Chapter: 13

UNLOCKING INDUSTRIAL INSIGHTS: HARNESSING MACHINE LEARNING FOR IN-DEPTH FUNDAMENTAL ANALYSIS IN THE BANKING SECTOR OF INDIA

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ABSTRACT

This study aims to identify effective and consistent key performance metrics in the Indian financial exchange market using AI algorithms. By analysing the compound annual growth rate (CAGR), yearly fluctuation rate, Sharpe ratio, Sortino ratio, and Calmar ratio of different stocks particular banking sectors, this research determines their risks and returns by delving into fundamental analysis through machine learning approach. The AI-generated analysis reveals that various stocks in the Indian securities exchange exhibit distinct performance in terms of volatility and returns. Markedly Bank of Baroda and State Bank of India consistently anchored as the strongest contender, displaying the highest CAGR, Sharpe ratio, Sortino ratio, and Calmar ratio. These results indicate consistently exposition of significant yields and are a favorable investment choice. Furthermore, this study explores the potential of machine learning algorithms in optimizing key performance indicators within the Indian stock market.

Keywords: Banking Stocks, NIFTY 50, AI, Machine Learning, Fundamental Analysis.

1.   INTRODUCTION

Stock markets around the world provide opportunities for investors to participate in various sectors and industries. The banking sector, in particular, plays a crucial role in the overall economy and is a preferred choice for many investors. Fundamental analysis, combined with the use of key performance indicators (KPIs), is an essential tool for long-run stock selection in the Indian stock market. By analyzing the financial health, growth prospects, and profitability of banking sector stocks, investors can make informed investment decisions. This study aims to explore the fundamental analysis of banking sector stocks in the Indian stock market using popular KPIs. In recent years, the Indian stock market has witnessed significant growth and has become an attractive destination for domestic and international investors. Among the various sectors, the banking sector stands out as a prominent contributor to the overall market performance. Fundamental analysis, which involves evaluating the intrinsic value of stocks, provides valuable insights into the financial strength and growth potential of banking sector stocks. To conduct a comprehensive fundamental analysis, various KPIs are used to assess the overall performance of banking sector stocks. Key performance indicators such as return on equity (ROE), net interest margin, price to earnings ratio (P/E ratio), loan growth rate, and capital adequacy ratio are widely utilized. These indicators help investors gauge the profitability, efficiency, and risk associated with the selected stocks. For instance, ROE measures the profitability of a company by comparing its net income to the shareholders' equity. A higher ROE indicates better profitability

and efficient utilization of capital. Similarly, the P/E ratio provides a measure of the market's expectations for future earnings growth. A low P/E ratio may indicate an undervalued stock, while a high P/E ratio may suggest an overvalued stock. Latest data from reputable sources, such as stock exchanges, regulatory bodies, and financial databases, are crucial in performing an accurate and up-to-date fundamental analysis. These data sources provide real-time information on financial statements, market trends, and corporate disclosures. Inline citation and referencing ensure the credibility of the data and support the validity of the findings. The use of artificial intelligence (AI) in the stock market has revolutionized the way investors approach stock selection and fundamental analysis. In the context of the Indian stock market, AI-powered algorithms are increasingly being utilized to analyze banking sector stocks and identify key performance indicators (KPIs) for long-run stock selection. With access to relevant and up-to-date data, AI algorithms can provide valuable insights into the financial health, growth prospects, and profitability of stocks. This study focuses on exploring the integration of AI and fundamental analysis in the Indian stock market, using relevant data and inline citations to support the findings. Fundamental analysis using key performance indicators is a vital tool for long-run stock selection in the stock and F&O sectors of the Indian stock market. By evaluating financial health, growth prospects, and profitability using appropriate KPIs, investors can make informed investment decisions.The Sharpe Ratio has been widely used as a stock performance analysis tool since the late 1960s, consisting of stock return, risk-free returns, and stock risk. However, measuring risk-free returns in Islamic finance, where interest rates are prohibited, poses a challenge. This study suggests a modified Sharpe Ratio, replacing interest rates with alternative approaches such as inflation and GDP, to measure the performance of Islamic stocks listed on the Indonesian Stock Exchange. The findings show that these modified models yield similar results to the original measurement, making them applicable in various circumstances. Inflation and GDP are recommended to measure risk-free returns in Islamic asset pricing models. (Qudratullah, 2021).

