Financial Statement Fraud and Bankruptcy Risk in Listed Manufacturing Firms in Vietnam: Empirical Analysis Using the M-Score And Z-Score Models

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Abstract

This study investigates the relationship between financial statement fraud and bankruptcy risk among manufacturing firms listed on Vietnam's stock exchanges during 2019–2023. Using the Beneish M-Score and Altman Z-Score models, the research aims to assess the reliability of pre-audit financial statements and evaluate the financial health of firms to detect potential manipulation and predict financial distress. Based on a dataset of 150 firm-year observations, empirical results show that 84% of firms exhibit high reporting reliability, while the proportion of firms with potential fraud risk has increased in recent years. The Beneish M-Score correctly classified 53.94% of observations, confirming its partial effectiveness in detecting financial statement manipulation, whereas the Altman Z-Score achieved 55.33% accuracy, indicating moderate predictive power for financial distress. The correlation analysis revealed no statistically significant relationship between M-Score and Z-Score ($r = –0.02$, $p = 0.806$), suggesting that fraudulent reporting does not necessarily translate into imminent bankruptcy risk. The findings imply that these two models capture different dimensions of corporate risk—reporting integrity and financial stability—and should be applied complementarily rather than interchangeably. The study contributes to the literature by providing empirical evidence from an emerging market and offers practical implications for auditors, investors, and regulators in strengthening financial transparency and early warning systems for corporate risk management in Vietnam.

Keywords: *Financial statement fraud, bankruptcy risk, Beneish M-Score, Altman Z-Score, listed manufacturing firms, Vietnam*

1. Introduction

According to Beaver (1966), financial statements (FS) serve as fundamental documents that comprehensively reflect a firm's financial position. Financial statements are not only a valuable source of information but also the primary channel through which external stakeholders—such as regulators (e.g., the State Securities Commission of Vietnam), investors, shareholders, and other interested parties—can evaluate a firm's performance, profitability, and growth prospects. Consequently, FS are of concern to multiple groups, including management boards, boards of directors, investors, creditors, banks, customers, regulators, insurance companies, and employees. The accuracy and transparency of financial information play a crucial role in strengthening trust, maintaining stability, and fostering socioeconomic development.

In Vietnam, according to Vietstock (2023), during the 2022 audit season, 447 listed companies on the HOSE, HNX, and UPCoM exchanges (excluding banking, securities, and insurance sectors) reported discrepancies between audited and unaudited financial statements. Specifically, 155 firms reported increased profits after auditing, 214 recorded lower profits, 47 showed increased losses, 16 reported reduced losses, 11 shifted from profit to loss, and 4 from loss to profit. These figures reveal a considerable degree of deviation, raising concerns about the reliability and potential manipulation of financial reporting in Vietnam.

Globally, financial statement fraud is a widespread phenomenon that causes severe consequences. Major scandals, e.g., Enron in the U.S., HIH and Harris Scarfe in Australia, Vivendi in France, Parmalat in Italy, and Royal Ahold in Netherlands during the period of 2002-2003, have shaken global capital markets. According to the Association of Certified Fraud Examiners (ACFE), global financial fraud results in annual losses exceeding USD 1 trillion, and the actual figure may be even higher when undetected frauds are considered. In Vietnam, although the scale of financial reporting fraud is not as severe as international cases, notable violations have occurred and significantly affected the domestic financial market. Typical examples include Vietnam Japan Medical Instrument JSC (JVC) and Cuu Long Pharmaceutical JSC, where substantial post-audit adjustments to financial results severely undermined investor confidence. Historically, the Dai Tin Bank case remains a prominent example, where manipulated

financial statements were used to conceal bad debts and poor performance, eventually leading to bankruptcy and systemic distress in Vietnam's financial sector. In practice, bankruptcy risk is often an inevitable consequence of financial statement fraud. Such misconduct undermines transparency and reliability, damages corporate reputation, and erodes investor and stakeholder trust. In today's volatile business environment, early detection of fraudulent behavior and assessment of bankruptcy risk have become urgent priorities.

