

The Relationship Between Expense Ratios and Risk-Adjusted Returns of US Mutual Funds & ETFs

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Abstract—The expense ratio represents one of the few predictable factors in mutual fund investing, yet its relationship with performance remains a subject of considerable debate among practitioners and academics alike. This paper investigates the hypothesis that funds with lower expense ratios achieve higher risk-adjusted returns, using a comprehensive dataset of 26,093 US mutual funds and ETFs from Kaggle. Through correlation analysis, regression modelling, and quartile-based comparisons, we find a statistically significant negative relationship between expense ratios and 5-year Sharpe ratios ($r = -0.180$, $p < 0.001$). Low-cost funds (bottom quartile) demonstrate a mean Sharpe ratio of 0.726 compared to 0.568 for high-cost funds (top quartile), representing a 27.8% performance advantage. Multiple statistical tests including Welch's t-test ($p < 0.001$), ANOVA ($F = 119.4$, $p < 0.001$), and bootstrap confidence intervals confirm the robustness of these findings. These results suggest that expense ratios function as a systematic drag on fund performance, supporting the cost-matters hypothesis central to passive investment strategies.

I. INTRODUCTION

THE mutual fund industry manages trillions of dollars in assets globally, with investors increasingly scrutinizing the fees charged by fund managers. Expense ratios—the annual fees expressed as a percentage of assets under management—represent a guaranteed cost to investors, directly reducing net returns regardless of market conditions. Unlike future performance, which remains inherently unpredictable, expense ratios are known in advance and remain relatively stable over time.

The central question motivating this research is whether these fees are justified by superior performance. Proponents of active management argue that skilled managers can generate alpha sufficient to overcome higher costs, while advocates of passive investing contend that fees simply erode returns without commensurate benefit. This debate has significant implications for individual investors, pension funds, and financial advisors making allocation decisions.

The purpose of this study is therefore to empirically examine the relationship between expense ratios and risk-adjusted returns across a large cross-section of US funds. Specifically, we test the hypothesis that funds with lower expense ratios demonstrate higher risk-adjusted returns as measured by the Sharpe ratio. From this central hypothesis, three specific inferences are derived and tested:

- 1) Funds with lower expense ratios should demonstrate superior risk-adjusted performance compared to high-cost funds.
- 2) Higher management fees are unlikely to be compensated by superior investment performance.
- 3) Expense ratios represent a systematic factor contributing to performance differences across funds.

The remainder of this paper is organized as follows: Section II reviews relevant background literature; Section III describes the data sources; Section IV presents the hypothesis framework; Section V details data cleaning procedures; Section VI outlines the analytical methods; Section VII presents results and analysis for each inference; Section VIII discusses implications; and Section IX concludes with limitations and recommendations.

II. BACKGROUND

A. The Efficient Market Hypothesis

The efficient market hypothesis (EMH), formalized by Fama [1], posits that asset prices fully reflect all available information. In its semi-strong form, EMH suggests that neither fundamental nor technical analysis can consistently generate excess returns. This theoretical framework has profound implications for active fund management: if markets are efficient, then the higher fees charged by active managers cannot be systematically justified by superior stock selection.

Empirical tests of EMH have produced mixed results, with some evidence of market anomalies [2]. However, the persistence of such anomalies after accounting for transaction costs and fees remains questionable, lending support to passive investment strategies.

B. Expense Ratios and Fund Performance

Several seminal studies have examined the relationship between fund expenses and returns. Carhart [3] demonstrated that expense ratios have a nearly one-for-one negative impact on fund returns, with a coefficient close to -1. This finding suggests that high-cost funds do not generate sufficient gross returns to offset their higher fees.

Sharpe [4] provided a mathematical proof that, in aggregate, active managers must underperform passive benchmarks by exactly the amount of their fees. This “arithmetic of active management” has been supported by numerous empirical studies showing that the average active fund underperforms its benchmark index.

More recently, studies by Morningstar [5] have consistently found that expense ratios are one of the strongest predictors

of future fund performance, with low-cost funds significantly more likely to outperform high-cost alternatives across all asset classes.

