

CAUSALITY EXAMINATION OF JOSEPH PIOTROSKI-F SCORE FRAMEWORK ON THE STOCK PRICE PERFORMANCE OF SELECTED IT SECTOR STOCKS

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Abstract: *This study examines the causal relationship between Joseph Piotroski F-Score framework and the stock price performance of selected IT sector stocks. The F-Score framework is widely used as a financial indicator to assess the fundamental strength of a company. The objective of this research is to investigate whether companies with higher F-Scores exhibit better stock price performance in the IT sector. The study utilizes a quantitative research design, analyzing historical financial data and stock prices of selected IT sector companies. The findings of this research will provide valuable insights into the effectiveness of the F-Score framework in predicting stock price movements and its applicability in the IT sector.*

Key Words: Piotroski F-score, Stock Performance, IT Industry, Profitability, Leverage

Introduction

Fundamental analysis is a method used to evaluate the intrinsic value of a company by considering financial and economic factors. In the context of the IT sector, fundamental analysis involves assessing the financial performance of IT companies, industry trends, and technological advancements. The IT sector in India has been a significant contributor to economic growth and has performed well in the stock market. However, investors should be cautious of risks such as global economic conditions, competition, and regulatory changes. Notable IT companies in India include TCS, Infosys, Wipro, HCL Technologies, and Tech Mahindra. Investing in the IT sector provides exposure to diverse companies with skilled workforces and global recognition. The sector is expected to continue growing due to the demand for technology services and the digital economy. Thorough research and analysis are essential before making investment decisions, considering factors like government policies, currency exchange rates, and global uncertainties. The IT sector is dynamic, driving communication and data management across sectors, offering growth opportunities for investors. The Piotroski F-score model evaluates companies based on nine financial criteria that are associated with financial strength and improving operating performance. These criteria include profitability, leverage, liquidity, efficiency, and operating efficiency. Each

criterion receives a score of either 0 or 1, and the total score ranges from 0 to 9, with a higher score showing stronger financial performance. This analysis could be conducted using various statistical methods, such as regression analysis, to find any significant relationships between a company's Piotroski F-score and its stock price performance.

Statement of Problem

Major problem in the IT sector of the stock market is the potential for rapid changes in technology and innovation to disrupt the industry. As modern technologies and trends appear, IT companies may be forced to quickly adapt to remain competitive. This can lead to uncertainty and volatility in the stock prices of IT companies, as investors may struggle to predict which companies will succeed and which will falter in the face of disruptive technological change.

Objective of the Study

1. To analyse the stock performance of selected IT sector stocks.
2. To examine the financial soundness of selected IT sector organisation using Joseph Piotroski-F Score framework.
3. To study the causality between Joseph Piotroski-F Score framework and stock performance in selected IT stocks.

Review of Literature

Das (2022) conducted an empirical investigation of the financial accounts of a leading information technology company in India, specifically focusing on Wipro Ltd. The research highlights Wipro's superior financial performance and its dominance in the IT industry over the past six years. Moilanen (2022) studied the combination of value investing with gross profitability in the Finnish stock market. The research assesses the performance of standalone value and quality portfolios, as well as combination portfolios, using various risk-adjusted performance indicators. The findings suggest that combining EV/EBIT and gross profitability leads to the best-performing portfolio, indicating the importance of considering both value and quality factors for equity investors. Priyadharshini *et al.* (2021) examined the stock prices of IT companies in the year 2020, specifically analysing the impact of the COVID-19 pandemic. The study reveals that the pandemic significantly affected the stock prices of the companies, leading to a significant decline between March and May 2020.

Dang & Singhal (2021) conducted a case study on fundamental analysis in the IT sector in

India, employing a top-down approach that includes economic, industry, and company analysis. The research assesses the intrinsic value of significant IT companies and evaluates the results against market value. The findings indicate that IT companies in India generally have low debt-to-equity ratios, which enhances profitability and reduces risk for shareholders. Rahman, Li Sa & Masud (2021) focused on predicting firms' financial distress using the F-Score model. The study reveals a significant association between the F-Score and the likelihood of companies experiencing financial difficulties. It also identifies that businesses at risk of default tend to have negative cash flow from operations and a higher decline in return on assets in the preceding year. This research contributes to the existing literature on financial crisis forecasts by reinforcing a model that has not been widely used before.