To address these challenges, quantitative models such as Beneish's M-Score and Altman's Z-Score have been widely applied in both academic research and professional practice to detect financial statement manipulation and forecast bankruptcy risk. Applying these models helps investors, auditors, and regulators assess financial risk levels and improve financial transparency. Drawing from these motivations, this study investigates the pre-audit financial statement fraud and bankruptcy risk among manufacturing firms listed on the vietnamese stock market. The study expects that the empirical findings will provide valuable insights to support investors, auditors, and regulators in identifying financial fraud risks and enhancing the effectiveness of financial supervision in Vietnam.

2. Objectives

This study aims to analyze the relationship between pre-audit financial statement fraud and the bankruptcy risk of manufacturing firms listed on Vietnam's stock exchanges. In the context of increasing financial fraud risk and potential business failures, recognizing and measuring these phenomena are essential for ensuring corporate transparency and stability. By employing quantitative models such as the Beneish M-Score (for fraud detection) and the Altman Z-Score (for bankruptcy prediction), this study assesses the prevalence of financial statement manipulation and financial distress among listed manufacturing firms. Based on the findings, it proposes management and policy implications to prevent financial statement fraud, strengthen corporate governance, and mitigate bankruptcy risk—particularly relevant in Vietnam's rapidly integrating capital market.

3. Materials and Methods

3.1. Review of prior studies using the M-Score model in detecting financial statement fraud

The Beneish M-Score model by Beneish (1999) has been extensively applied to detect financial statement fraud across various countries and contexts. Maniatis (2022) applied the M-Score to companies listed on the Athens Stock Exchange, focusing on identifying potential earnings manipulation during 2017–2018. The study employed the model's eight variables to assess the probability of fraud, demonstrating its applicability in different market contexts. Similarly, Meiryani et al. (2021) examined the effectiveness of the Beneish M-Score alongside the F-Score model, utilizing discriminant analysis to distinguish manipulated financial reports from non-manipulated ones. Their findings underscore the model's utility in fraud detection, highlighting its role in classifying suspicious financial statements. In the Indonesian context, Julianto et al. (2021) used the M-Score to analyze PT. Garuda Indonesia over the period 2017–2019. Their results indicated that the company was classified within the gray zone, suggesting a potential for manipulation in 2017 and 2018, while in 2019, it was classified as not manipulated. This demonstrates the model's capacity to detect varying degrees of financial statement integrity over time. Tarjo & Herawati (2015) combined the M-Score model with logistic regression to identify indicators predicting fraud among Indonesian firms. Their results showed that GMI, DEPI, SGAI, and TATA were significant predictors, while DSRI, AQI, and LVGI were not statistically significant, achieving a 77.1% detection accuracy.

The model's relevance extends to microfinance institutions as well. Adoboe-Mensah et al. (2023) employed the Beneish M-Score to detect potential fraud in Ghana's microfinance sector, establishing a link between earnings manipulation and institutional failures. Their findings support the model's effectiveness in micro-level financial environments. In Malaysia, Kamal et al. (2016) validated the Beneish M-Score's reliability in detecting earnings manipulation and financial statement fraud using a sample of 17 convicted fraudulent companies (1996–2014). The model achieved an 82% accuracy rate, suggesting its usefulness as a diagnostic tool for auditors and regulators. Kukreja et al. (2020) analyzed Comscore's financial statements (2012–2018) using both the M-Score and Z-Score models to detect early fraud signals. Their results indicated that the Beneish M-Score was less predictive than the Altman Z-Score, implying that model selection substantially influences fraud detection outcomes. Narsa et al. (2023) integrated the fraud triangle with the M-Score model to assess earnings manipulation among 284 Indonesian manufacturing firms (2017–2019). The results revealed that asset growth, changes in receivables, and auditor rotation were negatively associated with earnings management, whereas leverage had a positive relationship.

