



<https://amf.ui.ac.ir>

**Journal of Asset Management and Financing**

E-ISSN: 2383-1189

Vol. 11, Issue 1, No. 40, Spring 2023, p 77-100

Received: 03.09.2022 Accepted: 16.05.2023

**Research Paper**

**Analyzing the Sensitivity of the Bankruptcy Index to Financial Indicators in Different Stages of the Firm Life Cycle**

**Seyed Rasoul Hossaini**

Assistant Professor, Department of Accounting, Faculty of Humanities, University of Zanjan, Zanjan, Iran  
rasoulhosayni@yahoo.com

**Amin Hajian Nezhad** 

Assistant Professor, Department of Accounting, Faculty of Administrative Sciences and Economics, University of Isfahan, Isfahan, Iran  
a.hajiannejad@ase.ui.ac.ir

**Hamid Reza Ganji**

Assistant Professor, Department of Accounting, Faculty of Social Sciences and Economics, Alzahra University, Tehran, Iran  
h.ganji@alzahra.ac.ir

**Abstract**

In this paper, analysis of the sensitivity of the bankruptcy index to financial variables during the firm life cycle was investigated using Monte Carlo simulation. To measure bankruptcy risk, Altman's modified bankruptcy model was used. To simulate  $z'$  score of Altman's modified model, the probability distribution of each index of Altman's modified model was determined based on the historical data of the listed firms listed in the Tehran Stock Exchange (TSE) during the years 2011-2021. With the help of these distributions, 10,000 items for the bankruptcy index were simulated in each life cycle. The results of simulations showed that the bankruptcy index had high and low sensitivities to the indicators of working capital to total assets (X1) and accumulated earnings to total assets (X2) compared to the indices of earnings before interest and taxes to total assets (X3), the book value of equity to book value of total liabilities (X4), and sales to total assets (X5) in all stages of the firm life cycle, except for the decline stage.

**Keywords:** Bankruptcy Risk, Life Cycle, Altman's Modified Model, Monte Carlo Simulation.

**Introduction**

The theory of the firm life cycle is one of the main analyses for examining economic conditions. It has been proposed exclusively regarding the firms since the 1970s. The firm life cycle tendency to bankruptcy has been noticed by researchers in recent studies. Determining the probability of bankruptcy has become one of the most important tasks of risk management. Financial statements are one of the best sources of information along with other information like economic information for the use of stakeholders regarding the financial status of companies to predict future events. One of these cases is predicting the occurrence of a financial crisis, which has provided various models for prediction by using the analysis of financial ratios. Bankruptcy prediction models are used to determine credit ratings and the probability of business unit failure. Since financial ratios are used as the input data in most bankruptcy prediction models, the sensitivity of bankruptcy indices to these financial ratios can be different. This means that changing the standard deviation of each financial ratio to the same level can have different effects on the bankruptcy index. In addition, at each stage of the firm life cycle, the bankruptcy index may show different sensitivities to each input index. This means that an input index has a different effect on the bankruptcy index at each stage of the firm life cycle. Knowing how the bankruptcy index shows sensitivity to the input variables at each stage of the cycle can be important for the business unit. If the bankruptcy index shows a high sensitivity to an input variable, a small change in the input variable can change the bankruptcy index to a large extent. A large change in those input indicators, to which the bankruptcy index is highly sensitive, can have favorable (unfavorable) consequences for business units, especially those business units that are in the start-up and growth stages. Therefore, knowing the sensitivity of the bankruptcy index to input indicators

\*Corresponding author

Hossaini, S. R., Hajiannejad, A. & Ganji, H. (2023). Analyzing the sensitivity of the bankruptcy index to financial indicators in different stages of the firm life cycle. *Journal of Asset Management and Financing*, 11(1), 77-100.

2383-1189 © University of Isfahan



This is an open access article under the By-NC-ND/4.0/ License (<https://creativecommons.org/licenses/by-nc-nd/4.0/>).



<http://dx.Doi.org/10.22108/AMF.2023.134999.1756>

can help the business entity in this field to control its situation and improve it by focusing on these variables and their management and control if needed.

### **Materials and Methods**

The current research was generally designed as follows: First, the probability distribution of the input variables of Altman's modified model was determined at each stage of the life cycle and then, the parameters of these distributions were calculated by using historical data. In the next step, using the probability function of each input variable, some data were generated at each stage of the life cycle and the value of the bankruptcy index was calculated. In the last step, after determining the bankruptcy index, sensitivity analysis was done. To determine the statistical distribution of the input variables and estimate their parameters to generate the simulation values, the historical data of the companies listed in the Tehran Stock Exchange (TSE) during the years 2012-2022 were used.

### **Research Findings**

The results of the simulations showed that the bankruptcy index had high and low sensitivities to the indicators of working capital to total assets (X1) and accumulated earnings to total assets (X2) compared to the indicators of earnings before interest and taxes to total assets (X3), the book value of equity to book value of total liabilities (X4), and sales to total assets (X5) in all the stages of the firm's life cycle, except for the decline stage.

### **Discussion and Conclusion**

The current research investigated the issue of how sensitive the bankruptcy index calculated according to Altman's adjusted model was to changes in the input variables of this model at different stages of the firm life cycle. In this research, based on a simulation, the results showed that in almost all the stages of the life cycle, the bankruptcy index had a high sensitivity to the ratio of profit before interest and taxes to total assets (X3) and the ratio of total sales to total assets (X5). Thus, any small changes in the standard deviations of these input variables can greatly change the bankruptcy index. The interesting result that was obtained regarding the ratio of working capital to total assets (X1) and the ratio of accumulated profit to total assets (X2) was that the paths of changes of these two ratios almost overlapped in all stages of the life cycle, as well as the bankruptcy index compared to the mentioned variables. The inputs showed the lowest sensitivities. Using a simulated sample, the current research showed that bankruptcy risk could be different during the firm life cycle. In this regard, the results of this research are in line with the results of the research done by Akbar et al. (2019). Therefore, a different response to fiscal policy would be desirable at different stages of the firm life cycle.