Application of the Altman Z-Score Model in Assessing the Financial Health of Garment Manufacturing Enterprises Listed on the Vietnam Stock Market

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ABSTRACT: The article has provided the content and function of the Z-score model in predicting the possibility of bankruptcy through the actual financial situation of the enterprise. The study uses two research methods, namely the analytical method and the meta-analytic method. Through the methodology, the team obtained an overview of the study and identified gaps in which to conduct the research. Next, the research team aelected a sample of 9 garment manufacturing companies listed on the Vietnamese stock market. Combining the collection of secondary data from financial statements and the theory of the Z-score model, we have a basis to evaluate the financial situation of these 9 enterprises in 2022. 4 enterprises having in good financial condition, 4 enterprises with difficult financial situations and 1 enterprise with financial distress consistent with the actual situation of all 9 enterprises. The analysis results also show that the Z-score model is reliable and quite effective in assessing financial health and predicting the bankruptcy of enterprises.

KEYWORDS: Bankruptcy, Financial health, Manufacturing enterprises, Vietnam, Z-score model

1. INTRODUCTION

Corporate financial health is a major concern of shareholders, employees, auditors and external parties such as investors, banks and business partners. Each subject will base on its financial situation to make its decision. For example, investors and shareholders will decide to buy and hold more stocks and bonds if the financial situation of the business is good and vice versa. With business partners, they can continue cooperation or stop cooperation if there are signs of financial difficulties. Thus, in order to make an accurate decision, the above subjects need to have a good understanding of the financial market and need technical tools to assist them in accurately assessing the financial health of the business that is considering investment, cooperation, and loans. Altman's Z-score model is a quantitative tool with five coefficients: working capital to total assets, retained earnings to total assets, earnings before interest and taxes to total assets, market value market of equity to book value of total liabilities and the ratio of net sales to total assets. This model is considered by experts in financial markets and researchers as one of the best models for predicting the financial situation and bankruptcy of a business. Simple to use with data that can be easily collected from financial statements, so this tool is applied by many audiences. With the goal of studying the applicability of the Z-Score Model in assessing the financial health of garment manufacturing enterprises listed on the Vietnam stock market. The research team analyzes and evaluates the effectiveness of this model on actual data and considers the appropriateness of the model when applied in a developing country like Vietnam.

2. LITERATURE REVIEW

2.1. Model Z-score

Developed in 1968 by Edward I. Altman, the Z formula is used to predict a firm's product growth over two years. The Z-score model relies on multiple balance sheet values and the value of a business's earnings to assess the financial health of a business. When businesses fall into financial distress, it will seriously affect investors, shareholders and lenders. Through the combination of online calculation of 4 or 5 Common Business Variable Ratio calculated by the coefficient, Altman (1968) formulated for the first time the Z-score model formula which has the following format:

$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.64X_4 + 0.999X_5$ (p.589–609)

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Let's take a look at how the 5 indicators in the Z-score model are identified and calculated by Altman (1968).

X1: The ratio of working capital to total assets. The measure of liquid assets is related to the size of the company (pages 589–609).

X1 = Working capital/Total assets

X2: Ratio of retained earnings to total assets. The profitability measure reflects a company's age and earning power (pages 589–609).

X2 = Retained earnings/Total assets

X3: The ratio of earnings before interest and taxes to total assets. Measure performance outside of taxes and leverage factors. It recognizes operating income as important to long-term viability (pp.589–609).

X3 = EBIT/Total Assets

X4: Ratio of market value of equity to book value of total liabilities. Adding market size can show stock price movements as possible red flags (pages 589–609).

X4 = Market Value of Total Equity / Book Value of Total Liabilities

X5: Ratio of sales to total assets (p.589–609).

X5 = Revenue/Total Assets

According to Altman (1968), after calculating the Z score, we will classify enterprises into three groups. Group 1 is a group of businesses with healthy finances, eligible for ratings in the safe zone. Group 1 needs to meet Z > 2.99. Group 2 is a group of businesses with weak financial performance, classified in the gray area as the warning area and at risk of product development. Group 2 includes enterprises with Z scores between 1.81 and 2.99, 1.81 < Z < 2.99. Group 3 is a group of businesses with financial distress that are classified as dangerous areas, the risk of product discovery is very high. Group 3 includes enterprises with Z < 1.81 (pp.589-609). With the combination of important figures and 5 financial indicators that are easily calculated through data collected on corporate financial statements, the Z-score model is widely applied in most countries around the world. However, we should note that it is a model built by Altman in 1986 using research samples, research data and performing analytical methods for manufacturing enterprises. Therefore, this original Z-score model only applies to studies conducted in listed manufacturing enterprises and is not suitable for enterprises in other regions.