In Vietnam, Anh & Linh (2016) applied the M-Score model to 229 non-financial firms listed on HOSE (2013–2014), finding that 48.4% of companies exhibited earnings management behavior. The study confirmed the model's effectiveness in detecting manipulation and improving reporting quality. Similarly, Ngoc (2017) employed logistic regression using data from 90 Vietnamese firms across various sectors (2011–2016), identifying LVGI as the most influential variable in fraud prediction. Sudden revenue growth, depreciation changes, and disproportionate selling expenses were also highlighted as key fraud indicators. Finally, Hai (2017)utilized the M-Score to identify fraud among 268 listed firms on HOSE, developing a logistic regression model with ten independent variables. The findings indicated that ratios such as net income to total assets, working capital to total assets, gross profit to total assets, and Z-Score were statistically significant in predicting fraud, with an accuracy rate of 58.58%—4.48% higher than the original Beneish model—demonstrating the potential for local model adaptation in Vietnam.

3.2. Review of prior studies using the Z-Score model in predicting bankruptcy risk

The Altman Z-Score model is one of the most widely used tools for predicting corporate bankruptcy and has been adapted for various firm types and market conditions. Milić et al. (2021) highlight the model's widespread application in assessing the creditworthiness of companies within the agricultural sector, specifically those involved in drying and storage of crops and plants, emphasizing its role as a common tool for bankruptcy prediction. Meeampol et al. (2014) applied both Z-Score and EM Z-Score models to 31 non-compliant Thai firms (2010-2011), showing that both models accurately predicted bankruptcy, with the Z-Score performing better even in an emerging market context. Goh et al. (2022) used the Z-Score to analyze the collapse of Thomas Cook Travel Group (2008–2018), demonstrating that financial ratios—beyond firm size and market position—were reliable indicators of bankruptcy risk. The study provided practical insights for financial risk monitoring in the tourism and hospitality industry.

The comparative effectiveness of the Z-score alongside other models has been explored in recent research. Marsenne et al. (2024) employed multiple models, including the Altman Z-score, Springate, Zmijewski, Taffler, and Grover, to evaluate the likelihood of financial difficulties in PT Garuda Indonesia, illustrating the model's role within a broader toolkit for bankruptcy prediction. Ishak et al. (2024) further integrated the Altman, Springate, Grover, and Zmijewski models into a logistic regression framework to classify financial distress among construction, technology, and property companies in Malaysia, demonstrating the model's utility in practical, industry-specific applications

In Vietnam, Vy & Cong (2013) applied the Z-Score to 11 listed pharmaceutical firms, finding that most were within the safe zone, though a few required financial restructuring. Similarly, Van (2020) applied Altman's revised (2007) model to 60 Vietnamese firms (30 bankrupt and 30 active), achieving 76.67% accuracy in predicting bankruptcy one year prior and 70% two years prior, confirming the model's applicability in Vietnam. More recently, Minh (2022) tested both Z-Score and H-Score models for 224 listed real estate firms, with accuracy rates of 63.82% and 99.11%, respectively. However, due to the industry's capital-intensive nature and early-stage negative profits, the predictive results may not fully reflect actual bankruptcy risk.

The review of prior studies reveals that both the Beneish M-Score and Altman Z-Score models have been widely utilized to detect financial statement fraud and predict bankruptcy, respectively. Empirical evidence across different contexts confirms their predictive validity; however, their accuracy often depends on contextual factors such as industry characteristics, regulatory framework, and financial reporting quality. In Vietnam, while both models have been separately applied, limited research has examined their interrelationship—particularly the potential link between pre-audit financial statement fraud and bankruptcy risk. This research gap underscores the need for an integrated approach that combines fraud detection and financial distress prediction to provide a comprehensive understanding of corporate transparency and financial health. Addressing this gap may enhance audit quality, corporate governance, and risk management practices in emerging markets like Vietnam.

3.3. Research Methods

Data Collection: This study employs secondary data collected from multiple reliable sources, including ISI Web of Knowledge, ScienceDirect, the Vietnam Center for Scientific and Technological Information (STD), the National University Library of Hanoi, the General Statistics Office, and Vietstock Finance. Additional data were retrieved from official websites such as the Hanoi Stock Exchange (www.hnx.vn), the Ho Chi Minh City Stock Exchange (HOSE), Stockbiz Vietnam (www.stockbiz.vn), and finance.vietstock.vn. The dataset consists of

financial statement information for manufacturing firms listed on Vietnam's stock exchanges during the 2019–2023 period, covering both pre-audit and post-audit reports. After screening and consolidation, 30 firms with 150 firm-year observations were retained for analysis. This dataset provides a sound basis for evaluating differences between pre- and post-audit financial data and for examining the relationship between financial statement manipulation and bankruptcy risk using the M-Score and Z-Score models.

