

Impact of Fund Size on Performance and Risk of Closed-End Mutual Funds: An Empirical Analysis in the Context of Bangladesh

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Abstract:

This study examines the prospective statistical relationship between the size of closed-end mutual funds and their performance and risk within a comprehensive framework. The analysis encompasses both linear and quadratic relationships, employing established performance metrics including the Sharpe Ratio, Excess Return, Treynor Ratio, and the fund's total & systematic risk. In order to test the relationship, this research used the data from 35 closed-end mutual funds traded on the Dhaka Stock Exchange (DSE) in Bangladesh from 2017 to 2022. The empirical tests reveal a statistically significant negative linear relationship between the size of closed-end mutual funds and the performance measures, as well as the fund's systematic and total risk. Moreover, the findings provide compelling evidence of a concave quadratic relationship between mutual fund size and total risk, underscoring the presence of an optimal fund size from a risk perspective.

Keywords: Mutual Fund, Fund size, Performance, Risk

Introduction:

Studies that have looked at how the size of a fund affects its performance have found inconsistent or mixed results. Larger mutual funds might benefit from economies of scale. As the fund size increases, fixed costs get spread across a larger asset base, potentially leading to lower expense ratios. Lower expenses can enhance overall returns for investors. However, there could be a point where the fund becomes too large, and the economies of scale start to diminish. Larger funds might have greater resources, including research teams, technology, and access to information, which could potentially provide them with an edge in analyzing and selecting investments. This could contribute to better performance in some cases. Larger funds might be able to invest in a wider range of assets due to their size, potentially diversifying their portfolios more effectively and managing risk. However, excessive size can also limit investment opportunities, particularly in smaller or less liquid markets. As mutual funds grow larger, they might be more prone to "style drift" where the fund's investment strategy deviates from its original intent. This could impact performance if the fund strays from its successful approach.

On the other hand, smaller funds might have more flexibility to invest in smaller or less liquid securities, potentially generating higher returns. Smaller funds can act more swiftly when identifying attractive investment opportunities. They can enter and exit positions more quickly without significantly impacting

the market, which might lead to better execution and potentially higher returns. Small funds might have an easier time building or reducing positions without substantially affecting market prices. Smaller funds might find it easier to stick to their original investment strategy and avoid "style drift" where the fund's strategy changes over time. They also have fewer layers of bureaucracy and decision-making, allowing for quicker and more agile investment decisions.

Concluding this study would yield significant insights into the ramifications of fund size on closed-end mutual funds operating within a developing market such as Bangladesh. While an extensive body of research has investigated the influence of mutual fund size on performance, a geographical research gap is noticeable, particularly in the context of the Bangladeshi closed-end mutual fund sector. Consequently, it introduces unique factors that may distinctively impact fund behavior in contrast to more mature markets. By scrutinizing this interrelation, both scholars and industry professionals can enhance their comprehension of the relationship between closed-end mutual funds' performance and risk dynamics in relation to their fund sizes. This enhanced understanding has the potential to facilitate more judicious investment choices and tailored regulatory approaches within the financial landscape of Bangladesh. Furthermore, a comprehensive assessment of this relationship necessitates accounting for the effects of fund strategies, investment styles, and fund objectives, thus augmenting the holistic comprehension of this relationship between optimal fund size and performance.

Literature Review:

Scholarly investigations into the influence of fund size on fund performance have yielded equivocal outcomes. While a predominant portion of the literature demonstrates a negative relationship between performance and asset size, it is noteworthy that a subset of authors has documented a positive association, as evidenced in Table 1.

Only a limited number of studies have been undertaken to examine the influence of fund size on performance within the context of the Indian and Pakistani subcontinent. In the Indian context, Keswani (2011) encountered inconclusive statistical significance, thereby failing to provide substantiated indications that the magnitude of fund size impacts the performance outcomes of Balanced Funds. A study conducted on mutual funds in Pakistan by Rehman & Baloch (2016), concluded that fund Size has a positive significant impact on mutual fund performance.

