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IMPACT OF FUND CHARACTERISTICS ON THE PERFORMANCE OF DEBT MUTUAL FUNDS

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ABSTRACT
This study investigates the determinants of debt mutual fund performance in India, focusing on Fund Age, Expense Ratio, Fund Type, and Plan Type. A panel of 441 debt fund schemes over 2014–2023 was analyzed, with data sourced from AMCs' factsheets and supplemented by SEBI, AMFI, Moneycontrol, ValueResearch Online, ET Money, and Yahoo Finance. Fund performance was measured using gross returns and risk-adjusted metrics, including the Sharpe ratio, Sortino ratio, and Jensen alpha. Panel regression models were applied, with multicollinearity, heteroskedasticity, and cross-sectional dependence accounted for through appropriate diagnostic tests and Driscoll–Kraay standard errors. Results indicate that fund maturity, expense efficiency, and scheme type significantly influence risk-adjusted performance, highlighting the importance of strategic fund design and management. This study contributes to the literature on debt mutual funds in emerging markets and offers practical insights for investors and fund managers seeking efficient portfolio construction.

1. INTRODUCTION
Debt mutual funds, as a prominent segment of the Indian and global mutual fund industry, play a critical role in providing investors with relatively stable returns while preserving capital. The performance of these funds is shaped by a combination of fund-specific characteristics and operational factors that influence both risk and return outcomes. Among the most significant determinants are fund age, expense ratio, fund type, and plan structure. Fund age reflects the maturity and operational experience of the fund; older funds may benefit from seasoned management, better market knowledge, and established investment strategies, but may also face diminishing flexibility or internal inefficiencies over time (Kaur, 2018; Prather et al., 2004; Raya, 2025). Expense ratio, representing the proportion of assets allocated to management and operational costs, directly impacts net investor returns. Higher expenses reduce the capacity of the fund to generate positive risk-adjusted returns, especially in the relatively moderate return environment of debt instruments (Haslem et al., 2008; Bello & Frank, 2010; Chunjing et al., 2023).

The type of fund is another critical factor, determining asset allocation, duration exposure, and risk profile. For example, government securities or gilt funds carry different interest rate sensitivities than corporate bond or liquid funds, resulting in varying risk-adjusted outcomes (Dash & Rita, 2023; Thomas & Varughese, 2024). Additionally, investor preference and fund performance may vary across fund categories due to differences in portfolio strategy, sectoral exposure, and liquidity management. The fund plan, whether direct or regular, further influences performance through the presence or absence of distributor commissions, operational fees, and marketing costs. Direct plans, by eliminating intermediary costs, tend to yield higher net returns, whereas regular plans may underperform due to additional fees and commissions (Das et al., 2023; Singh & Anon, 2021; Maheswari & Reddy, 2022).

Empirical studies have increasingly employed risk-adjusted performance measures such as the Sharpe ratio, Sortino ratio, and Jensen's Alpha to capture nuanced differences in fund performance, accounting not only for returns but also for volatility and market-adjusted excess returns (Nghia et al., 2022; Walavalkar et al., 2020). These studies consistently highlight that fund-specific characteristics have heterogeneous effects on debt fund outcomes, implying that investment decisions should be informed by a detailed understanding of these determinants. Thus, examining the interplay of fund age, expense ratio, fund type, and plan structure offers valuable insights for both theoretical development in asset pricing models and practical guidance for fund managers and investors.

1.2 RESEARCH PROBLEM AND RATIONALE OF THE STUDY
Debt mutual funds have gained prominence in India as a preferred investment avenue for risk-averse investors seeking stable returns and lower volatility compared to equity funds. However, despite their relatively conservative nature, empirical evidence indicates considerable heterogeneity in the performance of debt funds, influenced by fund-specific characteristics such as fund age, expense ratio, fund type, and plan structure. Fund age is often considered a proxy for managerial experience and operational resilience, with older funds potentially benefiting from accumulated expertise and refined investment strategies, while simultaneously facing bureaucratic rigidity, size-related constraints, and reduced responsiveness to changing market dynamics (Prather et al., 2004; Pambudi & Mahfud, 2016). Expense ratio, which represents the proportion of assets

