



A mixed-method approach to bankruptcy prediction: Altman z-score vs. Springate s-score

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ABSTRACT

This study aims to determine the cause of the bankruptcy of PT. Cahyabintang Respati using the Almant Z-Score method and the Springate S-Score method and find out the differences between the two methods. This study uses primary company data obtained directly from CBR companies. The research method used is a mixed method (Mix Method), which is a qualitative and quantitative method. The final results of this study indicate that the main cause of the bankruptcy of PT. CBR that is continuing to decrease the fleet of ships owned by PT. CBR which results in a reduced drag of the ship and the company's revenue continues to experience a decline to the minus number and lead to bankruptcy. The calculation results of the Altman Z-score method of PT CBR's financial condition from 2007 to 2014 are still experiencing a healthy financial condition and in 2015 to 2018 the financial condition of PT. CBR experienced a gray condition (Gray Area) and in 2019 the financial condition of PT. CBR is in a bankruptcy position while the Springate method calculation results show that in 2007 to 2014 the financial condition of PT. CBR is still in a healthy financial condition, further from 2015 until 2019 PT. CBR is experiencing a difficult financial condition or based on bankruptcy. After testing the independent sample t test using the SPSS program, there was no significant difference between the Almant Z-Score and Springate methods in analyzing the bankruptcy of PT. CBR.

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1. INTRODUCTION

The challenge of bankruptcy is consistently faced by companies, regardless of their scale, whether small or large, that struggle to compete or develop their business activities (Aminatuzzuhro, Indrawati, & Fitriani, 2024). Financial distress experienced by a company is a clear indicator of these difficulties. Financial distress can manifest as short-term financial struggles within a company. If a company fails to address these issues seriously, short-term financial distress can escalate into long-term financial distress, potentially leading to company closure. Evaluating and measuring the closure of a company can be observed through its financial statements (Rusman Rosmayana, 2020). Below are the profit generation data of PT. Cahyabintang Respati from 2007 to 2019.

From the data, it is evident that PT. Cahyabintang Respati began experiencing financial distress in 2014, reaching a loss of Rp. 3,423,772,412, compared to the preceding years from 2007 to 2013 when the company was profitable and financially healthy. The decline in company revenue was due to a reduction in its maritime transportation fleet, leading to decreased transport capacity. The reduction in the company's maritime fleet caused a continuous decline in revenue until the end of 2018, exacerbating financial difficulties and increasing debts, as expenses exceeded income. Consequently, in 2019, the company attempted to secure a bank loan to increase capital and improve its financial situation. However, this effort did not yield results. Therefore, the company's management decided to sell off the remaining fleet to cover outstanding debts, ultimately leading to the company's closure.

Assessment and estimation of bankruptcy risk is important for managers in decision making for improving a firm's financial performance, but also important for investors that consider it prior to making investment decision in equity or bonds, creditors and company itself (Bărbuță-Mișu & Madaleno, 2020). Factors such as supplier bankruptcy, changes in financial conditions, and sustainability challenges have been identified as key contributors to the risk of bankruptcy (Mrini & Tzavara, 2023; S. Wahyuni, Handayani, & Pujiharto, 2022). Bankruptcy is a condition where a company has insufficient funds to run its business. Issuers or public companies that fail or are unable to meet their obligations must report their failure to the superintendent of a securities exchange (BAPEPAM) and the Securities Exchange Commission shortly after the day of their bankruptcy (Salim & Sudiono, 2017). Bankruptcy analysis is a method for determining a company's financial condition using a bankruptcy prediction model (Wahyuningsih & Venusita, 2022).

