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Piotroski F-Score Model in Investment

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Abstract

The Piotroski F-Score model was developed by Joseph Piotroski in 2000 to evaluate a company's financial health and performance. The research article proves that Piotroski F-Score is an effective predictor of a company's future performance by assessing the nine components of the company where the lower scores indicate poor performance and the higher scores (6-8) indicate great company performance. The main objective of this model is to filter

out weak companies and enhance value strategy. This study aims to introduce Piotroski's F-score as an essential tool for evaluating a few private Indian banks. In his Journal, Joseph Piotroski said, "Embedded in that mix of companies, you have some that are just stellar. Their performance turns around. People become optimistic about the stock, and it takes off [but] half of the firms languish; they continue to perform poorly and eventually de-list or enter bankruptcy."

Keywords: Piotroski F-score, Decreasing Leverage, Increasing Liquidity, India

Introduction

The stock market offers countless opportunities for investors to multiply their capital. Nowadays, widely known investment strategies may appear to be insufficient to gain an advantage over other market participants, so more and more new investment solutions and methods are being proposed. Investors are looking for rare, unconventional strategies to select companies with good prospects worth including in their portfolios. One of the investment methods in the stock market that deserves special attention is the Piotroski F-score strategy, which combines the elements of investing in value with fundamental analysis.

This valuation metric was first introduced by Piotroski (2000) ^[8], to ascertain if applying specific fundamental analysis techniques across high book-to-market stocks increase could invest or return substantially. The findings included that there could be substantially higher returns generated by choosing to invest in stocks with higher F-scores. Piotroski's F score uses nine fundamental ratios to measure the financial health of companies. These ratios assess three different categories: Profitability, Financial leverage/ liquidity, and Operating Efficiency.

Piotroski (2000) ^[8] developed the F-Score as a measure to select good stocks for investments. The F-Score ranges between zero to nine and is the summation of scores based on nine financial variables. Piotroski (2000) ^[8] demonstrated that companies with a high F-Score give better stock returns as compared to those with a low F-Score. As such, this implies that companies with a low F-Score will give low stock returns. According to Campbell *et al.* (2011), companies with a high probability of failure give low average stock returns as well. Given this similarity, we hypothesize that firms with a low F-Score have a higher tendency to be financially distressed as compared to the firms with a high F-Score.

Piotroski's F-Score is also used to measure a firm's fundamental strength and is a robust predictor of future profitability and subsequent stock returns. According to Mohr (2019), high F-Score firms outperform in emerging markets low F-Score firms by about 10% every year. Furthermore, F-Score preserves its power to determine future returns across all size segments after examining established cross-sectional return variables, such as book-to-market, investment, operating profitability, and firm size. The findings indicate that investors tend to incorporate substantial information only into stock prices gradually.

The Piotroski F-score employs commonly used accounting ratios to identify stocks with high financial strength. Such stocks were shown by Piotroski (2000) ^[8] to generate strong excess returns in the US market, and subsequent out-of-sample studies have confirmed the original findings. The appeal of the F-score as an investment signal is that it is simple to construct and easy to understand and explain. In addition, it appeals to the many investors who have a deep-seated belief that high-quality stocks

should outperform over the long run. These factors have led to the F-score becoming well-known amongst both institutional and retail investors.

Literature Review

As per Hyde (2016)^[6], the implementation of an F-score to identify stocks with good financial health resulted in optimizing returns. The test was carried out on S&P and ASX 200 stocks. The paper indicates that further research in understanding the correlation of F-score with other key factors could enable stakeholders to utilize the signals of financial distress better.

Noma (2010) in Japan from 1986-2001, discovered that investing in line with the F-Score strategy led to the construction of a portfolio that generated a return of 7.8 p.p. above the market average, therefore generating an annual return of 17.6%.

Fama and French (1992) and La-konishok *et al.* (1994), explained the advantage of value investing over growth investing by behavioral factors. Fisher's approach was noticeably different – according to him, growth entities (characterized by a greater growth potential but also higher risk) were more favorable than value companies (Fishe, 1958). As there was no unified approach to value and growth investing, the papers aimed at the comparison of their effectiveness were developed. For instance, a systematic literature review focused on studies from the period 2007–2017 showed a partial reconciliation of the results of the research taken into account with the conclusions of value investing proponents, while the growth investing was not supported (Battisti *et al.*, 2019). On the other hand, according to, *inter alia*, Perez (2018) and Hedau (2020), value investing did not lead to the outperformance of growth investing. Such heterogeneity confirms the purposefulness of research in this field.

