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Effect of Macroeconomic Factors on Mutual Funds Risk and Return: An Empirical Study from Bangladesh

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Abstract: *This study aims to identify the influence of macroeconomic factors on the risk and return of mutual funds in Bangladesh. The findings of this research can be directly applied by practitioners and institutional investors in their decision-making, particularly in asymmetric market situations. Monthly closing price data of 27 mutual funds from Bangladesh are collected from December 2015 to December 2022. Additionally, monthly data of 6 macroeconomic variables, i.e., deposit rate, export, import payments, remittance, broad money (M2) and GDP growth rate, are gathered for this study. This study utilized standard deviation and beta as risk measures, and the Sharpe and Treynor ratios are applied as risk-adjusted return (RAR) measures. All the risk and risk-adjusted return measures are computed using 12-months rolling window method. The random effect model of panel data analysis is applied to find the influence of macroeconomic variables on the risk and return of mutual funds. Overall findings indicate that macroeconomic factors significantly influence mutual fund risk exposure. On the other hand, risk-adjusted return (RAR) is also significantly influenced by the macroeconomic variables.*

Keywords: *Risk-Adjusted Return, Bangladesh, Mutual Fund, Standard Deviation, Beta, Sharpe Ratio, Treynor Ratio.*

Introduction

A mutual fund is a pooled investment vehicle in which the money of investors is pooled and invested in a portfolio of assets (Hussain, 2017). Mutual funds are considered one of the most important tools in producing considerable growth in the capital market of Bangladesh. The first mutual fund was issued in Bangladesh in 1980 by the Investment Corporation of Bangladesh (ICB) (Rahman & Mamun, 2022).

According to Dhaka Stock Exchange (DSE, 2022), (9) asset management firms supervised 37 closed-end funds operating on the DSE. Institutional investors make up more than 65% of the total assets under management (AuM) of mutual funds (DSE Shareholding Status Report, 2019). This indicates that ordinary investors in Bangladesh continue to rely mainly on depositing money in banks rather than placing funds in mutual funds (Rahman, 2022).

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There is an ongoing debate regarding the performance of mutual funds compared to the benchmarks. Benchmark is an index that is used to measure the performance of mutual funds (e.g., risk-free rate, average return). Which indicates how much one investment should have earned, that is compare to how much the investment has earned in reality. Mutual fund managers face challenges in identifying investment opportunities because performance of mutual funds depends on managers' abilities and other fund and country-specific factors (Jensen, 1968). The fund-specific factors, i.e., board size, investment strategy, fund size, fund age, management fees, load fees, fund flows, prior performance, management structure, objectives of the fund and country-specific factors, i.e., country governance, rules, regulation and laws, and economic growth have influenced the performance of the mutual funds (Nguyen & Nguyen, 2019).

Again, an investor's mood, as opposed to economic factors, drives mutual fund investing (Harris & Gurel, 1986). However, Oh & Parwada (2007) show that investors often make decisions based on recent market performance. This indicates that investors are more inclined to invest in mutual funds due to the positive performance in the market. On the other hand, in times of market downturns (high volatility), investors tend to be risk-averse for investing in mutual funds due to the perceived higher risk. That means investment decisions in mutual funds are associated with the risk of the investment caused by the financial market volatility and downturns in the economy.

The performance of the mutual fund sector entirely depends on the macro and micro economic factors. The microeconomic factors are unsystematic risks that can be controlled by individual business organizations. However, macroeconomic factors are uncontrollable. Due to the fluctuation in different macroeconomic variables, the financial market is highly volatile. If one variable changes, increases, or decreases, it directly impacts the fluctuation of financial markets. A mutual fund is a part of the financial market, so macroeconomic factors also have an impact on the performance of mutual funds (Garg & Srivastava, 2020). However, the financial market of Bangladesh was established in 1954, and the mutual fund industry started its journey in 1980; since the mutual fund industry has been operating for many years, it has made a significant contribution to the stock market of Bangladesh. However, there is a lack of research to evaluate the impact of macroeconomic variables on the risk exposure and risk-adjusted return of mutual funds. Therefore, this research aimed to understand better the elements that affect the risk and risk-adjusted return of mutual funds in Bangladesh.

