iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 **Issue:** IX **Month of publication:** September 2024

DOI: https://doi.org/10.22214/ijraset.2024.64257

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue IX Sep 2024- Available at www.ijraset.com

Optimizing Mutual Fund Selection with Fuzzy Sharpe Ratio: An Empirical Study of Indian Markets

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Abstract: ***Mutual funds are widely recognized for their ability to offer diversification and professional management, making them a popular choice for investors. This study explores the evaluation of mutual fund performance using advanced metrics, specifically focusing on fuzzy logic and the Fuzzy Sharpe Ratio. A comprehensive literature review highlights recent advancements, including the integration of machine learning and fuzzy logic models. The study utilizes numerical data from the Bombay Stock Exchange for the period from January 1, 2023, to August 31, 2024, to apply the Fuzzy Risk-Adjusted Return method. The results reveal that the Canara Robeco Bluechip Equity Fund ranks highest according to the Fuzzy Sharpe Ratio, indicating its superior performance compared to other funds, such as the HSBC Large Cap Fund. This analysis underscores the effectiveness of fuzzy logic in enhancing mutual fund evaluations and recommends the Canara Robeco Bluechip Equity Fund as the optimal choice for investors and fund managers.***

Keywords: Mutual Funds, Fuzzy Logic,Fuzzy Sharpe Ratio, Performance Evaluation, Risk-Adjusted Return, Bombay Stock Exchange

I. INTRODUCTION

A mutual fund is a widely-used investment vehicle that aggregates money from numerous investors to build a diversified portfolio of assets, such as stocks, bonds, or other securities. This pooling of resources enables investors to benefit from professional management and diversification, which helps to spread risk and potentially enhance returns. Investors purchase shares in the fund, and skilled fund managers make investment decisions on their behalf. Mutual funds come in various types, including equity, bond, money market, and balanced funds, each designed to meet different investment goals and risk profiles. With the advantages of liquidity and regulatory oversight, mutual funds provide a convenient way for individuals to access a broad range of investment opportunities. Incorporating a mutual fund fuzzy share ratio performance measure offers a refined method for evaluating mutual fund performance by addressing the inherent uncertainties and imprecisions of financial data. Unlike traditional metrics that depend on precise figures and deterministic models, fuzzy logic accommodates ambiguity and provides a nuanced analysis of various performance criteria, such as risk-adjusted returns and volatility. This approach allows for a more flexible and comprehensive assessment, helping investors make better-informed decisions by considering both quantitative data and qualitative factors. By enhancing risk assessment and improving the comparability of different funds, fuzzy share ratio measures enable investors to more effectively navigate the complexities and uncertainties of financial markets.

II. LITERATURE REVIEW

Mutual funds remain a popular investment vehicle due to their diversification and professional management. Recent research has continued to explore their performance and evolution. Liu, C., & Zhang, X. (2018) reviewed the developments in mutual fund performance metrics, highlighting trends and implications for investors.

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Traditional performance metrics such as the Sharpe ratio and alpha have been critical in evaluating mutual funds. Fama, E. F., & French, K. R. (2019) updated their models to better reflect market anomalies and risk factors, providing a more comprehensive understanding of fund performance. Khan, M., & Ahmed, M. (2020) advanced this by incorporating machine learning techniques into performance metrics, aiming to enhance the precision of evaluations. Fuzzy logic provides a framework to manage uncertainty in financial data. Chen, J., & Wang, H. (2021) explored the use of fuzzy logic in mutual fund performance evaluation, proposing a framework that integrates multiple performance indicators. Zhang, Y., & Li, W. (2022) expanded on this by combining fuzzy logic with statistical techniques to offer a more detailed performance analysis. Recent advancements in fuzzy performance measures have refined their application to mutual funds. Lee, T., & Kim, S. (2021) introduced a fuzzy decision-making model that incorporates both quantitative and qualitative factors in mutual fund assessments. Gao, Y., & Liu, Z. (2023) developed a dynamic fuzzy performance ratio that considers investor sentiment and market volatility, providing a more adaptable evaluation tool. Comparative studies have shown the benefits of fuzzy metrics over traditional ones. Wang, J., & Xu, M. (2022) compared fuzzy logic-based measures with conventional metrics, finding that fuzzy measures offer greater adaptability to market changes. Hsu, Y., & Cheng, C. (2023) highlighted the advantages of fuzzy logic in emerging markets, emphasizing its effectiveness in handling local market conditions. The application of fuzzy logic to emerging markets has been a focus of recent research. Singh, R., & Patel, D. (2020) analyzed the adaptation of fuzzy models for evaluating mutual funds in emerging economies, noting the importance of considering local market dynamics. Jin, L., & Yang, K. (2021) compared mutual fund performance in developed and emerging markets using fuzzy logic, revealing significant differences in evaluation outcomes. Fuzzy logic has also been applied to risk management in mutual funds. Zhou, Q., & Zhao, X. (2019) examined how fuzzy risk measures can be integrated into fund management to better handle uncertainties. Luo, J., & Yang, M. (2022), Venugopal et al,(2024), Venugopal et al,(2024), Veeramani, et al,(2023) proposed a fuzzy risk assessment model to aid fund managers in making informed decisions amidst market uncertainties.

