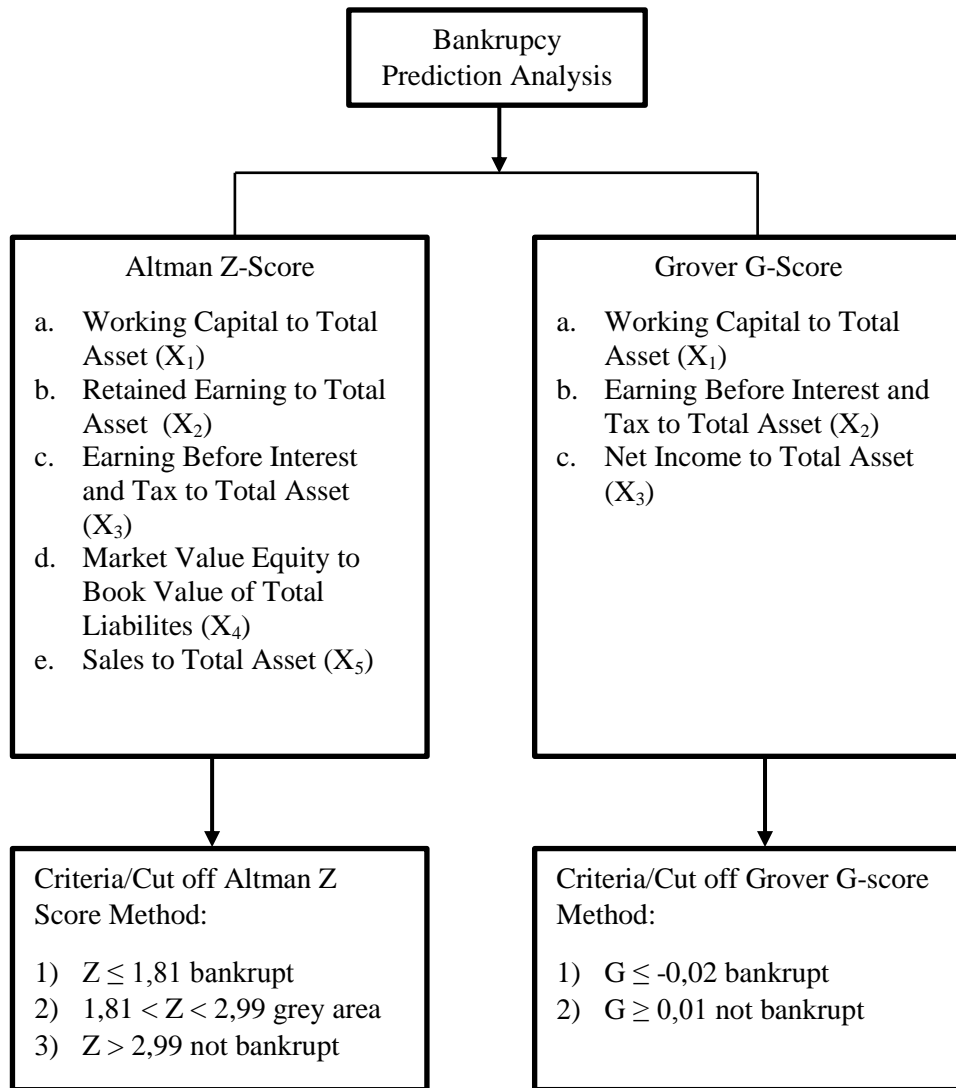
Description:

G = Bankruptcy model score

X1 = Working Capital to Total Asset

X2 = Earning before Interest tax to Total Asset

X3 = Net Income to Total Asset.