The empirical results and discussion focus on the examination of the relationship between environmental, social, and governance factors (ESG) and stock performance in the energy industry. The study collects ESG and stock returns data for 334 energy firms from 2015 to 2019. The findings suggest that considering ESG factors in investing in the energy industry can help reduce potential risks. Furthermore, the study highlights the need to assess the multi-dimensional relationship between ESG and stock returns using the ESG-SR-SBM DEA approach. The descriptive statistics of the dataset are provided, showing the wide range of ESG and stock return values. (Behl et al., 2021)

2. LITERATURE REVIEW

Lu, Chang, and Chien (2018) explored the application of a machine learning network-based approach to estimate interest in a specific product. Their study shed light on the use of artificial intelligence (AI) for identifying and predicting stock performance. By utilizing AI algorithms and incorporating relevant indicators from financial markets, it becomes possible to accurately forecast interest in specific industries or sectors, thereby facilitating fundamental analysis of stocks. In a study by Chen and Ma (2019), the application of artificial intelligence (AI) strategies in predicting stock patterns was explored. Key performance indicators (KPIs) were utilized as predictors, and a dataset was constructed using capital market data. Various algorithms, such as random benchmarks, support vector machines, and long short-term memory networks, were employed to forecast stock patterns. The findings demonstrated that the integration of KPIs and AI techniques can effectively predict stock patterns, offering valuable insights for fundamental analysis. Qudratullah, M. F. (2021). This literature review discusses the use of the Sharpe Ratio as a common tool for analysing stock performance. It highlights the challenges of measuring risk-free returns in Islamic finance, where interest rates are prohibited. The paper proposes modifying the Sharpe Ratio by replacing interest rates with alternative approaches such as inflation and GDP. The findings indicate that these modified models provide similar results to the original measurement and can be useful in other circumstances. The study recommends using inflation and GDP to measure risk-free returns in Islamic asset pricing models in case study of Indonesia. Srivastav, Vikas, et.al (2023) The present study aimed to establish effective key performance metrics (KPIs) in the Indian financial market using AI algorithms. The research analysed various indicators, such as CAGR, fluctuation rate, Sharpe ratio, Sortino ratio, and Calmar ratio, to determine stock risks and returns. The AI-based analysis revealed that different stocks in the Indian market exhibit distinct volatility and returns. Notably, ITC Ltd emerged as the strongest contender with the highest CAGR, Sharpe ratio, Sortino ratio, and Calmar ratio, consistently yielding significant returns. This study highlights the potential of machine learning algorithms in optimizing performance indicators in the Indian stock market.

3. RESEARCH METHODOLOGY

This study focuses on conducting a fundamental analysis of the banking sector stocks using some commonly applied performance indicators of stocks such as Compound Annual Growth Rate (CAGR), Calmar Ratio, Sharpe Ratio, and Sortino Ratio. The research methodology involves the following steps:

1. **Sample Selection:** The sample of banking sector stocks is selected from the Nifty 50 index. The sample size is determined to ensure statistical significance, considering the availability of data from a secondary data source, specifically Yahoo Finance. The time period for the analysis spans three years, from 2020 to 2023, with daily returns data for the selected stocks being considered.

2. **Fundamental Performance Metrics:** The chosen performance indicators for the fundamental analysis of banking sector stocks include CAGR, Calmar Ratio, Sharpe Ratio, and Sortino Ratio. These metrics provide insights into the financial performance, risk-adjusted returns, and volatility of the banking stocks.

3. **Data Analysis:** The calculated performance indicators will be analyzed by using python finance algorithms to assess the performance of the banking sector stocks. Patterns, trends, and outliers are identified to make logical deductions based on industry benchmarks and market indices. The analysis is conducted to understand the financial health and potential returns of the selected stocks.

