

Investigating the Factors Predicting the Financial Distress of Firms: A Study Based on Pakistani Firms

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ARTICLE INFO			ABSTRACT
Article History:			<i>This study tries to investigate the determinants of financial distress or bankruptcy prediction of the non-financial firms listed on the Pakistan Stock Exchange 100 Index. The study has taken a sample of 21 non-financial firms representing the cement, sugar, and textile sectors for analysis in the period spanning from 2014 to 2023. Altman's Z-score is considered as proxy for financial distress. This study applies the Panel Least Squares (PLS) approach to test the hypotheses besides the Fixed Effect (FEM) and Random Effect (REM) models. A comparative assessment of PLS, FEM, and REM was also performed in comparing the model performance. The results indicate that the liquidity, efficiency, and solvency ratios are positively associated with the financial distress measured using the Altman Z-score. On the other hand, leverage and firm size show a very important negative relationship with financial distress; this may further mean that even large firms may become distressed due to other contributing factors. Profitability, as represented by profit margins, does not show any significant impact on financial distress in this study. The study underscores the importance of using bankruptcy prediction models to enable firms to identify likely financial distresses early. Companies also need to look forward toward other factors that may cause distress and focus on if cash flow and debt management practices need improvement to meet their financial obligations efficiently.</i>
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Introduction

Financial distress is a critical challenge faced by organizations worldwide, manifesting as an entity's inability to meet its financial obligations, including debts, operational expenses, and other liabilities. This state often results from cash flow deficiencies, excessive liabilities, or declining revenues (Mallinguh & Zéman, 2020). Whitaker (1999) defines financial distress as a condition

that arises when a firm encounters a cash shortfall, rendering it unable to settle its current liabilities, such as accounts payable and interest expenses, necessitating urgent corrective measures. In recent years, the prevalence of financial distress has notably impacted non-financial firms in Pakistan. High equity costs, excessive leverage, and elevated capital costs have been significant contributors to this phenomenon. The companies like Indus Bank Limited, Bankers Equity Limited, Schon Modaraba, Samin Textiles etc have been bankrupted due to financial mismanagement and liquidity crisis. Additionally, the accumulation of non-performing loans further exacerbates the financial instability of firms. Research by Hassan et al. (2024) emphasizes the predictive accuracy of financial ratio indices in identifying financial distress, particularly in Pakistan's corporate sector. These ratios highlight critical predictors, including firm size, profitability, leverage, and efficiency. Moreover, reliability and comparability of financial statements serve as essential indicators of potential financial distress (Islam et al., 2023; Hanif et al., 2024; Ma et al., 2022).

Altman (1968) introduced Z-score formula to predict the possibility of a firm's bankruptcy within two years. Commonly utilized in academic research, Z-scores are effective in forecasting corporate defaults and serve as a simple measure of a company's financial distress. The computation is based on key financial indicators extracted from the firm's income statement and balance sheet to evaluate its financial stability.

$$\mathbf{Z\ score = 1.2X1 + 1.4X2 + 3.3X3 + 0.6X4+ 1.0X5}$$

X1 = working capital ratio

X2 = retained earnings ratio

X3 = earnings ratio

X4 = market value ratio

X5 = Firm size

Zones of discrimination:

$Z > 2.99$ – "safe" zone

$1.81 < Z < 2.99$ – "grey" zone

$Z < 1.81$ – "distress" zone

Background of the Study

The concept of financial distress has been a focal point in finance, with its study tracing back to early works by Merwin (1942) and Fitzpatrick (1931). Notable advancements were made in the 1960s, particularly through the seminal studies of Beaver (1966) and Altman (1968). These pioneering works introduced models based on financial ratios, such as the Z-score, to predict financial stability and preempt corporate failures. The Z-score, a multivariate discriminant analysis (MDA) model, became a cornerstone in financial distress prediction, offering a linear equation to categorize firms into stable and unstable entities.