allocated to operational and management costs, directly affects net returns, and in the context of debt funds where returns are moderate higher costs can significantly erode investor gains, underscoring the importance of cost efficiency in fund management (Haslem et al., 2008; Bello & Frank, 2010). Fund type determines asset allocation, duration exposure, and risk profile, with categories such as liquid funds, short-term debt, and gilt funds exhibiting varying sensitivity to interest rates, credit risk, and market conditions, thereby influencing performance outcomes (Thomas & Varughese, 2024; Dash & Rita, 2023). Additionally, the type of plan, whether direct or regular, affects returns primarily through fee structures, with direct plans often outperforming regular plans due to the absence of distributor commissions, though investor behavior and information asymmetry can modulate these effects (Das et al., 2023; Singh & Anon, 2021). While prior research has explored these variables individually, limited studies have examined their combined impact on risk-adjusted performance measures such as the Sharpe ratio, Sortino ratio, and Jensen's Alpha in the Indian debt mutual fund context. This study, therefore, seeks to address this gap by investigating how fund age, expense ratio, fund type, and plan type collectively influence debt fund performance, providing both theoretical contributions and practical guidance for investors and fund managers.

In this context, the study is guided by several research questions:

a) How does the age of a debt mutual fund influence its risk-adjusted performance, as measured by Sharpe ratio, Sortino ratio, and Jensen's Alpha?

b) To what extent does the expense ratio impact the risk-adjusted returns of debt mutual funds, and how do higher operational costs affect net investor gains?

c) How does the type of debt mutual fund (e.g., liquid, short-term, gilt) affect performance outcomes and the risk-return trade-off?

d) Does the type of plan (direct versus regular) significantly influence fund performance, and how does it interact with other fund characteristics to determine overall returns?

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Many research studies have been conducted to study the impact of variables like Fund age, Expense ratio, Type of fund, Type of Plan and Fund Size (Asset under Management). These variables have are studied extensively in the literature .

2.1 Fund age

Fund age, defined as the length of time a mutual fund has been operational, is often used as a proxy for managerial experience and the fund's resilience in navigating varying market conditions (Kaur, 2018; Prather et al., 2004). In the context of fixed income mutual funds, the effect of fund age on performance has been subject to considerable empirical scrutiny, yielding mixed results across different studies. While some researchers suggest that older funds benefit from accumulated expertise, superior market timing abilities, and more refined portfolio strategies, others argue that ageing funds may suffer from bureaucratic rigidity, declining adaptability, and structural inefficiencies.

For instance, Pambudi and Mahfud (2016) identified a positive but statistically insignificant relationship between fund age and the performance of fixed income funds, suggesting that longevity may bring incremental but non-conclusive benefits. In contrast, Triasesiarta and Fernandika (2022) reported a statistically significant negative relationship, indicating that older debt funds might underperform due to inertia or reduced responsiveness to changing market dynamics. These findings are echoed in international studies as well. For example, Blake and Timmerman (1998), Belgacem and Hellara (2011), and Lobao and Gomes (2015) found a positive correlation between fund age and performance, whereas others such as Otten and Bams (2002), Chen et al. (2004), and Ferreira et al. (2012) found a negative relationship, suggesting that performance may decline with age due to increasing size or internal inefficiencies.

Such conflicting evidence underscores the need for a nuanced assessment of fund age using performance indicators that adjust for risk, particularly in the case of fixed income funds where returns are relatively stable but sensitive to management efficiency. The Sharpe ratio, which evaluates returns relative to total risk; the Sortino ratio, which refines this measure by focusing on downside deviation; and Jensen's Alpha, which estimates abnormal returns over expected market returns, are robust metrics to assess fund performance.

Given the contrasting empirical findings and the relevance of risk-adjusted performance in evaluating debt mutual funds, the following hypotheses are proposed:

H_1: Fund age has no significant impact on the Sharpe ratio of fixed income mutual funds.

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H_2: Fund age has no significant impact on the Sortino ratio of fixed income mutual funds.

H_3: Fund age has no significant impact on Jensen's Alpha of fixed income mutual funds.

2.2 Expense ratio

The expense ratio, representing the proportion of a mutual fund's assets used to cover operating and management fees, is a critical determinant of net investor returns. In the context of fixed income mutual funds, where returns are relatively moderate compared to equities, cost efficiency becomes even more vital for maintaining competitive performance. Several empirical studies have explored the link between expense ratios and fund performance, generally concluding that higher expenses tend to erode returns (Haslem et al., 2008; Bello and Frank, 2010). These costs, unless offset by superior active management, reduce the fund's ability to generate value for investors.