Research Model

(i) M-Score Model: This study employs the M-Score model developed by Messod Daniel Beneish (Beneish (1999)) to identify the likelihood that firms manipulate earnings through financial ratios derived from their financial statements. The Beneish M-Score is one of the most widely recognized and applied quantitative models for detecting financial statement fraud.

Based on data collected from unaudited financial statements of listed manufacturing firms on the Vietnamese stock market during the period 2019–2023, the M-Score for each company is calculated to evaluate the model's ability to predict financial reporting manipulation.

The Beneish M-Score model is formulated as follows:

$$M\text{-}Score = -4,84 + 0,0920*DSRI + 0,528*GMI + 0,404*AQI + 0,892*SGI + 0,115*DEPI - 0,172*SGAI + 4,679*TATA - 0,327*LVGI$$

Where: M-Score: The dependent variable measuring the likelihood of financial statement fraud. DSRI: *Days' Sales in Receivables Index* – measures the ratio of receivables to sales, indicating potential revenue inflation. GMI: *Gross Margin Index* – reflects deterioration in gross profit margins that may motivate earnings manipulation. AQI: *Asset Quality Index* – captures the proportion of assets whose future benefits are uncertain. SGI: *Sales Growth Index* – indicates the pressure to sustain sales growth, which may lead to manipulation. DEPI*: Depreciation Index* – reflects changes in depreciation rate; an increase may indicate income manipulation. SGAI*: Sales, General and Administrative Expenses Index* – measures the change in SG&A expenses relative to sales. TATA*: Total Accruals to Total Assets* – indicates the extent of accrual-based earnings management. LVGI: *Leverage Index* – reflects changes in leverage, with higher values suggesting increased financial risk.

Interpretation of the M-Score:

M-Score < –2.22: The financial statements are considered reliable, with a low likelihood of manipulation or fraud.

–2.22 ≤ M-Score ≤ –1.78: The financial statements may have been manipulated, indicating a potential risk of earnings management.

M-Score > –1.78: The financial statements are highly likely to be fraudulent, suggesting a high risk of financial statement manipulation.

(ii) Z-Score Model: In addition to the M-Score model, this study also employs the Z-Score model developed by Edward Altman (Altman (1968)) to predict the bankruptcy risk of firms through five fundamental financial ratios. The Altman Z-Score is a classic model, widely applied in assessing financial distress and bankruptcy prediction, particularly for manufacturing companies.

Data are collected from unaudited financial statements of listed manufacturing firms in Vietnam during the period 2019–2023. The Z-Score is computed to evaluate the firm's probability of financial distress.

The Altman Z-Score model is expressed as follows:

$$Z\text{-}Score = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 1.0X_5$$

Where: Z-Score: Dependent variable measuring the likelihood of bankruptcy. X_1 = Working Capital / Total Assets. X_2 = Retained Earnings / Total Assets. X_3 = Earnings Before Interest and Tax / Total Assets. X_4 = Market Value of Equity / Total Liabilities. X_5 = Total Sales / Total Assets.

Interpretation of the Z-Score:

- Z-Score > 2.99: The firm is in a safe zone, with no indication of financial distress.
- 1.81 < Z < 2.99: The firm is in a gray or warning zone, indicating a possible risk of bankruptcy.
- Z-Score < 1.81: The firm is in a distress zone, facing a high probability of bankruptcy.