Subsequent research expanded upon these foundational models, integrating advanced methodologies such as hazard models, neural networks, and option pricing to identify factors leading to financial instability. For example, Mehmood and Luca (2023) adapted the Z-score model to predict financial distress in European economies, underscoring its applicability across diverse economic landscapes. Furthermore, newer models like the death rate model and neural systems have enhanced risk categorization, demonstrating the evolving nature of financial distress analysis

Wreckers Theory of Financial Distress

Jean Tirole presented his work in 1990s related to market failure. Wrecker's theory discovers how misaligned incentives among stakeholders can aggravate financial distress. The theory explores how misaligned incentives among stakeholders can exacerbate financial distress. Effective corporate governance and regulation are crucial to mitigating such behaviors. Tirole's theory examines the role of various stakeholders in financial distress and how their conflicting interests can worsen the situation.

Early Bankruptcy Theory

In 1966, Beaver introduced the Bankruptcy Theory, utilizing univariate analysis of financial ratios to forecast corporate failure. His study highlighted that specific financial metrics, such as the ratio of cash flow to total debt, served as reliable indicators of bankruptcy. Insolvency may be caused when a firm is unable to generate sufficient revenue in order to cover its cost except the financing costs, then this situation is referred to as an economic distress while on the other hand, a firm is in a position of financial distress if it becomes unable to service its debt i.e unable to pay off its obligations.

Problem Statement

Financial distress poses a significant threat to businesses, with severe implications for their operational continuity and ability to attract investors. Entities experiencing distress often fail to meet their financial obligations, leading to a loss of investor confidence and eventual bankruptcy. This is further compounded by the lack of effective predictive tools, whereby companies are unable to identify early warning signs of financial instability. The aim of this study was to fill this gap and examine the critical factors contributing to financial distress of non-financial companies listed on the Pakistan Stock Exchange PSX. The study applies Altman's Z-score model to assess the impact of variables such as profitability, liquidity, efficiency, solvency, leverage, and firm size on corporate stability. This will provide a strong framework for early identification of financial distress and remedial measures to deal with it efficiently.

Objectives of the Study

The main purpose of this research is to find out and explore the main factors contributing to financial distress in non-financial firms listed on the Pakistan Stock Exchange (PSX). More precisely, the research seeks to:

1. Examine the relationship between Z-scores and key financial determinants, including profitability, liquidity, efficiency, solvency, leverage, and firm size.
2. Provide actionable insights for management in the cement, textile, and sugar sectors to preempt financial instability through effective risk management and decision-making.

3. Assess the effectiveness of Altman's Z-score model as a predictive tool for financial distress.

Literature Review

Chronological Literature Development

The topic of financial distress and its prediction has been extensively studied over the decades, with researchers employing various methodologies and exploring diverse factors influencing corporate stability and failure. This review organizes the literature chronologically, highlighting the evolution of thought in this domain since 1990 till date.

Literature development in 1990s

Wilson and Sharda (1994) compared the effectiveness of neural network models and multivariate discriminant analysis in predicting corporate failure. Using data from Moody's Industrial Manuals (1975-1982) on 129 firms, the study concluded that neural networks outperformed discriminant analysis for predicting corporate failure. Similarly, Theodossiou (1996) employed a logit model to analyze factors such as profitability, firm size, leverage, managerial effectiveness, and growth, finding that asset turnover ratio was the most critical indicator of financial health. Koh and Tan (1999) explored predictive methods for going-concern and non-going-concern companies, using a neural network model and a probit model on data from 165 companies (1978-1985). Their findings favored the neural network model for more accurate crisis predictions.

Literature development in 2000s

Zhang Ling (2000) applied a discriminant analysis model on 120 companies listed on the Chinese stock market, demonstrating the model's efficacy in predicting corporate failure and analyzing credit risk. Shumway (2001) introduced a hazard model for bankruptcy prediction using data from 300 bankruptcies (1962-1992), showing it to be superior to static models. Sulaiman and Sanda (2001), in their study of corporate failure of Malaysian companies, employed a logit model and found that reduced liquidity increased the probability of financial distress. On the other hand, Fitzpatrick (2004) used a reduced form to examine financial stability in U.S. businesses and found that distressed firms relied more on equity financing than debt.

Gruszczynski (2004) focused on Polish companies (1995-1997) using binomial and trinomial logit models to identify liquidity, profitability, and debt ratio as key predictors of financial distress. Karbhari and Zulqarnain, 2004 examined Malaysian companies confronted with the Asian financial crisis in the period of 1990 to 1996 and found the ratio of total liabilities to total assets as statistically significant predictor in predicting financial distress.