For instance, Haslem et al. (2008) and Bello and Frank (2010) found that funds with lower expense ratios tend to outperform their high-cost counterparts in terms of net returns. This is particularly relevant for debt funds, where limited upside potential amplifies the importance of cost control. Garyn-Tal (2013) further argued that lower expenses not only improve performance but also increase investor inflows, thereby enhancing fund size and market credibility. Volkman and Wohar (1995) and Bers and Madura (2000) similarly noted that lower fees leave more capital for productive investment, leading to superior fund outcomes. Furthermore, Dahlquist et al. (2000) highlighted that funds with a combination of low fees and high trading activity demonstrated better performance.

More recent literature suggests that performance metrics such as the Sharpe ratio, Sortino ratio, and Jensen's Alpha are particularly sensitive to the impact of expense ratios, given their emphasis on risk-adjusted returns (Walavalkar et al., 2020). While some studies have indicated that investors tend to favour low-cost funds regardless of risk-return profiles (Zhao, 2008; Christoffersen et al., 2013), others, including Hackethal et al. (2010) and Bergstresser et al. (2009), showed that fund flows are directly influenced by fee structures, reinforcing the need to evaluate expense ratios in tandem with risk-adjusted performance.

Given the theoretical and empirical importance of cost efficiency in fixed income fund management, the following hypotheses are proposed to evaluate its impact on fund performance:

H_4: Expense ratio has no significant impact on the Sharpe ratio of fixed income mutual funds.

H_5: Expense ratio has no significant impact on the Sortino ratio of fixed income mutual funds.

H_6: Expense ratio has no significant impact on Jensen's Alpha of fixed income mutual funds.

2.3 Type of Fund

The type of mutual fund plays a pivotal role in determining performance outcomes, especially within the debt fund segment. Fund classification determines the underlying asset allocation, risk exposure, and investment horizon, all of which are critical to the risk–return trade-off (Thomas and Varughese, 2024). In the Indian context, recent empirical evidence suggests that liquid and short-term debt funds tend to deliver more favourable risk-adjusted returns, making them appealing options for investors with short-term liquidity needs. Conversely, gilt funds, due to their heightened sensitivity to interest rate movements, often exhibit elevated volatility and underperformance in adverse rate environments (Thomas and Varughese, 2024).

Performance differentiation among debt fund types is further influenced by portfolio composition across asset classes and duration profiles. Dash and Rita (2023) emphasize that asset class allocation and sectoral diversification materially affect the risk-return profile of different fund types. Supporting this, Adhav (2015) conducted a comparative analysis of debt fund subcategories and found that ultra-short-term debt funds consistently outperformed other debt fund variants, whereas long-term and short-term gilt funds underperformed, largely due to their duration risk exposure.

Evidence from comparative studies of equity, hybrid, and debt mutual fund schemes also reveals disparities in performance metrics such as Sharpe ratio and beta. For instance, Bansal and Taneja (2014) observed that while certain equity schemes exhibited strong performance, specific debt funds, including the UTI Short-Term Income Fund, lagged behind due to high systematic risk and lower risk-adjusted returns.

Moreover, the relationship between fund type and investor behaviour is gaining increased academic attention. Investors' responsiveness to performance varies by fund type and investment horizon. Cashman et al. (2007, 2012) found that some investors tend to assess fund performance over shorter time frames than previously assumed, which may influence inflows and persistence patterns across fund categories.

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Given the significant influence of fund type on risk-adjusted outcomes, it becomes essential to evaluate performance using comprehensive metrics. This study, therefore, investigates the impact of fund type on mutual fund performance using three widely accepted measures: the Sharpe ratio, which accounts for total risk; the Sortino ratio, which penalises downside volatility; and Jensen's Alpha, which reflects excess returns adjusted for market risk. Based on the reviewed literature, the following null hypotheses are proposed:

H_7: There is no significant influence of fund type on fund performance using the Sharpe ratio.

H_8: There is no significant influence of fund type on fund performance using the Sortino ratio.

H_9: There is no significant influence of fund type on fund performance using Jensen's Alpha

2.4 Type of Plan

The choice between direct and regular plans in mutual funds significantly influences fund performance and investor outcomes. Direct plans typically offer superior returns relative to their regular counterparts, largely due to the absence of distributor commissions and lower expense ratios. This performance differential is particularly pronounced in equity multi-cap funds, where direct plans consistently generate higher returns for investors (Das et al., 2023). Singh and Anon (2021) analysed fund flows in regular plan equity and balanced funds and found a positive relationship between recent past performance and investor inflows, suggesting a level of investor sophistication and informed decision-making.