In addition to the model built in 1968, Altman also built two variants of the Z-score model suitable for businesses other than the listed manufacturing sector. Let's explore the first variant of the Z-score model, the Z-score model. The Z' model was developed by Altman & Hotchkiss (2006) in 2006. The Z'-score model is used by firms in the non-manufacturing group in the emerging market. The goal of the Z'-score is to rate the bond quality. The model of Variant Z' is presented as follows:

Z' = 3.25 + 6.56X1 + 3.26X2 + 6.72X3 + 1.05X4

The calculation method of 4 indicators in the Z'-score model is similar to the Z-score model. Enterprises evaluated according to the Z'-score model are classified into 3 groups. Group 1 is a safe enterprise, not in danger of bankruptcy, Z' > 5.85. Group 2 are enterprises that are at risk of bankruptcy and are in the warning zone if 4.35 < Z < 5.85. The last group is the group of enterprises with Z < 4.35, this group of enterprises has a very high risk of bankruptcy because the financial situation is exhausted (Altman & Hotchkiss, 2006).

Finally, we learn that the second variant of the Z-score is the Z''-score model, which applies to manufacturing enterprises that are not listed on the stock market and enterprises belonging to the non-manufacturing group such as enterprises that provide financial, educational, or real estate services.

The Z''-score model of Altman et al (2017) has the following form:

Z'' = 6.56X1 + 3.26X2 + 6.72X3 + 1.05X4 (pp.131–171)

The calculation of 5 indicators in the Z''-score model is similar to the Z-score model. With the Z''-score model, enterprises are also classified into three groups. Group 1 includes enterprises located in the safe zone with Z'' score > 2.66. The second group includes businesses that are at risk of bankruptcy and are classified in the warning zone with 1.1 < Z'' < 2.6. The last group includes enterprises with high risk, located in the red zone and at high risk of bankruptcy, Z'' < 1.1 (Altman et al, 2017, pp131-171).

Many researchers have made the mistake of applying the 1968 Z-score model in their study to predict corporate bankruptcy for all manufacturing and non-manufacturing sectors. However, if the Z-score variant is not applied correctly, it will have serious consequences and errors in the assessment of the financial quality of the business. In this study, we assess the financial health of garment manufacturing companies listed on the Vietnamese stock market. So using the Z-score 1968 model is a perfect fit.

2.2. Overview

Anjum's study (2012) on models for predicting corporate bankruptcy and explores the focus on Altman's Z-score model (pp.212-219). The author identifies businesses that operate and want to achieve the highest profit target. However, is the financial position

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of the enterprise between the published figures and the actual figures consistent? The author believes that financial ratios should be used to assess the financial honesty of a business built by many different authors. In Anjum's research, it was shown that Altman's Z-score model development can predict the probability of bankruptcy 2 to 3 years in advance. The results of the study clearly show Altman's research on predicting corporate bankruptcy. Along with that, the author also considers that the Z-score model is suitable to be applied in predicting the bankruptcy of enterprises in the fields of the modern economy and this model can predict the recession and bankruptcy before 1 to 3 years (Anjum, 2012, pp212-219).

Research by Panigrahi (2019) on the value of the z-score model in predicting the financial difficulties of pharmaceutical companies group (pp.65-73). The author believes that predicting the financial decline of enterprises is a concern of many businesses after the 2008 crisis. The difficult financial situation greatly affects the operation of enterprises and enterprises. It is difficult for businesses to access loans and enter contracts with partner businesses. The author emphasizes that empirical research predicting the bankruptcy of enterprises is very necessary. Early detection of financial distress helps businesses find ways to overcome and avoid bankruptcy. Along with that, the author applies the z-score model to assess the financial difficulties of some pharmaceutical companies during the period from 2012 to 2017. Research data is secondary data from financial reports enterprise itself. The analysis results show that the average Z score of the selected enterprises is 5.9. This result has helped the author to assess the financial status of pharmaceutical enterprises in good condition (Panigrahi, 2019, pp.65-73).

