FINANCIAL RISK ANALYSIS

Coded Project Report

Submitted to

by

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CONTENTS

1.Problem Statement - FRA Project - Coded

Part A

Context

In the realm of modern finance, businesses encounter the perpetual challenge of managing debt obligations effectively to maintain a favourable credit standing and foster sustainable growth. Investors keenly scrutinize companies capable of navigating financial complexities while ensuring stability and profitability. A pivotal instrument in this evaluation process is the balance sheet, which provides a comprehensive overview of a company's assets, liabilities, and shareholder equity, offering insights into its financial health and operational efficiency. In this context, leveraging available financial data, particularly from preceding fiscal periods, becomes imperative for informed decision-making and strategic planning.

Objective

A group of venture capitalists want to develop a Financial Health Assessment Tool. With the help of the tool, it endeavours to empower businesses and investors with a robust mechanism for evaluating the financial well-being and creditworthiness of companies. By harnessing machine learning techniques, they aim to analyse historical financial statements and extract pertinent insights to facilitate informed decision-making via the tool. Specifically, they foresee facilitating the following with the help of the tool:

1. **Debt Management Analysis:** Identify patterns and trends in debt management practices to assess the ability of businesses to fulfil financial obligations promptly and efficiently, and identify potential cases of default.

2. **Credit Risk Evaluation:** Evaluate credit risk exposure by analysing liquidity ratios, debt-to-equity ratios, and other key financial indicators to ascertain the likelihood of default and inform investment decisions.

They have hired you as a data scientist and provided you with the financial metrics of different companies. The task is to analyse the data provided and develop a predictive model leveraging machine learning techniques to identify whether a given company will be tagged as a defaulter in terms of net worth next year. The predictive model will help the organization anticipate potential challenges with the financial performance of the companies and enable proactive risk mitigation strategies.

Data Dictionary

The data consists of financial metrics from the balance sheets of different companies. The detailed data dictionary is given below.

- Net worth Next Year: Net worth of the customer in the next year
- Total assets: Total assets of customer
- Net worth: Net worth of the customer of the present year
- Total income: Total income of the customer
- Change in stock: Difference between the current value of the stock and the value of stock in the last trading day
- Total expenses: Total expenses done by the customer
- Profit after tax: Profit after tax deduction
- PBDITA: Profit before depreciation, income tax, and amortization
- PBT: Profit before tax deduction
- Cash profit: Total Cash profit
- PBDITA as % of total income: PBDITA / Total income

- PBT as % of total income: PBT / Total income
- PAT as % of total income: PAT / Total income
- Cash profit as % of total income: Cash Profit / Total income
- PAT as % of net worth: PAT / Net worth
- Sales: Sales done by the customer
- Income from financial services: Income from financial services
- Other income: Income from other sources
- Total capital: Total capital of the customer
- Reserves and funds: Total reserves and funds of the customer
- Borrowings: Total amount borrowed by the customer
- Current liabilities & provisions: current liabilities of the customer
- Deferred tax liability: Future income tax customer will pay because of the current transaction
- Shareholders' funds: Amount of equity in a company which belongs to shareholders
- Cumulative retained profits: Total cumulative profit retained by customer
- Capital employed: Current asset minus current liabilities
- TOL/TNW: Total liabilities of the customer divided by Total net worth

- Total term liabilities / tangible net worth: Short + long term liabilities divided by tangible net worth
- Contingent liabilities / Net worth (%): Contingent liabilities / Net worth
- Contingent liabilities: Liabilities because of uncertain events
- Net fixed assets: The purchase price of all fixed assets
- Investments: Total invested amount
- Current assets: Assets that are expected to be converted to cash within a year
- Net working capital: Difference between the current liabilities and current assets
- Quick ratio (times): Total cash divided by current liabilities
- Current ratio (times): Current assets divided by current liabilities
- Debt to equity ratio (times): Total liabilities divided by its shareholder equity
- Cash to current liabilities (times): Total liquid cash divided by current liabilities
- Cash to average cost of sales per day: Total cash divided by the average cost of the sales
- Creditors turnover: Net credit purchase divided by average trade creditors
- Debtors' turnover: Net credit sales divided by average accounts receivable
- Finished goods turnover: Annual sales divided by average inventory
- WIP turnover: The cost of goods sold for a period divided by the average inventory for that period

- Raw material turnover: Cost of goods sold is divided by the average inventory for the same period
- Shares outstanding: Number of issued shares minus the number of shares held in the company
- Equity face value: cost of the equity at the time of issuing
- EPS: Net income divided by the total number of outstanding share
- Adjusted EPS: Adjusted net earnings divided by the weighted average number of common shares outstanding on a diluted basis during the plan year
- Total liabilities: Sum of all types of liabilities
- PE on BSE: Company's current stock price divided by its earnings per share

Note: A company will not be tagged as a defaulter if its net worth next year is positive, or else, it'll be tagged as a defaulter.

Part B

Context

Investors face market risk, arising from asset price fluctuations due to economic events, geopolitical developments, and investor sentiment changes. Understanding and analysing this risk is crucial for informed decision-making and optimizing investment strategies.

