



# USING ALTMAN'S Z-SCORE FOR DETECTING CASES OF FINANCIAL RESULTS MANIPULATION IN SERBIAN PUBLIC COMPANIES

Dijana Svirčević\* 

PhD candidate,  
Singidunum University,  
Belgrade, Serbia

---

## Abstract:

This study explores the use of Altman's Z-Score index as a tool for detecting possible cases of financial results manipulation among business entities in the Republic of Serbia. In recent years, concerns regarding the integrity of financial reporting have intensified, requiring robust methods for identifying irregularities and safeguarding investor interests. Drawing upon a research sample consisting of 56 year observations of business entities, observed in 2018 and 2019 reporting periods, this study employs quantitative analysis techniques to evaluate the financial health and stability of sampled companies. By calculating Z-scores and matching results with issued auditor opinion type, deviations from expected values, potential anomalies indicative of manipulation are identified and scrutinized. Results show that calculated score matches audits opinion type in app. 71.35% of cases. The results of this study enrich the existing body of knowledge on financial fraud detection and corporate governance by showcasing the effectiveness of Altman's Z-Score index in the context of Serbian corporations.

---

## Keywords:

audit report type, financial reporting, fraud, financial health.

---

## 1. INTRODUCTION

The subject of research in this paper is the Z-score which is used by default for estimating the probability of opening bankruptcy proceedings in certain business entity. To this day, this indicator is considered very reliable and valid in revealing the financial difficulties of companies and up to 3 years unmatched. All evidence supported by global market research gives credibility to this index. Today, more than ever, corporate fraud is a public threat to the financial system, as well as to validity and the credibility of the financial reports made available to the public. Therefore, authors try to find the best model to detect financial results management and some of them used Altman Z-score for those purposes. Research by Spathis (2002) utilized Z-Scores alongside other methods on data from seventy-six companies, demonstrating the capability of Z-Scores to identify fraudulent financial statements (FFS). The same researcher showed that Z-Scores attained an accuracy rate of over eighty-four percent in categorizing the entire sample, with their overall indicators being associated with FFS in the chosen companies (Mehta & Bhavani, 2017). Conversely, the Beneish model failed to identify any instances of fraud, while the Altman Z-Score suggested potential issues in the company's financial statements. Although the Beneish model is widely used for predicting fraudulent financial statements, the findings of this study did not confirm its effectiveness (Bhavani & Amponsah, 2017). Numerous previous experiments have tested the effectiveness of this model, including studies by Loebbecke (Summers & Sweeney, 1998). The findings of these studies affirm the dependability of this model in detecting financial deficiencies, which are considered key drivers of fraudulent behavior

Correspondence:  
Dijana Svirčević

e-mail:  
dijana.svircevic.23@singimail.rs



(Saleh et al., 2021). Building on the previous points, the research question can be articulated as follows: "Is Altman's Z score appropriate to use in detecting financial result management against financial reporting legislation on Serbian public companies?" Paper will be structured as follows. Firstly, existing literature from the field will be analyzed, which will be followed by research methodology. Finally, research results will be presented before final conclusions and recommendations for future work.

## 2. LITERATURE REVIEW

There are a lot of examples in literature where Altman Z-score was used along with the M-score for detecting financial results manipulation to a greater or less success. In addition to the most known example, the Toshiba Corporation, which can be taken as dominant because the Z-score showed an advantage over the M-score, there are other research papers that show similar results (Spathis, 2002; Dalnial et al., 2014; Ujal, 2012). Several authors used the synergy of M-score in combination with Z-score because Z score is very effective but in combination with other benchmarks as well as audit reports (Kukreja et al., 2020).

The main purpose of Beneish M-score is to discover financial fraud. The main issue with this index is that it can't be used in all countries, because each country has different financial reporting system. Investors gravitate towards markets they are acquainted with and have higher trust in nations that have embraced and applied international standards for financial reporting. Consequently, it is the shared interest of all nations to actively engage in the harmonization process of international financial reporting standards to facilitate the growth and enhance the competitiveness of their companies in the global market (Čehaet al., 2023). For this reason, other scores are used more often. The Z-score provides a valuable tool for identifying various financial issues within a company. According to Jolly and Chandani (2020), it can be used to detect accumulated losses. Kukreja, Mohan Gupta, Sarea, and Kumaraswamy (2020) suggest that the Z-score can reveal instances where a fictitious financial year may have been added to artificially enhance financial results and obscure potential bankruptcy risks. Additionally, the Z-score can identify potential financial manipulations and provide a broad assessment of a company's financial well-being (Mohammad et al., 2021). By analyzing various financial ratios, the Z-score can uncover hidden losses that may have accumulated over time, suggesting potential financial instability. It can also uncover fraudulent practices, such as fabricating financial years to enhance the appearance of a company's financial results. This capability to detect manipulative practices underscores the Z-score's significance

in financial analysis. Additionally, the Z-score provides a holistic assessment of a company's financial health, enabling stakeholders to make well-informed decisions based on its true financial standing (Jolly & Chandani, 2020; Kukreja et al., 2020).