C. Risk-Adjusted Performance Measurement

The Sharpe ratio, introduced by William Sharpe [6], measures the excess return per unit of risk:

$$\text{Sharpe Ratio} = \frac{R_p - R_f}{\sigma_p} \quad (1)$$

where R_p is the portfolio return, R_f is the risk-free rate, and σ_p is the standard deviation of portfolio returns. This metric enables comparison across funds with different risk profiles by normalizing returns for volatility.

The Sharpe ratio has become the industry standard for risk-adjusted performance evaluation, though it assumes normally distributed returns and penalizes upside volatility equally with downside risk. Despite these limitations, it remains the most widely used and understood measure of risk-adjusted returns [7].

D. Theoretical Framework

Building on the literature, we hypothesize that expense ratios create a systematic performance drag through two mechanisms:

- 1) **Direct cost mechanism:** Fees directly reduce net returns, creating a mathematical headwind that active managers must overcome simply to match passive benchmarks.
- 2) **Adverse selection mechanism:** Higher-fee funds may attract less cost-conscious investors, reducing competitive pressure for performance.

These mechanisms suggest that, on average, lower-cost funds should exhibit superior risk-adjusted returns over meaningful time horizons.

E. Cost Efficiency and Long-Term Compounding Effects

Although expense ratios are usually expressed as small annual percentages, their long-term impact on investment performance is often underestimated. Fees are deducted continuously from fund assets, which means they reduce not only annual returns but also the capital available for future compounding. Over long investment horizons, even minor differences in costs can therefore produce significant divergence in outcomes between high-cost and low-cost funds, despite similar gross returns. From a compounding standpoint, lower-cost funds retain a larger portion of returns each year, allowing wealth to grow more efficiently over time. In contrast, higher-cost funds experience a persistent structural disadvantage, as fees operate as a recurring drag on accumulated capital. Over periods of ten to twenty years, this compounding effect can lead to substantially lower terminal portfolio values for investors in higher-fee funds. This dynamic is consistent with the predictions of efficient market theory. In competitive and information-rich markets, generating consistent excess returns is inherently difficult. As a result, active managers must produce sufficient

alpha simply to offset their fee burden and match passive alternatives on a net-return basis. Because fees are known with certainty while excess returns are uncertain, higher-cost funds face an unfavorable risk-reward trade-off. Empirical evidence further indicates that sustained out performance is rare and often subject to mean reversion. Expense ratios, by contrast, remain stable and predictable, making them one of the few forward-looking characteristics available to investors. While managerial skill may exist, it must be both exceptional and persistent to overcome higher costs. When assessed using risk-adjusted measures such as the Sharpe ratio, the combined impact of lower net returns and greater volatility tends to further weaken the relative performance of high-cost funds, providing important theoretical context for the empirical results presented later in this study.

III. THE DATA

A. Data Source

The dataset used in this analysis was obtained from Kaggle, specifically the “Mutual Funds and ETFs” dataset compiled by Stefano Leone [8]. This comprehensive dataset contains detailed information on US-domiciled mutual funds and exchange-traded funds, including performance metrics, risk characteristics, expense ratios, and fund descriptors.

B. Dataset Composition

The raw dataset comprises two primary files:

- **MutualFunds.csv:** 23,783 mutual funds with 298 attributes
- **ETFs.csv:** 2,310 ETFs with 142 attributes

Combined, the dataset contains 26,093 fund records. Key variables extracted for this analysis include:

TABLE I
KEY VARIABLES USED IN ANALYSIS

Variable	Description
fund_annual_report_net_expense_ratio	Annual expense ratio
fund_sharpe_ratio_5years	5-year Sharpe ratio
fund_symbol	Unique fund identifier
fund_category	Investment category

The 5-year Sharpe ratio was selected as the primary performance metric because it captures sufficient market cycles to smooth short-term noise while remaining relevant to current fund characteristics. The annual expense ratio from fund reports was chosen over prospectus values as it reflects actual costs incurred by investors.