Objective

The objective of this analysis is to conduct Market Risk Analysis on a portfolio of Indian stocks using Python. It uses historical stock price data to understand market volatility and riskiness. Using statistical measures like mean and standard deviation, investors gain a deeper understanding of individual stocks' performance and portfolio variability.

Through this analysis, investors can aim to achieve the following objectives:

- **Risk Assessment:** Analyse the historical volatility of individual stocks and the overall portfolio.
- **Portfolio Optimization:** Use Market Risk Analysis insights to enhance risk-adjusted returns.
- **Performance Evaluation:** Assess portfolio management strategies' effectiveness in mitigating market risk.
- **Portfolio Performance Monitoring:** Monitor portfolio performance over time and adjust as market conditions and risk preferences change.

Data Dictionary

The dataset contains weekly stock price data for 5 Indian stocks over an 8-year period. The dataset enables us to analyse the historical performance of individual stocks and the overall market dynamics.

2.Executive Summary

This report presents a comprehensive financial risk assessment and market risk analysis, aimed at providing valuable insights to venture capitalists and investors.

The project comprises two main parts: (A) Financial Health Assessment of Indian companies using machine learning techniques, and (B) Market Risk Analysis of Indian stocks over an 8-year period using historical data.

Part A: Financial Health Assessment

The goal of this section is to build a predictive model to identify companies at risk of defaulting based on their financial statements.

Key tasks include exploratory data analysis, data preprocessing, machine learning model building (Logistic Regression and Random Forest), and performance comparison.

2.1. Exploratory Data Analysis (EDA)

The dataset contains various financial metrics derived from balance sheets. The EDA helped uncover trends and patterns in debt management, income, and profitability.

Univariate and multivariate visualizations were used to highlight important relationships, especially around net worth and debt-related ratios.