Research Hypotheses: Based on theoretical foundations and prior studies, the Beneish M-Score model is employed to detect earnings manipulation through financial ratios that reflect variations in revenue, expenses, assets, and leverage. Meanwhile, the Altman Z-Score model serves as a well-established tool for predicting corporate bankruptcy risk, based on profitability, working capital, and overall financial strength. Empirical evidence from both international and domestic research suggests that these two models are highly applicable; however, their predictive effectiveness may vary depending on market characteristics, industry type, and the

quality of financial disclosures. In the context of the Vietnamese stock market, where transparency and accounting standards are still in the process of improvement, the combined application of both models can provide a comprehensive understanding of the relationship between financial statement fraud and bankruptcy risk. Accordingly, this study proposes the following general hypotheses:

H_1: *The Beneish M-Score model can accurately classify firms that manipulate and do not manipulate financial statements among listed manufacturing companies in Vietnam.*

H_2: *The Altman Z-Score model effectively differentiates between firms with and without bankruptcy risk among listed manufacturing companies in Vietnam.*

H_3: *There is a positive relationship between the likelihood of financial statement manipulation (measured by M-Score) and the risk of bankruptcy (measured by Z-Score).*

In other words, firms engaging in earnings manipulation tend to face higher financial risk and a greater probability of bankruptcy. Testing these hypotheses allows for an assessment of the applicability and predictive power of both models under Vietnam's market conditions, while providing empirical evidence to support financial supervision, auditing, and corporate governance practices.

4. Results and Discussion

4.1. Analysis of Financial Statement Reliability Based on the Beneish M-Score

To evaluate the reliability of financial statements during the period 2019–2023, this study applies the Beneish M-Score, a metric developed by Beneish to detect potential earnings manipulation by firms. According to commonly used threshold values, when M-Score < –2.22, the financial statements are considered reliable; when –2.22 ≤ M-Score ≤ –1.78, they are considered less reliable; and when M-Score > –1.78, they are regarded as highly unreliable or potentially fraudulent.

Descriptive statistics presented in Table 1 show that most firms in the sample maintained high financial statement reliability in the early years; however, this trend exhibited a notable decline in recent periods.

Table 1 Classification of Financial Statement Reliability Based on Beneish M-Score (2019–2023)

Year	High Reliability (M-Score < –2.22)	Low Reliability (–2.22 ≤ M-Score ≤ –1.78)	Very Low Reliability (M-Score > –1.78)	Total Firms
2019	28	0	2	30
2020	29	0	1	30
2021	28	0	2	30
2022	22	2	4	30
2023	19	3	8	30
Total	**126**	**5**	**16**	**150**

The results presented in Table 1 indicate that during the first three years (2019–2021), the proportion of firms with an M-Score below –2.22 was exceptionally high, ranging from 93.3% to 96.7%, reflecting a relatively stable level of transparency and reliability in financial reporting during this period. Meanwhile, the proportion of firms with signs of possible fraud (M-Score > –1.78) remained low, at only 3.3% to 6.7%, suggesting a low level of earnings manipulation risk. However, beginning in 2022, the reliability of financial statements started to decline significantly. The percentage of firms with M-Score < –2.22 dropped to 73.3% in 2022 and further decreased to 63.3% in 2023. At the same time, the share of firms with M-Score > –1.78 (indicating a high likelihood of manipulation) rose sharply from 6.7% in 2021 to 13.3% in 2022, and 26.7% in 2023. Over the entire five-year period, a total of 126 observations (84%) were classified as high reliability, 5 observations (3.3%) as low reliability, and 16 observations (10.7%) as very low reliability. This fluctuation reveals a noteworthy trend: the quality of financial reporting among the sampled firms deteriorated during 2022–2023. Possible explanations include the pressure to sustain business performance in the post–COVID-19 period, macroeconomic volatility, or changes in accounting and disclosure regulations that may have motivated firms to manage earnings to maintain a stable financial image. Additionally, variations in the competence and independence of auditing firms may have contributed to differences in financial statement reliability across firms.

These findings imply that the risk of earnings manipulation has been increasing, especially amid heightened market uncertainty. Therefore, the regular application of fraud detection models such as the Beneish

M-Score can serve as an early warning tool for investors, auditors, and regulators, thereby enhancing transparency and the reliability of financial information in the capital market.