As credibility of Z-score index, we add some research that showed good results on the account of bankruptcy prediction. We used the example of research conducted in the Balkans, specifically focusing on Croatia. Namely, with business entities that opened bankruptcy proceedings, success rate predictions for one year before are 73.08% and 84.62% which were tested for upper and lower limits. Results for two years before the declaration of bankruptcy suggest model success rates of 71.15% and 86.54% when testing the upper and lower limits, while performance results for the third year on the same occasion testing the upper limit of 71.15%, and somewhat weaker in compared to the second year when testing the bottom limits 78.85%. According to research conducted from 2007 to 2016 on 26 companies, the authors claim that the probability of bankruptcy in the following sectors is as follows (Bareša et al., 2019):

- Agriculture, forestry and fishing – 2 companies – 7.7%;
- Production of food products, beverages and tobacco products – 3 companies – 11.5%;
- Production of textiles, clothing, leather and related products – 2 companies – 7.7%;
- Production of chemicals and chemical products – 3 companies – 11.5%;
- Manufacturing bricks, tiles, and other clay-based baked products for construction – 1 company – 3.8%;
- Manufacturing of primary metals and fabrication of metal products, excluding machinery and equipment – 1 company – 3.8%;
- Production of transport equipment – 1 company – 3.8%;
- Other sectors of manufacturing, repair, and installation of machinery and equipment – 1 company – 3.8%;
- Water supply; waste water removal, waste management – 1 company – 3.8%;
- Construction – 2 companies – 7.7%;
- Wholesale and retail trade, including maintenance and repair of motor vehicles and motorcycles – 2 companies – 7.7%;
- Transportation and storage – 3 companies – 11.5%;
- Activities of providing accommodation and preparing and serving food – 3 companies – 11.5%;
- Legal, accounting, management, architectural activities and engineering and technical examination and analysis – 1 company – 3.8%.



No matter how much some research may attempt to minimize the impact of the Covid-19 pandemic, the International Journal highlighted research that shows significant advantages of this index in predicting bankruptcy according to the obstacles provided by the pandemic in that time. In 2019, with a Z-Score of 1.82, the company exhibited relatively sound financial health and a low risk of bankruptcy. However, by 2020 and 2021, there was a significant drop in the Z-Score values to -7.62 and -7.46, indicating highly unstable financial conditions and a substantial risk of bankruptcy. This drastic decline in the Z-Score values over the past two years underscores severe issues in the company's financial framework, primarily stemming from reduced sales due to the impact of COVID-19 (Miyandini et al., 2023).

In 2019, the company boasted a Z-Score of 1.82, indicating a low risk of bankruptcy. However, by 2020 and 2021, the Z-Score values plummeted to -7.62 and -7.46, respectively, revealing highly unstable financial conditions and a significant risk of bankruptcy. This drastic drop in Z-Score values over the past two years highlights severe financial challenges within the company, largely attributed to reduced sales stemming from the impact of COVID-19 (Miyandini et al., 2023).

Tung and Phung (2019) in their research, conceptualize bankruptcy as a financial status rather than a specific event, implying that a thorough comprehension of bankruptcy risk allows companies to implement suitable management strategies to enhance their financial stability.

We agree with this viewpoint and emphasize the importance for managers, investors, and stakeholders to assess and forecast financial instability. This facilitates the identification of businesses facing probable risks, enabling the prompt development of effective management strategies (Tung & Phung, 2019).

### 3. RESEARCH METHODOLOGY

Based on the specified research query, a study sample was assembled comprising financial documentation and audit records from chosen corporate entities. Financial statements were needed in order to calculate Altman Z-score, while audit reports were needed in order to classify business entities in two groups. The initial group comprised corporate entities which had disclosures in audit reports that claimed that financial result has been managed due to certain events or occurrences, while the second one did not have disclosures of such kind. Audit and financial reports of the selected entities were sourced from the official website of the Serbian Business Registers Agency -SBRA. The table consists of 56 business entities and they were chosen by chance. Z-score indices were calculated from the selected sample, I used the formula for non-listed companies:

$$Z = 0,717 \times X1 + 0,847 \times X2 + 3,107 \times X3 + 0,420 \times X4 + 0,998 \times X5 \quad (1)$$

X1 = Working capital / Total assets

X2 = Retained Earnings / Total assets

X3 = Earnings before interest and taxes / Total assets

X4 = Book value of equity / Book value of total liabilities

X5 = Sales / Total assets

Z = Overall Index

### 4. RESEARCH RESULTS

By comparing the companies whose auditor's opinion showed that they had managed financial results, it can be concluded that out of possible 24 companies, the scores for 7 of them did not indicate manipulation and thus did not coincide with the auditor's opinion, and in this way, we arrive at a percentage of 29.17% accuracy.