C. Descriptive Statistics

Table II presents summary statistics for the key variables after data cleaning:

TABLE II
SUMMARY STATISTICS (N = 12,925)

Statistic	Expense Ratio	Sharpe Ratio
Mean	1.11%	0.682
Std Dev	0.67%	0.414
Min	0.01%	-3.450
25th Percentile	0.65%	0.460
Median	1.00%	0.700
75th Percentile	1.48%	0.950
Max	11.80%	1.890

The expense ratios range from 0.01% (ultra-low-cost index funds) to 11.80% (specialty or leveraged products), with a median of 1.00%. Sharpe ratios exhibit substantial variation, from -3.45 (funds with severe under performance) to 1.89 (exceptional risk-adjusted performance).



Fig. 1. Distribution of Expense Ratio Across US Mutual Funds and ETFs

Figure 1 illustrates the right-skewed distribution of expense ratio., with the majority of funds clustered below 2%, while a small number of specialty products exhibit substantially higher costs.

IV. HYPOTHESIS

A. Central Hypothesis

The primary hypothesis tested in this study is:

H1: Funds with lower expense ratios have higher risk-adjusted returns.

This hypothesis implies a negative correlation between expense ratios and Sharpe ratios. The null hypothesis (H_0) states that there is no systematic relationship between expense ratios and risk-adjusted performance.

Beyond showing a basic relationship, the central hypothesis suggests that fund costs play a structural role in determining performance. Expense ratios represent a guaranteed deduction from a fund's returns each year. This means that higher cost funds must generate significantly better investment results before fees just to match the performance of lower cost funds. In practice, consistently achieving such extra returns is difficult, especially over long periods.

From a theoretical point of view, this idea is supported by the arithmetic of active management. This principle explains that , before the average actively managed fund performs

similarly to the overall market. However, once management fees and operating costs are deducted, the average active fund is expected to under perform the market by approximately the amount of those costs. As a result, expense ratios create a built-in disadvantage that directly reduces investor returns.

This disadvantage becomes more apparent when performance is evaluated on a risk-adjusted basis, such as the Sharpe ratio. Because fees reduce returns without reducing risk, higher expense ratios can lower risk-adjusted performance even when gross returns appear similar. Over time, the compounding effect of fees further magnifies this impact, making cost differences increasingly important for long-term investors.

Importantly, the hypothesis does not claim that all high cost funds perform poorly or that no expensive fund can outperform in certain years. Short-term success may occur due to favorable market conditions or managerial skill. Instead, the hypothesis focuses on long term and population level outcomes. It predicts that, when examined across a large number of funds and over multi-year horizons, lower cost funds should achieve better average risk-adjusted performance.

Under this framework, the null hypothesis assumes that expense ratios have no systematic effect on performance, implying that the higher fees are fully offset by superior investment skill. Rejecting this null hypothesis would indicate that expense ratios act as a persistent structural drag on performance rather than a source of added value.

B. Derived Inferences

From the central hypothesis, three specific inferences are derived for empirical testing:

Inference 1 (Cost Efficiency Advantage): If expense ratios negatively affect risk-adjusted returns, then funds with lower expense ratios should demonstrate superior risk-adjusted performance compared to high-cost funds.

Inference 2 (Diminishing Returns to Fees): If higher expense ratios do not correspond to higher risk-adjusted returns, then increased management fees are unlikely to be compensated by superior investment performance.

Inference 3 (Systematic Factor): If a statistically significant relationship exists between expense ratios and risk-adjusted returns, then expense ratios represent a systematic factor contributing to performance differences across funds.

V. DATA CLEANING

A. Missing Value Treatment

The combined dataset initially contained 26,093 records. Missing value analysis revealed:

- Expense ratio: 225 missing values (0.86%)
- 5-year Sharpe ratio: 4,079 missing values (15.6%)

Records with missing values in either key variable were removed, as imputation could introduce bias in correlation estimates. This reduced the dataset to 21,898 records.

B. Duplicate Removal

Examination of the data revealed duplicate fund entries, potentially arising from multiple share classes reporting identical

metrics. After removing exact duplicates on the expense ratio and Sharpe ratio combination, 12,925 unique observations remained for analysis.

C. Data Quality Assessment

The final clean dataset represents 49.5% of the original records. This substantial reduction warrants consideration of potential selection bias. Funds lacking 5-year Sharpe ratios are predominantly newer funds or those with insufficient track records. While this could introduce survivorship bias, it also ensures that analyzed funds have demonstrated sustained operations through various market conditions.