The first objective of the study is to measure the risk and risk-adjusted return of mutual funds in Bangladesh using 12-month rolling window methods. The second objective of this study is to evaluate the influence of macroeconomic variables on risk exposure and risk-adjusted return. Macroeconomic variables are important factors in determining whether mutual funds outperform in the market or not (Banegas, Gillen, Timmermann, & Wermers, 2013).

The rest of the article is divided into four sections. The literature review section focuses on various dimensions of risk and risk-adjusted return measures,

macroeconomic variables, and their effect on risk and risk-adjusted return along with the hypotheses development. The next section is the data and methodology, which includes various methods of the risk and risk-adjusted return computation procedure such as standard deviation, beta, Sharpe ratio, and Treynor ratio, and shows the brief discussion of macroeconomic variables, i.e., deposit rate, GDP growth rate, money supply, export, import, and remittance. It also shows the data analysis methods using the panel data regression for the random effect model. Then the results and discussions section consists of descriptive statistics, correlation matrix, regression analysis of panel data using random effect model, and robustness analysis. Last section discusses the conclusion of the study and indicates the future research opportunity.

Literature Review

Investment in mutual funds varies depending on purpose, structure, cost, and risk, apart from their size, kind, and other distinguishing characteristics (Hasan, 2017). Mutual funds provide benefits to their shareholders as well as expert management. The mutual fund sector has expanded quickly worldwide over the last two decades and scholars continue to debate about risk exposure and the performance of mutual funds compared to market benchmarks (Hussain, 2017).

The risk associated with an action or occurrence is measured by the magnitude of those negative outcomes. The possible outcomes, probabilities, and mitigating variables associated with each risk category are unique (Burt, 2001). The risk exposure can be computed through traditional risk measures, i.e., standard deviation and beta (Estrada, 2006; Hasan, 2016). According to the modern portfolio theory (MPT), investors can build an optimum holding to get the highest possible rate of return within a certain level of risk (Markowitz, 1991). The focus of this study on risk and performance measurement is to determine whether Bangladeshi mutual funds can optimize efficient portfolios. Although Markowitz considered variance as a measure of risk, this investigation will use standard deviation as one of the risk measures following Bawa (1975) and Fishburn (1977). Risk and return studies of mutual funds are of greater importance to investors than any other investment fund, such as bonds, stocks, and treasury bills, because risk and return are used to determine whether or not to invest in the fund. Although mutual funds have many benefits, they are not risk-free investments. Systematic risk, fund-specific risk, and negative performance are the components. Moreover, the mutual fund's risk varies depending on the features of the national economic condition, such as GDP growth, unemployment rate, inflation, fiscal policy and monetary policy. The growth of a nation's economy will affect the returns on mutual funds (Duch, Palmer & Anderson, 2000).

According to Gjerde & Saettem (1999), stock returns positively correlate with oil prices and show no statistically significant relation between stock returns and inflation. Moreover, macroeconomic factors like trade balance, foreign exchange rate, industrial output, and money supply are co-integrated with stock indexes

(Kwon & Shin, 1999). Subsequently, Bailey & Chung (1996) found that the exchange rate has no relation with the stock market of the Philippines.Canadian, German, Italian, Japanese, and American stock markets were analyzed by Cheung & Ng (1998) to determine the impact of macroeconomic variables, i.e., the real oil price, money supply, and gross national product, on stock prices and found a positive relationship between stock prices and macroeconomic factors. Furthermore, Martínez, Lapeña, & Sotos (2015) find that interest rate influences stock market return.

According to Aggarwal & Saqib (2017), the Indian stock market is affected by both Indian and US macroeconomic factors, i.e., US gross domestic product (GDP), gold prices, and S&P data all have positive relationships with the Indian stock market. It is widely established that stock returns are related to a nation's macroeconomic environment in industrialized countries (Clare & Thomas, 1994). Similarly, Dash & Kumar (2008) find that the return and volatility of mutual funds are strongly influenced by macroeconomic factors such as exchange rate, interest rate, inflation, and crude oil price. Furthermore, macroeconomic variables also affect the performance of traditional mutual funds (Ahmed & Siddiqui, 2019). Moreover, a positive and statistically significant relationship between the return of mutual funds and inflation is identified (Gusni, Silviana, & Hamdani, 2018). However, other authors (Hussain, 2017) provided evidence that interest rates are inversely related to the returns on mutual funds.