**Figure 1. Conceptual Framework**

### Conceptual Framework

The purpose of this study is to analyze bankruptcy predictions for the pharmaceutical subsector listed on the Indonesia Stock Exchange for the 2019-2021 period using a

comparison of the Altman Z-Score method and the Grover G-Score method (Fig. 1). In the analysis of the Altman method, because the pharmaceutical subsector is part of the manufacturing company in the goods and consumption industry sector, it uses the Altman Model I with 5 ratios, namely: working capital to total assets (X1), retained earnings to total assets (X2), earnings before interest and taxes to total assets (X3), market value equity to book value of total liabilities (X4), sales to total assets (X5). Whereas in the Grover method there are 3 ratios including: working capital to total assets (X1), earnings before interest and taxes to total assets (X2), net income to total assets (X3).

## RESEARCH METHODS

The chosen population includes the whole in accordance with the object to be studied. The population in this study was a pharmaceutical subsector company listed on the Indonesia Stock Exchange for the 2019-2021 as many as 9 companies that were covered in the study. Sampling used in this study uses nonprobability sampling techniques using saturated samples.

Saturated samples are sampling techniques used in research if the sample used is relatively small, as well as for generalization purposes with more small mistakes. In a saturated sample all populations were used as samples in the study (Hartanto, 2018), so that the sample of the Pharmacy Subsector company listed on the Indonesia Stock Exchange for the 2019-2021 was 9 samples.

**Table 1. List of Pharmacy Companies Listed on the IDX 2019–2021**

No.	Code	Company Name
1	DVLA	Daria Varya Laboratoria, Tbk.
2	INAF	Indofarma (Persero), Tbk.
3	KAEF	Kimia Farma, Tbk.
4	KLBF	Kalbe Farma, Tbk.
5	PEHA	PT. Phapros, Tbk.
6	PYFA	Pyridam Farma, Tbk.
7	SIDO	Industri Jamu dan Farmasi Sido Muncul, Tbk.
8	SOHO	PT. Soho Global Health, Tbk.
9	TSPC	Tempo Scan Pacific, Tbk.

Source: Data processed (2023).

Data collection techniques in this study in the form of secondary data with the financial statements of pharmaceutical companies listed on the IDX 2019-2021 and use quantitative data types in the form of numbers in the financial statements. The data analysis technique used is to calculate the financial statements of the pharmaceutical company listed on the IDX for the 2019-2021 with 2 methods namely the Altman (Z-Score) method and the Grover Method (G-Score) which is then adjusted to the criteria of each method. The Altman (Z-Score) formula (Sumarna, 2020) is shown as an equation [3].

$$Z = 1,2(X1) + 1,4(X2) + 3,3(X3) + 0,6(X4) + 1,0(X5) \text{ -----}[3]$$

Description:

- Z = Bankruptcy model score
- X1 = Working Capital/Total asset
- X2 = Retained Earning/Total asset
- X3 = Earning Before Interest and taxes/Total asset
- X4 = Market Value Equity/Book Value of Total Liabilities
- X5 = Sales/Total asset.

Classification of healthy or bankrupt companies according to the grover method of cut-off values/criteria:

1. Z value  $\leq 1,81$  bangkrup
2. Value  $1,81 < Z < 2,99$  grey area (enter into categories whose predictions change, cannot be ascertained whether in good health or bankruptcy)
3. Z value  $> 2,99$  not bangkrup (is in the healthy category)

The formula formulated by Grover (Sumarna, 2020) is shown as an equation [4].

$$G = 1,650(X1) + 3,404(X2) + 0,016 ROA + 0,057 \text{ -----}[4]$$

Description:

- G = Bankruptcy model score
- X1 = Working Capital to Total Asset
- X2 = Earning before Interest tax to Total Asset
- X3 = Net Income to Total Asset.

Classification of healthy or bankrupt companies according to the grover method of cut-off values/criteria:

- a)  $G \leq -0,02$ , then the company is classified as experiencing bangkrup.
- b)  $G \geq 0,01$ , then the company is classified as not experiencing bangkrup.

