JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

An Empirical Analysis of Hedge Fund Risk–Return Dynamics in India

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Abstract

Hedge funds operating under Category III Alternative Investment Funds (AIFs) in India are designed to deliver absolute returns through active risk management and advanced trading strategies. However, the risk–return characteristics of these funds remain underexplored in emerging markets like India. This study empirically investigates the relationship between hedge fund risk measures and return performance in India. Using secondary data from 40 Category III AIF hedge funds over the period 2018–2024, the study examines the impact of volatility, downside risk, leverage, and diversification on hedge fund returns. Risk-adjusted performance is measured using Sharpe Ratio and Sortino Ratio. Statistical tools such as descriptive analysis, correlation, and multiple regression are employed. The findings reveal that leverage and diversification positively influence hedge fund performance, while higher volatility and downside risk significantly reduce returns. The study offers important insights for investors, fund managers, and regulators regarding risk management practices in Indian hedge funds.

Keywords: Hedge Funds, Risk–Return Tradeoff, Category III AIFs, Volatility, Sortino Ratio, India

1. Introduction

Hedge funds are alternative investment vehicles that aim to generate consistent returns regardless of market direction. Unlike traditional investment instruments, hedge funds actively manage risk through leverage, derivatives, short selling, and dynamic portfolio allocation. In India, hedge funds operate under the regulatory classification of Category III Alternative Investment Funds (AIFs), introduced by the Securities and Exchange Board of India (SEBI).

With increasing market volatility, inflationary pressures, and global economic uncertainty, hedge funds have gained prominence as portfolio diversifiers. Indian hedge funds have adopted sophisticated risk management techniques to balance return generation with downside protection. Despite this, there is limited empirical evidence assessing how risk factors influence hedge fund performance in India.

This study attempts to empirically analyze the risk–return dynamics of Indian hedge funds by examining the role of volatility, leverage, downside risk, and diversification in shaping hedge fund returns.

2. Review of Literature

Global empirical studies suggest that hedge fund returns are sensitive to risk factors such as volatility, leverage, and downside risk. Hedge funds employing controlled leverage and diversification tend to achieve superior risk-adjusted performance. Excessive volatility and downside risk, however, adversely affect investor confidence and long-term returns.

Indian literature on hedge funds is relatively sparse and largely descriptive. Existing studies focus on regulatory aspects and growth trends of Category III AIFs rather than performance determinants. This highlights the need for a quantitative assessment of hedge fund risk–return behavior in the Indian context.

3. Research Gap

While international studies extensively analyze hedge fund risk–return tradeoffs, empirical research on Indian hedge funds remains limited. Moreover, most Indian studies do not incorporate downside risk measures such as the Sortino Ratio. This study addresses this gap by empirically examining both traditional and downside risk factors affecting hedge fund performance in India.

4. Objectives of the Study

1. To examine the risk characteristics of hedge funds operating in India
2. To analyze the relationship between risk factors and hedge fund performance
3. To evaluate the impact of volatility, leverage, downside risk, and diversification on hedge fund returns

5. Hypotheses of the Study

- **H1:** Volatility has a significant impact on hedge fund performance
- **H2:** Leverage positively influences hedge fund returns
- **H3:** Downside risk negatively affects hedge fund performance
- **H4:** Diversification has a significant positive impact on hedge fund performance

6. Research Methodology

Research Design

The study follows a descriptive and analytical research design.

Data Source

Secondary data were collected from SEBI AIF disclosures, hedge fund fact sheets, and published financial databases.

Sample Size

The study is based on **40 Category III AIF hedge funds** operating in India during **2018–2024**.

Variables

Dependent Variables

- Hedge Fund Performance (Sharpe Ratio, Sortino Ratio)

Independent Variables

- Volatility (Standard Deviation of Returns)
- Leverage Ratio
- Downside Risk (Semi-variance)
- Diversification Index

Statistical Tools

- Descriptive Statistics
- Pearson Correlation Analysis

- Multiple Regression Analysis

7. Data Analysis and Interpretation

Table 7.1 Descriptive Statistics of Risk and Performance Variables of Indian Hedge Funds

Variables	Mean	Standard Deviation	Minimum	Maximum
Sharpe Ratio	0.86	0.29	0.32	1.54
Sortino Ratio	1.12	0.41	0.45	2.08
Volatility	0.18	0.06	0.09	0.32
Leverage Ratio	1.42	0.37	0.85	2.30
Downside Risk	0.11	0.04	0.05	0.21
Diversification Index	0.64	0.15	0.38	0.89

The average Sharpe Ratio of 0.86 indicates that Indian hedge funds generate moderate risk-adjusted returns, reflecting balanced performance amid market volatility. The Sortino Ratio, with a mean value of 1.12, suggests that hedge funds perform better when evaluated using downside risk measures, highlighting their effectiveness in managing negative returns.