Rangapriya & Meenakumari (2021) conducted a study on Using Piotroski F-Score for Assessing Financial Health: Evidence from Leading Indian Private Banks. Each of these ratios has been examined in this study to learn valuable information about the banks (at the company level). Analysis of Variance (ANOVA) of various ratios decides the degree of the link between banks (at the industry level). This can aid in controlling portfolio exposure to the economic climate. This study aims to establish Piotroski F-score as a crucial value indicator for assessing Indian banking equities. Agrawal, Sehgal & Agrawal (2020) conducted a study on Disruptive Innovations, Fundamental Strength and Stock Winners: Implications for Stock Index Revisions. The data show that the disruptor's portfolio—the Next 50 equities—outperforms the incumbent's portfolio—the Nifty 50 members—with a return of 1.61 percent compared to 0.47 percent. The study has significant implications for governments, investors, companies, and academia. Balasubramanian *et al.* (2019) conducted a study on Modelling corporate financial distress using financial and non-financial variables The case of Indian listed companies. The findings suggest that models with financial variables had a prediction accuracy of 85.19 and 86.11 percent, while models with a combination of financial and non-financial variables predict with a comparably superior accuracy of 89.81 and 91.67 percent. Murthy (2019) conducted a study on Liquidity, Leverage, Profitability and Operating Efficiency of Energy Sector through 'F' Score – A Special focus on Andhra Pradesh Southern power Distribution Company Limited. Each business must thoroughly assess its financial condition, liquidity, profitability, and operational efficiency. Jarno & Janne (2018) proposed a study on “does the F-Score improve the performance of different value investment strategies in Europe”. The outcomes of the

research offer strong proof that the performance of all examined investment strategies is greatly improved by the F-Score screening procedure.

Research Methodology

Type of Research: This study will utilize a causal research design to examine the relationship between the Piotroski-F score and stock price performance of IT sector stocks. Data will be collected from various sources, including company websites, annual reports, news platforms, and balance sheets. The analysis will focus on five selected companies based on market capitalization, revenue, sales, and performance. The study will cover a 5-year period from April 2018 to March 2022.

Variables:

Independent Variable: - Stock Return

Dependent Variable: - Profitability, Leverage & Liquidity, Operating Efficiency equivalent

Model Framework: Joseph Piotroski F-Score Model, Linear Regression Describes Piotroski F Score

PIOTROSKI F- SCORE
I. Profitability
1. Return on Assets > 0
2. Operating cash flow > 0
3. Δ ROA > 0
4. Accruals [Cr] > 0
II. Leverages & Liquidity Ratios:
1. Δ Leverage < 0
2. Δ Current Ratio > 0
3. Δ No of shares > 0
III. Operating Efficiency Ratios:
1. Δ Gross Margin > 0
2. Δ ATR > 0

Multi-Regression Model to Measure the Exposure

$$\bar{R}_i = \alpha_i + \beta_1 P_i + \beta_2 LL_i + \beta_3 OE_i + \varepsilon_i$$

$\beta_1, \beta_2, \beta_3$ = Sensitivity Co-Efficiency Related to Profitability, Leverage & Liquidity, Operating Efficiency Respectively

ε_i = Residual to the fitted model

α_i = Exposure free term

P_i = Profitability

LL_i = Leverage & Liquidity

OE_i = Operating Efficiency

Hypothesis Testing

HYPOTHESIS 1

$H_{0(1)}$ = There is no significant relationship between the Stock return and the Profitability ($\beta_1 = 0$)

$H_{1(1)}$ = There is significant relationship between the Stock return and the Profitability ($\beta_1 \neq 0$)

HYPOTHESIS 2

$H_{0(1)}$ = There is no significant relationship between the Stock return and the Leverage & Liquidity ($\beta_1 = 0$)

$H_{1(1)}$ = There is significant relationship between the Stock return and the Leverage & Liquidity ($\beta_1 \neq 0$)

HYPOTHESIS 3

$H_{0(1)}$ = There is no significant relationship between the Stock return and the Operating Efficiency ($\beta_1 = 0$)

$H_{1(1)}$ = There is significant relationship between the Stock return and the Operating Efficiency ($\beta_1 \neq 0$)

Limitation of the Study

- Financial statements may be subject to manipulation or errors, which could affect the accuracy of the score and affect the study's results.
- Stock prices are highly volatile and subject to sudden fluctuations, which could affect the study's findings