Research by Grice & Ingram (2001) on testing the generality of the Z-score model (pp.53-61). With the aim of testing the bankruptcy predictability of the Z-score model at banks listed on the Indonesian stock exchange. Secondary data is taken from the financial statements of 29 banks for the period 2011-2013. Applying Altman's Z-score analysis technique with the evaluation criteria of 2.99-point oscillation. Calculation results and comparison with Z scores at 29 banks in 2011 show that there are 14 banks facing bankruptcy, 13 banks with a good financial situation with Z score higher than 2, 99 and 2 banks are in the gray zone, their financial status is weak. In 2012, the results changed slightly, leaving only 10 banks with healthy financial status, 14 banks with poor financial status and 5 banks in the gray area. In the last year of the study, the number of financially healthy banks was 11.4 in the gray area and 14 in bankruptcy (Grice & Ingram, 2001, pp.53-61).

Research by Andriawan & Salean (2016) on Altman's Z-score analysis method (pp.67-82). With the aim of studying the efficiency of bankruptcy prediction and testing the influence of independent variables on the value of financial ratios in Altman's Z-score model. The author used secondary data from the financial statements of 6 companies in the pharmaceutical sector listed on the stock exchange of Indonesia. Through the linear regression method, the research results of Andriawan & Salean (2016) have shown that in the period 2009 to 2013, most of the research companies have good financial status. stock price coefficient is 52% (pp.67-82). Thus, this study also appreciates the effectiveness of Altman's bankruptcy predictor.

Research by Altman et al. (2014) on assessing troubled businesses and their likelihood of bankruptcy through the Z-score model (1-48). Continuing their studies, Altman et al. (2014) conducted a study on a large sample of data from 32 European countries and 3 non-European countries. Except for China and the United States, the remaining companies are in the industrial sector, so the research team applies the Z-score model developed by Altman in 1983 to manufacturing and non-manufacturing companies export. Based on the theoretical basis from 34 high-quality scientific articles of prestigious journals from 2000 to the time of research and the theory of the Z-score model in 1983. The research results show that the score model Z performed quite well when assessing the financial situation in many countries with an accuracy of about 75%. Although there are many other studies that suggest that Z-score does not achieve the expected predictive effect, this study has shown that we need to incorporate some additional variables that will help increase the accuracy of the prediction higher (pp1-48).

Research by Mohammed (2016) on using the Z-score model to predict the probability of bankruptcy at Raysut SAOG and its subsidiary in Oman (70-80). From the perspective that a stable financial situation is the top concern of businesses. The measurement of corporate financial status has many technical tools, but the author believes that Altman's Z-score model has been proven to ensure high reliability. Therefore, with secondary research data from the financial statements of the cement business Raysut SAOG and its subsidiaries in Oman and the evaluation method of Altman, the author gives the results of data analysis as follows: For 8 years (from 2007 to 2014) shows that Raysut SAOG and its subsidiaries are in good financial condition and Z-score is always higher than 2.99. Identify the benefits of the Z-score model for managers in supporting financial decision-making, changing operating policies, or helping investors avoid risks when investing in businesses with unhealthy finances.

Research on bankruptcy prediction by Li (2012) for the period from 2008 to 2011 shows the superiority and efficiency of the Z-score model (31-41). The author used three models to predict the probability of bankruptcy of enterprises in the United States in the period 2008-2011. Of the three models, which are the original Z-score model, the re-estimated Z-score model, and the re-estimated model with additional variables, all have the highest predictability results for the criterion "Market value" market of

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equity/total debt". The author also identifies the superiority of the Z-score model compared to other technical models based on accounting data. The author argues that the change in total assets has almost no effect and is not a decisive factor in predicting bankruptcy. At the same time, the author finds that all models can make mistakes and predict the bankruptcy of enterprises (Li, 2012, pp31-41).

From the research overview, we can see that assessing the financial status of enterprises is considered by many authors to be very important. The application of Altman's bankruptcy prediction model in research in Vietnam is quite limited. Therefore, our team must conduct research on the content and application of the Z-Score model in assessing the financial health of garment manufacturing enterprises listed on the Vietnamese stock market and make sense.

3. METHODS

Methodology: The research team used the methodology to conduct research on the literature on the origin, construction process, role and applicability, and effectiveness of Altman's Z-score model. Along with that, the research team searched the internet for published articles in the form of research papers, reports, and books on the content of the Z-score model. We use some case study documents on the Z-score model to include in our research in this article.

Methods of analysis and synthesis: The research team uses secondary data which is the financial statements of garment manufacturing enterprises listed on the Vietnam stock market for analysis. From the analysis results of 5 indicators of the Z-score model, the research team summarizes them in two tables and presents them in the article. Based on the results of analysis and synthesis, the research team has identified businesses at risk of bankruptcy and businesses in the safe group.