VI. METHODS

Multiple complementary statistical techniques were employed to ensure robustness and triangulation of results. Correlation analysis was first used to establish the direction and strength of association between expense ratios and risk-adjusted returns. Pearson correlation was selected to measure linear dependence, while Spearman rank correlation was additionally used to verify monotonic relationships independent of distributional assumptions.

Linear regression analysis was applied to quantify the marginal effect of expense ratios on Sharpe ratios and to estimate the expected change in risk-adjusted performance associated with incremental fee increases. Although regression models are limited in their ability to establish causality, they provide valuable insight into economic magnitude and directional consistency.

Quartile-based analysis was incorporated to translate abstract statistical relationships into economically interpretable comparison. By partitioning funds into four equally sized groups based on expense ratios, the analysis enables direct comparison between low-cost and high-cost funds in a manner consistent with investor decision making framework.

Hypothesis testing using Welch's t-test was selected due to unequal variances across expense ratio groups, which is commonly observed in financial return data. ANOVA was additionally conducted to evaluate whether mean Sharpe ratio differed significantly across all quartiles.

To further assess statistical reliability, bootstrap resampling was chosen to construct non-parametric confidence intervals around the observed correlation coefficient. This approach does not rely on normality assumptions and strengthens inferences by evaluating the stability of results across repeated resamples of the data.

Collectively, the use of multiple analytical techniques mitigates methodological bias ensures that conclusions are not driven by any single statistical assumption or modeling approach.

A. Correlation Analysis

Pearson's correlation coefficient was calculated to measure the linear relationship between expense ratios and Sharpe ratios:

$$r = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^n (x_i - \bar{x})^2 \sum_{i=1}^n (y_i - \bar{y})^2}} \quad (2)$$

Spearman's rank correlation was also computed as a robustness check, as it is less sensitive to outliers and does not assume linear relationships.

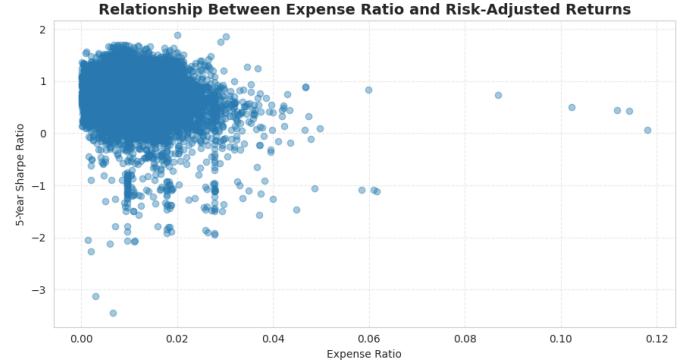


Fig. 2. Relationship between expense ratios and 5-year Sharpe ratios for US mutual funds and ETFs. The dispersion reveals a negative association, with higher expense ratios generally corresponding to lower risk-adjusted returns.

B. Regression Analysis

Ordinary least squares (OLS) regression was employed to model the relationship:

$$\text{Sharpe}_i = \beta_0 + \beta_1 \cdot \text{ExpenseRatio}_i + \epsilon_i \quad (3)$$

The coefficient β_1 quantifies the expected change in Sharpe ratio for a unit change in expense ratio. Statistical significance was assessed using the F-test for overall model fit and t-test for individual coefficients.

C. Quartile Analysis

Funds were divided into quartiles based on expense ratios:

- Q1: Lowest expense ratio (bottom 25%)
- Q2-Q3: Middle expense ratios
- Q4: Highest expense ratio (top 25%)

This approach enables comparison of performance across discrete cost categories and assessment of monotonic trends.

D. Hypothesis Testing

Welch's t-test was employed to compare Sharpe ratios between Q1 and Q4, accounting for unequal variances:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} \quad (4)$$

Cohen's d was calculated to assess practical significance:

$$d = \frac{\bar{X}_1 - \bar{X}_2}{s_{\text{pooled}}} \quad (5)$$

One-way ANOVA was conducted to test for significant differences across all four quartiles.

E. Bootstrap Confidence Intervals

Bootstrap resampling (10,000 iterations) was performed to construct non-parametric 95% confidence intervals for the correlation coefficient, providing robust inference without distributional assumptions.