4. **Statistical Validation:** To ensure the validity and reliability of the findings, relevant statistical tests are applied. Regression analysis, hypothesis testing, and other statistical techniques may be utilized to determine the significance of the observed differences. This validation process helps strengthen the argument and provides robust evidence of the results.

5. **Presentation of Findings:** The research findings are summarized in comprehensive reports and documentation. The calculated KPIs and their interpretation are presented using appropriate visual aids such as tables, charts, and graphs. The findings are presented in a concise and statistically valid manner to facilitate easy comprehension and interpretation.

6. **Review and Refinement:** The research methodology is continuously reviewed and refined to enhance the accuracy and reliability of the findings. Feedback from experts or other researchers is sought to incorporate different perspectives and further improve the research.

$$\text{Compound Annual Growth Rate } = \text{CAGR} = \left(\frac{Vfinal}{Vbegin}\right)^{1/t} - 1$$

Annualized votality = $\sqrt{252} * \sqrt{(\sum (P_{av} - P_i)^2 / n)}$ where 252 is number of trading days and $P_{av} - P_i)^2$ is variance

Sharpe ratio = $\frac{Rp - Rf}{\sigma p}$ where Rp is return of portfolio, Rf risk-free rate, σp = standard deviation of portfolio excess return

Sortino ratio = $\frac{Rp-Rf}{\sigma d}$ where Rp is return of portfolio, Rf risk-free rate, σp = standard deviation of down side.

Calmer Ratio = $\frac{Ri}{Md}$ where Ri = Annualized rate of return, Md = maximum Draw down

Table: 1

Stock (Banks)	Period	CAGR %0	Annualized Votality	Sharpe Ratio (%)	Sortino Ratio (%)	Calmer Ratio (%)
HDFC	30-10-2020 to 30-10-2023	8.61	23.23	0.24	0.41	0.24
ICICI		33.95	25.32	1.22	2.28	1.38
AXIX		27.42	27.39	0.891	1.54	0.94
Kotak		3.36	24.01	0.015	0.026	0.014
SBI		46.82	28.73	1.52	2.78	2.1
PNB		42.38	40.28	0.977	1.66	1.021
BOB		72.81	40.56	1.72	3.094	2.042

Source: Author's calculation using Python algorithm from www.yahoofinance.com stocks data.

4. RESULTS

The above table results can be summarized as below for all stocks picked up for sample analysis.

HDFC Bank

- **CAGR:** HDFC has shown a Compound Annual Growth Rate (CAGR) of 8.61% over the period from 30-10-2020 to 30-10-2023.

- **Annualized Volatility:** The stock has exhibited an annualized volatility of 23.23%, indicating moderate fluctuations in its returns.

- **Sharpe Ratio:** With a Sharpe Ratio of 0.24%, HDFC's risk-adjusted returns appear to be relatively low.

- **Sortino Ratio:** The Sortino Ratio of 0.41 suggests that the stock has produced satisfactory returns relative to its downside risk.

- **Calmar Ratio:** HDFC's Calmar Ratio of 0.24 indicates that the stock has difficulty producing consistent returns compared to its maximum drawdown.

ICICI Bank

- **CAGR:** ICICI demonstrates a substantial CAGR of 33.95% over the specified period.

- **Annualized Volatility:** The stock exhibits relatively higher volatility with an annualized volatility of 25.32%.

- **Sharpe Ratio:** ICICI's Sharpe Ratio of 1.22 implies that the stock has delivered attractive risk-adjusted returns.

- **Sortino Ratio:** With a Sortino Ratio of 2.28, ICICI has displayed exceptional returns relative to its downside risk.

- **Calmar Ratio:** The Calmar Ratio of 1.38 indicates that ICICI has been successful in producing consistent returns relative to its maximum drawdown.

AXIS BANK

- **CAGR:** AXIS has demonstrated a CAGR of 27.42% over the given period.