Data Analysis and Interpretation

Description of Piotroski F- score for 5 Companies

Joseph Piotroski Ratios	Tech Mahindra	Wipro	TCS	HCL Technologies	INFOSYS
I. Profitability Ratios:					
1. Return on Assets (%)	1	1	1	1	1
2. Operating cash flow	1	1	1	1	1
3. Δ ROA (%)	1	0	1	1	1
4. Accruals [Cr.]	1	1	0	1	0
II. Leverage & Liquidity Ratios:					
1. Δ Leverage (%)	0	0	0	0	0
2. Δ Current Ratio	0	0	0	1	1
3. Δ No of shares (%)	1	1	0	0	0
III. Operating Efficiency Ratios:					
1. Δ Gross Margin	1	0	0	0	0
2. Δ ATR	1	1	1	0	0

Source: Author's Own Calculation

Model Fitness Test

1. Tech Mahindra Limited

Describes the outcomes of model fitness Examination and Significance of Explanatory Variables.

Sl. No.	Parameters definition	Value	Remarks
1	R ² (Coefficient of determination)	0.572	Moderate Explanatory Power
2	Model Fitness Statistics (Fisher's Test)	F = 0.446 (p=0.769)	Insignificant
3	α _i (Exposure free term)	0.139 (t = 0.576, p = 0.668)	Insignificant
4	β ₁ (P-Profitability)	-0.389 (t = -0.681, p = 0.619)	Insignificant
5	β ₂ (LL-Leverage & Liquidity)	2.105(t = -1.101, p = 0.469)	Insignificant
6	β ₃ (OE-Operating Efficiency)	-0.018 (t = -0.227, p = 0.858)	Insignificant

$$\widehat{R}_t = \alpha_t + \beta_1 P_t + \beta_2 LL_t + \beta_3 OE_t + \varepsilon_t$$

$$\widehat{R}_t = 0.139 - 0.389P_t + 2.105LL_t - 0.018OE_t + \varepsilon_t$$

Source: Author's own calculations
 Level of Significance ***0.01, **0.05, *0.1

Wipro Limited

Describes the outcomes of model fitness Examination and Significance of Explanatory Variables.

Sl. No.	Parameters definition	Value	Remarks
1	R ² (Coefficient of determination)	0.474	High Explanatory Power
2	Model Fitness Statistics (Fisher's Test)	F = 301 (p=0.834)	Insignificant
3	α _i (Exposure free term)	0.455 (t = 0.786, p = 0.576)	Insignificant
4	β ₁ (P-Profitability)	-0.169 (t = -0.332, p = 0.796)	Insignificant
5	β ₂ (LL-Leverage & Liquidity)	-0.774(t = -0.893, p = 0.536)	Insignificant
6	β ₃ (OE-Operating Efficiency)	0.243 (t = -0.876, p = 0.542)	Insignificant

$$\widehat{R}_t = \alpha_t + \beta_1 P_t + \beta_2 LL_t + \beta_3 OE_t + \varepsilon_t$$

$$\widehat{R}_t = 0.455 - 0.169P_t - 0.774LL_t + 0.243OE_t + \varepsilon_t$$

Source: Author's own calculations
 Level of Significance ***0.01, **0.05, *0.1

TCS Limited

Describes the outcomes of model fitness Examination and Significance of Explanatory Variables.

SI. No.	Parameters definition	Value	Remarks
1	R ² (Coefficient of determination)	0.987	High Explanatory Power
2	Model Fitness Statistics (Fisher's Test)	F = 25.9 (p=0.143)	Insignificant
3	α _i (Exposure free term)	-0.045(t = -0.814, p = 0.565)	Insignificant
4	β ₁ (P-Profitability)	-0.009 (t = -0.328, p = 0.798)	Insignificant
5	β ₂ (LL-Leverage & Liquidity)	-0.492(t = -8.447*, p = 0.075)	Significant
6	β ₃ (OE-Operating Efficiency)	-0.160 (t = -4.602, p = 0.136)	Insignificant

$$\widehat{R}_t = \alpha_t + \beta_1 P_t + \beta_2 LL_t + \beta_3 OE_t + \varepsilon_t$$

$$\widehat{R}_t = -0.045 - 0.009P_t - 0.492LL_t - 0.160OE_t + \varepsilon_t$$

Source: Author's own calculations
 Level of Significance ***0.01, **0.05, *0.1

CL Technologies Limited

Describes the outcomes of model fitness Examination and Significance of Explanatory Variables.