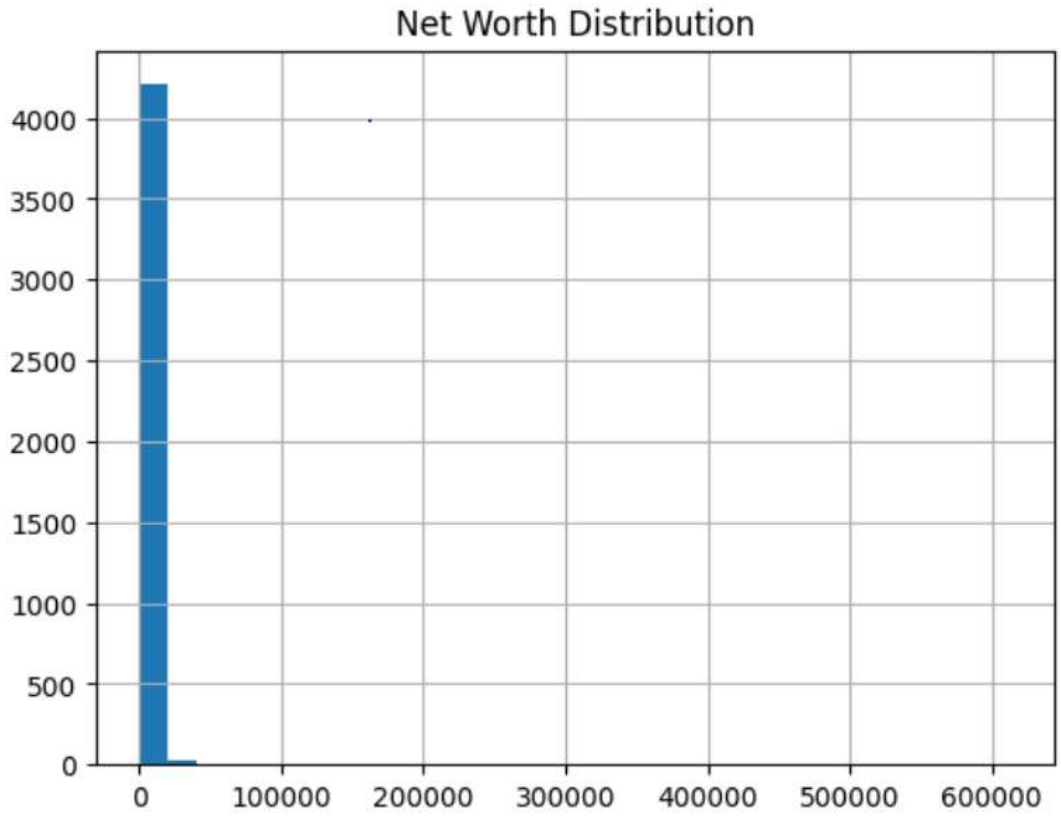

Fig. 1 Univariate Analysis

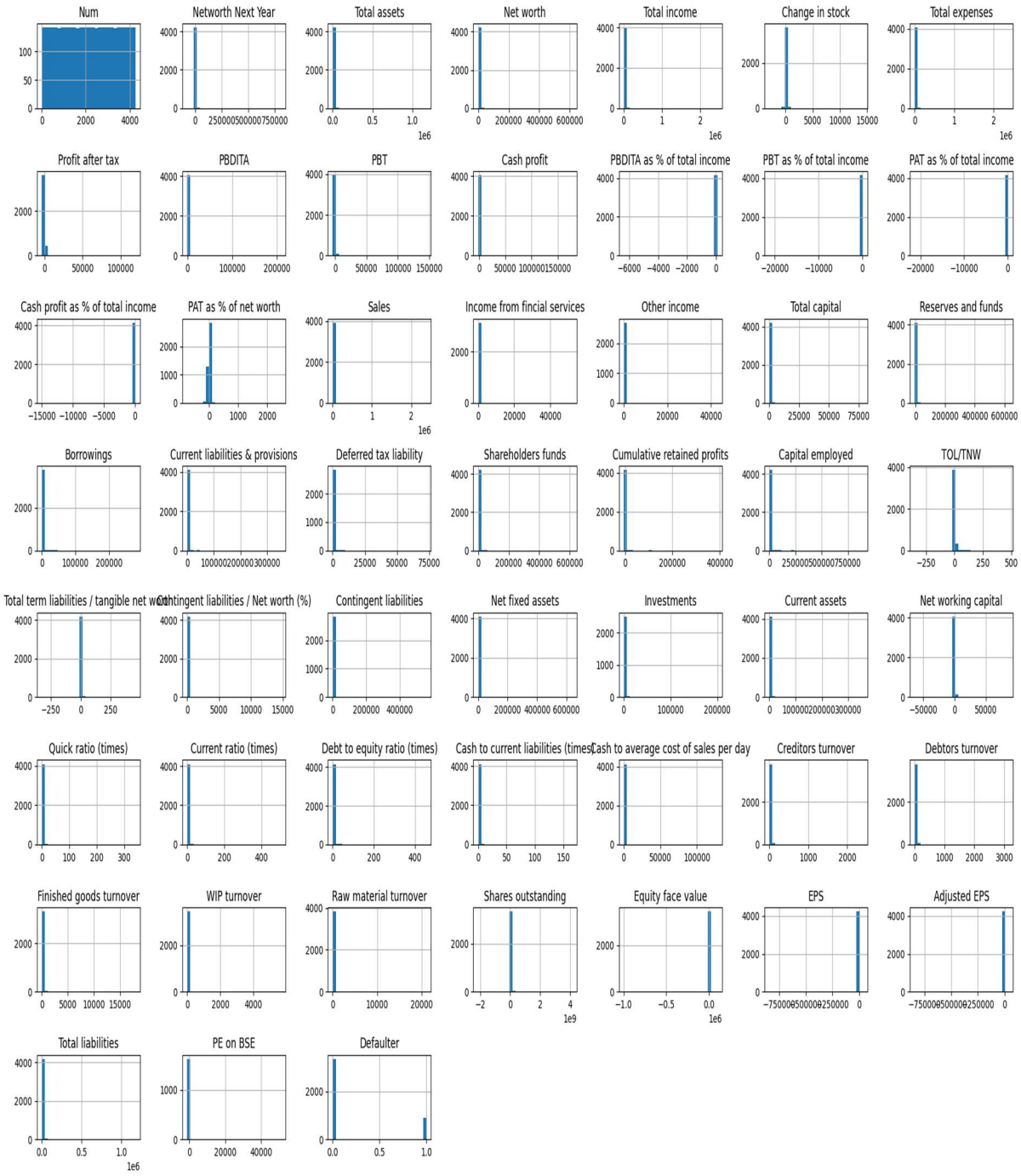

Fig. 2 Univariate Analysis

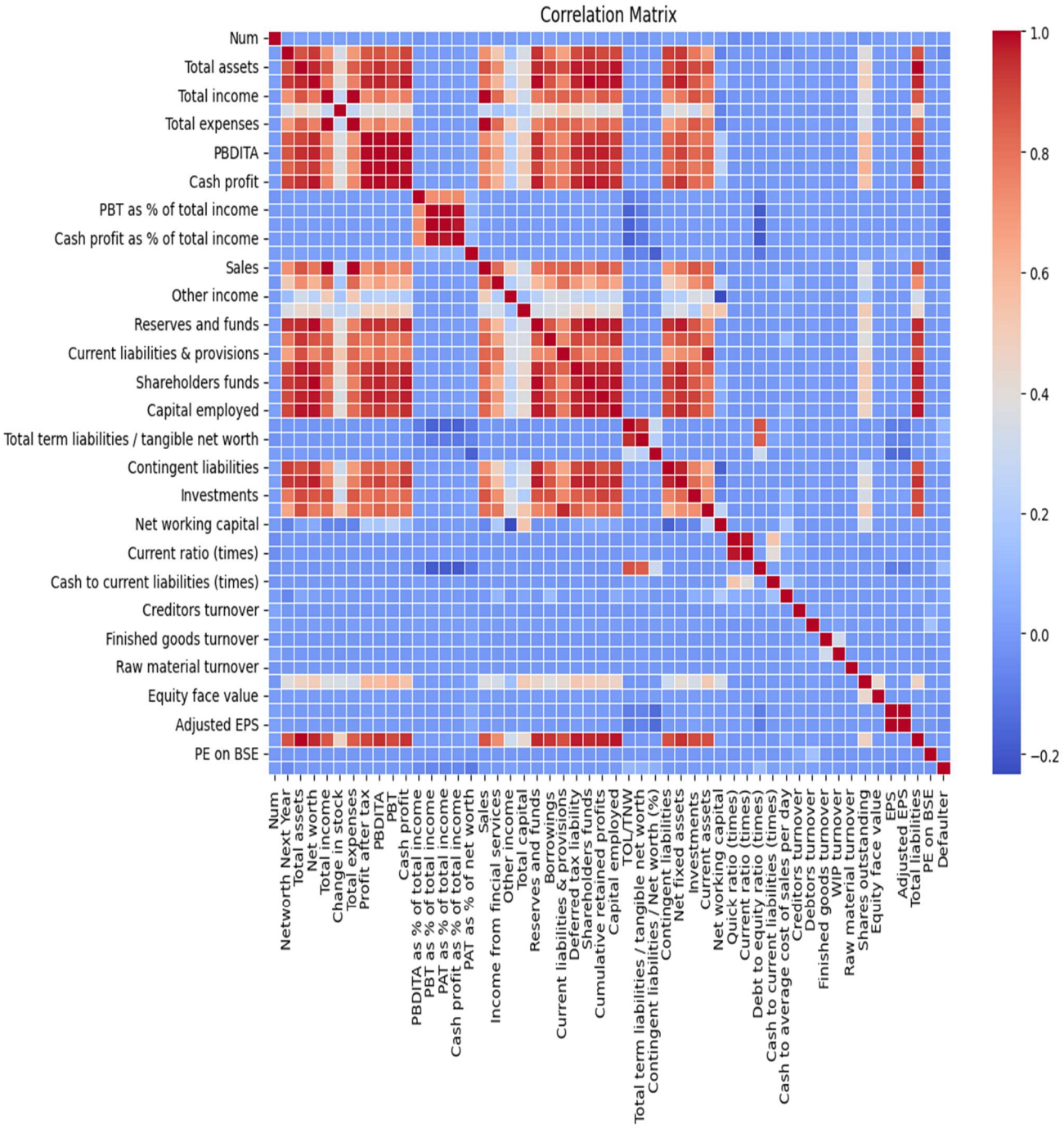

Fig. 3 Bivariate Analysis