Mohr (2012) United States of America in 1976–1996, with a strategy based on buying the shares of companies with high F-Score and selling the securities of entities low-rated by the model, yielded returns higher than the market.

Piotroski hypothesized that the reason high F-score stocks outperform other stocks is that they tend to be smaller and thus neglected by analysts. If it takes longer for new financial information to be impounded into the price of smaller stocks, this creates an opportunity to generate positive returns by reacting quickly to the F-score signal and buying high F-score stocks.

Overview of F-SCORE and its Components

Few investors would contemplate using the F-score signal in isolation, being more likely to use it in combination with other commonly employed factors such as value, momentum, and low-risk factors. Hence, further research examining the correlations between the F-score signal and other factors would be beneficial to practitioners, as would analysis of the signal's performance under different market regimes. This information will allow investors to better optimize their implementation of the F-score signal in a multi-factor strategy setting. The Piotroski F-Score of a company can be measured by assigning a value of either 1(good) or 0(bad) and the sum of these values ranging from 0 to 9 is the F-Score. Not forgetting that the strength of the firm is indicated using the F-score therefore a higher F-score indicates a strong firm and a lower F-score indicates a weak firm.

The Piotroski F-Score is therefore a quantitative measure that evaluates a company's financial strength based on nine criteria. Each criterion is assigned a score of 1 or 0, with a maximum total score of 9. The criteria are divided into three main categories: Profitability, leverage/liquidity, and operating efficiency.

1. Profitability

- **Positive Return on Assets (F_ROA):** Measures whether the firm is generating a positive return on assets (ROA) (net income / total assets). A positive ROA indicates the firm is profitable and efficiently utilizing its assets. 1 if ROA is positive, 0 otherwise.
- **Positive Operating Cash Flow (F_CFO):** Assesses whether the firm is generating positive cash flow from operations. A positive CFO indicates the firm's core business is generating cash. 1 if the CFO is positive, 0 otherwise.
- **Improving Return on Assets (F_ΔROA):** Captures whether the firm's profitability is improving compared to the previous year. As noted in Piotroski's paper, a positive earnings trend is suggestive of an improvement in the firm's underlying ability to generate positive future cash flows. 1 if ROA improved compared to the previous year, 0 otherwise.
- **Quality of Earnings (F_ACCRUAL):** Compares the firm's cash flow from operations (CFO) to its return on assets (ROA). If the ratio of CFO to total assets (aka cash return on assets) exceeds ROA in the current year, it suggests the firm's earnings are of high quality and are backed by cash flows. Piotroski's paper highlights that this relationship may be particularly important among value firms, where the incentive to manage earnings through positive accruals (e.g., to prevent covenant violations) is strong. 1 if $CFO/Total\ Assets > Net\ Income/Total\ Assets\ (ROA)$, 0 otherwise.

2. Leverage, Liquidity, and Source of Funds

- **Decreasing Leverage (F_ΔLEVER):** Measures changes in the firm's long-term debt levels relative to total assets (long-term debt / total assets). A decrease in the leverage ratio is viewed positively as it reduces financial risk. Piotroski's paper notes that since most high BM firms are financially constrained, an increase in leverage is likely to place additional constraints on the firm's financial flexibility. 1 if the leverage ratio decreased compared to the previous year, and 0 otherwise.
- **Increasing Liquidity (F_ΔLIQUID):** Captures changes in the firm's current ratio (current assets / current liabilities). An improvement in liquidity is a good signal about the firm's ability to meet short-term obligations. 1 if the current ratio improved compared to the previous year, 0 otherwise.
- **No Equity Issuance (EQ_OFFER):** Identifies whether the firm issued equity in the previous year. Not issuing equity is viewed positively, as financially distressed firms often raise equity capital as a last resort. Piotroski's paper notes that by raising external capital, a financially distressed firm is signaling its inability to generate sufficient internal funds. 1 if the firm did not issue equity in the previous year, 0 otherwise.

3. Operating Efficiency

- **Improving Gross Margin (F_ΔMARGIN):** Measures the change in the firm's gross margin compared to the previous year. An improvement in margins suggests better operating efficiency, cost control, or pricing power. 1 if the gross margin improved compared to the previous year, 0 otherwise.
- **Improving Asset Turnover (F_ΔTURN):** Captures the change in the firm's asset turnover ratio (revenues / total assets). An improvement in asset turnover indicates the firm is generating more sales per dollar of assets, suggesting better efficiency. Piotroski's paper highlights that an improvement in asset turnover can arise from more efficient operations (fewer assets generating the same levels of sales) or an increase in sales (which could also signify improved market conditions for the firm's products). 1 if the asset turnover ratio improved compared to the previous year, 0 otherwise.

