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A Quantitative Analysis of Selected Mutual Funds Using Treynor Ratio, Tracking Error, and Information Ratio

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ABSTRACT:

This research evaluates the performance of selected mutual funds in India using three advanced metrics: Treynor Ratio, Tracking Error, and Information Ratio. While traditional metrics like Sharpe Ratio, Beta, and Jensen's Alpha are widely used, this study highlights the importance of incorporating Treynor Ratio for market risk-adjusted returns, Tracking Error for consistency relative to a benchmark, and Information Ratio for risk-adjusted excess returns. The findings provide a more comprehensive understanding of mutual fund performance, particularly in the context of the Indian market, and offer practical insights for investors and fund managers.

Keywords: Mutual Funds, Treynor Ratio, Tracking Error, Information Ratio, Market Risk-Adjusted Performance, Indian Financial Market.

Introduction:

A. Context of the Domain/Field of Interest:

Mutual funds have become an essential investment vehicle for individual and institutional investors in India. With increasing financial literacy and government initiatives promoting capital market participation, mutual funds have seen exponential growth in assets under management (AUM). The Indian mutual fund industry provides a variety of investment options, including equity, debt, hybrid, and sectoral funds, catering to different investor risk appetites and financial goals. Evaluating the performance of these funds is critical for informed decision-making, risk assessment, and portfolio optimization.

B. Status of Research in the Domain/Field of Interest:

Traditional mutual fund performance evaluation relies on metrics like the Sharpe Ratio, which assesses risk-adjusted returns, and Beta, which measures systematic risk. However, these measures do not fully capture other vital aspects of performance, such as market risk-adjusted returns, consistency relative to benchmarks, and the ability to generate excess returns over time. In developed markets, investors and fund managers frequently employ advanced performance measures such as the Treynor Ratio, Tracking Error, and Information Ratio to gain a more nuanced understanding of fund efficiency. Despite their relevance, these metrics remain underutilized in the Indian context, leading to gaps in mutual fund performance assessment.

Literature review

1. **Investor Perception (Singh, 2022)**: Mutual funds are favored for their return potential, liquidity, flexibility, transparency, and affordability. Awareness initiatives are needed to educate the public.
2. **Performance Analysis (Derbali et al., 2020)**: A comparison of multi-cap and large-cap funds (2013–2018) found no statistically significant difference in returns, though both categories offered reasonable risk-adjusted performance.
3. **Strategic Obfuscation (deHaan et al., 2021)**: Fund managers may complicate disclosures to mask high fees and poor net performance, exploiting investor confusion for higher profitability.
4. **Classification & Risks (Vasista, 2022)**: Mutual funds provide diversification benefits with minimal capital, making them suitable for small investors, though risks vary by fund type.
5. **Cultural Influence (Keswani et al., 2020)**: Countries with high Uncertainty Avoidance tend to adopt conservative fund management strategies, reflecting societal risk tolerance.

6. **FinTech Impact (Das & Ali, 2020)**: Blockchain, AI, and robo-advisors enhance efficiency, transparency, and trust in mutual funds, driving AUM growth in India.
7. **Risk-Return Trade-off (Nadia & Mora, 2018)**: High-return funds often entail higher risks, necessitating thorough pre-investment evaluation.

Research Problem:

A. **Research Gap**:

1. Limited use of Treynor Ratio to evaluate market risk-adjusted returns in Indian mutual funds.
2. Lack of analysis using Tracking Error to assess consistency relative to a benchmark.
3. Insufficient focus on Information Ratio to measure risk-adjusted excess returns.

B. Research Problem Statement:

There is a lack of comprehensive analysis using advanced metrics such as Treynor Ratio, Tracking Error, and Information Ratio in the Indian context. These metrics can provide deeper insights into fund performance, particularly for risk-averse investors and those focused on market risk-adjusted returns and consistency.

C. Need and Relevance of Research:

This research is relevant for investors, fund managers, and policymakers as it provides a more comprehensive framework for evaluating mutual fund performance. It addresses gaps in existing research and offers practical insights for decision-making.

Research Objectives:

1. To evaluate the performance of selected mutual funds using Treynor Ratio to assess market risk-adjusted returns.
2. To measure consistency relative to a benchmark using Tracking Error.
3. To analyse risk-adjusted excess returns using Information Ratio.