After adjusting to the method criteria, then conducting the accuracy test, the use of this test is to see the accuracy of the results of the calculation of the prediction of the company's bankruptcy model by comparing the 2 Prediction Methods of Bankruptcy used, namely the Altman Method and the Grover Method. This test shows the percentage of the method in predicting the condition of the company based on the entire sample used (Mulyani, 2018) Analysis is accompanied by using the calculation of the percentage of accuracy of each method. The formula [5] is as follow:

$$\text{Compatibility Level} = \frac{\text{The number of predictions is correct}}{\text{Number of samples}} \times 100\% \text{ -----}[5]$$

## RESULTS AND DISCUSSIONS

### Calculation of the Value of the Altman Method

The first step that must be taken is to calculate the ratio in the Altman (Z-Score) method. The formula in this method there are 3 formulas, but what is used in this study is the Altman 1 method formula because the pharmaceutical subsector is part of the manufacturing sector so that the Altman 1 formula is used (for public manufacture), the second step is adjusted to the results of the Z-Score per year the company is already adjusted the cut-off so that it can be seen companies that are predicted to experience financial distress or healthy conditions in the results of the prediction score. The calculation results from Altman predictions in pharmaceutical companies listed on the IDX for the 2019-2021 of 9 samples of the company with 27 samples according to the 2019-2021 stated that there were 6 companies classified bankrupt, 1 company was in the gray area, and 20 companies were declared healthy.

### Calculation of the Value of the Grover Method

The first step that must be taken is to calculate the ratio contained in the Grover (G-Score) method. After calculating based on the ratio of the grover, then adjusted to the results of the G-Score per year the company that has been adjusted for the cut-off so that it can be seen companies that are predicted to experience financial distress conditions or healthy on the results of the prediction score. The calculation results from the Grover Prediction in Pharmacy Companies listed on the Indonesia Stock Exchange for the 2019-2021 of 9 samples of the company with 27 samples according to the 2019-2021 state that overall the calculated pharmaceutical companies are classified as healthy based on the Grover method that has been adjusted to its cut-off .

### Accuracy Test

This test is used to determine the accuracy of the bankruptcy prediction method used in predicting pharmaceutical companies listed on the IDX for the 2019-2021. Following are the results of the accuracy test of the two bankruptcy prediction methods:

**Table 2. Calculation of Accuracy Levels of Altman Method Predictions and Grover Method**

Prediction	Altman	Grover
Bangkrup	6	-
<i>Grey Area</i>	1	-
Not Bangkrup	20	27
Total Sample Data	27	27
Accuracy (%)	77.7%	100%

Source : Data processed (2023).

Based on these calculations it can be concluded that the level of accuracy of the Altman method gets results (77.7%) by stating 6 companies are in a bankrupt area, 1 in the gray area, and 20 berda in non-bankruptcy conditions. In the calculation of the company's accuracy test in the Gray Area, the condition is not bankrupt. While the Grover method gets the results of accuracy (100%) by stating the overall sample of healthy pharmaceutical companies in financial statements during the 2019-2021. So that the use of the Grover



method is more accurate to predict the bankruptcy of pharmaceutical companies listed on the IDX for the 2019-2021.

The Altman method has cut off criteria, namely it is said to be bankrupt if the Z-Score value is less than 1.81, it is said to be in the gray area if the Z-Score value is  $1.81 < Z < 2.99$ , and  $\geq 2.99$  then otherwise healthy. Looking at the results of the annual calculations, it shows that there are 3 companies in the category of results of the calculations that are in the category of bankruptcy and the gray area, including companies with issuer code (KAEF) which obtain results of calculations in 2019 of 0.97911 which are stated to be in a condition bankrupt according to the Altman method criteria, in 2020 (KAEF) obtained a Z-Score of 2.00079 which is in the gray area category according to the Altman method cut-off so it is not certain whether the company is in the healthy category or not, in 2021 obtaining a result of 1.72191 is predicted to be in the bankrupt category.

