

ASSESSING FINANCIAL DISTRESS IN PAKISTANI MANUFACTURING FIRMS: THE ROLE OF PROFITABILITY, LIQUIDITY, LEVERAGE, FIRM SIZE, AND FREE CASH FLOW

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DOI: <https://doi.org/10.5281/zenodo.16900532>

Keywords

Financial Distress, Altman Z-Score, Profitability, Leverage, Liquidity, Free Cash Flow, Manufacturing Sector, Pakistan

Article History

Received: 12 May, 2025

Accepted: 17 July, 2025

Published: 14 August, 2025

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Abstract

This study looks at how five important financial indicators—profitability, liquidity, leverage, firm size and free cash flow—affect whether manufacturing companies in Pakistan run into financial trouble. Using the Altman Z-Score, a popular measure of bankruptcy risk, we examine financial data from 2018–2023 collected by the State Bank of Pakistan. Each company is classified as healthy, borderline or distressed based on its score. We then use panel data analysis to see how the five indicators relate to financial distress. The results show that companies with good profits and strong cash positions are much less likely to get into difficulty, while those that rely heavily on debt are more vulnerable. Being large helps to an extent, but poor management can still drag down big firms. Companies with plenty of free cash flow have a buffer that helps them keep operating and service their debt when conditions worsen. These findings provide practical insights for investors, managers and policymakers who want to strengthen the financial resilience of Pakistan's manufacturing sector.

INTRODUCTION

Keeping a business financially healthy is critical for owners, employees, and investors—especially in Pakistan's volatile economy, where market shocks are frequent. Manufacturing firms are particularly vulnerable due to their reliance on fixed assets, regular cash cycles, and large working capital needs (Altman & Hotchkiss, 2010). This study examines what drives financial distress in Pakistani manufacturing companies by focusing on five key indicators—profitability, liquidity, leverage, firm size, and free cash flow—using the Altman Z Score Model (Altman, 1968) on 2018–2023 data to track changes in stability over time. The sector plays a vital role in

jobs, exports, and GDP, yet faces rising costs, energy shortages, regulatory shifts, and currency depreciation. Understanding these dynamics and identifying early warning signs can help firms take timely action—through operational restructuring, debt renegotiation, or fresh financing—to avoid insolvency (Gürel & Tat, 2017; Brigham & Ehrhardt, 2022). Building on prior research, the study reinforces that strong profitability, adequate liquidity, balanced leverage, optimal scale, and healthy free cash flow are essential to withstand shocks and maintain long-term viability in Pakistan's manufacturing sector.

2. Literature Review

A firm's ability to generate returns on its assets reflects operational efficiency and sound resource allocation. Higher profitability reduces distress risk by providing a buffer against economic shocks and ensuring obligations are met (Ananto et al., 2017; Rohmadini et al., 2018). The capacity to meet short-term obligations with current assets lowers financial stress, especially in uncertain cash flow environments (Hapsari, 2012; Almeida et al., 2004). However, excessive liquidity may signal idle or poorly allocated assets, making balance essential (Kasmir, 2012). Debt can boost returns in good times but magnifies risk when profits decline. High debt-to-equity ratios significantly increase bankruptcy likelihood, underscoring the need for moderate leverage (Modigliani & Miller, 1958; Sayari & Muga, 2017). Larger firms often enjoy economies of scale, diversified revenues, and better credit access (Titman & Wessels, 1988). Yet, they may also face inefficiencies and greater exposure to macroeconomic risks, making size an imperfect predictor of stability (Boubaker et al., 2014). Strong free cash flow enables self-financing and lowers reliance on costly external funding, reducing bankruptcy risk (Jensen, 1986; Dittmar & Mahrt Smith, 2007). In markets like Pakistan, where financing can be scarce, its role is especially critical.

3. Methodology

This study adopts a quantitative design and uses secondary panel data. A panel data approach lets us observe multiple companies over several years, capturing differences between firms as well as changes over time (Baltagi, 2008).

The study gathered financial data on manufacturing firms listed with the State Bank of Pakistan. The dataset covers the years 2018 to 2023, a period that includes varying economic conditions. We collected financial statements and performance metrics and cross-checked them against audited reports and SBP listings to ensure accuracy.