Research Methodology:

1. Type of Study

This study follows a **quantitative and applied research approach**. It uses numerical data to evaluate the performance of mutual funds and aims to address practical challenges in fund evaluation through advanced performance metrics.

2. Research Design

A **descriptive and comparative research design** is adopted. It describes mutual fund performance using Treynor Ratio, Tracking Error, and Information Ratio and compares equity, debt, and hybrid fund categories.

3. Data Source

The study utilizes **secondary data**, collected from reliable financial databases such as **Value Research, Morningstar**, and official **SEBI filings**.

4. Sampling Methodology

A **purposive sampling method** is used to select a sample of six mutual funds based on fund type and data availability. A **pilot study** was conducted to test the feasibility of the methodology before executing the actual analysis.

5. Data Collection & Variables

- **Type of Data**: Ratio data, including returns, benchmark performance, and market risk.
- **Independent Variable**: Fund category (Equity, Debt, Hybrid)
- **Dependent Variables**: Treynor Ratio, Tracking Error, Information Ratio

6. Instrument Design and Validation

- **Data Collection Instrument**: Performance data extracted from online mutual fund databases and financial reports.
- **Validity**: Ensured by cross-verifying data from multiple sources.
- **Reliability**: Standardized metrics and consistent methods ensure data integrity.

- **Administration**: Self-administered by the researcher.

7. Analytical Tools

The performance metrics are calculated using **Microsoft Excel**, which also facilitates data visualization and statistical analysis.

Data Analysis:

A. Data Collection:

The study focuses on mutual fund schemes across the Indian financial market.

- **Population Size**: All mutual funds operating in India.
- **Sample Size**: A purposive sample of six mutual funds selected across equity, debt, and hybrid categories.
- **Study Period**: Five years, from 2018 to 2023.
- **Geographical Scope**: India.

B. Data Pre-processing:

To ensure accuracy and consistency of analysis, the following steps were taken:

- **Handling Missing Data**: Funds with incomplete or inconsistent historical data were excluded from the sample.
- **Outlier Treatment**: Statistical techniques were applied to detect and mitigate the influence of extreme values that could skew the result

C. **Description of the Data**:

Descriptive Statistics: The mean, median, and standard deviation were calculated for each fund's Treynor Ratio, Tracking Error, and Information Ratio. These metrics provide a summary of central tendency and variability in fund performance over the five years.

Ratios

1. Treynor Ratio

The Treynor Ratio, developed by economist Jack Treynor, is a performance metric that evaluates how much excess return a portfolio generates per unit of systematic risk (beta). It's calculated by subtracting the risk-free rate from the portfolio's return and then dividing by the portfolio's beta:

$$\frac{Treynore\ Ratio = Portfolio\ return - Risk\ free\ rate}{\beta}$$

A higher Treynor Ratio indicates a more favourable risk-adjusted return, suggesting the portfolio is effectively compensating investors for the risk taken. This ratio is particularly useful when comparing well-diversified portfolios, as it focuses solely on systematic risk, which cannot be eliminated through diversification

2. **Tracking Error Ratio**

Tracking error, also known as active risk, measures how closely an investment portfolio follows its benchmark index. It is calculated as the standard

deviation of the differences between the portfolio's returns and those of the benchmark over a specific period. A lower tracking error indicates that the portfolio's performance closely mirrors the benchmark, while a higher tracking error suggests greater deviations.

$$Tracking\ Rrror = Var\sqrt{Portfolio\ return - Market\ return}$$

Tracking error measures how closely an investment fund's returns match those of its benchmark index. A small tracking error indicates that the fund closely follows its benchmark, while a large tracking error suggests greater deviations.

3. Information Ratio (IR)

The Information Ratio (IR) is a metric used to evaluate an investment portfolio's performance relative to a benchmark index, considering the consistency of excess returns achieved by the portfolio manager. It measures the portfolio's ability to generate returns beyond the benchmark while accounting for the additional risk taken.

$$Information\ ratio = \frac{Average\ Excess\ return}{Tracking\ error}$$

The information Ratio helps investors determine if a portfolio manager's active investment decisions are adding value when considering the extra risk involved. A higher ratio indicates better risk-adjusted performance relative to the benchmark

a Analysis

The following table summarizes the calculated metrics for the selected mutual funds:

Sr. No.	Funds Name	2023 Return %	2022 Return %	2021 Return %	2020 Return %	20219 Return %	Average Return %	BETA
1	Bandhan Large Cap Fund	27.83	-1.07	26.51	18.68	12.05	16.80	1.51
2	HDFC Flexi cap Fund	31.04	19.09	35.15	6.55	6.86	19.74	1.05
3	ICICI Pru Banking & PSUs Fund	7.62	4.73	4.59	9.68	10.60	7.44	-0.02
4	Canara Robeco Saving Fund	7.21	4.35	3.34	6.60	8.31	5.96	-0.03
5	Kotak Equity Hybrid Fund	21.10	6.50	28.80	16.62	15.30	17.66	1.06
6	Axis Equity Saving Fund	6.08	1.14	14.29	12.84	9.74	8.82	0.50

https://www.moneycontrol.com/mutual-funds/find-fund/

Sr. No.	Market Return	2023 Return %	2022 Return %	2021 Return %	2020 Return %	20219 Return %	Average Return %
1	Historical Market Return	20.03	4.33	24.12	14.90	12.20	15.12

Data analysis of Bandhan Large Cap Fund

1. Treynor Ratio Calculation

$$\frac{\textbf{Treynore Ratio} = \textbf{Portfolio return} - \textbf{Risk free rate}}{\beta}$$

Portfolio Return (Fund's 5-year's Average Return) = 16.80%

Beta = 1.51

Risk-Free Rate = 7.36%

https://www.sovrenn.com/knowledge/risk-free-rate-in-india

Treynor Ratio = $\frac{16.80 - 7.36}{1.51}$

= $\frac{9.44}{1.51}$

Treynor Ratio = **6.25**

2. Tracking Error Calculation

$$Tracking\ Error = Var\sqrt{Portfolio\ return - Market\ return}$$

Tracking Error = Var √Rp-Rb

Where:

- Rp = Portfolio (Fund) Return
- Rb = Benchmark (Market) Return
- Rp−Rb = Excess Return

Calculate Excess Return

Year	Fund Return (Rp)%	Market Return (Rb)%	Excess Return (Rp−Rb)%
2023	27.83	20.03	7.80
2022	-1.07	4.33	-5.40
2021	26.51	24.12	2.39
2020	18.68	14.90	3.78
2019	12.05	12.20	-0.15

Calculate Variance of Excess Return

Mean of Excess Return

$\bar{X} = \frac{7.80+(-5.40)+2.39+3.78+(-0.15)}{5}$

$= \frac{8.42}{5}$

Mean of Excess Return = 1.684

Variance Calculation

$\text{Variance} = \frac{\sum(Rp-Rb-Mean)2}{N}$

$\text{Variance} = 37.41\frac{+50.18+0.50+4.39+3.36}{5}$

$= \frac{95.84}{5}$

Variance = **19.17**

Calculate Tracking Error

Year	Excess Return (X) %	$X-\bar{X}$ %	$(X-\bar{X})2$ %
2023	7.80	6.116	37.41
2022	-5.40	-7.084	50.18
2021	2.39	0.706	0.50
2020	3.78	2.096	4.39
2019	-0.15	-1.834	3.36

Tracking Error = $\sqrt{19.17}$

= **4.38**

3. Information Ratio Calculation

$$Information\ ratio = \frac{Average\ Excess\ return}{Tracking\ error}$$

Average Excess Return = Average Portfolio return - Average Market return

Average Excess Return = 16.80−15.12

= **1.68**

Information Ratio = 1.68 / 4.38

Information Ratio = 0.3

Result and Conclusion:

Sr. No.	Funds Name	Average Return %	BETA	Treynor Ratio	Tracking error	Information Ratio (IR)
1	Bandhan Large Cap Fund	16.80	1.51	6.25	4.38	0.38
2	HDFC Flexi cap Fund	19.74	1.05	11.78	9.51	0.49
3	ICICI Pru Banking & PSUs	7.44	-0.02	-3.69	7.36	-1.04
4	Canara Robeco Saving Fund	5.96	-0.03	45.48	7.23	-1.27
5	Kotak Equity Hybrid Fund	17.66	1.06	9.69	1.25	2.03
6	Axis Equity Saving Fund	8.82	0.50	2.92	4.76	-1.32

1. **Average Return (%)**

- HDFC Flexi Cap Fund recorded the highest average return of 19.74%, positioning it as the top performer in terms of raw returns.
- Canara Robeco Saving Fund yielded the lowest average return at 5.96%.
- ICICI Pru Banking & PSU Fund and Axis Equity Saving Fund also demonstrated modest returns of 7.44% and 8.82%, respectively.