The Altman Z-Score and Springate methods were chosen for this study due to their widespread acceptance and proven effectiveness in predicting corporate bankruptcy. The Altman Z-Score method, which utilizes five financial ratios that are deemed crucial for such predictions (Ishmah, Solimun, & Mitakda, 2022; Radivojac, Krčmar, & Mekinjić, 2021). Similar to Altman method, the Springate method also employs multivariate discriminant analysis (MDA). Within MDA, several interconnected financial ratios are essential in forming an effective method. In determining ratios capable of detecting potential company closures, Springate utilizes MDA with 4 out of 19 financial ratios that are well-known and believed to accurately differentiate between failing and non-failing companies (Sari, Umar, Al, Fadhil, & Sari, 2024). Several researchers have compared the accuracy between the two methods, such as Azzahra and Pangestuti's research resulting in a comparison of the accuracy of the Springate model of 70.77%, and the Altman model of 50.29% (Azzahra & Pangestuti, 2022).

The Altman Z-Score's main advantage is its long-standing use and validation across various studies and industries, making it a reliable tool for bankruptcy prediction. Companies need to pay attention to the potential for bankruptcy through the Z-score value (Priambodo & Kurniasih, 2021). To assess the financial health of manufacturing firms, the Altman Z-Score model's financial ratio analysis can be employed, as this model demonstrates a high level of accuracy (Baranyi, Faragó, Fekete, & Szeles, 2018; Rangga, Herdi, & Mitan, 2020). The Springate method, while slightly less accurate overall, offers a simpler calculation process and has been found to be effective in various industry contexts, including those outside manufacturing (Putra, 2021; Sari et al., 2024; Sariwati & Fachruzzaman, 2024). Similar to other methods, the Altman and Springate models are shaped by their underlying assumptions, which may limit their ability to fully capture the complexities of a company's financial situation compared to more sophisticated models. This should be considered when interpreting their results.

Therefore, the objective of this research is to analyze the factors contributing to the bankruptcy of PT. Cahyabintang Respati, examine the factors leading to the decline in revenue at PT. Cahyabintang Respati, analyze the causes of bankruptcy at PT. Cahyabintang Respati using the Altman Z-Score method and the Springate method, and compare the differences in bankruptcy prediction between the Altman Z-Score and Springate methods. The results of this study are expected to provide valuable insights for the management of PT. Cahyabintang Respati and its partner companies to forecast future financial performance and avoid bankruptcy, thereby safeguarding the interests of both internal and external stakeholders. Additionally, this research

aims to offer thoughtful contributions to the Ministry of Finance to foster greater awareness and support for the economy and businesses in the maritime transport sector.

2. RESEARCH METHOD

This study is a mixed-methods research with a sequential explanatory approach, which involves the collection and analysis starting from qualitative data followed by quantitative data (Ghozali, 2017; R. Wahyuni, Juniati, & Wijayanti, 2024). This research is also comparative in nature, as it compares two bankruptcy analysis methods, namely the Altman Z-Score and Springate.

The financial data used in this study were obtained from the audited financial statements of PT. Cahyabintang Respati from 2007 to 2019. These financial statements include the assets report, balance sheet, income statement, cash flow statement, and notes to the financial statements. The data were sourced directly from the company's annual reports, which were accessed through the company's official records and archives. Non-financial data was obtained from interviews with the Director of PT. Cahyabintang Respati.

In analyzing the data, the researchers used the Altman Z-Score model and the Springate Score model as predictors of potential corporate bankruptcy. The steps in data analysis in this study are as follows:

- a. Conduct direct interviews with informants by asking several questions related to the factors that cause the bankruptcy of PT Cahyabintang Respati.
- b. Calculate the financial ratios that are important variables in the bankruptcy prediction models of Altman Z-Score and Springate Score.
- c. After identifying the above ratios, the next step is to determine the Z-Score and Springate Score values from the financial statements under study using the following formulas:

$$\text{Z-Score} = 6.56X1 + 3.26X2 + 6.72X3 + 1.05X4 \text{ (Pradana \& Chalid, 2023)}$$

$$\text{Springate Score} = 1.03A + 3.07B + 0.66C + 0.4D \text{ (Andriani, Rahardja, Efriadi, \& Cindi, 2023; Muzanni \& Yuliana, 2021)}$$

- d. The calculated Z-Score results are then evaluated based on the following classification criteria (Nusyirwan, Kusdiana, Tinaria, Zubir, & Masril, 2023) :

Z-Score > 2.60: The company can be categorized as healthy.