When assessing plan-level dynamics across fund types, Maheswari and Reddy (2022) identified that private sector mutual funds across both direct and regular plans tended to outperform public sector funds. A comparative study by Adhav (2015) found that ultra-short-term debt funds outperformed other debt fund categories, while sectoral equity funds led performance among equity schemes. Additionally, equity-oriented hybrid funds outperformed other hybrid types, underscoring the relevance of plan structure and category.

Investor decision-making has been shown to be sensitive to marketing efforts, broker incentives, and perceived information costs. Studies by Christoffersen et al. (2013) and Bergstresser et al. (2009) demonstrated that payments to brokers and marketing initiatives significantly affect mutual fund inflows. Marisetty and Venugopal (2010) emphasized that the evolution of the mutual fund industry in India is also shaped by investor sophistication and commission structures. Sirri and Tufano (1998) and Hortaçsu and Syverson (2004) found that the decision to invest in mutual funds is often influenced by the accessibility of performance information and the costs of acquiring it.

Furthermore, highly sophisticated investors tend to be less swayed by advertisements and broker influence. These investors are more likely to maintain their holdings in underperforming funds and invest in high-performing ones based on performance metrics rather than promotional activities (Ferreira et al., 2012; Sirri and Tufano, 1998). In contrast, less sophisticated investors may be influenced by fee structures and broker recommendations. Gowri and Deo (2016) noted that regular plans often underperform due to additional intermediary fees, which dilute returns. Anagol et al. (2017) explored the impact of banning entry loads in India and concluded that while the regulation reduced fund expenses, it did not significantly affect overall investor inflows.

These findings suggest that the type of plan whether direct or regular plays a critical role in fund performance and investor decision-making. Consequently, this study proposes the following hypotheses to investigate performance outcomes across plan types using risk-adjusted performance measures:

H_{10}: There is no significant influence of type of plan on mutual fund performance using the Sharpe ratio.

H_{11}: There is no significant influence of type of plan on mutual fund performance using the Sortino ratio.

H_{12}: There is no significant influence of type of plan on mutual fund performance using Jensen's Alpha.

3. RESEARCH DESIGN

3.1 Data and sources

The study uses a sample of 441 debt mutual fund schemes categorized into 16 types, as per the classification provided by SEBI in 2017. The sample period spans from April 2014 to March 2023. Data for four key fund attributes, namely Fund Age, Expense Ratio, Type of Fund, and Type of Plan, were collected from the factsheets of the respective Asset Management Companies (AMCs), along with supplementary information obtained from SEBI, AMFI, Moneycontrol, ValueResearch Online, ET Money, and Yahoo Finance. Only those schemes were selected for which complete data for all four attributes were available during the study period. Since the study focuses on debt mutual funds, both growth and dividend payout schemes are included, and the

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data reflect the actual fund characteristics over time. Panel data is used to estimate the relationships between fund attributes and performance. The descriptive statistics and the normality test results of the dataset are presented in Table 1 and Table 2, respectively.

3.2. Methodology

3.2.1 Performance Measures of Mutual Funds

The evaluation of mutual fund performance has evolved from the classical mean-variance framework introduced by Markowitz (1952), which emphasized the trade-off between risk and return. Building on this, the Capital Asset Pricing Model (CAPM) proposed by Sharpe (1964, 1966), Lintner (1965), and others, introduced the distinction between systematic and unsystematic risk, suggesting that the returns of a portfolio can be explained by exposure to market-wide risk factors. While gross returns provide a basic measure of fund performance, modern finance recognizes the importance of risk-adjusted measures, which account for the variability of returns and the exposure to market risk. In this study, three widely used risk-adjusted performance indicators are employed: Sharpe ratio, Sortino ratio, and Jensen alpha.