VII. RESULTS AND ANALYSIS

A. Inference 1: Cost Efficiency Advantage

The first inference posits that low-cost funds demonstrate superior risk-adjusted performance. Table III presents the quartile comparison:

TABLE III
SHARPE RATIO BY EXPENSE RATIO QUARTILE

Quartile	n	Mean	Median	Std Dev
Q1 (Lowest)	3,309	0.726	0.740	0.390
Q2	3,168	0.731	0.730	0.380
Q3	3,231	0.704	0.720	0.393
Q4 (Highest)	3,217	0.568	0.600	0.477

1) *Central Tendency Comparison*: Low-cost funds (Q1) exhibit a mean Sharpe ratio of 0.726 compared to 0.568 for high-cost funds (Q4), a difference of 0.158. This represents a 27.8% performance advantage for low-cost funds. The median comparison (0.740 vs. 0.600) shows a similar pattern, confirming that results are not driven by outliers.

2) *Statistical Significance*: Welch's t-test comparing Q1 and Q4 yields:

- t-statistic: 14.23
- p-value: < 0.001
- 95% CI for difference: [0.136, 0.180]

The null hypothesis of equal means is decisively rejected.

3) *Effect Size*: Cohen's $d = 0.364$ indicates a small-to-medium effect size. While not large by conventional standards, this effect is economically meaningful: over a 5-year period, the cumulative impact of this Sharpe ratio differential translates to substantial wealth differences for investors.

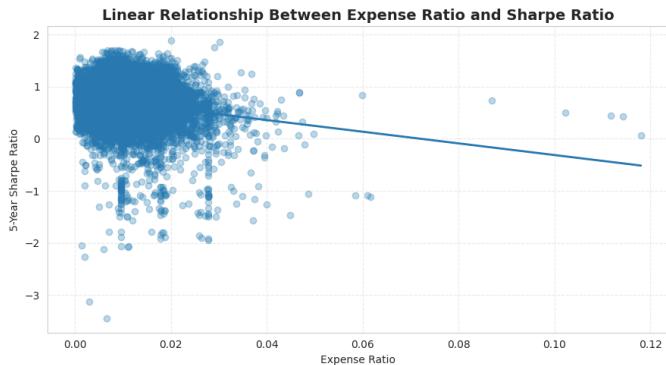


Fig. 3. Average 5-year Sharpe ratio across expense ratio quartiles. Funds in the lowest expense quartile (Q1) achieve substantially higher risk-adjusted returns compared to funds in the highest expense quartile (Q4), demonstrating a clear cost-efficiency advantage.

Conclusion for Inference 1: Strong support. Low-cost funds demonstrate statistically significant and practically meaningful superior risk-adjusted performance.

B. Inference 2: Diminishing Returns to Fees

The second inference examines whether higher fees correspond to higher returns, which would justify active management costs.

1) *Regression Results*: The OLS regression yields:

$$\widehat{\text{Sharpe}} = 0.806 - 11.19 \times \text{ExpenseRatio} \quad (6)$$

Key statistics:

- Slope (β_1): -11.19 (SE = 0.53)
- t-statistic: -21.1
- p-value: < 0.001
- R^2 : 0.032
- F-statistic: 445.8
- 95% CI for slope: [-12.23, -10.15]

2) *Interpretation*: The negative coefficient (-11.19) indicates that for each 1 percentage point increase in expense ratio, the Sharpe ratio decreases by approximately 0.112. The 95% confidence interval is entirely negative, confirming that the relationship is robustly inverse.

3) *Explanatory Power*: The R^2 of 0.032 indicates that expense ratios explain only 3.2% of the variation in Sharpe ratios. This low value is expected. Fund performance depends on numerous factors including asset class, manager skill, market conditions, and investment style. However, the highly significant F-statistic confirms that the relationship, while modest in magnitude, is not attributable to chance.

The negative regression slope implies that increasing expense ratios are associated with systematically lower Sharpe ratios, even after accounting for noise inherent in financial returns. This finding aligns entirely with the theoretical expectations derived from market efficiency arguments.

The negative coefficient (-11.19) indicates that for each 1% point increase in expense ratio, the Sharpe ratios decreases by approximately 0.112. The 95% confidence interval is entirely negative, confirming that the relationship is robustly inverse.