Hedges (2004) showed that smaller funds outperform larger funds, whereas mid-sized funds underperform both smaller and larger funds. Agarwal et al (2004) examined the role of fund size, past flows, managerial incentives, lock-up, and restriction periods on the cross-sectional variation in fund performance. Their findings suggest that funds with larger sizes and higher flows are associated with poor future performance. Yan (2008) found that there is a significant inverse relationship between fund size and fund performance. This inverse relationship is stronger among funds that hold less liquid portfolios and is also more pronounced among growth and high turnover funds that tend to have high demands for immediacy. Fuss et al (2009) confirmed that experience and size have a negative effect on performance, with a positive curvature at the higher quantiles. At lower quantiles, however, size has a positive effect with negative curvature. Both factors show no significant level at the median.

According to Tang (2007), the size of the fund has a significant impact on the expense ratio of the fund. The larger the fund size, the lower the expense ratio because of the economies of scale and reduction in marginal cost. Therefore, the fund size is mostly considered as having a positive relationship with fund performance. This result is also supported by the study of Madura & Zera (2001). Latzko (1999)

concluded that there are economies of scale in bond funds, as a fund’s cost elasticity is found to be less than unity. Amenc et al (2004) demonstrated that the mean alpha for large funds exceeds the mean alpha for small funds.

Bodson et al (2011) found evidence of a concave quadratic relationship between mutual-fund performance and size, which suggests the presence of an optimal fund size in terms of performance. According to Indro et al (1999) mutual funds must attain a minimum fund size in order to achieve sufficient returns to justify their costs of acquiring and trading information.

Ammann & Moerth (2005) studied the effect of fund size with respect to fund returns, standard deviations, and Sharpe ratios that derived from a multi-asset class factor model. Empirical evidence is shown for a quadratic relationship between fund size and returns using a cross-sectional regression analysis.

According to Gregoriou & Rouah (2003), there is no correlation between size and performance although they acknowledge that the data set used in the study suffered from survivorship bias. A study conducted by Guidotti (2009) found no precise size impact on performance as it is positive for some hedge fund strategies and negative for others.

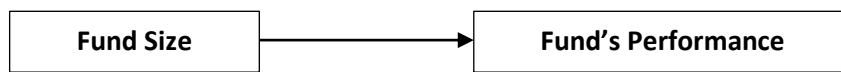
Table 1: Summary of the existing literature on the size-performance relationship

Authors	Period	Fund Universe	Size Performance Relationship	Performance Measures
Keswani (2011)	2007-2010	Mutual Fund	No Statistically Significant Relationship	CAGR, Sharpe Ratio, Fund Momentum
Rehman & Baloch (2016)	2010-2014	Mutual Fund	Linear & Positive	Sharp Ratio
Hedges (2004)	1995–2001	Hedge Fund	Quadratic & Concave	Alpha
Agarwal et al (2004)	1994–2000	Hedge Fund	Linear & Negative	Returns
Yan (2008)	1993–2002	Mutual Fund	Linear & Negative	Alpha
Fuss et al (2009)	2005–2006	Hedge Fund	Linear & Negative	Returns
Amenc et al (2004)	1996–2002	Hedge Fund	Linear & Positive	Alpha
Bodson et al (2011)	2000-2016	Mutual Fund	Quadratic & Concave	Alpha, Sharpe Ratio, Treynor Ratio, Multi Alpha, BCH Ratio
Indro et al (1999)	1993–1995	Mutual Fund	Quadratic & Concave	Returns

Ammann, Moerth (2005)	1994–2002	Hedge Fund	Quadratic & Concave	Returns, Sharpe Ratio, Alpha
Gregoriou and Rouah (2003)	1994–1999	Hedge Fund	No Clear Relationship	Returns, Sharpe Ratio, Treynor Ratio
Guidotti (2009)	2003–2008	Hedge Fund	No Clear Relationship	Alpha

The significant points learned through the reviews of the literature led to the conceptualization of the following theoretical framework and hypotheses:

Figure 1: Theoretical Framework



Research Methodology:

To assess the proposed hypotheses within the confines of the Bangladeshi closed-end mutual fund sector, pertinent data has been combined from a carefully chosen subset of 35 closed-end mutual funds trading on the Dhaka Stock Exchange (DSE) spanning the timeframe from 2017 to 2022. The requisite Closed-End Mutual Fund Net Asset Value (NAV) data was meticulously gathered through manual extraction from both annual reports of the mutual funds and the official Dhaka Stock Exchange Limited website.