The Sharpe ratio (Sharpe, 1966) measures the excess return earned per unit of total risk, where risk is captured by the standard deviation of portfolio returns. It provides a way to assess whether a fund's returns compensate adequately for the volatility experienced by investors. The formula is:

$$\text{Sharpe Ratio} = (Rp - Rf) / \sigma p \qquad \text{---- Equation (1)}$$

where:

Rp = Average portfolio return

Rf = Risk-free rate

σp = Standard deviation of portfolio returns

The Sortino ratio refines the Sharpe measure by focusing only on downside volatility, penalizing returns that fall below a minimum acceptable threshold (usually the risk-free rate), making it particularly useful for conservative investors. The Sortino ratio is calculated as:

Sortino Ratio:

$$\text{Sortino Ratio} = (Rp - Rf) / \sigma d \qquad \text{---- Equation (2)}$$

where:

Rp = Average portfolio return

Rf = Risk-free rate

σd = Downside deviation (standard deviation of negative returns)

The Jensen alpha (Jensen, 1968) provides an absolute measure of risk-adjusted performance by comparing the actual returns of a portfolio with the expected returns predicted by the CAPM, considering the fund's sensitivity to market movements. A positive alpha indicates superior performance relative to market expectations. Mathematically, it is expressed as:

$$Rp - Rf = \alpha p + \beta p \times (Rm - Rf) \qquad \text{---- Equation (3)}$$

where:

Rp = Portfolio return

Rf = Risk-free rate

Rm = Market return

βp = Portfolio beta

αp = Jensen's alpha

3.2 Panel Data Regression :

At the outset, pooled regression was performed to obtain preliminary estimates. Multicollinearity among independent variables was examined using the Variance Inflation Factor (VIF). While classical literature considers VIF > 10 as a critical concern (Neter et al., 1990; Draper & Smith, 2012; Chatterjee & Simonoff,

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2013), more recent studies suggest a conservative threshold of VIF > 5 (Marcoulides et al., 2018; Kim, 2019), with Choueiry (2022) noting that either threshold can be applied depending on context. In the present study, higher VIF values were observed for Fund Age, Expense Ratio, Type of Fund, and Type of Plan, requiring corrective measures following the approaches suggested by Giliberto (1985) and Lance (1988).The appropriate panel model was determined using the Hausman test (Hausman, 1978) to choose between fixed and random effects, consistent with recommendations from Baltagi (2005), Hsiao (2003), and Kothari & Warner (2001). Heteroskedasticity was assessed using the Breusch–Pagan test, which identifies non-constant error variance that could bias standard errors and test statistics (Halunga, 2017; Oluwafemi, 2020; Bolakale, 2021; Habeebullah, 2024). Clustered robust standard errors at the fund level were applied to correct for heteroskedasticity.

The diagnostics for autocorrelation and cross-sectional dependence indicated the need for further adjustment. To address these issues and enhance the reliability of results, Driscoll–Kraay standard errors (Driscoll & Kraay, 1998) were employed, which are robust to heteroskedasticity, autocorrelation, and cross-sectional dependence. This methodology has been widely applied in finance and economics panels of moderate time dimension, as demonstrated by Hoechle (2007), Chen et al. (2011), Sjöholm and Lundin (2013), Ghosh and Kanjilal (2016), and Ahmed and Rehman (2021). The combination of these diagnostic procedures ensures that the panel regression estimates are consistent, unbiased, and robust to potential violations of classical assumptions.

3.3 Descriptive Statistics

The descriptive statistics based on 16 fund categories summarize the characteristics and performance of the sampled mutual funds. On average, funds are 9.73 years old, with an expense ratio of 0.674% and AUM of ₹5,703.69 crore, indicating a diverse fund size. Risk-adjusted performance is moderate, with mean Sharpe ratio 0.20, Sortino ratio 0.59, and Jensen's Alpha 2.12, though substantial standard deviations and extreme minimum–maximum values reflect heterogeneity and the presence of outliers across funds as shown in Table 1 .

Table 1: Aggregate Descriptive Statistics by Type of Fund (TF)

Based on 16 fund Categories

Variable	Fund Age(FA)	Expense Ratio (ER)	Asset under Management (AUM)	Sharpe Ratio (SR)	Sortino Ratio (SOR	Jensen's Alpha (AL)
Mean of Means	9.73	0.674	5,703.69	0.20	0.59	2.12
Mean of SDs	5.79	0.332	5,652.02	0.51	1.67	1.92
Min of Mins	1	0.04	12	-3.62	-31.14	-23.88
Max of Maxs	28	2.16	71,061.00	3.79	24.59	38.08

Note(s) : **Note(s)**:

- *Mean of Means* = Average of the means across 16 fund categories.
- *Mean of SDs* = Average of standard deviations across categories.
- *Min of Mins* = Lowest of minimum values across categories.
- *Max of Maxs* = Highest of maximum values across categories.