4. EXPERIMENTAL STUDY IN GARMENT MANUFACTURING ENTERPRISES LISTED ON THE VIETNAM STOCK MARKET

Vietnam is a country with production capacity in the garment, knitting and export industries. The number of enterprises operating in the garment manufacturing industry is very large and there are many high-value order contracts from major economies around the world. Although Vietnam has many enterprises participating in the garment production market, the number of garment and knitting enterprises listed on the stock market is still limited. The study collects secondary data from the financial statements of 9 garment manufacturing companies listed on the stock exchange in 2022. Results of analysis of 5 Z-score model indexes of enterprises. The study is shown in Table 1.

Table 1: Analysis results of 5 indicators of the Z-score model

Company	Stocks	X1	X2	X3	X4	X5
Thanh Cong Textile Garment Investment Trading Joint Stock company	TCM	0.372	0.311	0.166	2.954	1.887
Viet Thang Corporation	TVT	0.128	0.156	0.059	0.363	1.074
Garmex Saigon Corporation	GMC	0.543	-0.002	-0.155	3.610	0.532
DamSan Joint Stock Company	ADS	-1.767	0.147	0.192	0.490	2.497
Everpia JSC	EVE	0.510	0.286	0.084	1.702	0.701
Mirae JSC	KMR	0.417	0.043	0.037	0.803	0.646
Song Hong Garment Joint Stock Company	MSH	0.326	0.204	0.144	1.671	1.676
Binh Thanh Import - Export Production & Trade JSC	GIL	0.842	0.274	0.120	1.246	0.794
TNG Investment and Trading JSC	TNG	-0.060	0.047	0.098	0.537	1.280

Source: Analysis of results from the company's financial statements

From the analysis results in Table 1, we see that the ratio of working capital to total assets of DamSan Joint Stock Company and TNG Investment and Trading JSC has a negative sign. This means that the two businesses are experiencing financial distress and difficulty in paying their short-term debts. The index of retained earnings over total assets of Garmex Saigon Corporation is showing a negative sign, which shows that the business is operating at a loss. In addition, a negative X2 index means that Garmex Saigon Corporation is taking on a lot of debt to finance its capital needs instead of using retained earnings. In the X3 index, Garmex Saigon Corporation has another negative indicator, and it shows that the business is losing profitability on assets. Through Table 1, we preliminary evaluate a few indicators with bad signs. There are 4 businesses in this situation. To evaluate the overall through the Z-score model, we follow Table 2 - the results of business classification based on the Z-score.

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Table 2: Enterprise classification results based on Z-score

Stocks	Z-score	Review Z-score	Business classification
TCM	5.205	Z >2.99	"Safe" area
TVT	1.871	1.81 < Z <2.99	"Gray" area
GMC	2.979	1.81 < Z <2.99	"Gray" area
ADS	1.527	Z <1.81	"suffering" area
EVE	3.077	Z >2.99	"Safe" area
KMR	1.842	1.81 < Z <2.99	"Gray" area
MSH	3.895	Z >2.99	"Safe" area
GIL	3.382	Z >2.99	"Safe" area
TNG	1.940	1.81 < Z <2.99	"Gray" area

Source: Author's data analysis results

Looking at Table 2, we see that all 4 enterprises with bad indicators are in the danger zone of bankruptcy. In particular, Garmex Saigon Corporation appeared in two consecutive negative indexes, but the negative number was not too large, so the calculation results on the Z-score model are that this enterprise belongs to the "Gray" area. It means that Garmex Saigon Corporation is at risk of bankruptcy but not high. In addition, for two enterprises with negative indexes, DamSan Joint Stock Company and TNG Investment and Trading JSC, respectively, the results are Z < 1.81 and 1.81 < Z < 2.99, respectively. Thus, these two businesses have a very high risk of bankruptcy and will face great difficulties in the time after 2022.

5. DISCUSSION

The results of the Z-score model analysis showed that out of 9 enterprises included in the study with 2022 data, 4 enterprises have good financial status and are classified as safe, currently not at risk of bankruptcy produce. The group of enterprises with difficult financial situations and classified in the "gray" area includes 4 enterprises. businesses located in this gray zone are at risk of bankruptcy. However, if enterprises recognize early signs and have an adjustment plan in management and production, these enterprises will be able to recover. Finally, there is a group of businesses with a high risk of bankruptcy with poor financial status. Out of the nine enterprises studied, 1 enterprise is in the danger zone, which means that it is very difficult to avoid the risk of bankruptcy. In summary, risk assessment models and financial status are very effective in identifying businesses at risk of bankruptcy. From the research results and considering the actual situation, we believe that the Z-score model is a good and effective model for assessing the financial health of enterprises in Vietnam.

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