Literature development in 2010s

Salehi and Abedini (2009) investigated profitability's impact on financial distress in Tehran Stock Exchange companies, identifying a significant negative relationship. Dakovic, Czado, and Berg (2010) applied advanced statistical models to Norwegian firms, outperforming traditional methods like Altman's variables. Pranowo (2010) examined liquidity's role in Indonesian non-financial firms (2004-2008), emphasizing its importance in predicting instability. Chia-Hua and Chiung-Ying (2010) used linear regression to predict financial crises in Taiwanese firms, highlighting net per share and debt ratio as critical indicators. Szilagyi, Hilscher, and Campbell (2011) analyzed

profitability's negative correlation with financial distress using data from Kamakura Risk Information Services (KRIS). Tan (2012) assessed leverage's impact on firm performance during hardships, finding that lower leverage correlated with healthier firms.

Bose and Chen (2014) applied data mining techniques to Chinese firms (2001-2008), emphasizing profitability's role in predicting distress. Nindita and Indrawati (2014) examined financial and non-financial variables in Indonesian mining firms (2008-2009), finding financial variables to be significant predictors.

Literature development in 2020s

Mohamed (2020) developed a predictive model integrating accounting, market, and macroeconomic indicators, demonstrating that market-based and macroeconomic ratios enhance predictive accuracy beyond accounting data alone. Farooq, Noor, Qureshi, and Bhutta (2021) analyzed leverage, intangible assets, and investment policy's effects on financial distress costs in Pakistani firms.

Mehmood and Luca (2023) introduced a modified Z-score model for European economies, providing valuable insights for practitioners. Hassan et al. (2024) highlighted financial ratio indices' superiority in predicting distress in Pakistan's corporate sector, identifying firm size, profitability, leverage, and efficiency as key factors. Kottala and Sahu (2024) proposed a framework combining ergonomics and financial distress to enhance organizational sustainability. Binesh, E-Vahdati, and Ozdemir (2024) explored ESG practices' impact on financial distress, noting their increased significance during the COVID-19 pandemic.

Design of Hypothesis

Based on previous studies and related literature, the following hypotheses have been drawn to test the influence of the Z-Score as a proxy for financial distress along with the independent variables included in this study:

- H1: Liquidity ratio has significant positive effect on financial affliction of firms (Z-score).
- H2: Efficiency has significant positive effect on financial affliction of firms (Z-score).
- H3: Profit margin has significant positive effect on financial affliction (Z-score).
- H4: Solvency ratio has significant positive effect on financial affliction (Z-score).
- H5: Leverage has significant positive effect on financial affliction (Z-score).
- H6: Firm size has significant positive effect on financial affliction (Z-score).

Research Methods

Method of Data Collection

This study uses panel data analysis in collecting data. The dataset used in the study is obtained from the Pakistan Stock Exchange (PSX) and the State Bank of Pakistan for the period 2014 to 2023. Although PSX, formerly known as KSE, includes financial and non-financial companies, this research will only focus on non-financial firms. The study analyzed three sectors of non-financial companies namely cement, textile and sugar for predicting corporate distress.

Sample Size

A sample size of 210 observations has been selected for this research study. The sample comprises non-financial firms listed on the Pakistan Stock Exchange (PSX), belonging to three major sectors: cement, textile, and sugar. The data has been collected from 21 firms for 10 years with 7 firms from each of the above-mentioned sectors.

Statistical Technique

This research study investigates the determinants that cause the financial affliction. Panel regression is used to carry out the hypotheses testing of the research because the study uses panel data. Firstly, the relationship between the Z-score (i.e the representative of financial affliction) and the variables is tested through Panel Least Squares. In the next step, Fixed and Random effect model analysis is made. Here, the study also covers the comparative analysis of the three models – PLS, Fixed Effect Model –FEM and Random Effect Model – REM. In so doing, the study uses the Redundant Fixed Effect Test and the Correlated Random Effects – Hausman Test. More precisely, the Redundant Fixed Effect Test is used for the comparison of PLS and FEM, while the Hausman Test is used to establish the differences between FEM and REM.