4.2. Analysis of Firms' Bankruptcy Risk Based on the Altman Z-Score

To assess the bankruptcy risk and financial stability of the sampled firms, this study applies the Altman Z-Score model (Altman (1968)). The model is recognized as a powerful tool for predicting financial distress and insolvency risk, using five financial ratios that reflect a firm's operational efficiency, liquidity, financial leverage, and asset utilization. According to Altman's classic classification thresholds, firms with a Z-Score above 2.99 are considered financially healthy, those with $1.81 < Z \leq 2.99$ fall within the gray (warning) zone, and firms with a Z-Score ≤ 1.81 are classified in the distress zone, indicating a high probability of bankruptcy.

Table 2 Classification of Firms Based on Altman Z-Score (2019–2023)

Year	Z > 2.99 (Safe Zone)	1.81 < Z ≤ 2.99 (Warning Zone)	Z ≤ 1.81 (Distress Zone)	Total Firms
2019	16	7	7	30
2020	17	12	1	30
2021	18	11	1	30
2022	16	10	4	30
2023	16	6	8	30
Total	**83**	**46**	**21**	**150**

The analysis of Altman Z-scores over the five years from 2019 to 2023 provides insightful evidence regarding the financial health and bankruptcy risk of the sampled firms. As presented in Table X, the majority of firms consistently fell within the *safe zone* (Z > 2.99), indicating a relatively strong financial position and low likelihood of financial distress. Specifically, the number of financially stable firms fluctuated slightly between 16 and 18, suggesting that most enterprises maintained prudent financial management and profitability throughout the period. In contrast, firms categorized in the *warning zone* (1.81 < Z < 2.99), representing potential financial instability, accounted for a moderate proportion of the sample. The number of firms in this category increased from 7 in 2019 to 12 in 2020 and remained relatively high during 2021–2022 before declining to 6 in 2023. This pattern implies that some firms experienced temporary declines in financial performance, possibly driven by external shocks such as the COVID-19 pandemic and subsequent market disruptions, but were able to recover in the post-pandemic years. Meanwhile, the *distress zone* (Z < 1.81), which signals a high probability of bankruptcy, initially included 7 firms in 2019 but dropped sharply to only 1 firm in both 2020 and 2021. However, the figure rose again to 4 in 2022 and 8 in 2023, indicating a potential deterioration in financial resilience among certain firms. This upward trend may reflect the delayed impact of macroeconomic uncertainties, increasing financial leverage, or tightening credit conditions in the post-pandemic recovery phase.

Overall, the longitudinal evidence suggests that while most firms in the sample remained financially healthy, the proportion of high-risk firms increased slightly toward the end of the study period. This finding underscores the importance of continuous financial monitoring and strategic adjustment to maintain solvency, particularly in the context of evolving economic environments and external shocks.

4.3. Evaluation of Model Accuracy
4.3.1. Accuracy of the Beneish M-Score Model

According to Clauses 4 and 5, Article 14 of Circular No. 96/2020/TT-BTC issued by the Ministry of Finance of Vietnam (Ministry of Finance (2020)), listed or public companies are required to provide explanations when the difference in net profit before and after auditing exceeds 5%, or when there is a change from loss to profit (or vice versa). Therefore, firms with post-audit profit deviations of less than 5% are considered to have reliable and truthful financial statements. Based on this regulatory framework, this study evaluates the predictive accuracy of the Beneish M-Score by comparing its classification results with the actual differences between pre-audit and post-audit net profits. Specifically, when a firm has a profit deviation of less than 5% and is classified by the M-Score as "reliable," or when the deviation exceeds 5% and the model indicates "low or very low

reliability," the prediction is deemed accurate. Conversely, inconsistencies between the two measures are treated as inaccurate predictions.