The assessment of fund performance was conducted through the computation of the compound annual growth rate (CAGR) of dividend-adjusted Net Asset Value (NAV) over the period spanning from 2017 to 2022. Additionally, performance metrics including the Sharpe Ratio, Excess Market Return, and Treynor Ratio were calculated. Concurrently, the evaluation of risk encompassed the determination of standard deviation and beta.

To ascertain the robustness of our findings, we intend to employ a standard regression analysis. Following the initial regression of fund performance metrics against the size (represented by the natural logarithm of the Net Asset Value) of the closed-end funds, a subsequent regression will be conducted utilizing the square of the logarithm of the Net Asset Value (Size). This sequential regression procedure facilitates an examination of the potential presence of a quadratic association between mutual fund size and performance.

Research Model: This research investigation is based on the following research model:

1. Pairwise correlation between fund size, fund's performance & risk measurement.
2. Fund's Sharpe Ratio = $b_0 + b_1(\text{Fund Size})$
3. Fund's Excess Return = $b_0 + b_1(\text{Fund Size})$
4. Fund's Treynor Ratio = $b_0 + b_1(\text{Fund Size})$
5. Fund's Total Risk = $b_0 + b_1(\text{Fund Size})$
6. Fund's Systematic Risk = $b_0 + b_1(\text{Fund Size})$
7. Fund's Sharpe Ratio = $b_0 + b_1(\text{Fund Size}) + b_2(\text{Fund Size}^2)$

- 8. Fund’s Excess Return = $b_0 + b_1(\text{Fund Size}) + b_2(\text{Fund Size}^2)$
- 9. Fund’s Treynor Ratio = $b_0 + b_1(\text{Fund Size}) + b_2(\text{Fund Size}^2)$
- 10. Fund’s Total Risk = $b_0 + b_1(\text{Fund Size}) + b_2(\text{Fund Size}^2)$
- 11. Fund’s Systematic Risk = $b_0 + b_1(\text{Fund Size}) + b_2(\text{Fund Size}^2)$

The above-mentioned models were applied by Bodson, Cavenaile, & Sougne (2011).

- **Returns:** Return represents the fund’s performance, and it has been calculated as a compound annual growth rate (CAGR) of dividend-adjusted Net Asset Value (Market Price) of the Closed-End Mutual Fund from 2017 to 2022.
- 1. Sharpe Ratio: The Sharpe ratio functions as a metric for assessing returns with respect to risk. It is computed by determining the Compound Annual Growth Rate (CAGR) between 2017 and 2022 for the net asset value (NAV) of a closed-end fund, then subtracting the risk-free rate, and finally dividing by the standard deviation of the fund's returns. Here 364 days Bangladesh Govt. Treasury is considered a risk-free rate.
- 2. Treynor Ratio: The Treynor Ratio, a metric for assessing risk-adjusted returns, takes into account the fund’s systematic risk. It is computed by dividing the compound annual growth rate (CAGR) of closed-end mutual funds NAV in excess of the risk-free rate by the fund's beta, which serves as a representation of the fund's systematic risk. Here 364 days Bangladesh Govt. Treasury is considered as a risk-free rate.
- 3. Excess Return: Calculated as the CAGR of dividend-adjusted Net Asset Value (Market Price) of the Closed-End Mutual Fund (2017 to 2022) minus the CAGR of the DSEX (Main Index of Dhaka Stock Exchange) in the same period.
- **Total Risk:** Annualized standard deviation of the weekly change of mutual funds’ dividend-adjusted Net Asset Value (2017-2022)
- **Systematic Risk:** Systematic risk of a fund, often referred to as market risk or non-diversifiable risk, signifies the component of total risk that cannot be mitigated through diversification. It stems from macroeconomic factors and market-wide influences. Systematic risk is inherently linked to the overall market conditions and can affect a fund's performance irrespective of its specific attributes or diversification strategies. Here the systematic risk is represented by Beta.
- **Fund size:** It has been calculated as the natural log of the net asset value of the closed-end mutual fund.