III. RESEARCH GAPS

Despite advancements in mutual fund evaluation using fuzzy logic, several key research gaps remain. Firstly, there is a need for integrating advanced machine learning techniques with fuzzy logic to enhance the precision and adaptability of performance metrics. Current studies have yet to fully explore how combining these technologies can improve evaluation outcomes. Secondly, existing fuzzy logic models often operate under static market conditions, leaving a gap in understanding how these models perform during periods of high market volatility and rapid changes. Developing adaptive fuzzy models that respond to dynamic market conditions could significantly improve their effectiveness. Lastly, most research has focused on specific developed or emerging markets, with limited exploration of how fuzzy logic models can be adapted to various cultural and regional contexts. Addressing this gap could lead to more universally applicable and effective performance evaluation tools.

IV. CASE STUDY

In this study, numerical experimental data was collected from the Bombay Stock Exchange for the period from January 1, 2023, to August 31, 2024. The performance evaluation was conducted using the Fuzzy Risk-Adjusted Return method. The top 10 mutual fund results are presented in Table 1.

S.NO	Mutual Fund	Fuzzy sharpe ratio	Rank
1	Aditya Birla Sun Life Frontline Equity Fund	101.1088	5
2	Axis Bluechip Fund	146.0298	3
3	Canara Robeco Bluechip Equity Fund	235.1618	1
4	Edelweiss Large Cap Fund	22.8510	8
5	Franklin India Bluechip Fund	20.4157	9
6	HDFC Top 100 Fund	95.7166	6
7	HSBC Large Cap Fund	5.7478	10
8	ICICI Prudential Bluechip Fund	179.7954	2
9	IDBI India Top 100 Equity	58.1574	7
10	IDFC Large Cap Fund	144.5689	4