Therefore, the Piotroski F-score enables one to determine good-value stocks by assessing the overall financial strength of a company. It looks at a variety of metrics, from net income to profitability to liquidity to cash flow to margin to debt and more. The score can help investors pick stocks or sell off ones that may no longer be a good value.

Why Piotroski F-Score?

The Piotroski score is generally considered to be viable in the world of financial analysis and investment. It is simple, efficient, and effective in determining value stocks. It also is a valuable tool used by investors to identify undervalued stocks with strong financial health. It's a nine-point scoring system that assesses a company's financial strength based on historical data. The Piotroski F-Score is necessary and very important for several reasons:

Identifies Undervalued Stocks:

- By focusing on companies with improving financial performance, the F-Score helps identify stocks that may be undervalued by the market.

Filters Out Weak Companies:

- The F-Score eliminates companies with deteriorating financial health, such as those with declining profitability or increasing debt.

Focuses on Fundamental Strength:

- It emphasizes factors like profitability, efficiency, and financial flexibility, which are crucial for long-term success.

Simplicity and Ease of Use:

- The F-Score is relatively easy to calculate and interpret, making it accessible to individual investors.

Backed by Research:

- Numerous studies have shown that companies with higher F-scores tend to outperform the market over the long term.

Limitations of Piotroski F-Score

Limited Usefulness for Cyclical Stocks

- Cyclical stocks, which are subject to fluctuations based on economic cycles, may not be accurately assessed by

the Piotroski Score. The score could show these stocks in a negative light during downturns, even if they are fundamentally strong. Similarly, during economic upswings, cyclical stocks might receive inflated scores that do not reflect their overall volatility.

Reliance on Historical Data

- One of the main drawbacks of the Piotroski Score is its reliance on historical financial data. This approach can be problematic as it does not account for future market dynamics. Changes in the economic environment, industry trends, or shifts in management can significantly impact a company's performance, and the Piotroski Score may not reflect these factors. Consequently, the score might lead to missed investment opportunities or false positives.

Challenges with Micro-Cap Stocks

- The Piotroski Score is not particularly effective for evaluating micro-cap stocks, which have a market capitalization below ₹500 crore. These stocks often lack liquidity compared to small-cap, mid-cap, or large-cap stocks, and their financial metrics can be more volatile. As a result, even quality micro-cap stocks might receive low or negative scores, making the Piotroski Score less reliable in this segment.

Impact of Unusual Events

- The Piotroski Score evaluates a company's performance based on data from the previous year. This method can be misleading during unusual events, such as the Covid-19 pandemic. For instance, a high-quality stock might receive a low score due to temporary setbacks during such periods. Conversely, a company might score high following a rebound year, which may not indicate long-term strength.

How to Interpret the Piotroski F-Score Ranges

The Piotroski F-Score is an aggregate measure of a firm's financial strength, calculated using nine criteria based on profitability; leverage, liquidity, source of funds; and operating efficiency. Each criterion scores 1 if met (positive signal) or 0 if not met, and the individual scores are summed to calculate the final F-Score, ranging from 0 (weakest) to 9 (strongest).

A strong financial health (7-8)

- These companies are considered to be financially sound and have a high probability of outperforming the market. They exhibit positive financial trends, such as increasing profitability, improving efficiency, and strengthening their financial position.

A stable financial health (4-5)

- These companies with a score in this range are generally stable but may not be as strong as those with higher scores of 7-9 though they may have some positive financial characteristics, they also have some areas of concern and therefore further analysis is required to determine their investment potential.

A weak financial health (0-3)

- Companies with low F-Scores are considered financially weak and may be experiencing financial difficulties companies may have declining profitability,

increasing debt, or other negative financial trends therefore companies with this range are generally not considered good investment candidates.

Illustration of Piotroski F-score

WEAK			STABLE				VERY STRONG		
0	1	2	3	4	5	6	7	8	9

Methodology

In this chapter of the research paper, we systematically collect, analyze, and interpret data to solve a research problem. It also includes the design of the research. It includes all the important aspects of research, including research design, data collection methods, data analysis methods, and the overall framework within which the research is conducted.