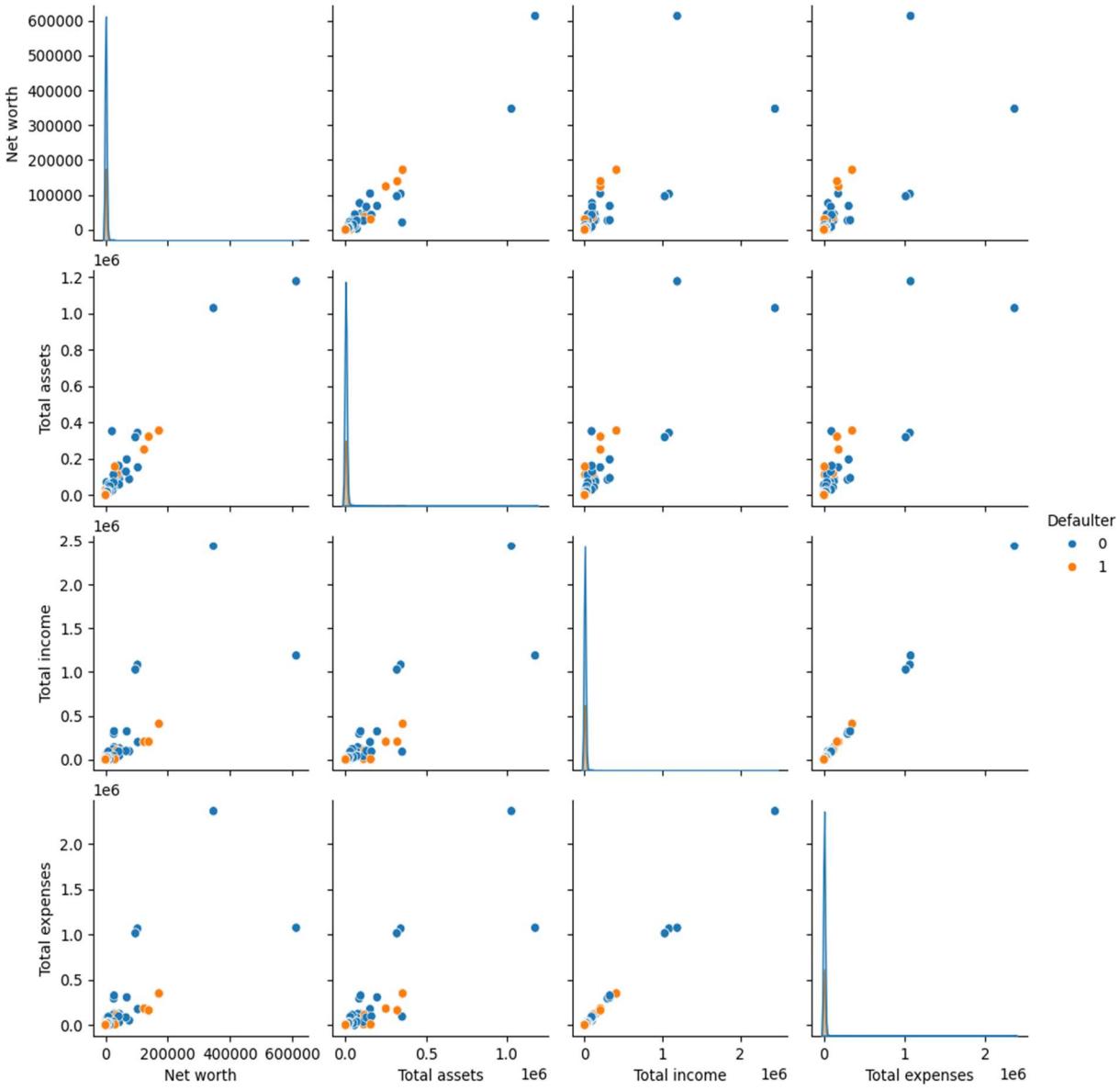

Fig. 4 Bivariate Analysis (pair-plot subset for speed)

2.2. Data Preprocessing

Missing values and outliers were treated. Data was scaled appropriately and the target variable ('default') was created as 1 if Net Worth Next Year < 0, else 0.

Features were encoded and the dataset was split into training and testing sets for model training.