Source : Author's Calculations

Table 2: Aggregate Descriptive Statistics by Type of Plan (TP**)**

Based on 2 Plan Categories: Direct and Regular

The descriptive statistics for mutual fund characteristics and performance based on Direct and Regular plans is shown in Table 2 . Funds have an average age of 9.47 years, mean expense ratio of 0.63%, and AUM of ₹6,662.45 crore, indicating a diverse sample in terms of size and maturity. Risk-adjusted returns are moderate, with mean Sharpe ratio 0.22, Sortino ratio 0.59, and Jensen's Alpha 1.93, while high standard deviations and wide minimum–maximum ranges reveal substantial heterogeneity and the presence of extreme values across funds.

Statistic	Fund Age(FA)	Expense Ratio (ER)	Asset under Management (AUM)	Sharpe Ratio (SR)	Sortino Ratio (SOR	Jensen's Alpha (AL)
Mean of Means	9.47	0.63	6,662.45	0.22	0.59	1.93
Mean of SDs	4.02	0.36	10,077.70	0.59	2.01	2.41

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Min of Mins	1	0.04	12	-3.62	-31.14	-23.88
Max of Maxs	28	2.16	71,061.00	3.79	24.59	38.08

Note(s) : **Note(s)**:

- *Mean of Means* = Average of the means across 2 plan categories.
- *Mean of SDs* = Average of standard deviations across categories.
- *Min of Mins* = Lowest of minimum values across categories.
- *Max of Maxs* = Highest of maximum values across categories.

Source : Author's Calculations

Normality Test :

The normality test statistics for key fund variables is shown in Table 3. Skewness and kurtosis values indicate notable departures from normality, particularly for AUM, Sortino ratio, and Jensen's Alpha, which exhibit high positive skew and leptokurtic distributions. The Jarque-Bera test confirms these deviations, with all p-values effectively zero, rejecting the null hypothesis of normality at the 5% significance level. These results suggest the data are highly non-normal, highlighting the presence of extreme values and asymmetric distributions across the sample.

Table 3: Summary of Normality Test Statistics for Key Variables

Statistic	Fund Age (FA)	Expense Ratio (ER)	Asset under Management (AUM)	Sharpe Ratio (SR)	Sortino Ratio (SOR	Jensen's Alpha (AL)
Skewness	0.495	0.974	2.957	-0.43	1.289	2.762
Kurtosis	2.49	3.246	14.587	6.847	48.701	41.182
Jarque-Bera	228.191	708.793	31,100.16	2,852.11	3,84,730.62	2,73,307.79
p-value	2.81E-50	1.22E-154	0	0	0	0

Note(s): Significance at 5 percent level of significance

Source : Author's Calculations

4. DATA ANALYSIS

4.1Test for Multicollinearity

The Variance Inflation Factor (VIF) values to assess multicollinearity among independent variables is shown in Table 4 . All VIFs are below the common threshold of 5, with FA at 2, ER at 4.75, and various TF and TP categories ranging between 1.08 and 3.02, indicating moderate correlation at most. These results suggest that multicollinearity is not a serious concern, and the regression estimates are likely reliable and not distorted by redundant predictors.

Table 4 :Test for Multicollinearity

Variable	**VIF**
Fund Age	2
Expense Ratio	4.75
Type of Fund	
2	1.75
3	1.87
4	2.36
5	1.33
6	1.14
7	2.73
8	2.2
9	3.48
10	1.08
11	2.18
12	1.94

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13	2.05
14	1.26
15	2.31
16	1.88
Type of Plan	
2	3.02
Mean VIF	2.185

(VIF : Variance Inflation Factor)

Source : Author's Calculations

4.2 Heteroskedasticity , Cross-dependence and Autocorrelation

The Diagnostic tests for panel regression models of mutual fund performance is shown in Table 5. The Breusch-Pagan LM test indicates significant random effects, while the Hausman test results favor fixed effects for Sharpe ratio and Jensen's Alpha, and suggest random effects for Sortino ratio. Heteroskedasticity (Breusch-Pagan test), cross-sectional dependence (Pesaran's CD), and autocorrelation (Wooldridge test) are all significant, confirming the presence of common panel data issues. Accordingly, all models adopt Fixed Effects with Driscoll-Kraay standard errors to provide robust estimates accounting for heteroskedasticity, autocorrelation, and cross-sectional dependence.