The next result that has been calculated is in a distress condition, namely companies with issuer code (PEHA) successively from 2019 obtaining a result of 1.33033, then in 2020 obtaining a result of 1.50610 and in 2021 obtaining a result of 1.39147 so that the calculation (PEHA) during the 2019-2021, the z-score calculation results were in the bankrupt category according to the Altman cut-off method. Other results were also obtained by companies with issuer codes (PYFA) which obtained a z-score calculation result in 2021 of 1.78109 so that they are in the bankrupt category according to the Altman Z-Score cut-off method. However, several other companies show prediction results that are in the healthy category annually based on calculations from their annual financial report data for the 2019-2021 according to the Altman Z-Score criteria/cut-off method.

In the Grover method based on the criteria if the calculation results are less than -0.02 then the company is in the bankrupt category, pharmaceutical company calculations for the 2019-2021 period using the Grover method show the results of bankruptcy prediction calculations that there are 9 pharmaceutical companies with a total of 27 data based on the 2019 -2021, which is the object of research, obtains prediction results in the healthy category, this is based on the annual calculation results for the 2019-2021.

The results of the calculation of the accuracy test for the comparison of the two methods used, in this case the Grover method obtains an accuracy of 100% based on the calculation of 27 sample data from a total of 9 pharmaceutical companies for the 2019-2021, while the accuracy results of the Altman method obtain an accuracy of 77. 7% based on the calculation of 27 sample data from a total of 9 pharmaceutical companies for the 2019-2021, so it can be concluded that the use of the bankruptcy prediction method with the Grover method is suitable for use in predicting the bankruptcy of pharmaceutical companies listed on the Indonesia Stock Exchange for the 2019-2021 due to prediction calculations and its accuracy is in accordance with the real conditions of companies that are still operating today.

## **CONCLUSIONS AND RECOMMENDATIONS**

The results of the calculation of the Altman method with 9 pharmaceutical companies and the number of samples of 27 data based on the scope of the 2019-2021 stated that there

were 6 companies predicted to go bankrupt, 1 company was in the gray area, and 20 companies were in good health. The next method is the Grover method which states that based on the calculation results obtained the overall results of the pharmaceutical company as many as 9 companies with 27 data samples with the scope of the 2019-2021 are in a healthy condition that has been adjusted to the cut-off.

The results of the accuracy test calculation in the Altman method are (77.7%) while the results of the accuracy of the Grover method get the results of (100%), this means the use of the Grover Prediction Model is appropriate to be used in predicting the bankruptcy of pharmaceutical companies listed on the Indonesia Stock Exchange for the 2019-2021 because the prediction results are in accordance with the real conditions of the company that is still operating today.

There is a bankruptcy prediction calculation used in this study using the Altman Z-Score method and the Grover G-Score method used for early detection of a company's financial bankruptcy. In determining bankruptcy, companies do not rely on financial reports alone but can come from external factors such as changes in consumer tastes, high industry competition, and many other factors. Companies that are predicted to experience bankruptcy do not necessarily go directly to bankruptcy, but with the prediction of bankruptcy it can be used as a reference for company management to improve the company's performance so that the calculated predictions do not occur.

The limitation of this study is the use of the bankruptcy prediction method for only two comparisons, so that future researchers are expected to be able to compare the bankruptcy prediction method more than the two methods currently used by researchers. To test the level of accuracy, it is hoped that the next researcher will add the type of error to see the accuracy of the predictive tool used.

Based on the conclusions above, the recommendations can be stated that the company is expected to always maintain the stability of the condition of its financial statements and increase the company's capital. For investors the results of this study can be used as a reference for information before making decisions in investment, especially in pharmaceutical companies listed on the Indonesia Stock Exchange. For further research, researcher can use other bankruptcy prediction methods that are not used in this study, to compare the level of accuracy of each method in predicting company bankruptcy.

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