Research Model

The representation of the regression model for this study is as under:

$$Z_{it} = \alpha + \beta_1 \text{Liq}_{it} + \beta_2 \text{Eff}_{it} + \beta_3 \text{Prof. Mar}_{it} + \beta_4 \text{Solv}_{it} + \beta_5 \text{Lev}_{it} + \beta_6 \text{Size}_{it} + \varepsilon$$

Where,

Z = Z score (for Financial Affliction)

Liq = Liquidity (Current ratio)

Eff = Efficiency

Prof. Mar = Profit Margin

Solv = Solvency

Lev = Leverage

Size = Firm size

ε = the error symbol.

The dependent variable (Z-score for financial affliction) is measured by the application of Altman's Z-score model which is developed on the basis of five key financial ratios, the representation of which is given as under:

Z= Score evaluating Financial Distress

$$Z = 1.2X1 + 1.4X2 + 3.3X3 + 0.6X4 + 1.0X5$$

Therefore, Z is calculated by finding out the following ratios one after another:

X1= Ratio 1 = working Capital ÷ Total Assets

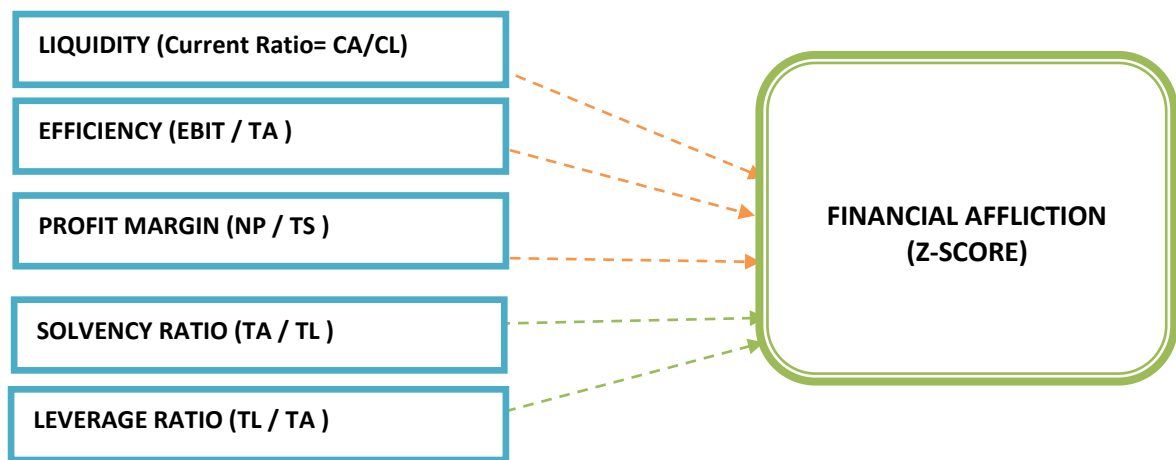
X2= Ratio 2 = Retained Earnings ÷ Total Assets

X3= Ratio 3 = EBIT ÷ Total Assets

X4= Ratio 4 = Market Value of Equity ÷ Total Liabilities

X5= Ratio 5 = Sales ÷ Total Assets

Conceptual Framework



Source: Based on the Altman Z-Score Model (1968) and available literature

Results & Findings

The following are the PLS findings achieved using Eviews, a statistical computation program:

Table 1: Panel Least Squares

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CURRENT_RATIO	0.375760	0.102692	3.659090	0.0003
EFFICIENCY	9.671744	0.652895	14.81364	0.0000
LEVERAGE_RATIO	-0.918760	0.245532	-3.741919	0.0002
PROFIT_MARGIN	-0.022257	0.187767	-0.118537	0.9058
SOLVENCY_RATIO	0.096906	0.044964	2.155220	0.0323
FIRM_SIZE	-0.179638	0.044542	-4.033016	0.0001
C	3.648905	0.717253	5.087331	0.0000
R-squared	0.801378	Mean dependent var		1.884931
Adj R-sq	0.795508	S.D. dept var		1.547356
Prob (F-statistic)	0.000000			

Estimation of the Regression Equation will be as follows:

$$Z_{it} = 3.64 + 0.37 \text{Liq}_{it} + 9.671 \text{Eff}_{it} - 0.918 \text{Lev}_{it} - 0.022 \text{Prof. Mar}_{it} + 0.096 \text{Solv}_{it} - 0.179 \text{Size}_{it}$$

Testing of Hypotheses

H₁: Liquidity/current ratio has significant positive effect on financial affliction.