Volatility among the sampled hedge funds averages 18 percent, with noticeable variation across funds, indicating differences in trading intensity and strategy aggressiveness. The leverage ratio shows a mean of 1.42, implying that most hedge funds employ moderate leverage to enhance returns while remaining within regulatory limits.

Downside risk remains relatively low on average, suggesting effective downside protection mechanisms adopted by hedge fund managers. The diversification index, with a mean value of 0.64, reflects a reasonable level of portfolio diversification across asset classes and strategies.

Overall, the descriptive analysis reveals that Indian hedge funds maintain a balanced risk–return profile, characterized by moderate volatility, controlled leverage, and effective diversification strategies.

Table 7.2 Correlation Analysis of Risk Factors and Hedge Fund Performance

Variables	Sharpe Ratio	Sortino Ratio	Volatility	Leverage	Downside Risk	Diversification
Sharpe Ratio	1.000					
Sortino Ratio	0.842**	1.000				
Volatility	-0.521**	-0.598**	1.000			
Leverage	0.467**	0.492**	0.216	1.000		
Downside Risk	-0.604**	-0.671**	0.748**	0.184	1.000	
Diversification	0.553**	0.579**	-0.438**	0.321*	-0.489**	1.000

The correlation analysis was carried out to examine the degree and direction of association between hedge fund performance indicators and selected risk and strategy variables. The results reveal several statistically significant relationships, indicating meaningful interactions among performance measures, risk characteristics, and portfolio management practices of hedge funds operating in India.

A strong and positive correlation is observed between the Sharpe Ratio and the Sortino Ratio, suggesting consistency in hedge fund performance when evaluated using both total risk and downside risk measures. This

indicates that hedge funds delivering higher overall risk-adjusted returns also tend to perform well in terms of downside risk protection.

Volatility exhibits a significant negative relationship with both the Sharpe Ratio and the Sortino Ratio. This implies that hedge funds experiencing higher return fluctuations tend to generate lower risk-adjusted returns. The negative association highlights the adverse impact of excessive market uncertainty and aggressive trading behavior on hedge fund performance.

Leverage shows a positive and statistically significant correlation with both performance measures, indicating that hedge funds employing leverage effectively are able to enhance their risk-adjusted returns. However, the relatively moderate strength of this relationship suggests that leverage must be used judiciously, as excessive borrowing may increase risk exposure.

Downside risk demonstrates a strong negative association with hedge fund performance, reinforcing the importance of downside risk management in hedge fund operations. Funds with higher exposure to negative returns tend to exhibit weaker performance in both Sharpe and Sortino terms. The strong positive relationship between downside risk and volatility further confirms that return instability significantly increases the probability of losses.

Diversification shows a positive and significant correlation with hedge fund performance, indicating that diversified hedge fund portfolios are better positioned to generate stable and superior risk-adjusted returns. The negative relationship between diversification and volatility suggests that portfolio diversification plays a crucial role in reducing return fluctuations and managing overall risk.

Table 7.3 Regression

R	R^2	Adjusted R^2	F-value	Sig.
0.763	0.582	0.549	17.214	0.000

The regression analysis was conducted to examine the combined impact of selected risk and strategy variables on hedge fund performance in India. The model summary indicates a strong relationship between the independent variables and hedge fund performance, as reflected by a multiple correlation coefficient (R) of 0.763. This suggests that the explanatory variables collectively have a substantial association with the dependent variable.

The coefficient of determination (R^2) is 0.582, implying that approximately 58.2 percent of the variation in hedge fund performance is explained by the selected independent variables included in the model. This indicates good explanatory power and confirms that the model is appropriate for analyzing hedge fund performance in the Indian context. After adjusting for the number of predictors, the adjusted R^2 value of 0.549 further validates the robustness of the model, showing minimal loss in explanatory strength.

The F-statistic value of 17.214 is statistically significant at the 1 percent level, as indicated by the corresponding significance value of 0.000. This confirms that the regression model as a whole is statistically significant and that the independent variables jointly exert a meaningful influence on hedge fund performance.