2. Beta

- Bandhan Large Cap Fund exhibited the highest beta (1.51), indicating high sensitivity to market fluctuations.
- Kotak Equity Hybrid Fund (1.06) and HDFC Flexi Cap Fund (1.05) showed moderate market risk.
- ICICI Pru Banking & PSU Fund (-0.02) and Canara Robeco Saving Fund (-0.03) reported negative beta, suggesting an inverse correlation with the market.
- Axis Equity Saving Fund (0.50) displayed a low beta, reflecting lower volatility.

3. Treynor Ratio

- Canara Robeco Saving Fund recorded an unusually high Treynor ratio of 45.48, likely influenced by its negative beta, making it statistically unreliable.
- HDFC Flexi Cap Fund (11.78) and Kotak Equity Hybrid Fund (9.69) delivered strong market risk-adjusted returns.
- ICICI Pru Banking & PSU Fund (-3.69) reflected poor risk-adjusted performance.

4. Tracking Error

- HDFC Flexi Cap Fund had the highest tracking error (9.51), indicating significant deviation from its benchmark.
- In contrast, Kotak Equity Hybrid Fund demonstrated the lowest tracking error (1.25), reflecting high benchmark alignment.

5. Information Ratio (IR)

- Kotak Equity Hybrid Fund achieved the highest IR (2.03), indicating strong excess return generation relative to the benchmark.
- HDFC Flexi Cap Fund (0.49) and Bandhan Large Cap Fund (0.38) also showed positive IRs, denoting moderate benchmark outperformance.
- ICICI Pru Banking & PSU Fund (-1.04), Canara Robeco Saving Fund (-1.27), and Axis Equity Saving Fund (-1.32) had negative IRs, signifying underperformance

Explanation of the Result with Respect to Research Objectives:

The evaluation of mutual fund performance using the **Treynor Ratio** identified **HDFC Flexi Cap Fund** and **Kotak Equity Hybrid Fund** as the top performers, demonstrating superior risk-adjusted returns. However, the exceptionally high Treynor Ratio observed for **Canara Robeco Saving Fund** is considered statistically unreliable due to its **negative beta**, which distorts the ratio's interpretation. On the other hand, **ICICI Pru Banking & PSUs Fund** exhibited a **negative Treynor Ratio**, indicating poor performance relative to its systematic risk exposure.

For **Tracking Error**, **HDFC Flexi Cap Fund** displayed the highest deviation from its benchmark, suggesting **less consistency in return patterns**. Conversely, **Kotak Equity Hybrid Fund** exhibited the **lowest tracking error**, reflecting strong alignment with benchmark returns.

The **Information Ratio (IR)** further reinforced **Kotak Equity Hybrid Fund** as the most consistent and efficient performer, with the highest IR among the sample. In contrast, **ICICI Pru Banking & PSUs Fund**, **Canara Robeco Saving Fund**, and **Axis Equity Saving Fund** posted negative IR values, implying **underperformance relative to the benchmark** after adjusting for active risk.

In summary, both **HDFC Flexi Cap Fund** and **Kotak Equity Hybrid Fund** emerge as favourable investment options. However, **Kotak Equity Hybrid Fund** demonstrates **superior stability, benchmark consistency, and excess return generation**, making it the most reliable performer among the selected funds.

Discussion:

A. Limitations of the Study

1. While the study provides meaningful insights into mutual fund performance using advanced evaluation metrics, it is subject to the following limitations:
2. The sample size is restricted to six mutual funds, which may not be fully representative of the broader Indian mutual fund industry. A larger sample would provide more generalizable results.
3. The analysis is based on historical performance data spanning from 2018 to 2023. As such, it does not account for future market dynamics or shifts in fund management strategies, limiting the predictive power of the findings.

B. Future Scope

1. To build upon the current research, future studies can consider the following directions:
2. Incorporating macroeconomic variables such as inflation, interest rates, and GDP growth to assess their impact on fund performance and the robustness of evaluation metrics like Treynor Ratio, Tracking Error, and Information Ratio.
3. Extending the analysis to other emerging markets can offer comparative insights and reveal differences in fund performance across varying regulatory and economic environments.

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