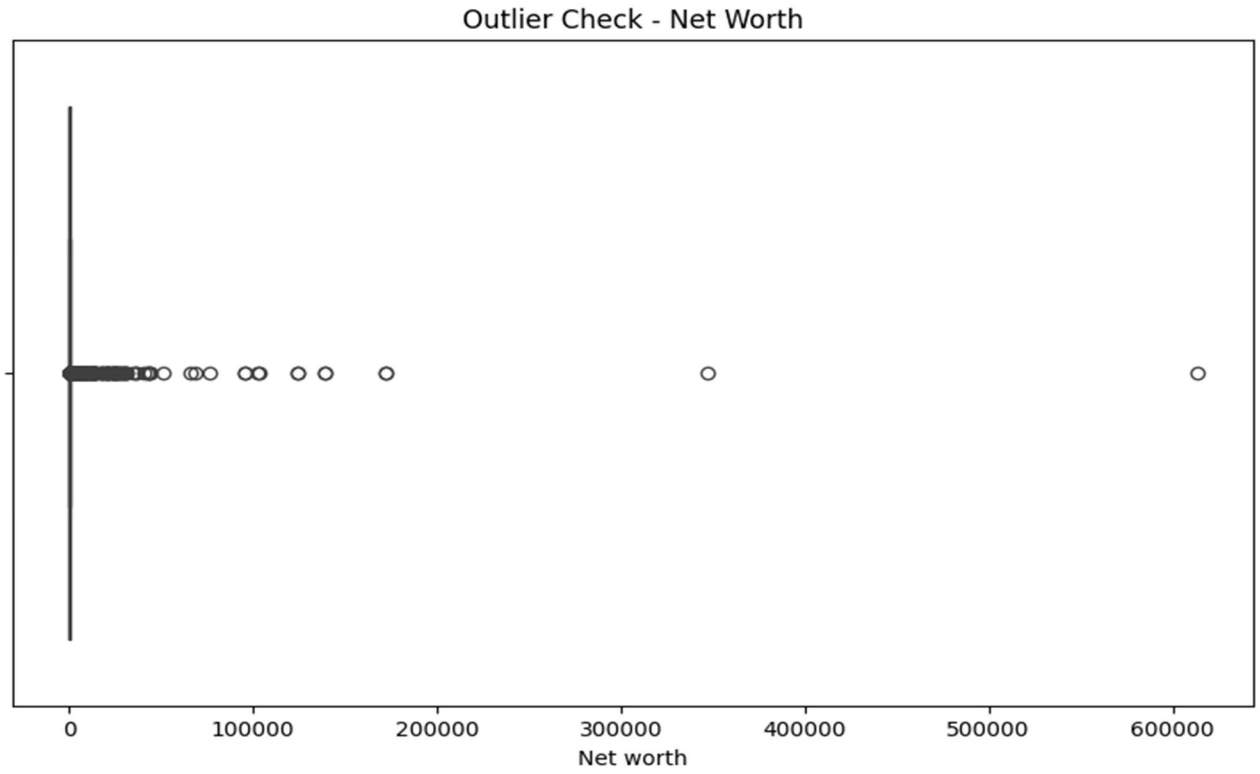

Fig. 5 Outlier Detection

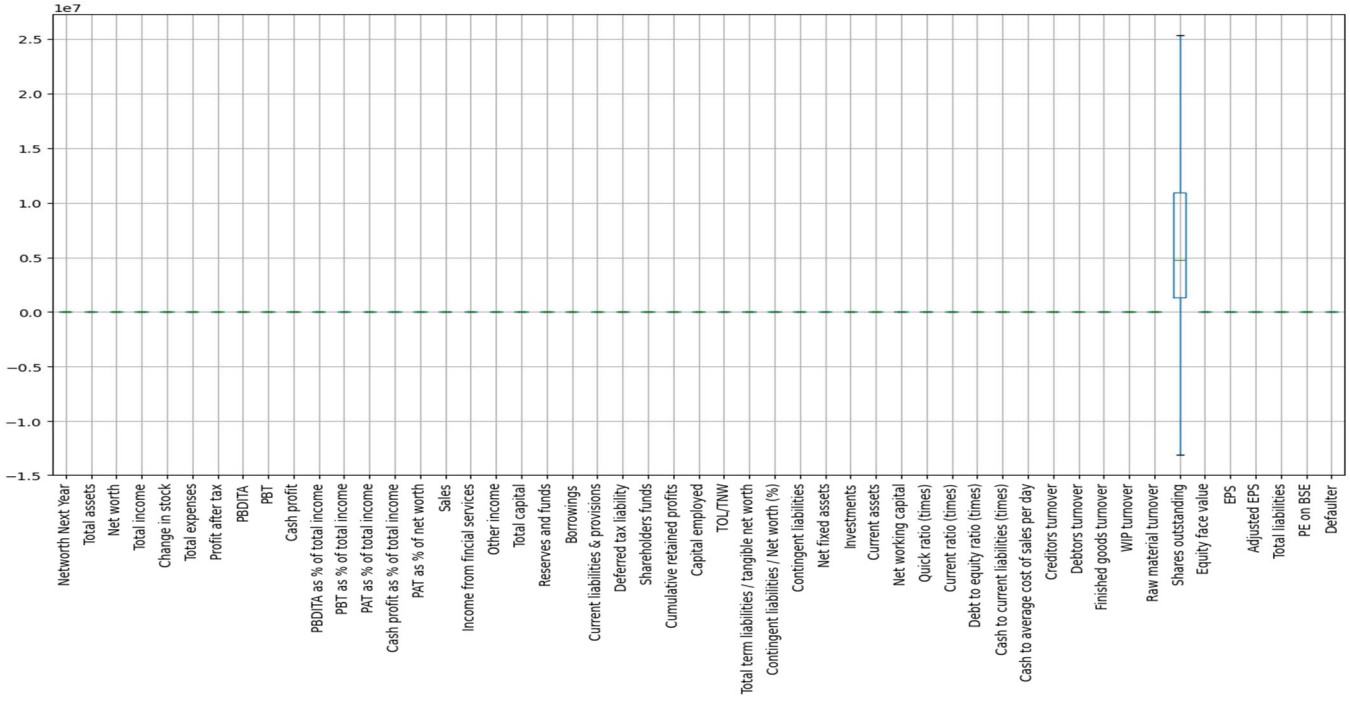

Fig. 6 Outlier Treatment

2.3. Model Building and Evaluation

Two models were implemented: Logistic Regression and Random Forest.

Logistic Regression:

	precision	recall	f1-score	support
0	0.81	0.99	0.89	1029
1	0.53	0.04	0.07	248
accuracy			0.81	1277
macro avg	0.67	0.51	0.48	1277
weighted avg	0.76	0.81	0.73	1277

Random Forest:

	precision	recall	f1-score	support
0	0.80	0.86	0.83	1029
1	0.14	0.10	0.12	248
accuracy			0.71	1277
macro avg	0.47	0.48	0.47	1277
weighted avg	0.67	0.71	0.69	1277

Evaluation metrics such as Accuracy, Precision, Recall, F1-score, and ROC-AUC were used.

Random Forest outperformed Logistic Regression in identifying potential defaulters.

2.4. Model Performance Improvement

Variance Inflation Factor (VIF) was calculated to reduce multicollinearity.

Hyperparameter tuning (GridSearchCV) improved model performance.

The optimal classification threshold for Logistic Regression was determined using the ROC Curve.