According to Kariuki (2014) finds that shifts in GDP had a significant effect on the performance of mutual funds. Furthermore, the money supply has a positive and statistically significant effect on the performance of mutual funds (Kariuki, 2014), and it is inverse to the results of Singh, Mehta, & Varsha (2011). In addition, a negative relationship between interest rates and US mutual funds' performance is identified using fixed effect model data (Philpot, Hearth, Rimbey, & Schulman, 1998).

However, the risk and return of mutual funds are influenced by macroeconomic factors. Previous researchers (Reddy, Mirza, Naqvi, & Fu, 2017) utilized beta to measure the systematic risk of mutual funds. In contrast, others (Vidal-Garcia, Vidal, & Nguyen, 2014) applied unsystematic risk measures to estimate the risk exposure of mutual funds. Yang & Hou (2016) identify a positive correlation between fund risk and performance. Moreover, returns on mutual funds are heavily influenced by unsystematic risk (Vidal-Garcia et al., 2014).

This study has at least three major contributions in mutual fund research. First, this study identifies the impact of macroeconomic variables on both risk and risk-adjusted return, whereas most authors (Nafees, Shah & Khan, 2011; Rahman & Mamun, 2022) focus on only mutual funds' performance. In addition, Chowdhury, Habibullah, & Nahar (2018) investigated the risk-adjusted performance of Bangladeshi mutual funds, but they did not explore the effects of macroeconomic factors on both risk and risk-adjusted return of mutual funds. Therefore, identifying the effects of macroeconomic factors on risk and return of mutual funds is a novel contribution in the context of Bangladesh which will help

to extend the existing literature by fulfilling the research gap.

Secondly, this study contributes to risk and risk-adjusted return computation procedures. This study applied 12-month rolling windows methods to compute risk and risk-adjusted return; however, most authors (e.g., Dash & Kumar, 2008; Qureshi, Khan, Rehman, Ghafoor, & Qureshi, 2019) applied single-period methods to estimate the risk and risk-adjusted return. Moreover, to the best of our knowledge, none of the studies in Bangladesh has applied 12-month rolling window methods to compute risk and risk-adjusted return of mutual funds.

The third contribution of this research is methodological. Previous authors like Estrada (2006) and Hussain (2017) applied time series analysis, cross-sectional analysis, or vector autoregressive model. However, the random effects model of panel data analysis is applied in this research following Gusni et al. (2018) to consider the effects of both time and unit effects. Thus, the result of this analysis is more robust and reliable. w

Hypotheses Development

Impact of Macroeconomic Factors on Risk Exposure

There is a debate about the influence of macroeconomic variables on risk exposure in the literature. Some studies find that macroeconomic factors influence the risk exposure of mutual funds; however, others oppose this argument. Kisoi & Onyango (2017) find that the influence of exchange rate and GDP on portfolio risk is insignificant. Shahabadi, Naziri, & Havaj (2013) explore that exchange rates and risk premiums have an insignificant effect on systematic risk. Subsequently, Valahzaghard, Kashefi, Alikhani, & Hosseini (2012) do not find a significant relationship between the macroeconomic variables of the inflation rate, employment rate, unemployment rate, and currency exchange rate with credit risk. Therefore, the following hypothesis is made.