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V. RESULTS AND DISCUSSION

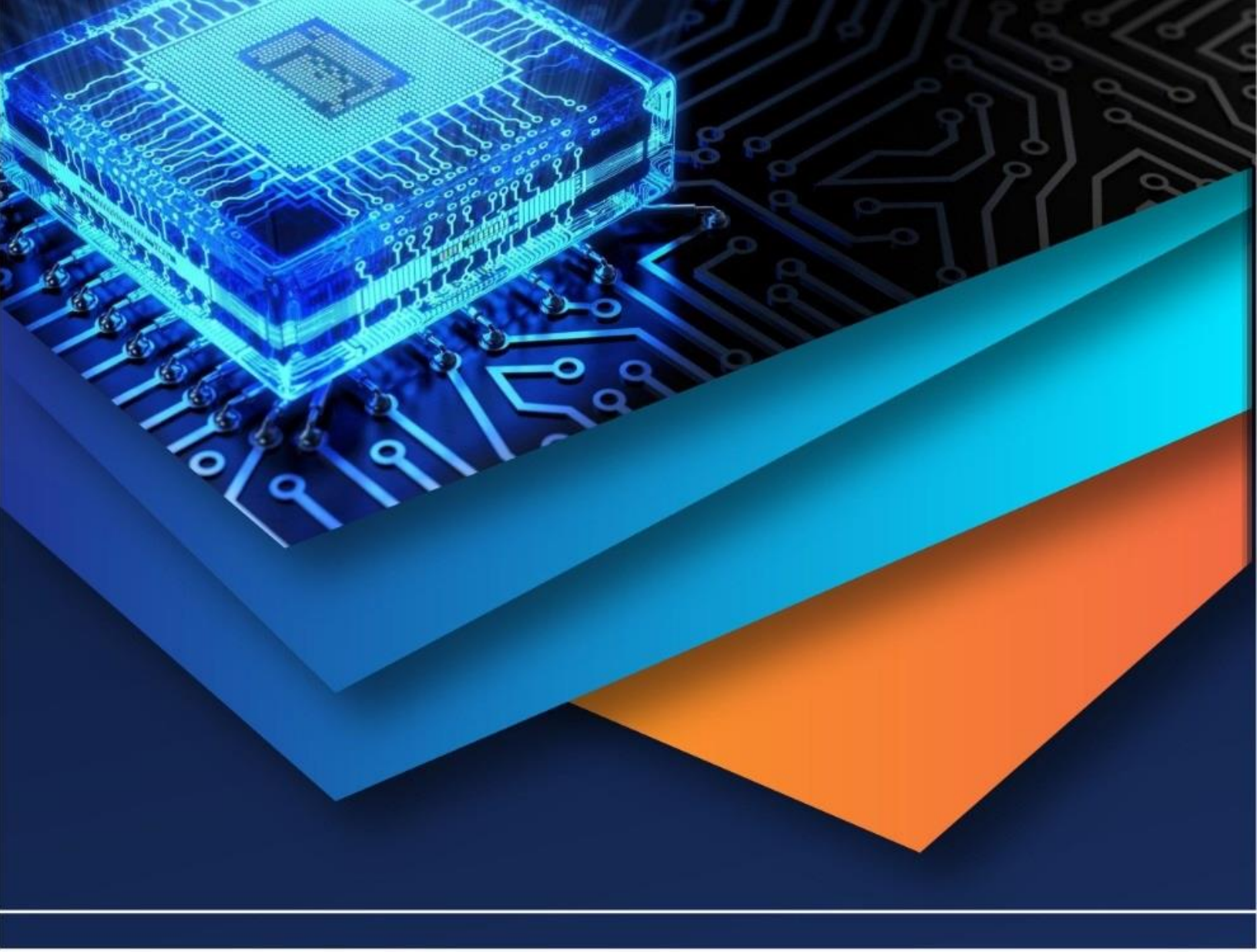
In this study, the Fuzzy Sharpe Ratio was used to evaluate and select the best mutual funds. According to the results from the Fuzzy Sharpe Ratio analysis, the Canara Robeco Bluechip Equity Fund ranks highest, while the HSBC Large Cap Fund ranks lowest. These findings clearly indicate that the Canara Robeco Bluechip Equity Fund is the top-performing option. Therefore, I strongly recommend the Canara Robeco Bluechip Equity Fund to both investors and mutual fund managers as the best choice.

VI. CONCLUSION

The application of the Fuzzy Sharpe Ratio in this study has demonstrated its efficacy in evaluating mutual fund performance by incorporating fuzzy logic to handle uncertainties and provide a nuanced analysis. The study's findings highlight the Canara Robeco Bluechip Equity Fund as the top-performing mutual fund, based on its superior Fuzzy Sharpe Ratio ranking. This indicates that the fund excels in terms of risk-adjusted returns compared to its peers. In contrast, the HSBC Large Cap Fund ranked lowest, suggesting it may not be as effective in providing optimal returns relative to its risk. The research not only confirms the value of using advanced metrics like fuzzy logic in mutual fund evaluations but also suggests further exploration into integrating these techniques with machine learning and adapting them to dynamic market conditions and diverse regional contexts. This approach can enhance the accuracy and applicability of performance evaluations, making it a valuable tool for both investors and fund managers.

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