- **Annualized Volatility:** The stock exhibits a relatively high level of volatility, with an annualized volatility of 27.39%.

- **Sharpe Ratio:** With a Sharpe Ratio of 0.891, AXIS shows moderate risk-adjusted returns.

- **Sortino Ratio:** AXIS's Sortino Ratio of 1.54 indicates that the stock has been able to generate significant returns compared to its downside risk.

- **Calmar Ratio:** The Calmar Ratio of 0.94 suggests that AXIS faces challenges in producing consistent returns relative to its maximum drawdown.

Kotak: Mahindra Bank

- **CAGR:** Kotak has exhibited a lower CAGR of 3.36% over the specified period.

- **Annualized Volatility:** The stock shows an annualized volatility of 24.01%, implying moderate fluctuations in its returns.

- **Sharpe Ratio:** Kotak's Sharpe Ratio of 0.015 suggests relatively poor risk-adjusted returns.

- **Sortino Ratio:** The Sortino Ratio of 0.026 indicates that the stock has struggled to generate satisfactory returns relative to its downside risk.

- **Calmar Ratio:** Kotak's Calmar Ratio of 0.014 implies difficulty in producing consistent returns compared to its maximum drawdown.

  State Bank of India

- **CAGR:** SBI has demonstrated an impressive CAGR of 46.82% over the given period.

- **Annualized Volatility:** The stock exhibits relatively higher volatility, with an annualized volatility of 28.73%.

- **Sharpe Ratio:** SBI's Sharpe Ratio of 1.52 suggests attractive risk-adjusted returns.

- **Sortino Ratio:** With a Sortino Ratio of 2.78, SBI showcases exceptional returns relative to its downside risk.

- **Calmar Ratio:** The Calmar Ratio of 2.1 indicates that SBI has been successful in producing consistent returns relative to its maximum drawdown.

Punjab National Bank

- **CAGR:** PNB demonstrates a substantial CAGR of 42.38% over the specified period.

- **Annualized Volatility:** The stock exhibits relatively high volatility with an annualized volatility of 40.28%.

- **Sharpe Ratio:** PNB's Sharpe Ratio of 0.977 suggests moderate risk-adjusted returns.

- **Sortino Ratio:** The Sortino Ratio of 1.66 indicates that PNB has been able to generate satisfactory returns relative to its downside risk.

- **Calmar Ratio:** PNB's Calmar Ratio of 1.021 suggests that the stock faces challenges in producing consistent returns compared to its maximum drawdown.

Bank of Baroda

- **CAGR:** BOB has demonstrated impressive growth with a CAGR of 72.81% over the given period.

- **Annualized Volatility:** The stock exhibits relatively high volatility, with an annualized volatility of 40.56%.

- **Sharpe Ratio:** BOB's Sharpe Ratio of 1.72 suggests attractive risk-adjusted returns.

- **Sortino Ratio:** With a Sortino Ratio of 3.094, BOB showcases exceptional returns relative to its downside risk.

- **Calmar Ratio:** The Calmar Ratio of 2.042 indicates that BOB has been successful in producing consistent returns relative to its maximum drawdown.

5. COMPARATIVE ANALYSIS

The comparative analysis of the mentioned bank stocks based on the provided data: is as below

i. CAGR Comparison:

- BOB has shown the highest CAGR of 72.81%, followed by SBI at 46.82%, PNB at 42.38%, ICICI at 33.95%, AXIS at 27.42%, HDFC at 8.61%, and Kotak at 3.36%.

- BOB stands out with the highest growth rate, indicating potentially attractive long-term returns, while Kotak lags behind with the lowest CAGR among the analyzed stocks.

ii. Annualized Volatility:

- PNB exhibits the highest annualized volatility at 40.28%, followed by BOB at 40.56%, SBI at 28.73%, AXIS at 27.39%, ICICI at 25.32%, HDFC at 23.23%, and Kotak at 24.01%.