1.10 < Z-Score < 2.60: The company falls into the grey area category, where it cannot be determined whether the company is healthy or experiencing distress.

Z-Score < 1.10: The company is in distress or experiencing financial difficulties and has a high potential for bankruptcy. The term "distress" is used for this category as companies in this position cannot be fully declared bankrupt, making "distress" more appropriate to describe the financial difficulty that can lead to actual bankruptcy.

- e. The calculated Springate Score results are then evaluated based on the following classification criteria (Putra, 2021; Sari et al., 2024):

Score > 0.862: If the Springate value is greater than 0.862, the company is categorized as healthy.

Score < 0.862: If the Springate value is less than 0.862, the company is categorized as unhealthy or potentially bankrupt.

- f. Calculate the average Z-Score and Springate Score from the 13 years of financial statements studied, from 2007 to 2019, to determine the causes of PT. Cahyabintang Respati's bankruptcy from these averages.

- g. Analyze the average Z-Score and Springate to see if there is a comparison between the two methods and determine which method is most accurate for analyzing corporate bankruptcy using the Independent Sample T-Test with SPSS.

Independent Sample T-Test According (Ghozali, 2017), "The t-test is used to determine whether two unrelated samples have different means. The t-test is conducted by comparing the difference between the two means with the standard error of the difference in the means of the two samples."

The t-test is used to compare the two methods, Altman Z-Score and Springate, to determine if there is a difference between the two methods, provided the data is normally distributed and homogeneous.

Hypothesis Testing:

H0: There is no significant difference in bankruptcy analysis using the Altman Z-Score and Springate methods.

H1: There is a significant difference in bankruptcy analysis using the Altman Z-Score and Springate methods.

- h. The final step is to draw conclusions from the research results obtained.

3. RESULTS AND DISCUSSIONS

The results of the direct interview with the Director of PT. CBR regarding the factors that caused PT. CBR to experience bankruptcy are as follows: (a) the bankruptcy of PT. CBR was caused by the continuous reduction of the company's fleet, which began in 2014: (b) The ships owned by PT. CBR were mostly old and could not operate normally. As a result, when the ships were sold, they were only valued as scrap metal rather than as functional vessels; (c) The management underestimated or did not seriously address the issues, such as the reduction of PT. CBR's fleet, which led to the problem persisting continuously, (d) Due to the management's lack of seriousness in considering the best steps to address the ongoing issues, the fleet continued to diminish, and the company could not cover its operational expenses, ultimately leading to the company's closure or liquidation.

The following is a review of the answers obtained from several questions posed to informants at PT. CBR about Factors Causing Asset Decline at PT. CBR is : (a) PT. CBR experienced a significant decline in assets due to the aging ships that could no longer operate as usual. This situation forced the company to sell these ships, but not as functional vessels, rather as scrap metal that could no longer function as cargo ships; (b) The neglected and old condition of the ships resulted in some of PT. CBR's ships sinking.

Factors Causing Revenue Decline at PT. CBR is In 2014, PT. CBR experienced a significant revenue decline, resulting in a loss of IDR 3,423,772,412. This was caused by the aging ships that had to be sold, reducing PT. CBR's towing capacity and thereby decreasing its revenue. This revenue decline continued, with PT. CBR suffering losses over the next six years until 2019. The worst loss occurred in 2015, amounting to IDR 6,018,758,082. This severe loss was due to the sale of some ships at the beginning of 2014, which prevented PT. CBR from covering its debts to shipping agents. Consequently, from 2016 onwards, PT. CBR was forced to sell operationally viable ships to cover these debts. This situation led to a continuous decline in PT. CBR's revenue over the past six years.

Results of Bankruptcy Prediction Using Altman Z-Score will be evaluated based on the standard assessment applied in the Altman Z-Score formula, which are: (a) If $Z > 2.60$: The company is in a financially healthy condition ; (b) If $1.10 < Z < 2.60$: The company is in a grey financial condition ; (c) If $Z < 1.10$: The company is in an unhealthy financial condition or experiencing difficulties. Below is the table that illustrates the financial condition of PT. Cahyabintang Respati.