The chart pie shows the total number of companies to which audit reports gave adverse opinion, with the Altman index still recognizing them as companies with a clean result, i.e., companies that did not manipulate.

While, if we look at the other 32 companies with unmodified opinion, the program declared 9 as manipulated reports. The reason for the poorer precision for unmodified opinions is that we used a harsher benchmark for drawing the limits of manipulation, and for this reason, reports that potentially fall into the gray zone, in this way, come into the zone of manipulation. In this way, we arrive at a percentage of 28.125%.

The chart pie shows the total number of companies to which the audit reports gave unmodified opinion, with Altman's index still recognizing them as companies with adverse result, that is, companies that carried out manipulation.

Considering that both percentages are close to 30%, we calculated the average value of these two percentages and came to the result of 28.65%, meaning that Altman Z-score classified sampled companies with the remaining – app. 71.35% precision. Also, by listing audit reports, we concluded that overestimated results indicate manipulation. We have constantly seen this in theory with an emphasis on management error where they very often try to increase profits (and it can often be observed in the same way) in order to present the company to investors as attractive and successful as possible.

It is important to emphasize that International Accounting Standards do not include quantitative financial indicators, making them less relevant for detecting manipulations using the Altman index. Consequently, a synergy of qualitative and quantitative methods can yield a more effective solution. Considering a selected sample of 24 companies with adverse audit opinion, we came to further assertions:



Figure 1. Reports with adverse audit opinion.

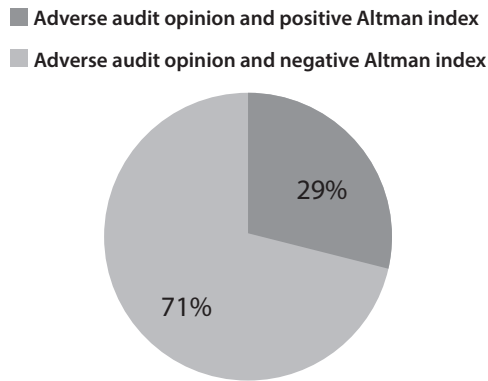
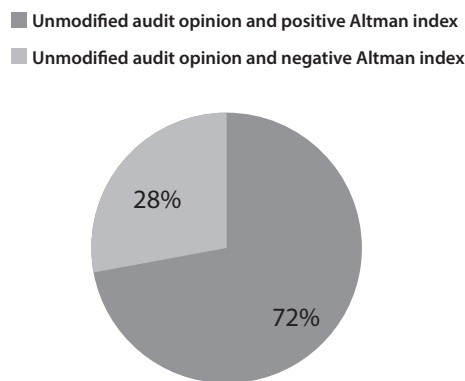


Figure 2. Reports with adverse audit opinion.



- Auditor expressed doubt that the client is capable of continuing operations according to the Going Concern principle, found in 10 reports.
- Frozen bank account was found in 5 audit reports.
- Short-term liabilities exceeded current assets, or negative net working capital, were found in 4 cases.
- Violation of International Accounting Standard 16 - Property, Plant and Equipment was found in 4 reports.

The situation we most often encounter, and which explicitly implies the manipulation of financial results is when the authorized auditor notes that revenues, expenses, and liabilities were overstated or understated with an effect to financial result. There were eight such cases within research sample, where only in one company out of eight had Altman's Z-score value that did not indicate high probability of default / financial result manipulation.

At the end, it is important to bear in mind that Altman's Z score cannot guarantee 100% effectiveness in detecting financial manipulation. While it may identify some cases with potentially adverse forecasts for the future, this does not necessarily imply financial wrongdoing. Combining both methods in research yields the safest and most accurate results because the Altman index lacks

the capability to incorporate qualitative methods such as International Accounting Standards into its calculations. Although it comprises numerous quantitative measures that may signal potential issues, it may not capture more nuanced indicators.