The study examined five key variables profitability (ROA and net profit margin) to assess asset and sales efficiency (Rohmadini et al., 2018), liquidity (current and quick ratios) to gauge short-term solvency (Almeida et al., 2004), leverage (debt-to-equity ratio) to measure reliance on debt financing (Graham &

Leary, 2011), firm size (total assets and market capitalization) as an indicator of operational scale and financial reach (Titman & Wessels, 1988), and free cash flow (operating cash minus capital expenditures) to reflect available discretionary funds (Jensen, 1986). These variables were analyzed using a multivariate regression model to evaluate their individual and combined impact on financial distress. To classify the financial health of each firm, we used the Altman Z-Score, which combines five financial ratios into one score:

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

where:

$X1 = \text{Working Capital} \div \text{Total Assets}$

$X2 = \text{Retained Earnings} \div \text{Total Assets}$

$X3 = \text{Earnings Before Interest and Taxes (EBIT)} \div \text{Total Assets}$

$X4 = \text{Market Value of Equity} \div \text{Book Value of Total Debt}$

$X5 = \text{Net Sales} \div \text{Total Assets}$

The score sorts companies into three categories:

- $Z > 2.99$: financially healthy (unlikely to become bankrupt)
- $1.81 \leq Z \leq 2.99$: "grey area" (moderate risk)
- $Z < 1.81$: distressed (high bankruptcy risk)

This model has been validated in many countries and is popular because it is easy to apply and reliable (Altman & Hotchkiss, 2010). The study began by using descriptive statistics to summarize the data and compare averages across the Z-score categories. A panel least squares regressions ran with the Z-score as the dependent variable and the five financial indicators as predictors. Before running the regressions, it was checked for issues such as multicollinearity, heteroscedasticity and autocorrelation to ensure model was robust. The study also used a correlogram to explore correlations between independent variables. All analyses were performed using EViews software.

4. Results

The core aim of this study is to use the Altman Z-Score model to gauge the financial stability and bankruptcy risk of selected manufacturing companies. Because manufacturing is so capital-intensive requiring large outlays for

equipment, raw materials and staffing these firms are especially sensitive to shifts in liquidity, debt and cash flow. A predictive tool like the Altman Z-Score therefore provides investors, lenders and managers with an early warning system when a company’s financial health starts to deteriorate.

The Altman Z Score model classifies firms into three financial health zones: Healthy ($Z > 2.99$), Grey Area ($1.81-2.99$), and Distressed ($Z < 1.81$). In Pakistan’s manufacturing sector, outcomes vary widely. Strong performers like GOC (Pak) Ltd., Gillette Pakistan Ltd., and Pakistan Tobacco Co. Ltd. consistently score above 2.99, with Philip Morris (Pakistan) Ltd. exceeding 25 in some years, reflecting exceptional profitability, liquidity, and asset efficiency. At the other extreme, firms such as Treet Corporation Ltd.,

Fateh Industries Ltd., and Pak Leather Crafts Ltd. post scores well below 1.81—sometimes negative—signalling severe instability and high insolvency risk. Borderline cases, including United Brands Ltd., Mughal Iron & Steel Industries, and Crescent Steel & Allied Products Ltd., hover near the risk threshold, though some, like International Steel Ltd., have improved into the healthy range. Overall, the sector shows a mix of resilience and chronic vulnerability. The model’s trend analysis confirms its effectiveness in distinguishing financially stable firms from those in decline, highlighting the need for targeted measures such as debt restructuring, tighter financial controls, and cost efficiency to ensure long-term viability.