Table 3 Comparison between Beneish M-Score Predictions and Profit Deviations Before and After Audit

Prediction Based on M-Score	Prediction Based on Profit Deviation	Total
Potential Fraud	5	17
No Fraud Indication	19	109
Total	**24**	**126**

From Table 3, the model's classification accuracy is calculated as follows:

Table 4 Evaluation of Beneish M-Score Model Accuracy

Explanation	Number of Observations	Correct Predictions	Correct Prediction Rate
Non-fraudulent Firms	128	109	85.16%
Fraudulent Firms	22	5	22.73%
Average Accuracy Rate	–	–	**53.94%**

The results indicate that the Beneish M-Score correctly classifies 85.16% of non-fraudulent firms and 22.73% of fraudulent firms, with an overall average accuracy rate of 53.94%. This suggests that the model demonstrates a moderate ability to identify the reliability of financial statements; however, its sensitivity to actual fraud cases remains limited. These findings are consistent with prior studies by Tarjo and Tarjo & Herawati (2015) and Anh & Linh (2016), which confirm that while the Beneish M-Score retains practical applicability in emerging markets such as Vietnam, model calibration may be required to improve fraud detection performance.

Accordingly, Hypothesis H1 is partially accepted, indicating that the Beneish M-Score can distinguish between fraudulent and non-fraudulent firms, though its predictive accuracy is influenced by the quality of accounting data and local reporting standards in Vietnam.

4.3.2. Accuracy of the Altman Z-Score Model

For the Altman Z-Score, the study assesses predictive accuracy by comparing model classifications with actual firm status (bankrupt vs. non-bankrupt). The accuracy rate is computed using the formula:

$$Accuracy = \frac{Number\ of\ Correct\ Predictions}{Total\ Observations} * 100\%$$

Table 5 Comparison between Altman Z-Score Predictions and Actual Firm Status

Prediction Based on Z-Score	Actual Status	Total
Bankrupt	0	67
Non-bankrupt	0	83
Total	**0**	**150**

Table 6 Evaluation of Altman Z-Score Model Accuracy

Explanation	Number of Observations	Correct Predictions	Correct Prediction Rate
Entire Sample	150	83	55.33%

The results show that the Altman Z-Score correctly classifies 55.33% of the total observations, indicating a moderate predictive capability in identifying financial distress and bankruptcy risk. Although some misclassifications remain, the model proves to be a valuable tool for early warning of insolvency and financial instability. Therefore, Hypothesis H2 is accepted, confirming that the Altman Z-Score is suitable for distinguishing between financially healthy and distressed firms among listed manufacturing companies in Vietnam. Collectively, the findings suggest that both the Beneish M-Score and Altman Z-Score exhibit acceptable levels of accuracy, demonstrating their practical applicability in emerging markets. While the M-Score excels in

detecting earnings manipulation and transparency issues, the Z-Score provides reliable insights into financial stability and bankruptcy risk. The combined use of both models enables a comprehensive evaluation of firms' financial risk and accounting information quality.

4.4. Relationship between Beneish M-Score and Altman Z-Score

To examine the relationship between financial statement fraud and bankruptcy risk, a correlation analysis was conducted between the Beneish M-Score and the Altman Z-Score. The results are presented in Table 7.

Table 7. Results of Correlation Analysis

Independent Variable	Dependent Variable	Correlation Coefficient (r)	Significance Level (Sig.)
M-Score	Z-Score	-0.02	0.806

The Pearson correlation coefficient ($r = -0.02$, Sig. $= 0.806 > 0.05$) indicates a very weak and statistically insignificant relationship between the two variables. This suggests that the degree of financial statement manipulation (measured by the Beneish M-Score) is not significantly related to the likelihood of bankruptcy (measured by the Altman Z-Score) among Vietnamese listed manufacturing firms. This finding implies that earnings manipulation does not directly reflect overall financial health in the short term. The independence between the two indices may stem from characteristics specific to the Vietnamese context, where factors such as firm size, industry type, and accounting policies could weaken the link between fraudulent reporting and financial distress. In contrast to several international studies (e.g., Tarjo & Herawati (2015); Narsa et al. (2023)), which identified a significant negative relationship between financial statement fraud and bankruptcy risk, the results here suggest that the two models may not fully capture the dynamics of an emerging market like Vietnam, where corporate governance and accounting standards are still evolving. Based on these findings, Hypothesis H3 is rejected. This indicates that the two indices reflect distinct dimensions of corporate financial behavior: the Beneish M-Score detects earnings manipulation, while the Altman Z-Score captures overall bankruptcy risk. Given the absence of a statistically significant relationship, the study does not proceed with regression analysis to ensure analytical objectivity and methodological soundness.