In the above table 1, the probability value for current ratio is 0.0003, the current ratio shows a statistically and positive significant relation with the Z-score, which means this variable is important to predict financial distress. This result is in line with Suleiman, 2001 who reported a positive relation of the current ratio with financial distress. The above is explained by the fact that increased current ratio increases a firm's ability to pay the debt.

H₂: Efficiency has major positive effect in relation with Z-score to predict financial affliction.

The results of the table 1 reveals that the probability value for the efficiency is 0.00 which represents that it is highly significant statistically and has positive relationship with Z-score of a firm. This shows consistent finding with Yohannes Tesfamariam (2014) whereby efficiency is positively related with the Debt service coverage as proxy of financial distress.

H₃: There exists a considerable negative relation between leverage ratio & Z-score as a representative to predict financial affliction.

The coefficient value of -0.918760 indicates a high negative correlation between the leverage ratio of the firm and its Z-score. A higher leverage ratio indicates increased risk; hence, the lower the Z-score of the firm, and it will push the firm to the verge of financial distress. This finding agrees with the research of Pranowo et al. (2010), which depicts a negative relationship between leverage (Lev) and the leverage ratio.

H₄: Significant relation is present between profit margin & Z-score as proxy to predict financial affliction.

The relationship between the profit margin and the Z-score, used as a predictor for financial distress, is statistically not significant. This is based on the probability value of the profit margin, which is 0.9058, being greater than the critical threshold of 0.05. We therefore accept the null hypothesis, stating that there is no significant relationship between the profit margin and the Z-score in predicting financial distress, and reject the alternative hypothesis. The result came out to be similar to the study of Pranowo, Achsani, Manurung & Nuryartono (2010) where profitability shows no significant effect with financial distress.

H₅: Significant positive relationship is present between solvency ratio & Z-score as a representative to predict financial affliction.

The results of the PLS shows that the positive value of coefficient of solvency show that if one unit of solvency ratio increases then, there will be 0.096 increase in the Z-score of the firm. It shows that there is a positive relation present between solvency ratio and the Z-score of the firm. The

study of Yohannes Tesfamariam (2014) shows the similar results whereby solvency is positively related with the Debt service coverage as proxy of financial distress.

H₆: Significant relationship exists between firm size & Z-score as a representative to predict financial affliction.

Firm size has been considered a significant factor to determine a firm's financial distress, where most would assume a larger firm scores higher on the Z-score. Nonetheless, from this study, the coefficient of firm size is -0.179638. This negative value implies that firm size may be negatively related to the Z-score. In other words, a larger firm does not mean that it necessarily scores higher in the Z-score. So, it can be concluded that a firm may have lower Z-score even after having the large size and the result was supported by the study of Chang (2006) which portrays that firm size is one of the most significant factor in predicting financial distress.

Fixed Effect & Random effect Model Analysis along with their comparison

Fixed and Random effect models are necessarily tested for panel data. Therefore, this study will also test the above two models as the data of this study is panel data.

Fixed Effect Model

The fixed effect model shows the results that are not varied across time. The equation of fixed effect model is written as under:

$$\alpha_i = \alpha + F_i \dots\dots\dots$$

Where, F_i represents the values of the variables to be observed in which the effect values are put to get the desired form of the equation.

The actual representation of Fixed Effect Model Equation will be expressed in the form as below:

$$Z_{it} = \alpha_i + \beta_1 LIQ_{it} + \beta_2 Eff_{it} + \beta_3 Lev_{it} + \beta_4 Prof. Mar_{it} + \beta_5 Solv_{it} + \beta_6 Size_{it}$$

Random Effects Model:

The random effect model gives the results for explaining the random variation after holding time constant. The equation for the random effect model is defined as:

$$Z_{it} = \alpha + \beta_1 LIQ_{it} + \beta_2 Eff_{it} + \beta_3 Lev_{it} + \beta_4 Prof. Mar_{it} + \beta_5 Solv_{it} + \beta_6 Size_{it} + v_{it}$$

Where, α represents constant

$$v_{it} = F_i + \varepsilon_{it}$$

Moreover, F_i represent the unnamed variables of the random effect model.