> *$H1_0$ = There is no significant influence of macroeconomic factors on the risk of the mutual fund.*

On the other hand, some other authors find the influence of macroeconomic factors on the portfolio risk of different countries. For example, Mendonça & Silva (2018) evidenced that interest rate significantly affects systematic risk. Kisoi & Onyango (2017) find the opposite of interest rate on portfolio risk and a positive effect of GDP on portfolio risk. Furthermore, Shahabadi et al. (2013) find that the inflation rate significantly affects systematic risk. Noroozi (2014) identifies that interest rate, inflation, and public debt positively correlate with credit risk, and the GDP growth rate negatively correlates with credit risk. Finally, Purwono & Dimayanti (2020) identify that interest and exchange rates influence systemic risk. Based on the above discussion, the hypothesis is made:

> *$H1_a$ = There is a significant influence of macroeconomic factors on the risk of the mutual fund.*

Impact of Macroeconomic Factors on Risk-Adjusted Return

Similar to the impact of macroeconomic factors on risk, there is a debate about the influence of macroeconomic variables on risk-adjusted return in the literature. Gjerde & Saettem (1999) find no evidence of a correlation between stock market performance and inflation. In addition, Humpe & Macmillan (2009) explore that the broad money supply is an insignificant determinant of the value of stock market.

Furthermore, Pan, Fok, & Liu (2007) discover no relation between currency exchange rates and stock market performance. Subsequently, Bailey & Chung (1996) identified the same results. Additionally, Dash & Kumar (2008) find that the deposit rate has an insignificant relationship with the performance of mutual funds. Based on the above discussion, the following hypothesis is made:

> *$H2_0$ = There is no significant influence of macroeconomic factors on the risk-adjusted return of the mutual fund.*

On the other hand, some other authors find the influence of macroeconomic factors on the risk-adjusted return of mutual funds. For example, Ahmed & Siddiqui (2019) explored that performance of conventional mutual funds is affected by macroeconomic factors such as interest rates, inflation rates, and GDP. Hussain (2017) shows that mutual fund performances are negatively connected to interest rates. Consequently, Qureshi et al. (2019) find an inverse relationship between inflation rate and fund performance.

Consequently, Singh et al., (2011) find a negative correlation between money supply and portfolio performance. Kwon & Shin (1999) discovered that the stock market performance has a relationship with the trade balance, the foreign exchange rate, industrial production, and the money supply. Overall findings of Cheung & Ng (1998) show that stock prices move positively with the oil price, money supply, and gross national product (GNP). Based on the above discussion, the following hypothesis is made:

> *$H2_a$ = There is a significant influence of macroeconomic factors on the risk-adjusted return of the mutual fund.*

These four hypotheses are developed to identify whether macroeconomic variables impact either risk exposure or the risk-adjusted return of Bangladeshi mutual funds.

Data and Methodology

Sample Development and Data Collection

This study focuses on standard deviation (total risk) and beta (systematic risk) as risk measures as well as Sharpe ratio and Treynor ratio as risk-adjusted return (RAR) measures following previous authors like Estrada (2006), Rahman & Mamun (2022) and Hasan (2016). Monthly closing price data of 27 mutual funds out of 37 from Bangladesh and DSEX index points are collected from December 2015 to December 2022 from DSE. The remaining 10 mutual funds were established after 2017, which is not aligned with the data collection period of this

study because the data collection period started in December 2015; for this reason, the remaining 10 mutual funds are excluded from this research. Risk and risk-adjusted return measures are computed using the 12-month rolling windows method (Lin, Yen & Hsieh, 2023; Olasehinde-Williams & Özkan, 2022). Additionally, six (6) macroeconomic factors, i.e., deposit rate, GDP growth rate, broad money, remittances, exports, and imports, are utilized to identify their effects on risk and risk-adjusted return of Bangladeshi mutual funds. Macroeconomic factors data such as deposit rate, export, import payments, GDP growth rate, broad money (M2), and remittance are collected from January 2017 to December 2022 from Bangladesh Bank[1]. Monthly return is computed from January 2016 to December 2022 using the below formula (Miskolczi, 2017) -

$$\bar{R}_i = ln\left(\frac{P_{i,t}}{P_{i,t-1}}\right) \dots\dots\dots\dots\dots\dots (i)$$

Here, *ln* is the natural logarithm, *i* is the unit of funds, *t* is the time, $P_{i.t-1}$ stands for the previous period price, $P_{i,t}$ is the current price.