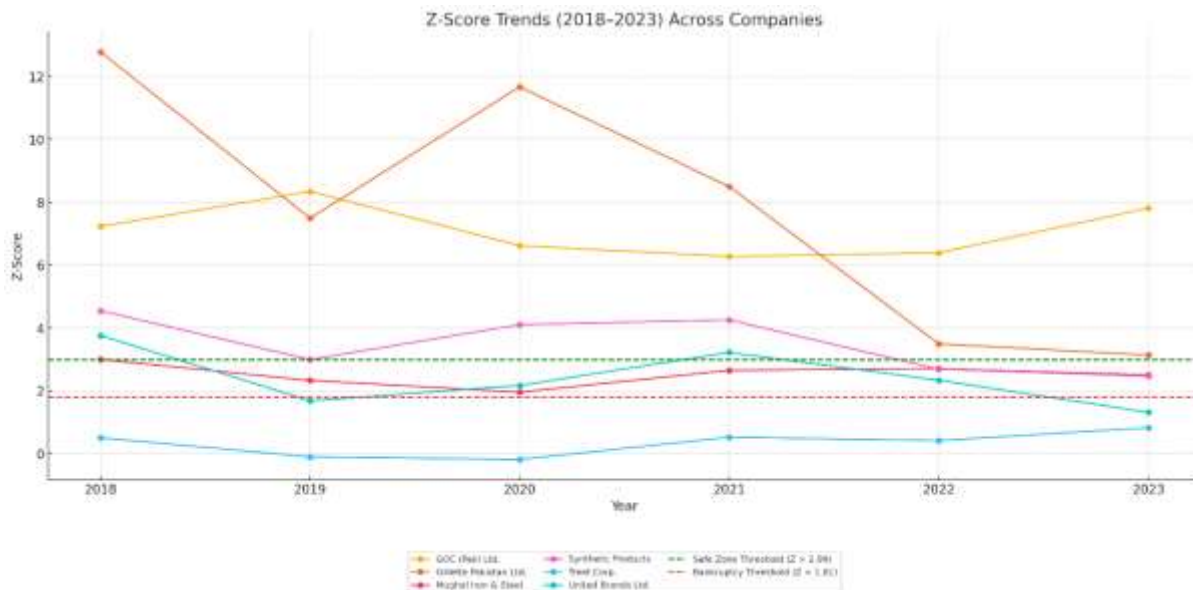


Figure 1: Bankruptcy

Five key metrics used to assess the financial strength of manufacturing firms across multiple years: Return on Assets (ROA), Current Ratio (CR), Debt-to-Equity Ratio (DER), Firm Size (FS) and Free Cash Flow (FCF). Taken together, these variables reveal the strengths and weaknesses of individual companies.

- Firms such as Pakistan Tobacco Co. Ltd. and Philip Morris (Pakistan) Ltd. combine high ROA, strong liquidity, low leverage, large size and positive free cash flow. These attributes correspond with robust financial

stability and a low risk of bankruptcy.

- Conversely, companies like Dost Steels Ltd., Treet Corporation Ltd. and United Brands Ltd. show cash deficits, heavy debt burdens, poor liquidity and negative ROA. Such firms are far more likely to experience financial distress. These indicators are therefore crucial for gauging a company’s financial health, investment potential and bankruptcy risk.

The financial performance of Pakistani manufacturing firms varies sharply across

profitability, liquidity, leverage, size, and cash flow. **Profitability (ROA)** ranges widely: firms like GOC (Pak) Ltd., Philip Morris (Pakistan) Ltd., and Pakistan Tobacco Co. Ltd. consistently post positive returns—Pakistan Tobacco’s 2020 ROA of 0.37 exemplifies operational efficiency—while United Brands Ltd., Treet Corporation Ltd., and Fateh Industries Ltd. record negative ROA, indicating recurring losses and financial distress. **Liquidity (CR)** also shows extremes. Siddiqsons Tin Plate Ltd. (160.65 in 2020) and Leather Up Ltd. (25.69 in 2020) hold unusually high working capital, suggesting inefficient asset use, whereas Dadex Eternit Ltd., Dost Steels Ltd., and Crescent Steel & Allied Products Ltd. report CR below 1.0, signalling possible short-term solvency issues. **Leverage (DER)** ranges from highly indebted companies like Dost Steels Ltd. (88.79 in 2023) and United Brands Ltd. (47.47 in 2023), facing elevated financial risk, to conservatively financed firms such as GOC (Pak) Ltd. (0.10 in 2023) and Synthetic Products Enterprises Ltd. (~0.40), which face lower default risk. **Firm size (FS)** remains relatively stable, with larger players—Mughal Iron & Steel Industries (7.78 in 2023) and Pakistan Tobacco Co. Ltd. (8.04 in 2023)—benefiting from scale, while smaller firms like

Leather Up Ltd. (4.65 in 2023) may face competitiveness challenges. **Cash flow (FCF)** is a major differentiator. Persistent deficits—e.g., Mughal Iron & Steel Industries (−11.10m in 2021) and Aisha Steel Mills Ltd. (−15.69m in 2019)—highlight operational strain, while positive flows from Pakistan Tobacco Co. Ltd. (19.24m in 2023) and Philip Morris (Pakistan) Ltd. (5.52m in 2020) indicate financial resilience. Descriptive statistics reinforce these disparities: the **Z-score** has a mean of 10.61 but a median of 2.29, with a wide range (−14.99 to 339.99) and high variance, reflecting the presence of both highly stable and severely distressed firms. ROA’s low median (2%) and high skewness reveal a few exceptional performers amid many low-return or loss-making companies. FCF shows a negative mean (−444,360), indicating widespread liquidity strain. DER averages 2.12 but with extreme outliers, while CR’s mean of 1.71 masks liquidity stress in many firms. Overall, the sector is marked by stark contrasts—where a few well-managed, profitable companies maintain strong liquidity and low debt, while many face profitability challenges, leverage risks, and cash flow deficits that heighten bankruptcy exposure.