Table 5 : Results for Statistical test for estimation method

Tests	Sharpe Ratio	Sortino Ratio	Jensen's Alpha
Breusch and Pagan Lagrangian multiplier test for random effects			
Chi-square statistic	9840.09	4,246.20	2457.26
p-value	0.00	0.00	0.00
Hausman Test			
Chi-square statistic	72.34	9.99	220.71
p-value	0.00	0.93	0.00
Breusch and Pagan Heteroskedasticity test			
Chi-square statistic	45500095.98	61,48,76,980.96	958408.58
p-value	0.00	0.00	0.00
Pesaran's CD Test (cross-dependence)			
CD statistic	37.13	910.78	969.45
p-value	0.00	0.00	0.00
Wooldridge Test for Autocorrelation			
F-value	17.195	17.195	17.195
p-value	0.00	0.00	0.00
Method adopted	Fixed Effects with Driscoll-Kraay SE	Fixed Effects with Driscoll-Kraay SE	Fixed Effects with Driscoll-Kraay SE

Source : Author's Calculations

4.3 Results for Panel data Regression

Table 6 : Results for Panel data regression

Fund characteristics	Sharpe Ratio		Sortino Ratio		Jensen's Alpha	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Fund Age	-0.0043	0.0630	-0.0175	0.0700	-0.0601	0.0070
Expense Ratio	-0.6360	0.0000	-1.0123	0.0000	-0.4234	0.0290
Type of Fund						
Type of Fund 2	0.0549	0.0040	0.0205	0.5160	-2.9744	0.0000
Type of Fund 3	1.7302	0.0000	2.4311	0.0000	1.1100	0.0000

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Type of Fund 4	0.6950	0.0000	1.0996	0.0000	-2.3888	0.0000
Type of Fund 5	0.5253	0.0000	0.6893	0.0000	-0.3616	0.0350
Type of Fund 6	0.3709	0.0040	0.4682	0.0320	-2.4773	0.0040
Type of Fund 7	0.5718	0.0000	0.9908	0.0010	-2.6777	0.0000
Type of Fund 8	0.3234	0.0000	0.7981	0.0000	-0.8192	0.0070
Type of Fund 9	-0.1502	0.0000	-0.1341	0.0010	-1.7983	0.0010
Type of Fund 10	1.8809	0.7680	1.5872	0.8890	-3.0202	0.0130
Type of Fund 11	0.7565	0.0010	0.6583	0.0300	-2.3512	0.0000
Type of Fund 12	1.1757	0.0000	1.9763	0.0000	-1.3126	0.0010
Type of Fund 13	-0.0386	0.0090	-0.0363	0.0910	-0.9589	0.0030
Type of Fund 14	-0.5834	0.0000	-1.3143	0.0000	-2.2452	0.0000
Type of Fund 15	0.2303	0.0000	0.7168	0.0010	0.5496	0.1320
Type of Fund 16	0.3382	0.0000	0.8766	0.0000	-1.1014	0.0010
Type of Plan						
Type of Plan 2	-0.0264	0.1880	-0.1166	0.1950	0.2046	0.1250
Model fit						
F-statistic(p-value)	0.0000		0.0000		0.0000	
R-squared	0.3532		0.1173		0.3731	

Note: Base category for Type of Fund = Category 1 (e.g., Overnight Funds). Base category for Type of Plan = Plan 1 (e.g., Regular Plan).

Source : Author's Calculations

4.3.1 Fund age

Fund age exhibits a small negative relationship with all performance measures, significant at 5% for Jensen's Alpha ($p = 0.007$) and marginally significant for Sharpe and Sortino ratios. This suggests that older funds do not necessarily generate higher risk-adjusted returns, and in fact, may slightly underperform relative to younger funds.

4.3.2 Expense ratio

Expense ratio has a strong and significant negative impact across all three performance metrics ($p < 0.05$), indicating that higher costs materially reduce risk-adjusted returns and Jensen's Alpha, reinforcing the importance of cost efficiency in fund management.

4.3.3 Type of Fund

Type of fund shows heterogeneous effects on performance. Certain categories (e.g., Type 3, Type 4, Type 12) significantly enhance Sharpe and Sortino ratios, while several types (e.g., Type 2, Type 4, Type 6, Type 7) negatively affect Jensen's Alpha, highlighting that fund strategy and investment focus materially influence risk-adjusted returns.