Data Analyses and Results:

Table 2: Correlation of Fund’s performance and total risk with Fund’s size.

		Fund_Size	Sharpe	Excess_Return	Treynor_Ratio	Standard_Deviation	Beta
Fund_Size	Pearson Correlation	1	-.490*	-.573**	-.543**	-.573**	-.438**
	Sig. (2-tailed)		0.003	0	0.001	0	0.008
	N	35	35	35	35	35	35

Sharpe	Pearson Correlation	-.490**	1	.911**	.989**	0.216	0.165
	Sig. (2-tailed)	0.003		0	0	0.213	0.343
	N	35	35	35	35	35	35
Excess_Return	Pearson Correlation	-.573**	.911*	1	.938**	.555**	.486**
	Sig. (2-tailed)	0	0		0	0.001	0.003
	N	35	35	35	35	35	35
Treydor_Ratio	Pearson Correlation	-.543**	.989*	.938**	1	0.299	0.211
	Sig. (2-tailed)	0.001	0	0		0.081	0.224
	N	35	35	35	35	35	35
Standard_Deviation	Pearson Correlation	-.573**	0.216	.555**	0.299	1	.926**
	Sig. (2-tailed)	0	0.213	0.001	0.081		0
	N	35	35	35	35	35	35
Beta	Pearson Correlation	-.438**	0.165	.486**	0.211	.926**	1
	Sig. (2-tailed)	0.008	0.343	0.003	0.224	0	
	N	35	35	35	35	35	35

** . Correlation is significant at the 0.01 level (2-tailed).

The result suggests that ($p > 0.01$) there is a significant inverse relationship between fund size and the fund's Sharpe Ratio, Excess Return, Treynor Ratio, Standard Deviation & Beta.

Regression Analysis

Table 2: Regression results: Linear regression

	Sharpe Ratio	Excess Return	Treynor Ratio	Standard Deviation	Beta
Log(Fund Size)	-0.1853	-0.0250	-0.0378	-0.0869	-0.2552
t-Statistic	-3.2255	-4.0207	-3.7179	-4.0127	-2.8009

P- Value	0.0028**	0.0003**	0.0007**	0.0003**	0.0085
Constant	0.6422	0.0980	0.1305	0.3778	1.3634
t-Statistic	3.5925	5.0699	4.1296	5.6075	4.8086
P- Value	0.0011**	0.0000**	0.0002**	0.0000**	0.0000
R-squared	0.2397	0.3288	0.2952	0.3279	0.1921
Adjusted R-squared	0.2167	0.3085	0.2739	0.3076	0.1676
F-statistic	10.4037	16.1664	13.8230	16.1019	7.8451
Prob(F-statistic)	0.0028	0.0003	0.0007	0.0003	0.0085

** mean significance at the 5% level

Standard regression results are reported in Table 2. The results from the linear regression provide strong evidence of a negative linear relation between mutual fund performance and size. Statistical significance is found in the coefficients of all performance measures concerning fund size. These results are consistent with Agarwal et al (2004), their findings suggest that funds with larger sizes and higher flows are associated with poor future performance. We can notice that the size coefficient is negative for all the performance measures (at the 5% level). We can also observe that the (adjusted) coefficient of determination is relatively low for all performance measures and the highest for the Excess Return.