Table 1: Descriptive Analysis of the Variables

	Z	ROA	FS	FCF	DER	CR
Mean	10.61417	0.039676	6.647917	-444360.3	2.123565	1.710417
Median	2.295000	0.020000	6.715000	-136091.0	1.255000	1.195000
Maximum	339.9900	3.080000	8.040000	19246153	88.79000	25.69000
Minimum	-14.99000	-1.230000	4.630000	-15699437	-1.790000	0.000000
Std. Dev.	44.49061	0.254263	0.798047	3435940.	7.331840	2.211059
Skewness	6.281331	7.717212	-0.644016	1.704731	9.353253	6.756685
Kurtosis	43.19231	99.81773	2.784736	16.79385	100.6940	67.45748
Jarque-Bera	15959.18	86507.04	15.34829	1817.054	89046.42	39036.41
Probability	0.000000	0.000000	0.000465	0.000000	0.000000	0.000000
Sum	2292.660	8.570000	1435.950	-95981830	458.6900	369.4500
Sum Sq. Dev.	425574.0	13.89968	136.9290	2.54E+15	11557.51	1051.088
Observations	216	216	216	216	216	216

Some firms show strong profitability and liquidity, while others face high debt, negative cash flow, and insolvency risk. Extreme skewness and kurtosis reveal outliers, highlighting the need for deeper analysis of

financial resilience. Correlogram results indicate strong autocorrelation at lag 1 (AC and PAC = 0.653), meaning past values heavily influence future trends. Autocorrelation declines across subsequent

lags, turning minimal by lag 5, suggesting a gradual weakening of historical influence and possible mean-

reverting or cyclical patterns.

Table 2: Correlogram results

Date: 02/18/25 Time: 12:49						
Sample: 2018 2023						
Included observations: 216						
Autocorrelation	Partial Correlation	AC	PAC	Q-Stat	Prob	
		1	0.653	0.653	93.437	0.000
		2	0.292	-0.234	112.25	0.000
		3	0.151	0.125	117.26	0.000
		4	0.071	-0.072	118.39	0.000
		5	0.030	0.032	118.59	0.000

The Q-statistics rise from 93.44 at lag 1 to 118.59 at lag 5, with all p-values at 0.000, confirming strong and statistically significant autocorrelation. This shows that past trends strongly shape future outcomes, making time-series models like ARIMA essential for accurate forecasting.

The regression model explains 96.74% of the variation in Z-scores ($R^2 = 0.9674$) and is highly significant (F-statistic $p < 0.001$). ROA is the

strongest predictor of financial health, with higher profitability linked to improved stability, while firm size is marginally significant. Free cash flow, leverage, and liquidity show no meaningful effect. Significant AR(1) and AR(2) terms confirm the influence of past performance, underscoring the need to incorporate historical trends into bankruptcy prediction.

Table 3: Panel Least Squares Analysis

Method: Panel Least Squares				
Dependent Variable: Z				
Sample (adjusted): 2020 2023				
Periods included: 4				
Cross-sections included: 36				
Total panel (balanced) observations: 144				
Convergence achieved after 5 iterations				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-4.833084	3.628919	-1.331825	0.1851
ROA	5.930241	0.839382	7.065009	0.0000
FS	1.035914	0.536814	1.929744	0.0557
FCF	7.49E-08	7.83E-08	0.956047	0.3407
DER	-0.018033	0.031743	-0.568090	0.5709
CR	0.162117	0.131410	1.233676	0.2195
AR(1)	0.281630	0.022201	12.68556	0.0000
AR(2)	0.114941	0.015433	7.447678	0.0000
R-squared	0.967426	Mean dependent var	5.922917	
Adjusted R-squared	0.965749	S.D. dependent var	17.17043	
S.E. of regression	3.177721	Akaike info criterion	5.204159	
Sum squared resid	1373.316	Schwarz criterion	5.369148	

Log likelihood	-366.6994	Hannan-Quinn criter.	5.271201
F-statistic	577.0142	Durbin-Watson stat	1.263138
Prob(F-statistic)	0.000000		
Inverted AR Roots	.51	-.23	

4. Discussion and Conclusion

This study uses the Altman Z Score model to evaluate the financial health of Pakistani manufacturing firms from 2018–2023, analyzing profitability, liquidity, leverage, firm size, and free cash flow to classify companies as healthy ($Z > 2.99$), grey area (1.81–2.99), or distressed ($Z < 1.81$). Healthy firms like Pakistan Tobacco Co. and Philip Morris (Pakistan) show strong profitability, stable cash flows, and efficient asset use, while distressed firms such as Treet Corporation Ltd. and Fateh Industries Ltd. face severe liquidity issues, shrinking market share, and heavy debt. Grey area firms, including Crescent Steel & Allied Products Ltd., display fluctuating stability, highlighting the need for restructuring and efficiency improvements. Regression results identify profitability (ROA) as the most significant predictor of financial health, with firm size marginally significant, while leverage, liquidity, and free cash flow show no direct impact. Significant autoregressive terms confirm that financial distress often reflects cumulative historical trends. The findings stress that strong profitability, prudent debt management, and timely monitoring via Z-scores can lower insolvency risk, while targeted restructuring and transparency can strengthen sector-wide financial sustainability.

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