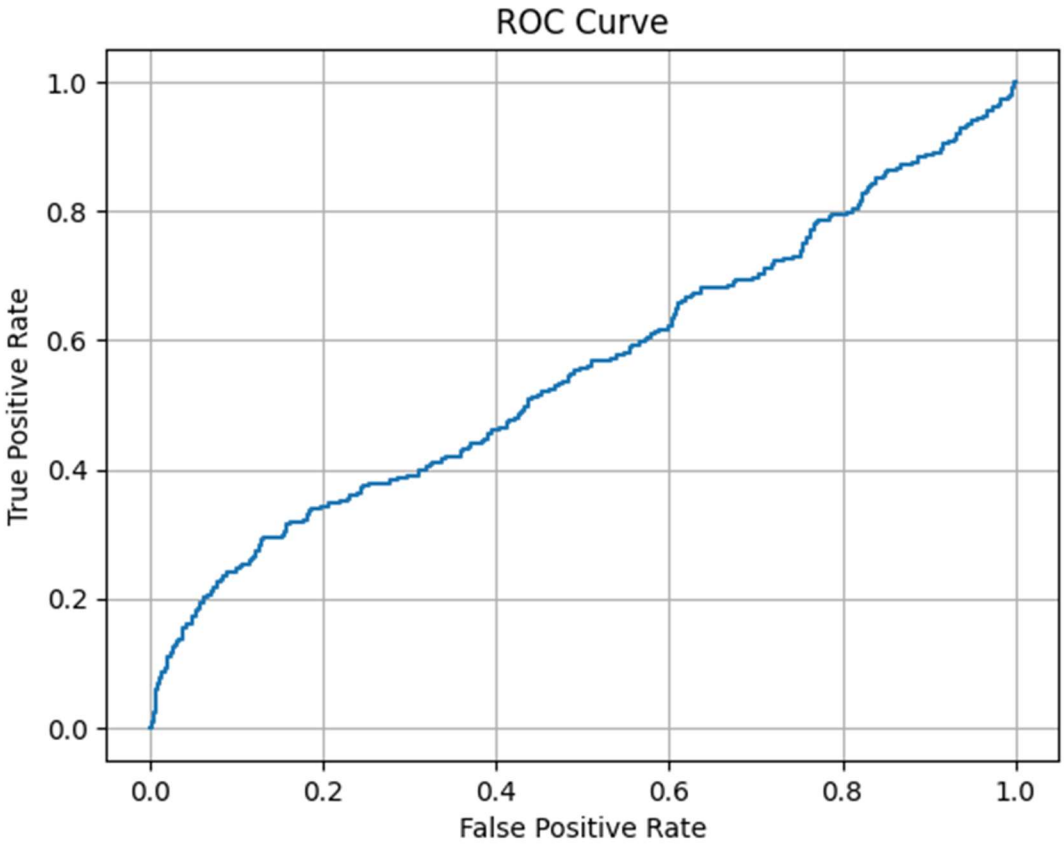

Fig. 7 Logistic Threshold using ROC

2.5. Final Model Selection

Random Forest was chosen as the final model due to better overall performance.

Feature importance analysis showed key variables like Borrowings, Net Worth, and Debt Ratios were most influential in predicting default.

2.6. Actionable Insights & Recommendations

- Firms with high borrowings and poor debt-equity ratios are more prone to default.
- Maintaining a positive net worth and managing liabilities effectively are key indicators of financial stability.
- Investors should closely monitor companies with weak liquidity and profitability ratios.

Part B: Market Risk Analysis

This section analyzes weekly stock price data for 5 Indian companies over 8 years to evaluate volatility and portfolio risk.

Key performance measures like returns, standard deviation, and mean-variance plots were used to derive insights.

2.6. Stock Price Graph Analysis

Price trends showed varying degrees of volatility. Some stocks had stable upward trends while others showed cyclical patterns.

This helps identify stable vs high-risk stocks for portfolio construction.