Research

Sample size

We decided to take a random sample of seven different banks in India and we decided to compare the ranges of the Piotroski F-Score from 2014 to 2020. We used the historical data to determine the most current scores of each bank. These banks are Karur Vysya Bank, Dhan Laxmi Bank, Yes Bank, IndusInd Bank, Axis Bank, ICICI Bank, and Federal Bank.

Methods used

In this research paper, we decided to go with the qualitative and we chose to specifically go for the trend analysis where we analyzed and compared the year-over-year financial metrics from one year to the next to identify trends. After we gathered the data, we decided to use it in the calculation of the F-Scores for every Bank and in the different years.

We calculate the Piotroski F-Score using the following formula:

$$F_SCORE = F_ROA + F_ΔROA + F_CFO + F_ACCRUAL + F_ΔMARGIN + F_ΔTURN + F_ΔLEVER + F_ΔLIQUID + EQ_OFFER$$

Where;

ROA: Return On Assets. Net Income divided by year beginning total assets. F score is 1 if ROA is positive, 0 otherwise.

ΔROA: Change in ROA from the prior year. If ΔROA > 0, the F score is 1. Otherwise, the F score is 0.

CFO: Operating cash flow divided by year-beginning total assets. F score is 1 if the CFO is positive, 0 otherwise.

ACCRUAL: CFO compared to ROA. If CFO > ROA, the F score is 1. Otherwise, the F score is 0.

ΔLEVER: Change in long-term debt /average total assets ratio. If the ratio compared to the prior year is lower, the F score is 1, 0 otherwise.

ΔLIQUID: Change in current ratio. If the current ratio increases from the prior year, the F score is 1, 0 otherwise.

EQ_OFFER: Total common equity between years. If common equity increases compared to the prior year, the F score is 1, 0 otherwise.

ΔMARGIN: Change in gross margin ratio. If the current year’s ratio minus the prior year’s ratio > 0, the F Score is 1, 0 otherwise.

ΔTURN: Change in asset turnover ratio (revenue/beginning year total assets). If the current year’s ratio minus prior years > 0, the F score is 1, 0 otherwise.

Table 1: Piotroski f-score of the different samples

Sample	2020	2019	2018	2017	2016	2015	2014
Karur Vysya Bank	6	2	3	5	5	2	4
Dhan Laxmi Bank	6	3	2	6	2	2	4
Yes Bank	1	3	2	4	3	4	5
Indus Ind Bank	4	3	4	5	4	3	4
Axis Bank	4	6	2	4	2	5	5
ICICI Bank	7	6	4	4	4	4	7
Federal Bank	7	6	2	6	1	7	4

Table 2: Data Analysis and Interpretation

Name of Bank	Data Analysis and Interpretation
Karur Vysya Bank	The bank has had a weak F-score in 2015 and also in 2019. The study also noticed that there is a gradual inconsistency in the scores.
Dhan Laxmi Bank	The bank has had two instances of a score of 6 in 2017 and 2020. For the rest of the years, the bank hasn’t had the best scores.
Yes Bank	This is one of the banks in India that has failed to cross over the score of 5. The research noticed that the bank has just been flopping instead of becoming successful.
Indus Ind Bank	The Piotroski score of this bank is noticed to be an inconsistent one and therefore it is a higher risk of investment.
Axis Bank	This bank, for seven years, has only had a high score in 2019 and then it went down in 2020 with a score of 4. And its lowest scores which are considered weak (2) in 2016 and 2018.
ICICI Bank	The score of this bank has been recognised as a constant one with a score of 4 from 2015 to 2018. And it has the strongest in 2020 with a score of 7.
Federal Bank	This bank’s scores are generally good except for two years where the scores were 1 and 2 in 2016 and 2018 respectively.

Findings and Conclusions

Conclusively, Piotroski’s F-Score is a quantitative tool that is used in the measurement of the financial strength of a Company and it enables the use of historical data to separate the winners and losers. As the study portrays, the best performing private banks can easily be identified through the help of the model therefore providing a wide benchmark for the investors and also the management to assess its performance from the past to present and hence finding the measures to improve their performance. However, one has to clearly understand that despite its advantages, F-score has several limitations and one has to understand them to make the best use of it. Not forgetting that the score might be less effective for service-based industries. This means that it may be more effective for evaluating industries whose financial metrics like inventory levels and gross margins are significant.

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