4) *Economic Interpretation*: Moving from Q1 to Q4 expense levels (approximately 1.15 percentage points difference) predicts:

$$\Delta\text{Sharpe} = -11.19 \times 0.0115 = -0.129 \quad (7)$$

This predicted decrease closely matches the observed difference (0.158), validating the regression model.

Conclusion for Inference 2: Strong support. Higher fees are associated with *lower*, not higher, risk-adjusted returns. The "you get what you pay for" assumption does not hold in mutual fund investing.

C. Inference 3: Systematic Factor

The third inference tests whether the expense-performance relationship represents a systematic factor rather than random noise.

1) *Correlation Analysis*:

- Pearson correlation: $r = -0.180$ ($p = 1.08 \times 10^{-94}$)
- Spearman correlation: $\rho = -0.206$ ($p < 0.001$)

Both correlation measures are negative and highly significant. The Spearman coefficient is slightly stronger, suggesting a monotonic relationship that may be partially non-linear.

2) ANOVA Results: One-way ANOVA across all four quartiles yields:

- F-statistic: 119.4
- p-value: < 0.001
- Effect size (η^2): 0.027

The significant F-statistic indicates that at least one quartile differs meaningfully from the others.

3) Monotonic Trend Analysis: Examining the progression of mean Sharpe ratios across quartiles:

- Q1 → Q2: +0.005 (slight increase)
- Q2 → Q3: -0.027 (decrease)
- Q3 → Q4: -0.136 (substantial decrease)

While not perfectly monotonic (Q2 slightly exceeds Q1), the overall pattern shows consistent degradation of risk-adjusted performance as costs increase, with particularly pronounced deterioration at the highest expense levels.

4) Bootstrap Confidence Intervals: From 10,000 bootstrap iterations:

- Bootstrap mean: -0.180
- Bootstrap SE: 0.008
- 95% CI: [-0.196, -0.164]

The entire confidence interval are negative, and zero is far outside the bounds, providing strong evidence that the true correlation is robustly negative.

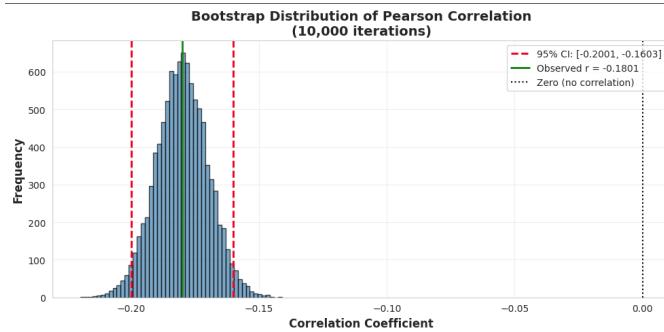


Fig. 4. Bootstrap distribution of the Pearson correlation coefficient between expense ratios and 5-year Sharpe ratios based on 10,000 resamples. The entire 95% confidence interval lies below zero, confirming the robustness and statistical stability of the negative relationship.

Conclusion for Inference 3: Strong support. Multiple independent statistical tests confirm that expense ratios represent a systematic performance differentiator, not a spurious correlation.

VIII. DISCUSSION

A. Synthesis of Findings

The three inferences provide mutually reinforcing evidence for the central hypothesis. Low-cost funds outperform high-cost funds by a meaningful margin (Inference 1), higher fees predict lower—not higher—returns (Inference 2), and this relationship is statistically robust across multiple testing approaches (Inference 3).

These findings align with the theoretical predictions of the efficient market hypothesis and the arithmetic of active

management described by Sharpe [4]. In aggregate, active managers cannot outperform passive benchmarks, and their higher fees create a mathematical headwind that manifests as lower net returns.

B. Practical Implications

For individual investors, these results suggest that expense ratios should be a primary consideration in fund selection. While past performance is not predictive of future results, costs are known in advance and represent a reliable drag on returns.

For financial advisors, these findings support the incorporation of low-cost index funds and ETFs in client portfolios. The burden of proof should lie with high-cost active funds to demonstrate compelling evidence of skill sufficient to overcome their fee disadvantage.