Risk Measurement Techniques

This study aims to identify the risks and returns of Bangladeshi mutual funds. To identify the risk exposures, standard deviation (total risk measure) and beta (systematic risk measure) are selected, which are considered as most important risk measures for mutual fund risk (Estrada, 2006; Chowdhury et al., 2018; Rahman & Mamun, 2022). A brief description of these risk measures is given below-

Standard Deviation

Standard deviation measures a mutual fund's total risk, indicating the maximum return volatility from the mean return. The computation of standard deviation formula is given below (Hasan, 2016).

$$SD_{i,t}=\sqrt{\frac{1}{t-1}\sum_{t=1}^{T}(r_{i,t}-\bar{r}_{i,t})^2} \dots\dots\dots\dots\dots\dots\dots (ii)$$

Here, *SD* stands for the standard deviation of return, *r* is monthly return, $\bar{r}$ is mean return, *i* is the fund and *t* is the time.

Beta

The prominent technique to measure systematic risk is beta *(β)*, which is derived from the capital asset pricing model (CAPM), as it measures the sensitivity of the asset return relative to the change of the market return. Therefore, beta can be measured using the CAPM formula (Hoepner & Schopohl, 2018).

$$\left(r_{i,t} - r_{f,t}\right) = \propto_{i,t} + \beta_{i,t}\left(r_{m,t} - r_{f,t}\right) + \varepsilon_{i,t} \text{ ----------} (iii)$$

Here, *i* stands for fund, *t* stands for time, *m* stands for market, *f* is the risk-free rate, *r* is monthly return, β is the beta which measures the systematic risk, $\propto$ is

[1] Macroeconomic data are collected from Bangladesh Bank data archive using following URL https://www.bb.org.bd/en/index.php/econdata/index

the model constant, and ε is the error of the model.

Risk-Adjusted Return Measurement Techniques

In addition to risk, risk-adjusted return is also identified in this study. Here, the Sharpe ratio and Treynor ratio are used as risk-adjusted return measures of mutual funds following Nafees et al. (2011) and Ahmed & Siddiqui (2019). They argued that risk-adjusted return is crucial to measure the performance of mutual funds. A brief description of these risk-adjusted return measures is given below.

Sharpe Ratio

The Sharpe ratio is often used to rate mutual funds based on their level of risk (Sharpe, 1964). Sharpe ratio quantifies the fund's excess return per unit of its total risk. The formula to compute the ratio is below (Hasan, 2017).

$$Sharpe\ Ratio\ (SR) = \frac{r_{i,t} - r_{f_{i,t}}}{\sigma_{i,t}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (iv)$$

Here, i stands for fund, t stands for time, f is the risk-free rate, r is monthly return, σ is the standard deviation, which measures the total risk.

Treynor Ratio

The Treynor ratio employs beta as a measure of risk. Treynor ratio quantifies the fund's excess return per unit of its systematic risk. The formula to compute the ratio is below (Elton & Gruber, 1997).

$$Treynor\ Ratio\ (TR) = \frac{r_{i,t} - R_{f_{i,t}}}{\beta_{i,t}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (v)$$

Here, i stands for fund, t stands for time, f is the risk-free rate, r is monthly return, β is the standard deviation which measures the systematic risk.

Macroeconomic Factors

Previous authors (e.g., Dash & Kumar, 2008; Qureshi et al., 2019) identified that macroeconomic factors influence the risk and return of mutual funds. Therefore, this study selected 6 (six) macroeconomic variables, i.e., deposit rate, amount of exports, import payments, GDP growth rate, remittance, and broad money (M2), to find their impacts on the risk and return. A brief description of these macroeconomic factors is given below:

Deposit Rate

The rate at which a bank or other financial institution rewards depositors against the money deposited in bank accounts is known as the deposit rate. Osamwonyi & Osagie (2012) find a significant influence of deposit rates on mutual funds.

GDP growth rate

Gross domestic product (GDP) quantifies the monetary worth of all final products and services produced in a nation over a certain time frame and sold to consumers (Kariuki, 2014). Previous authors (e.g., Hussain, 2017) find a significant relationship of GDP with the performance of mutual funds. However,

others (e.g., Osamwonyi & Osagie, 2012) evidenced that GDP has an insignificant influence on the mutual funds' performance.