SI. No.	Parameters definition	Value	Remarks
1	R ² (Coefficient of determination)	0.99	High Explanatory Power
2	Model Fitness Statistics (Fisher's Test)	F = 596** (p=0.030)	Significant
3	α _i (Exposure free term)	0.285 (t = 18.57**, p = 0.034)	Significant
4	β ₁ (P-Profitability)	-0.329 (t = -4.36, p = 0.144)	Insignificant
5	β ₂ (LL-Leverage & Liquidity)	-0.497(t = -31.00**, p = 0.021)	Significant
6	β ₃ (OE-Operating Efficiency)	-0.406 (t = -26.95**, p = 0.024)	Significant

$$\widehat{R}_t = \alpha_t + \beta_1 P_t + \beta_2 LL_t + \beta_3 OE_t + \varepsilon_t$$

$$\widehat{R}_t = 0.285 - 0.329P_t - 0.497LL_t - 0.406OE_t + \varepsilon_t$$

Source: Author's own calculations
 Level of Significance ***0.01, **0.05, *0.1

Infosys Limited

Describes the outcomes of model fitness Examination and Significance of Explanatory Variables.

Sl. No.	Parameters definition	Value	Remarks
1	R ² (Coefficient of determination)	0.789	High Explanatory Power
2	Model Fitness Statistics (Fisher's Test)	F = 1.25 (p=0.564)	Insignificant
3	α _i (Exposure free term)	0.072 (t = 0.239, p = 0.851)	Insignificant
4	β ₁ (P-Profitability)	0.145 (t = 0.865, p = 0.546)	Insignificant
5	β ₂ (LL-Leverage & Liquidity)	-0.161(t = -1.644, p = 0.348)	Insignificant
6	β ₃ (OE-Operating Efficiency)	0.276 (t = -0.856, p = 0.549)	Insignificant

$$\hat{R}_i = \alpha_i + \beta_1 P_i + \beta_2 LL_i + \beta_3 OE_i + \varepsilon_i$$

$$\hat{R}_i = 0.072 + 0.145P_i - 0.161LL_i - 0.276OE_i + \varepsilon_i$$

Source: Author's own calculations

Level of Significance ***0.01, **0.05, *0.1

The Analysis Of Joseph Piotroski Ratios For The Selected Companies Indicates Varying Levels Of Explanatory Power In Predicting Stock Returns. While Some Ratios Show Significance, Others Are Found To Be Statistically Insignificant.

Tech Mahindra And Wipro Have Insignificant Model Fitness Tests, Indicating That The Examined Ratios Have Limited Explanatory Power In Predicting Their Stock Returns. TCS Has A High Explanatory Power But Insignificant Results For Profitability And Operating Efficiency Ratios. HCL Technologies Shows A Significant Model Fitness Test, With Leverage And Liquidity Ratios Being The Most Influential Factors. Infosys Also Exhibits High Explanatory Power But With Insignificant Results For All Examined Ratios.

Overall, The Analysis Suggests That The Examined Ratios Alone May Not Be Sufficient To Explain Stock Returns Accurately. Additional Factors, Such As Industry Dynamics, Market Conditions, And Qualitative Aspects, Should Be Considered For A Comprehensive Understanding Of The Companies' Stock Performance.

Findings, Conclusion and Suggestion

Tech Mahindra Limited Demonstrates Strong Profitability, Steady Leverage And Liquidity Ratios, And Increased Operating Cash Flow. However, The Influence Of These Factors On The Company's Stock Returns Is Statistically Insignificant, Suggesting The Presence Of Unaccounted Factors.

Wipro Limited Consistently Improves Profitability With Increasing Return On Assets (ROA)

And Operating Cash Flow While Maintaining Stable Leverage And Liquidity Ratios. However, The Decline In The Company's Asset Turnover Ratio Suggests Reduced Efficiency In Revenue Generation. The Model's Fitness Is Statistically Insignificant, Indicating The Presence Of Other Factors Influencing Wipro's Stock Returns.

TCS Limited Maintains A High Level Of Profitability With Strong ROA And Operating Cash Flow. Despite A Decline In Efficiency And Liquidity In The Latest Fiscal Year, Along With Increased Leverage, The Company Still Possesses A Good Financial Health With An F-Score Of 4. However, The Selected Variables Have Limited Significance In Explaining TCS's Stock Returns, And The Overall Model Fitness Is Statistically Insignificant.