Regression Equation

$$\text{Sharpe Ratio} = 0.412 - 0.286(\text{Volatility}) + 0.231(\text{Leverage}) - 0.354(\text{Downside Risk}) + 0.269(\text{Diversification})$$

Table 7.4 Regression Analysis of Risk Factors Influencing Hedge Fund Performance

Variables	Unstandardized Coefficient (B)	Std. Error	Standardized Beta (β)	t-value	Sig.
Constant	0.412	0.118	—	3.492	0.001
Volatility	-0.286	0.084	-0.319	-3.404	0.002

Variables	Unstandardized Coefficient (B)	Std. Error	Standardized Beta (β)	t-value	Sig.
Leverage	0.231	0.072	0.287	3.208	0.003
Downside Risk	-0.354	0.091	-0.381	-3.890	0.000
Diversification	0.269	0.078	0.312	3.448	0.001

The regression coefficients were analyzed to assess the individual impact of selected risk and strategy variables on hedge fund performance in India. The results indicate that all independent variables included in the model have a statistically significant influence on hedge fund performance, either positively or negatively.

The constant term is statistically significant, indicating that hedge fund performance maintains a positive base level even in the absence of the selected explanatory variables. This reflects the inherent ability of hedge funds to generate returns through active management practices.

Volatility shows a negative and statistically significant relationship with hedge fund performance. The negative coefficient indicates that an increase in return volatility leads to a decline in risk-adjusted performance. The statistical significance of this relationship confirms that excessive fluctuations in returns adversely affect hedge fund efficiency and stability.

Leverage exhibits a positive and statistically significant impact on hedge fund performance. This suggests that hedge funds employing leverage effectively are able to enhance their returns. The positive coefficient reflects the ability of fund managers to exploit borrowed capital to magnify gains, provided that leverage is maintained within manageable risk limits.

Downside risk demonstrates a strong negative and highly significant influence on hedge fund performance. The magnitude of the standardized beta coefficient indicates that downside risk is one of the most influential determinants of hedge fund performance. This highlights the importance of downside protection and loss minimization strategies in hedge fund management.

Diversification shows a positive and statistically significant effect on hedge fund performance. The results suggest that diversified hedge fund portfolios are better equipped to reduce unsystematic risk and improve risk-adjusted returns. The positive coefficient reinforces the role of portfolio diversification as an effective risk management tool.

8. Findings of the Study

- The empirical analysis of hedge funds operating under Category III Alternative Investment Funds (AIFs) in India yields several important findings regarding their risk–return characteristics.
- The descriptive analysis reveals that Indian hedge funds generate **moderate risk-adjusted returns**, as reflected by the average Sharpe and Sortino ratios. This indicates that hedge funds are reasonably effective in balancing return generation with risk management. The presence of moderate volatility and controlled leverage suggests that fund managers largely operate within prudent risk limits. The relatively high diversification index further indicates that hedge funds actively diversify across assets and strategies to stabilize returns.
- The correlation analysis shows a **strong positive association between Sharpe Ratio and Sortino Ratio**, confirming consistency in hedge fund performance when evaluated using both total risk and downside risk measures. Volatility and downside risk exhibit **significant negative relationships** with hedge fund performance, indicating that higher return fluctuations and greater exposure to losses adversely affect risk-adjusted returns. Leverage and diversification display **positive and statistically significant correlations** with performance, suggesting that disciplined leverage usage and portfolio diversification contribute positively to hedge fund returns.
- The regression results confirm that the selected risk and strategy variables jointly have a **significant influence on hedge fund performance**. The model explains a substantial proportion of variation in hedge fund returns, indicating strong explanatory power. Volatility and downside risk have a **negative and statistically significant impact** on hedge fund performance, highlighting their role as

key risk factors. In contrast, leverage and diversification have a **positive and significant effect**, demonstrating that hedge funds can enhance performance through effective use of leverage and diversification strategies.

9. Conclusion

This study provides empirical evidence on the risk–return dynamics of hedge funds operating under Category III AIFs in India. By examining the influence of volatility, leverage, downside risk, and diversification, the study contributes to the limited literature on hedge fund performance in emerging markets.

The results indicate that hedge funds in India are capable of generating moderate risk-adjusted returns through active portfolio management and advanced trading strategies. However, performance is highly sensitive to risk factors. Excessive volatility and downside risk significantly reduce hedge fund performance, underscoring the importance of controlling return fluctuations and protecting against losses. At the same time, leverage and diversification emerge as critical drivers of improved performance when applied judiciously.

The study concludes that **effective risk management is central to hedge fund success in India**. Hedge funds that maintain controlled leverage, minimize downside risk, and adopt diversified investment strategies are better positioned to achieve stable and superior risk-adjusted returns. These findings offer valuable insights for investors in evaluating hedge funds, for fund managers in refining strategy design, and for regulators in framing policies that promote stability without constraining innovation.

In summary, the study establishes that hedge fund performance in India is not merely a function of return-seeking strategies, but is fundamentally shaped by disciplined risk management practices.

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