Table 1. Bankruptcy Prediction for PT. CBR from 2007 to 2019 With Altman Z-Score formula

No	Year	Z-SCORE	Bankruptcy Prediction
1	2007	4.88	Healthy
2	2008	5.31	Healthy
3	2009	5.62	Healthy
4	2010	9.22	Healthy
5	2011	7.71	Healthy
6	2012	4.13	Healthy
7	2013	5.24	Healthy
8	2014	3.84	Healthy
9	2015	1.36	Grey Area
10	2016	2.11	Grey Area
11	2017	2.00	Grey Area
12	2018	1.32	Grey Area
13	2019	0.96	Bankrupt

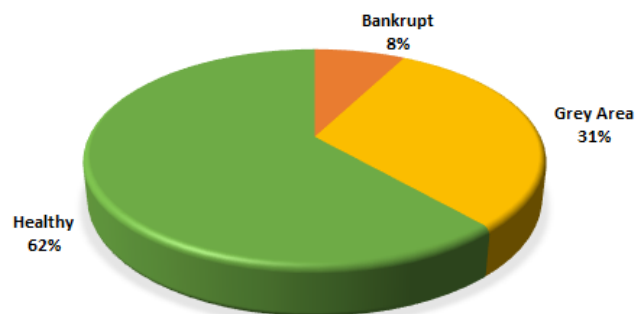


Figure 1. Classification of PT. CBR Bankruptcy Prediction from 2007 to 2019 with Altman Z-Score Method

Based on the analysis conducted on the data of PT. CBR from 2007 to 2019, it is known that PT. CBR experienced a healthy financial condition from 2007 to 2014, with a Z-Score above 2.60. From 2015 to 2018, the company was in the grey area with a Z-Score ranging from 1.36 to 2.11. In this condition, the company is vulnerable, meaning it is experiencing financial problems that need to be addressed quickly to prevent prolonged issues and potential bankruptcy.

In 2019, PT CBR experienced a decline with a Z-Score of 0.96, indicating a distressed condition and a high potential for bankruptcy. This decline was due to the weakening of all bankruptcy indicator ratios in 2019, including liquidity ratio, profitability ratio, solvency ratio, earning power of total investment, and total asset turnover, all of which showed a decrease resulting in the drop of PT CBR's Z-Score. This decline was also caused by the reduction of PT CBR's fleet, leading to decreased company activities and ultimately forcing the company to close or go bankrupt. The results of this study show that the Altman Z-Score method is capable of measuring and predicting company bankruptcy, which is consistent with the findings of the previous research (Kasir, 2021; Rangga et al., 2020).

The results of the calculation using the Springate method will be evaluated based on the standard assessment applied using the Springate formula, which are: If S-Score < 0.862: The company can be classified as bankrupt ; and If S-Score > 0.862: The company can be classified as not bankrupt. Below is the table that illustrates the financial condition of PT. Cahyabintang Respati.

No	Year	S-Score	Bankruptcy Prediction
1	2007	2.20	Healthy
2	2008	2.46	Healthy
3	2009	1.21	Healthy
4	2010	7.21	Healthy
5	2011	9.23	Healthy
6	2012	4.86	Healthy
7	2013	5.81	Healthy
8	2014	1.24	Healthy
9	2015	-1.95	Bankrupt
10	2016	0.19	Bankrupt
11	2017	0.01	Bankrupt
12	2018	-0.30	Bankrupt
13	2019	0.11	Bankrupt

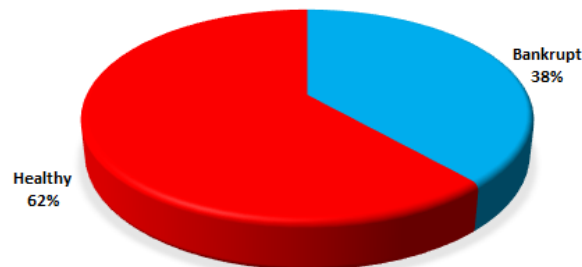


Figure 2. Classification of PT. CBR Bankruptcy Prediction from 2007 to 2019 with Springate S-Score method

Based on the analysis conducted on the data of PT. CBR from 2007 to 2019, it is known that PT. CBR experienced a healthy financial condition from 2007 to 2014, with a Score above 0.862. This was because the company had a substantial fleet of ships operated by PT. CBR, allowing the company's operations to run smoothly and cover all of PT. CBR's expenses.