In the context of the capital market of Bangladesh, small mutual funds may possess greater maneuverability to engage in transactions involving smaller or comparatively illiquid securities, thereby potentially yielding enhanced returns. Given the sufficient magnitude of the Bangladeshi market, it can readily accommodate the liquidity needs of smaller funds; however, larger investment funds may encounter notable challenges when seeking to procure or divest securities, owing to their substantial scale. This situation could engender market impact costs, wherein the endeavors of sizable funds to purchase or sell securities may exert a visible influence on prevailing market prices. By way of illustration, if a substantial mutual fund endeavors to amass a significant volume of a specific stock, its acquisition activities could instigate an escalation in the stock's valuation, consequently leading to escalated expenses for the fund. To provide a quantitative perspective on the scope of the Bangladeshi capital market, it is noteworthy that as of April 2023, the cumulative market capitalization amounted to 41.761 billion US dollars. In a comparative context, neighboring India's capital market commands a substantially larger market capitalization, quantified at 3,612.985 billion US dollars.

An additional significant factor that could reveal the negative correlation between a mutual fund's size and its performance is the impact of Initial Public Offering (IPO) quotas. According to the regulations set forth by the Bangladesh Securities and Exchange Commission, mutual funds, among other eligible investors, are entitled to a 25% quota in IPOs conducted through the fixed price method. In cases where multiple mutual funds apply for IPO shares at the highest allocation allowed, regardless of their individual sizes, each mutual fund is allocated an equivalent share of the IPO offering. Given that a substantial number of IPOs in Bangladesh tend to be underpriced, smaller funds stand to reap optimal advantages from investing in IPO shares.

Test of Non-Linearity

The following test shows whether the relation between funds size and the fund’s performance and risk is linear or quadratic in nature.

Table 3: Regression results: Quadratic Regression

	Sharpe Ratio	Excess Return	Treynor Ratio	Standard Deviation	Beta
log(Fund Size)	-0.2377	-0.1558	-0.1107	-0.9109	- 2.0274
t-Statistic	-0.2671	-1.6679	-0.7062	-3.0157	- 1.4732
P- Value	0.7911	0.1051	0.4852	0.005**	0.1505
log(Fund Size)^2	0.0083	0.0207	0.0115	0.1303	0.2802
t-Statistic	0.0590	1.4035	0.4664	2.7339	1.2905
P- Value	0.9533	0.1701	0.6441	0.0101**	0.2061
Constant	0.7243	0.3029	0.2448	1.6685	4.1393
t-Statistic	0.5163	2.0574	0.9905	3.5046	1.9082
P- Value	0.6092	0.0479	0.3293	0.0014***	0.0654
R-squared	0.2398	0.3677	0.3000	0.4552	0.2320
Adjusted R-squared	0.1923	0.3282	0.2562	0.4211	0.1840
F-statistic	5.0465	9.3057	6.8564	13.3675	4.8344
Prob(F-statistic)	0.0124	0.0007	0.0033	0.0001	0.0146

** mean significance at the 5% level

The outcomes of the quadratic regression analysis are detailed in Table 3. A noticeable deviation from the linear regression results becomes apparent. Specifically, each performance metric exhibits dissimilar signs for both the primary and secondary coefficients. Furthermore, it is noteworthy that the quadratic regression model demonstrates statistical significance solely in the context of the risk assessment metric, namely, the Standard Deviation. These findings strongly suggest that the connection between the size of a mutual fund and its aggregate risk might adhere to a quadratic pattern rather than a linear one.

Conclusion:

The Mutual Fund serves as a contemporary investment tool tailored for small-scale investors in Bangladesh, particularly those lacking access to vital information, skills, or knowledge required for engaging in capital market investments. This research project sought to ascertain the influence of a mutual fund's size on both its performance and risk across a sample of 35 closed-end mutual funds within Bangladesh.

The study's outcomes revealed noteworthy insights. Firstly, it was determined that the size of a closed-end mutual fund exhibits a significant and negative linear relationship with the fund's overall performance. Moreover, the study found a statistically significant quadratic relationship between the

Total Risk of a fund and its size. Based on these findings, it is recommended that asset management companies consider establishing a multitude of smaller-sized funds as opposed to pursuing larger fund formations. Such an approach could potentially lead to improved outcomes in terms of fund performance and risk management.

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