- PNB and BOB's high volatility suggests greater price fluctuations and associated risks, while HDFC shows the lowest volatility among the stocks analyzed.

iii. Risk-Adjusted Returns (Sharpe Ratio):

- BOB displays the highest Sharpe Ratio of 1.72, followed by SBI at 1.52, ICICI at 1.22, AXIS at 0.891, HDFC at 0.24, PNB at 0.977, and Kotak at 0.015.

- A higher Sharpe Ratio signifies better risk-adjusted returns, hence BOB's and SBI's stocks appear more attractive in terms of balancing risk and return.

iv. Downside Risk Management (Sortino Ratio):

- BOB has the highest Sortino Ratio of 3.094, followed by SBI at 2.78, ICICI at 2.28, PNB at 1.66, AXIS at 1.54, HDFC at 0.41, and Kotak at 0.026.

- A higher Sortino Ratio indicates better risk-adjusted returns during downside movements, implying BOB and SBI offer potentially greater protection against losses.

v. **Consistency of Returns (Calmar Ratio):**

- Similar to the above two ratios, BOB displays the highest Calmar Ratio of 2.042, followed by SBI at 2.1, ICICI at 1.38, PNB at 1.021, AXIS at 0.94, HDFC at 0.24, and Kotak at 0.014.

- A higher Calmar Ratio suggests better consistency of returns, with BOB and SBI leading the pack.

Overall, BOB and SBI consistently rank high across the various metrics analyzed, indicating their potential as strong performers. ICICI and PNB also show favorable results, demonstrating attractive returns, albeit with higher levels of volatility. HDFC and Kotak demonstrate comparatively lower performance across all metrics. Investors should carefully consider their risk tolerance and investment goals before making decisions based on the provided analysis.

6. CONCLUSION

In this study, machine learning algorithms were used to analyze the fundamental performance of selected top-performing banking sector stocks in the period from 2020 to 2023. The analysis focused on various performance metrics such as CAGR, annualized volatility, Sharpe ratio, Sortino ratio, and Calmar ratio to evaluate the potential returns and risks associated with each stock. Based on the analysis, BOB emerged as the top performer with the highest CAGR of 72.81%, indicating impressive growth over the specified period. SBI also performed well with a CAGR of 46.82%, demonstrating substantial returns. PNB followed closely with a CAGR of 42.38%, while ICICI and AXIS showed strong growth with CAGRs of 33.95% and 27.42% respectively. On the other hand, Kotak had the lowest CAGR of 3.36%, indicating relatively slower growth compared to the other stocks. When examining annualized volatility, PNB and BOB displayed the highest levels, suggesting greater price fluctuations and associated risks. HDFC, on the other hand, showed the lowest volatility among the stocks analyzed, indicating a relatively stable performance in terms of price movements. In terms of risk-adjusted returns, BOB exhibited the highest Sharpe ratio, implying attractive risk-adjusted returns compared to other stocks. SBI also showed favourable risk-adjusted returns with a high Sharpe ratio. However, Kotak displayed the lowest Sharpe ratio, indicating relatively poor risk-adjusted returns. Looking at downside risk management, BOB had the highest Sortino ratio, reflecting exceptional returns relative to

downside risk. SBI also performed well in this aspect, indicating strong risk management during market downturns. HDFC, on the other hand, had a relatively lower Sortino ratio, suggesting that it struggled to generate satisfactory returns during downside movements. Lastly, the Calmar ratio, which measures the consistency of returns, was highest for BOB and SBI, indicating their ability to produce consistent returns relative to their maximum drawdown. HDFC and Kotak had lower Calmar ratios, suggesting challenges in maintaining consistent returns. In conclusion, based on the machine learning analysis, BOB and SBI emerged as top performers across multiple metrics, showcasing impressive growth, attractive risk-adjusted returns, and consistency in returns. ICICI and PNB also displayed favorable results, although with higher levels of volatility. HDFC and Kotak showed relatively lower performance across various metrics. Investors should consider their risk tolerance and investment goals when making investment decisions in the banking sector based on the findings of this analysis.

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