From 2015 to 2019, the company experienced a significant decline, with a Score below 0.862, indicating a bankrupt or unhealthy condition. The decline reached negative values, with Scores ranging from 0.01 to -0.30. This decline was caused by the weakening of all bankruptcy indicator ratios from 2015 to 2019, including the working capital to total assets ratio, net profit before interest and tax to total assets ratio, net profit before tax to current liabilities ratio, and total asset turnover, all of which showed a decrease resulting in the drop of PT. CBR's Score. Additionally, this decline was due to the reduction of the company's fleet, which was the main source of PT. CBR's revenue. The reduced fleet led to hindered income or revenue for PT. CBR, making it impossible to cover the company's operational expenses, and thus PT. CBR could not continue its business activities. By using the Springate method, the same situation was also experienced by PT. Garuda has a score so low that it can be categorized as being in poor condition or being threatened with bankruptcy (Bilondatu, Dungga, Ekonomi, & Gorontalo, 2019).

To test the differences between the Altman Z-Score and Springate methods, an independent sample t-test will be conducted. One of the requirements for this test is that the data must be normally distributed. Therefore, before conducting the independent sample t-test, a normality test will be performed to determine whether the data are normally distributed or not.

Table 3. Case processing summary

	Method	Valid		Cases Missing		Total	
		N	Percent	N	Percent	N	Percent
Data	AZC	13	100,0%	0	0,0%	13	100,0%
	Springat	13	100,0%	0	0,0%	13	100,0%

Table 4. Tests of normality

	Method	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Data	AZC	,170	13	,200	,930	13	,346
	Springat	,195	13	,188	,915	13	,216

Based on the SPSS output above, it is known that the significance value (Asymp. Sig. 2-tailed) is 0.200. This value is greater than the significance level of 0.05. This indicates that the data meets the assumption of normality.

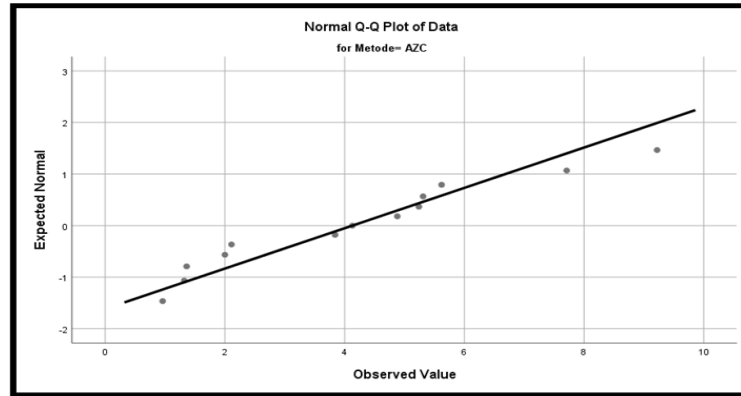


Figure 3. Normatily test graph

Based on the graph above, it can be seen that the points are scattered around the line and follow the diagonal line. This graph indicates that the regression model meets the assumption of normality. Based on this assumption, the residual data are normally distributed.