4.5. Discussion

The empirical results reveal that both the Beneish M-Score and Altman Z-Score models retain certain applicability in assessing corporate transparency and financial stability within Vietnam's emerging market context, though their predictive power remains moderate and context-dependent. First, the Beneish M-Score achieved an average classification accuracy of 53.94%, correctly identifying 85.16% of non-manipulating firms but only 22.73% of those engaging in earnings manipulation. This limited sensitivity to fraudulent behavior aligns with prior studies by Tarjo & Herawati (2015) and Anh & Linh (2016), which similarly reported moderate detection capability in Southeast Asian markets. The finding suggests that financial statement manipulation in Vietnam often occurs through subtle adjustments in accounting estimates rather than overt misstatements easily captured by ratio-based models. Moreover, differences in auditor quality, corporate governance, and compliance with accounting standards may also constrain the model's effectiveness. Second, the Altman Z-Score correctly classified 55.33% of the sample, reflecting a moderate ability to predict financial distress. Although this result is lower than those observed in earlier studies (e.g., Altman (1968); Van (2020); Marsenne et al. (2024)), it demonstrates that the model remains a useful early warning indicator of solvency risk, especially when complemented by qualitative assessment. The increasing proportion of firms in the distress zone during 2022–2023 further supports the view that post-pandemic financial instability, rising debt ratios, and tightening credit conditions have weakened corporate resilience in Vietnam's manufacturing sector. Third, the correlation analysis ($r = -0.02$, $p = 0.806$) indicates that no statistically significant relationship exists between the M-Score and Z-Score, implying that fraudulent financial reporting and bankruptcy risk are largely independent phenomena in the short term. This finding diverges from international evidence (e.g., Narsa et al. (2023); Kukreja et al. (2020)) that found a negative association between manipulation and financial health. In Vietnam, contextual factors such as flexible accounting policies, delayed enforcement, and differences in firm size or ownership structure may dilute the linkage between these two forms of risk.

Overall, these findings contribute to the regional literature by demonstrating that traditional models like Beneish M-Score and Altman Z-Score, though conceptually robust, require contextual calibration when applied in emerging economies. For regulators and auditors, the results highlight the necessity of combining quantitative tools with qualitative indicators—such as governance quality and auditor independence—to enhance fraud detection and financial monitoring. For investors, the coexistence of reliable M-Score and Z-Score measures offers complementary insights: while the M-Score evaluates reporting transparency, the Z-Score captures long-term solvency risk.

5. Conclusion

This study provides empirical evidence on the relationship between financial statement fraud and bankruptcy risk among manufacturing firms listed on the Vietnamese stock exchanges during 2019–2023. The finding confirms that the Beneish M-Score can classify firms according to the reliability of financial statements, though its sensitivity to fraud detection remains limited. This study results also demonstrate that the Altman Z-Score model provides a moderately accurate prediction of financial distress among listed firms. The result indicates no statistically significant correlation between the degree of financial statement fraud and bankruptcy risk. These findings clarify both the usefulness and limitations of the two classic models in the setting of an emerging economy. They suggest that in Vietnam, effective fraud detection and bankruptcy prediction require a combination of quantitative and qualitative indicators, including corporate governance quality, audit effectiveness, and the regulatory environment.

From a practical perspective, the tegulators should encourage the adoption of models such as the M-Score and Z-Score in early warning systems for financial risk among listed firms. Auditors and investors may utilize the M-Score to detect potential manipulation and the Z-Score to evaluate overall financial health. Firms should enhance transparency and compliance with accounting standards to reduce the likelihood of being classified as fraudulent or financially distressed. Future research could extend the analysis to other industries, compare pre- and post-audit data, or develop a hybrid model combining M-Score, Z-Score, and corporate governance indicators to improve predictive performance and fraud detection in Vietnam's capital market.

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