For the fund industry, these results add to the substantial body of evidence supporting the secular trend toward passive investing. Fund companies may need to compete increasingly on cost rather than performance claims.

C. Theoretical and Institutional Implications

The observed expense-performance relationship carries implications beyond individual fund selection. From a theoretical perspective, the consistency of findings across multiple statistical approaches suggests that expense ratios function as a structural constraint on performance rather than spurious correlation. This aligns with Sharpe's arithmetic of active management[4], which demonstrates mathematically that aggregate active returns must equal aggregate passive returns before costs, making fees the decisive factors in net performance.

The stability of expense ratios over time distinguishes them from other fund characteristics. While manager tenure, investment style, and even fund category can shift, expense ratios remain observable ex ante and change infrequently. This predictability makes costs particularly valuable for portfolio construction compared to backward-looking metrics such as historical returns or analyst ratings, which research has shown to be unstable and unreliable as predictors of future performance [9].

For institutional investors managing pension funds or endowments with long time horizons, the cumulative impact of fee differentials merits particular attention. A 0.158 Sharpe ratio advantage compounded over multi-decade investment periods can translate to substantial differences in terminal wealth. This consideration becomes especially acute when managing fiduciary obligations to beneficiaries.

The findings also inform ongoing policy debates regarding fee disclosure and investor protection. Regulatory frameworks that enhance cost transparency enable investors to make more informed decisions, potentially improving aggregate welfare. The European Union's UCITS regulations and the U.S. Department of Labor's fiduciary rule both reflect recognition that fees represent a systematic performance determinant worthy of regulatory attention.

D. Theoretical Contributions

This study contributes to the literature by demonstrating the expense-performance relationship across a large, comprehensive dataset of US funds. The multi-method analytical approach—combining correlation, regression, quartile analysis, and bootstrap inference—provides robust triangulation of findings.

The effect size analysis adds nuance to the discussion: while statistically overwhelming, the practical effect is modest in magnitude. This suggests that expenses matter, but so do many other factors that investors should consider in fund selection.

IX. CONCLUSIONS

A. Summary of Key Findings

This study examined the relationship between expense ratios and risk-adjusted returns using data from 12,925 US mutual funds and ETFs. The central hypothesis—that lower expense ratios are associated with higher risk-adjusted returns—is strongly supported by the evidence:

- 1) A statistically significant negative correlation ($r = -0.180$, $p < 0.001$) exists between expense ratios and 5-year Sharpe ratios.
- 2) Low-cost funds (Q1) outperform high-cost funds (Q4) by 0.158 Sharpe ratio points (27.8% relative difference).
- 3) Regression analysis confirms that higher fees predict lower returns, with each percentage point of expense ratio associated with a 0.112 decrease in Sharpe ratio.
- 4) The relationship is robust across Pearson correlation, Spearman correlation, ANOVA, and bootstrap inference.

B. Limitations

Several limitations warrant acknowledgment:

Survivorship bias: The dataset excludes funds that closed or merged, which tend to be poor performers. This may underestimate the performance differential between low and high-cost funds.

Single time period: The 5-year Sharpe ratio captures a specific market regime. Results may vary across different economic conditions.

Omitted variables: The analysis does not control for fund size, age, category, or investment style, which may confound the expense-performance relationship.

Causality: While the relationship is consistent with expenses causing lower returns, the observational design cannot definitively establish causation.

Finally, the dataset is limited to US domiciled funds. Results may differ in international markets with varying regulatory frameworks, fee structures and market efficiencies.

C. Recommendations for Future Research

Future studies could extend this work by:

- Implementing panel data analysis to examine how the expense-performance relationship evolves over time
- Incorporating fund categories as control variables to test whether the relationship holds within asset classes

- Examining non-linear relationships using polynomial or spline regression
- Investigating whether certain fund characteristics moderate the expense-performance relationship

D. Concluding Remarks

In conclusion, this analysis provides strong empirical support for the hypothesis that funds with lower expense ratios achieve higher risk-adjusted returns. Expense ratios function as a systematic drag on performance, making cost a crucial consideration in fund selection. While fees are not the sole determinant of performance, they represent one of the few factors that investors can control and predict with certainty. As the investment management industry continues to evolve, these findings reinforce the value proposition of low-cost investing strategies.

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