The t-test is used to determine whether two unrelated samples have different means. The t-test is performed by comparing the difference between two mean values with the standard error of the difference between the two sample means. This test aims to see if there is a significant difference between the Altman Z-Score method and the Springgate method. The decision criteria for the independent sample t-test are: (a) If the sig. (2-tailed) value > 0.05, it means there is no significant difference between the Altman Z-Score method and the Springgate method; If the sig. (2-tailed) value < 0.05, it means there is a significant difference between the Altman Z-Score method and the Springgate method. The output of the independent sample t-test is as follows:

Table 5. Group statistics

	Method	N	Mean	Std. Deviation	Std. Error Mean
Results	Altman Method	13	4.1308	2.55687	.70915
	Springgate method	13	2.4831	3.31955	.92068

Based on the "Group Statistics" output table above, it is known that the number of research data samples for the Altman and Springgate methods is 13 each. The mean of the research results for the Altman method is 4.1308, while for the Springgate method it is 2.4831. Thus, descriptively, it can be concluded that there is a difference in the average research results between the Altman and Springgate methods. To further prove whether this difference is significant (real) or not, we can look at the results from the "Independent Sample Test" output as follows:

Table 6. Independent samples test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Result	Equal variances assumed	.883	.357	1.418	24	.169	1.64769	1.16213	-.75082	4.04620
	Equal variances not assumed			1.418	22.532	.169	1.64769	1.16213	-.75912	4.05450

Based on the output table above, it can be seen that the Sig. value for Levene's Test for Equality of Variances is 0.357 > 0.05, which means that the variances between the Altman and

Springate methods are homogeneous or equal. Thus, the interpretation of the "Independent Sample Test" output table is based on the values in the "Equal Variances Assumed" section.

Based on the tests conducted on the Altman Z-Score and Springate methods in analyzing the bankruptcy of PT. CBR, the significance value is found to be 0.169, indicating that $0.169 > 0.05$. Therefore, H_0 is accepted, meaning there is no significant difference between the Altman Z-Score and Springate methods in the bankruptcy analysis of PT. CBR. Considering the above results, this study supports the research by (Ayvaz & Arkaz, 2023; Kasir, 2021), which also found no significant difference between the Altman Z-Score and Springate methods in bankruptcy analysis.

4. CONCLUSION

The main cause of PT. CBR's bankruptcy was the continuous reduction of the company's fleet, leading to decreased transportation operations. This decline in operations caused PT. CBR to experience a continuous drop in revenue, making it unable to cover its debts, and ultimately forcing the company to close. The financial analysis of PT. Cahyabintang Respati from 2007 to 2019 using the Altman Z-Score and Springate methods revealed key insights. The Altman Z-Score showed that PT. Cahyabintang Respati was financially healthy with scores above 2.60 from 2007 to 2014. However, from 2015 to 2018, the company entered the grey area with scores between 1.36 and 2.11, indicating financial instability. In 2019, the Z-Score dropped to 0.96, suggesting potential bankruptcy. Similarly, the Springate Score indicated that PT. Cahyabintang Respati was financially healthy from 2007 to 2014, with scores above 0.862, with the lowest score in 2009 at 1.21. In 2015, the score plummeted to -1.95, and never rose above 0.862 again until 2019, indicating bankruptcy or poor financial health.

The specific values of the Z-Score and Springate Score provide a clear indication of the company's financial trajectory over the years. Initially, PT. Cahyabintang Respati had strong financial health with high scores. However, a gradual decline is observed starting from 2012, placing the company in the grey area where the risk of bankruptcy becomes more apparent. By 2015, the scores had dropped significantly, indicating financial distress. This decline reflects the company's deteriorating financial condition, influenced by various internal and external factors, and underscores the importance of timely intervention and corrective measures to prevent bankruptcy.

An Independent Sample T-test showed no significant difference between the Altman Z-Score and Springate method in bankruptcy analysis, with a significance value of 0.169. This finding supports previous research, concluding that both methods provide equally accurate results in analyzing a company's bankruptcy.

The results of this study can be instrumental for stakeholders, particularly investors and creditors. Investors can use the findings to assess the risk associated with their investments in PT. Cahyabintang Respati. A low Z-Score or Springate score indicates a higher risk of bankruptcy, prompting investors to reconsider their investment strategies. Similarly, creditors can use these scores to evaluate the creditworthiness of the company and make more informed lending decisions. By understanding the financial health of the company, stakeholders can take proactive measures to mitigate potential risks.

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