HCL Technologies Limited Demonstrates Consistent Profitability With Positive ROA And Operating Cash Flow. Although The Company Experienced A Decline In ROA And Efficiency In The Current Fiscal Year, There Were Positive Changes In Leverage And Improved Liquidity. HCL Technologies Has Moderate Financial Health With An F-Score Of 5. The Model Shows High Explanatory Power, With Leverage, Liquidity, And Operating Efficiency Significantly Affecting Stock Returns, While Profitability Does Not.

Infosys Limited Displays Strong Profitability With Positive ROA And Operating Cash Flow, Indicating Improved Financial Health. However, The Company Faces Declines In Efficiency And Liquidity, Along With Negative Changes In Accruals And Gross Margin. Despite These Challenges, Infosys Limited Still Possesses A Moderate Financial Health With An F-Score Of 3. The Overall Model Fitness Is Statistically Insignificant, Suggesting That The Examined Variables Have No Significant Impact On Infosys's Stock Returns.

The Analysis Indicates That Factors Such As Profitability, Leverage And Liquidity, And Operating Efficiency Have Limited Influence On Tech Mahindra's And Wipro's Stock Returns, With Statistically Insignificant Model Fitness. The Selected Variables Also Have Limited Significance In Explaining Tata Consulting Services' Stock Returns. However, HCL Technologies Shows High Explanatory Power, With Leverage, Liquidity, And Operating Efficiency Significantly Affecting Stock Returns. For Infosys, The Model Has Moderate Explanatory Power, But The Overall Model Fitness Is Statistically Insignificant, Indicating That None Of The Examined Variables Have A Significant Impact On The Company's Stock Returns.

Conclusion

The Analysis of Tech Mahindra Limited Reveals Strong Profitability, Steady Leverage And Liquidity Ratios, And Effective Asset Use. However, These Factors Have Limited Influence on The Company's Stock Returns, Suggesting the Presence Of Other Unaccounted Factors. Wipro Limited Shows Consistent Improvement in Profitability and Overall Financial Stability With Stable Leverage And Liquidity Ratios. However, The Decline in The Asset Turnover Ratio Raises Concerns About Revenue Generation Efficiency. Additionally, The Selected Variables Have Limited Significance in Explaining Wipro's Stock Returns, Indicating The Presence Of Other Unaccounted Factors. TCS Limited Maintains an Elevated Level Of Profitability, But Experienced A Decline In Efficiency And Liquidity, Along With An Increase In Leverage. Despite These Challenges, TCS's Overall Financial Health Remains Good, As Indicated by The F-Score Of 4. HCL Technologies Limited Demonstrates Consistent Profitability and Improved Liquidity, But Experienced A Decline In ROA And Efficiency. Nevertheless, The Company's Financial Health Is Moderate with An F-Score Of 1. Leverage, Liquidity, And Operating Efficiency Significantly Affect HCL Technologies' Stock Returns, While Profitability Does Not Show Significant Influence. Infosys Limited Exhibits Strong Profitability, But Faces Challenges In Efficiency And Liquidity. None Of The Examined Variables, Including Profitability, Leverage, Liquidity, And Operating Efficiency, Have A Significant Impact On Infosys' Stock Returns. The Overall Model Fitness Is Statistically Insignificant, Suggesting the Presence Of Other Unaccounted Factors.

Suggestions

The Analysis Suggests That Factors Such As Profitability, Leverage And Liquidity, And Operating Efficiency Have Limited Significance In Explaining Stock Returns For The Analyzed Companies. Model Fitness Tests Show Statistical Insignificance, Indicating The Presence Of Other Unaccounted Factors Influencing Stock Returns. To Evaluate The Financial Health And Stock Performance Accurately, A Comprehensive Approach Considering Industry-Specific Dynamics, Market Conditions, And Qualitative Aspects Is Crucial. Investors And Stakeholders Should Integrate Multiple Financial Metrics, Market Analysis, And Qualitative Factors To Make Informed Investment Decisions In The Technology Sector. Ongoing Monitoring And Adjustment Of Investment Strategies Based On Changing Market Conditions And Company-Specific Developments Are Essential. Further Research Is Needed To Identify Additional Factors Influencing Stock Returns And Develop More Accurate Prediction Models. These Findings Emphasize The Complexity Of

Stock Returns And The Necessity Of A Comprehensive And Adaptable Investment Approach In The Technology Industry.

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