4.3.4 Type of Plan

Type of plan does not exhibit statistically significant effects on any performance measure ($p > 0.1$), suggesting that the plan variant has negligible influence on fund performance relative to age, expense ratio, or fund type.

5. DISCUSSION AND IMPLICATIONS OF THE STUDY

The present study investigates the impact of key fund characteristics, including fund age, expense ratio, fund type, and plan type, on mutual fund performance measured through Sharpe ratio, Sortino ratio, and Jensen's Alpha. The findings highlight the critical role of expense efficiency and fund strategy in shaping risk-adjusted returns, while fund age and plan type exhibit limited or mixed effects. These results underscore the heterogeneous nature of fund performance and provide valuable insights for both theory and practice.

5.1 Implications to Theory

From a theoretical perspective, the results reinforce the notion that fund characteristics significantly shape performance, supporting existing asset pricing and mutual fund literature. Specifically, the negative impact of expense ratio aligns with cost-efficiency theories, while the differential effects of fund types on risk-adjusted returns validate the importance of investment strategy and fund specialization in explaining performance

heterogeneity. These findings contribute to the refinement of performance evaluation models by emphasizing the joint consideration of fund age, cost, and strategy.

5.2 Implications to Managers

For fund managers, the study highlights actionable insights to enhance performance. Minimizing expense ratios emerges as a clear lever to improve risk-adjusted returns, while careful selection and design of fund type or investment strategy can optimize outcomes for investors. Additionally, given the limited influence of fund age and plan type, managers may prioritize strategic and operational efficiency over legacy or structural factors when designing and marketing mutual fund products.

6. LIMITATIONS OF THE STUDY AND FUTURE DIRECTIONS

Despite its contributions, the study has certain limitations. The analysis is based on historical fund data, which may not fully capture market dynamics under changing economic conditions. Further, the focus on selected performance metrics excludes other dimensions such as downside risk or investor behavior. Future research could expand the dataset across multiple market cycles, incorporate behavioral and qualitative factors, and explore the interplay between fund governance, regulatory changes, and performance to provide a more holistic understanding.

7. CONCLUSION

This study provides a comprehensive examination of the determinants of mutual fund performance within the Indian fixed income segment, focusing on fund age, expense ratio, fund type, and plan type, using risk-adjusted metrics Sharpe ratio, Sortino ratio, and Jensen's Alpha. The findings reveal that expense ratio consistently exerts a strong and significant negative influence across all performance measures, highlighting the critical importance of cost efficiency in enhancing investor returns. Fund type also emerges as a significant determinant, with certain categories outperforming others in terms of risk-adjusted returns, reflecting the pivotal role of investment strategy, asset allocation, and duration exposure in shaping fund performance. In contrast, fund age demonstrates a limited effect, with only a marginal negative relationship observed, particularly for Jensen's Alpha, suggesting that longevity alone does not guarantee superior performance. Similarly, plan type (direct versus regular) does not significantly influence performance, indicating that intermediary costs and plan structure have minimal impact relative to strategic and operational factors.

The empirical evidence underscores the heterogeneity inherent in fixed income mutual fund performance, driven primarily by managerial decisions regarding expenses and strategic fund focus rather than structural attributes such as age or plan type. These insights have theoretical relevance, reinforcing cost-efficiency and strategy-based frameworks in performance evaluation, while also informing managerial practices aimed at optimizing investor outcomes. Fund managers are advised to prioritize minimizing expenses and strategically positioning fund types to align with market opportunities and investor risk preferences.

Nonetheless, the study is bounded by certain limitations. Historical data may not fully capture market volatility and structural changes in the mutual fund industry, and the analysis focuses exclusively on select risk-adjusted metrics, omitting behavioral, qualitative, and broader market factors. Future research can extend this framework by incorporating multi-cycle data, exploring investor behavior, and evaluating the influence of governance, regulatory changes, and market sentiment on fund performance.

In sum, the study highlights that while fund age and plan type play secondary roles, expense efficiency and strategic fund classification are decisive in determining fixed income mutual fund performance. These findings provide actionable guidance for fund managers, while contributing to the broader literature on mutual fund performance evaluation by emphasizing the interplay between costs, strategy, and risk-adjusted returns.

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