Table 2: Statistical Tests Summary

VARIABLES	PLS MODEL 1 p-values	FEM MODEL 2 p-values	REM MODEL 3 p-values
LIQ (Current Ratio)	0.0003	0.0002	0.0001
Eff (Efficiency)	0.0000	0.0000	0.0000

Prof. Mar (Profit Margin)	0.9058	0.5612	0.6299
Solv (Solvency Ratio)	0.0323	0.0191	0.0185
Lev (Leverage)	0.0002	0.0130	0.0012
Size (Firm Size)	0.0001	0.7897	0.0440
R Squared	0.801378	0.863516	0.746567
Adjusted R	0.795508	0.844124	0.739077
F-Statistics	136.5073	44.53123	99.66696
Prob. (F-Statistics)	0.000000	0.000000	0.000000
Redundant Fixed Effects Tests	Cross-section F 0.0000		
Correlated Random Effects - Hausman Test	Chi-Sq. Statistic 5.521233	Prob. 0.4789	

All five variables; current ratio (liquidity), efficiency, solvency, leverage, and firm size—are significant at the 5% level of significance, going by the P-values of the three models in table 2 above. Only the variable of profit margin is found to be insignificant at the 5% level of significance across the three models that were examined.

Moreover, the R squared values and Prob (F-statistics) values of all the three models are significant but for determining which model is the best one to be selected out of all three, comparison has been made. So, from the comparison results it can be summarized that while comparing the models of PLS & FEM the Cross-section F value comes out to be 0.0000 which clearly portrays that the FEM model is more significant as it is less than 0.05. On the other hand, while comparing the FEM and REM models, the Cross-section random probability value obtained through Hausman test is 0.4789 which is greater than 0.05. Therefore, it shows that the REM model is significant and efficient of all.

Conclusion and Recommendations

Conclusion

This therefore means that this research finding indicates a positive relation of liquidity, current ratio, efficiency, and solvency with the Altman Z-score. In other words, increased ratios of liquidity, efficiency, and solvency result in an increased Z-score and, therefore, decreased chances of a firm going into financial distress. On the other hand, there is a negative relation of leverage and firm size with the Z-score; meaning higher leverage ratios correspond to lower Z-scores and, therefore, greater chances of facing financial difficulties. Whereas, firm size implies that a firm can be financially distressed even after having large size. This can happen due to the occurrence of various other factors. Since it has a higher p-value compared to the critical value of 0.05, profitability or the profit margin has no significant association with financial distress. By comparing tests for this study—carried between the three models PLS, FEM, and REM—in choosing between PLS and FEM, there is the presence of showing the Fixed Effect model as being most efficient and more appropriate. Similarly, while comparing the best fit model to be selected between FEM & REM, the Random Effect Model comes out to be more appropriate.

However, it can also be concluded that in order to stay away from the bankruptcy firms must give importance to maintaining higher values of liquidity ratio, solvency ratio and efficiency ratio. But

in fact they must consider to keep the leverage ratio lower because high leverage is a sign of riskiness for the firms.

Recommendations & Policy Implications

The recommendations and suggestions necessary for the firms to remain safe from the situation of financial affliction or bankruptcy are as under:

- The use of the bankruptcy prediction tools on a regular basis by the firms, enable to remain identified about their financial position which will help them to take corrective actions at the right time.
- More attention shall be given in order to have higher values of liquidity ratio, solvency ratio and efficiency ratio. This will help them to have efficient cash flows to pay off debt obligations, efficient debt management and proper utilization of assets in generating net income. As these ratios have very much significant relation with the financial distress.
- Firms must try to decrease their leverage as leverage also represents how much of a company's assets are financed through loans.
- Firms must focus on other variables or factors as well which can lead them towards bankruptcy in future.

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