## 5. CONCLUSIONS AND DISCUSSION

Following adequate literature, respecting the views of the world's leading scientists and the creator of the Z-score index himself, and results of this research, it can be verified that "The Altman Z-score can be used as an instrument for detecting potential manipulations of the result. During the writing of the paper and conducting the research, there were some minimal limitations that should not cause the change in results, such as the Covid-19 pandemic or availability financial statements. There is considerable potential for the use and enhancement of this index. Court proceedings can be considered in cases where manipulation is transparently evident, such as when audit reports explicitly state that the results were either reduced or increased. In my analysis, I used almost twice as many limited liability companies as stock companies and observed that reports from 2019 were predominant. The companies are distributed throughout the Republic



of Serbia, and in this regard, we did not limit ourselves to any specific territory. Also, the activities of these companies vary from food industry to construction, agriculture, processing industry, gas supply, wholesale and retail trade, transport, and storage. As for the gender of the auditor who audited a given company, they are equally included. It is noticeable that a lot of companies engaged one of the big four audit companies (KPMG), and apart from that, there are no more frequent engagements of other audit firms. In order to enhance and lend credibility to future research, expanding the geographical scope of respondents, starting with the Balkans and potentially extending to a continental level, could be beneficial. Additionally, conducting sector-specific analyses and comparing them with others is also feasible. Furthermore, as utilized in the research (Stanišić 2012) it is important to consider certain parameters such as ROE, as there is a proven moderate correlation with firm indebtedness and company capitalization.

## 6. ACKNOWLEDGEMENT

Special appreciation goes to prof. Vule Mizdraković for his support, guidance, and constructive feedback throughout the course of this research.

## 7. LITERATURE

- Altman, E. I.-D. (2017). Financial distress prediction in an international context: A review and empirical analysis of Altman's Z-score model. *Journal of international financial management & accounting*, 28(2), 131-171.
- Bareša, S., Hađina, V., & Bogdan, S. (2019). Testing the applicability of the Altman's Z-score model for predicting bankruptcy in the Republic of Croatia. *Notitia - journal for economic, business and social issues*, 42.
- Bhavani, G., & Amponsah, C. T. (2017). M-Score and Z-Score for detection of accounting fraud. *Accountancy Business and the Public Interest*, 1(1), 68-86.
- Ćeha, N., Aničić, J., Aničić, D., Ćeha, M., & Nestorović, O. (2023). High quality financial reporting in the function of company growth in Serbia. *The European Journal of Applied Economics*, 20(2), 111-130.
- Dalnial, H., Kamaluddin, A., Sanusi, Z. M., & Khairuddin, K. S. (2014). Accountability in financial reporting: detecting fraudulent firms. *Procedia-Social and Behavioral Sciences*, 145, 61 – 69.
- Jolly, T., & Chandani, A. (2020). Earnings Manipulation in listed automobile companies using Beneish M-Score and Altman Z-Score model. *International journal of modern agriculture*, 9(3), 1347.
- Kukreja, G., Mohan Gupta, S., Sarea, A., & Kumaraswamy, S. (2020). Beneish M-score and Altman Z-score as a catalyst for corporate fraud detection. *Journal of Investment Compliance*, 21(4), 231-241.
- Mehta, A., & Bhavani, G. (2017). Application of forensic tools to detect fraud: The case of Toshiba. *Journal of Forensic and Investigative Accounting*, 9(1), 692-710.
- Miyandini, R., Angelin Sirait, R., Pangestu, P., & Chen, L. (2023). Is the Altman Z-Score Method Still Relevant in Predicting Bankruptcy? A Study on PT. ESTIKA TATA TIARA TBK from 2019-2021. *International journal of trends in accounting research*, 4(1), 59-65.
- Mizdraković, V., Knežević, G., & Stanić, N. (2015). Bankruptcy exposure of Serbian hotels in the period 2008-2012. *SITCON - Singidunum International Tourism Conference*, 164-167.
- Mohammad, M., Saleh, A., & Al-Balqa. (2021). Predicting fraudulent financial statements using fraud detection models. *Academy of Strategic Management Journal*, 20(3).
- Saleh, M. M., Aladwan, M., Alsinglawi, O., & Salem, M. (2021). Predicting fraudulent financial statements using fraud detection models. *Academy of Strategic Management Journal*, suppl. Special, 20(3), 1-17.
- Spathis, C. (2002). Detecting false financial statements using published data: some evidence from Greece. *Managerial Auditing Journal* 17/4, 179–191.
- Stanišić, N., Radojević, T., Mizdraković, V., & Stanić, N. (2012). Capital efficiency analysis of Serbian companies. *Singidunum Journal of Applied Sciences*, 9(2), 41-49.
- Summers, S. L., & Sweeney, J. T. (1998). Fraudulently misstated financial statements and insider trading: An empirical analysis. *Accounting Review*, 131-146.
- Tung, D. T., & Phung, V. T. (2019). An application of Altman Z-score model to analyze the bankruptcy risk: Cases of multidisciplinary enterprises in Vietnam. *Investment management & financial innovations*, 16(4), 181.
- Ujal, M. A. (2012). Detection of fraudulent financial statement in India: An exploratory study. *Proceedings of the 2<sup>nd</sup> international conference on enterprise systems & accounting (ICESA 2005)*.