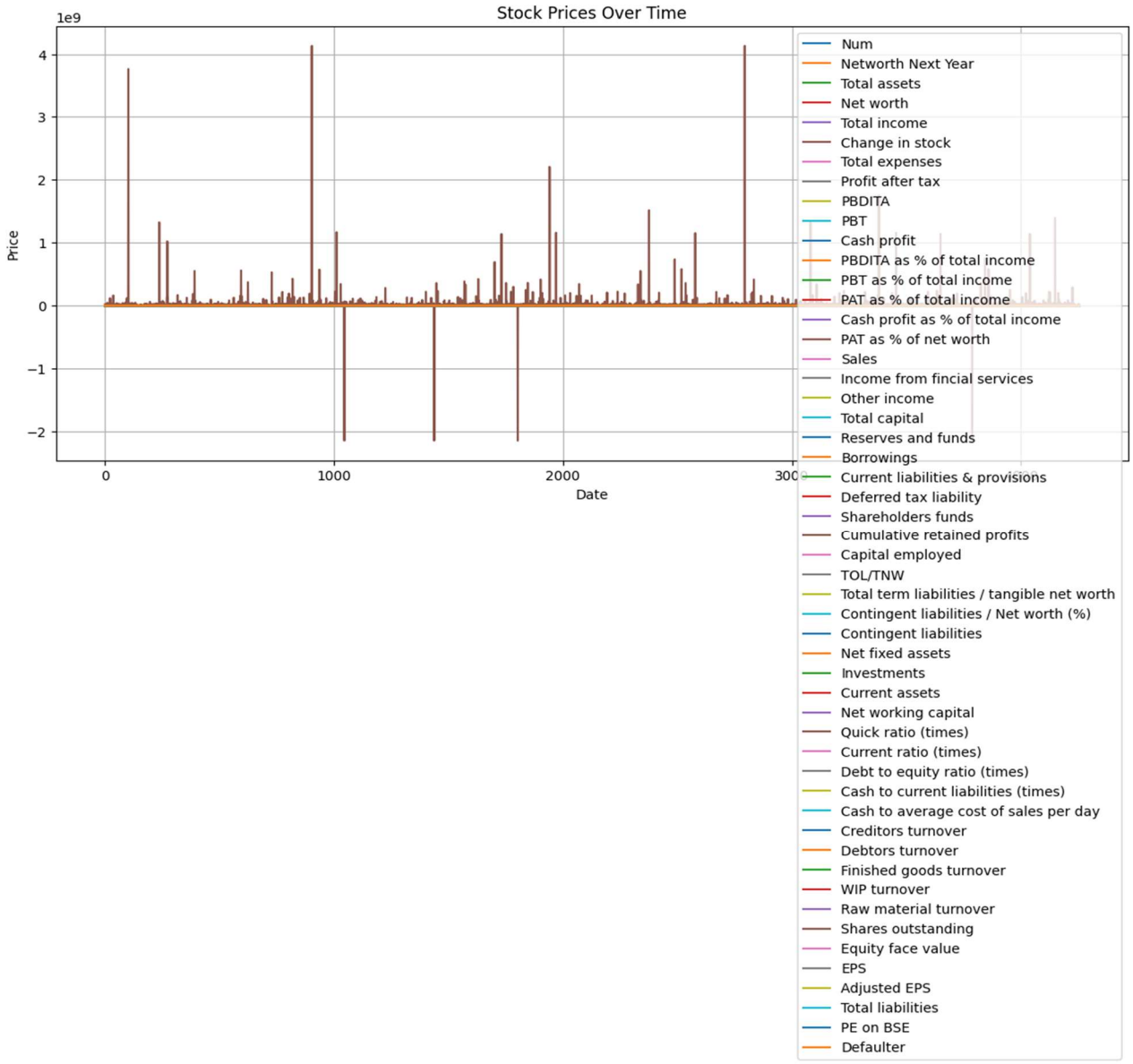

Fig. 8 Stock price Graph Analysis

2.7. Stock Return Analysis

Weekly returns were calculated for each stock.

Mean and standard deviation of returns indicated risk-return tradeoffs among the stocks.

Mean vs Std Dev plots highlighted stocks with high average returns but also high risk.

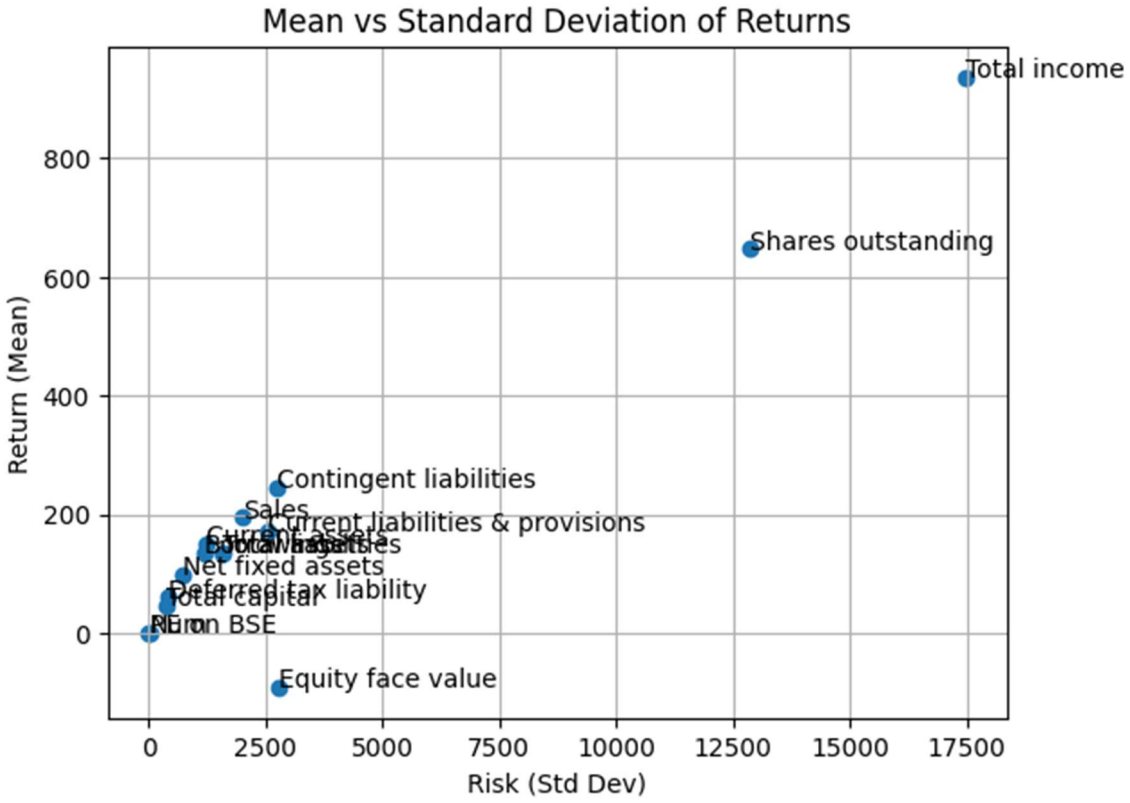

Fig. 9 Mean vs Std Deviation

2.8. Actionable Insights & Recommendations

- Diversification is key to reduce market risk.
- Investors should balance high-return stocks with more stable performers.
- Continuous monitoring of volatility helps in making dynamic investment decisions.