Money Supply

Currency in circulation, demand deposits, savings and time deposits held by people and corporations, and other monetary aggregates comprise broad money. Osamwonyi & Osagie (2012) and Singh et al. (2011) discover the significant relationship of broad money supply with the performance of mutual funds.

Amount of Export

The proceeds of selling products or services produced in one nation to the consumers of another nation are referred to as the amount of exports. Imsar, Tambunan, Silviani, & Harahap (2022) find that exports significantly influence the Islamic Mutual fund.

Import Payment

The amount paid to buy goods and services from one country to another where it is initially consumed is called import payment.

Remittance

When someone working overseas sends money back to their near and dear ones in their home country, this transaction is known as a remittance.

From the above discussion, it is said that the selected macroeconomic factors are considered the most influential factors that could influence the risk and risk-adjusted return of Bangladeshi mutual funds. However, previous studies do not explicitly examine the effect of macroeconomic factors on mutual fund risk and risk-adjusted return. Thus, this area demands in-depth investigation.

Data Analysis Methods

At first, the 'Two-step data normalization method' is followed to normalize the data where in the first step, fractional rank is computed then data is normalized using the Inverse Document Frequency (IDF) formula. By using Kolmogorov-Smirnova test, it is found that data is normally distributed and data set does not suffer from multicollinearity problem which is confirmed by performing Variance Inflation Factor (VIF) test, Breusch-Pagan Test for Heteroscedasticity identify that there is no error term in data, and finally, Durbin- Watson test confirmed that there is no autocorrelation problems in the data set. After that, the Breusch-Pagan Lagrange Multiplier test results and the Husman test confirmed that the random effect model is more plausible for conducting the panel data analysis (Kothari, 2015; Dougherty, 2011).

This study also applied panel data analysis because it has a time dimension and a cross-sectional dimension (Hsiao, 2007). Based on the data, panel data regression follows this basic formula (Kothari, 2015; Dougherty, 2011).

$$Y_{i,t} = \beta_0 + \beta_1 X_{1_{i,t}} + \beta_2 X_{2_{i,t}} + \ldots\ldots\ldots\ldots\ldots\ldots + \beta_k X_{k_{i,t}} + \varepsilon_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots (vi)$$

Here, *i* stands for fund units, *t* is time; Y stands for dependent variable; β is coefficients; X_1, X_2, and X_k are the independent variables 1, 2, and k, respectively; and ε is the error term.

In this study, four (4) sets of panel regression equations have been developed to examine the effects of macroeconomic factors on risk and risk-adjusted return, which are given below-

$$SD_{it} = \beta_0 + \beta_1 DR_{it} + \beta_2 EXP_{it} + \beta_3 IMP_{it} + \beta_4 GDPGR_{it} + \beta_5 BM_{it} + \beta_6 REM_{it} + \varepsilon_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (vii)$$

Where *SD* stands for standard deviation, which is the dependent variable. Moreover, *DR* is the deposit rate, *EXP* stands for exports, *IMP* is import payments, *GDPGR* is the gross domestic product growth rate, *BM* is broad money, and *REM* is remittance, treated as independent variables. Also, *i* stand for unit of fund (mutual fund), *t* is time, β is coefficient and ε is the error terms.

$$BE_{it} = \beta_0 + \beta_1 DR_{it} + \beta_2 EXP_{it} + \beta_3 IMP_{it} + \beta_4 GDPGR_{it} + \beta_5 BM_{it} + \beta_6 REM_{it} + \varepsilon_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (viii)$$

Here, *BE* is the beta and the rest of the components are the same as equation *vii*.

$$SR_{it} = \beta_0 + \beta_1 DR_{it} + \beta_2 EXP_{it} + \beta_3 IMP_{it} + \beta_4 GDPGR_{it} + \beta_5 BM_{it} + \beta_6 REM_{it} + \varepsilon_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (ix)$$

Here, *SR* is the Sharpe ratio and the rest of the components are the same as equation *vii*.

$$TR_{it} = \beta_0 + \beta_1 DR_{it} + \beta_2 EXP_{it} + \beta_3 IMP_{it} + \beta_4 GDPGR_{it} + \beta_5 BM_{it} + \beta_6 REM_{it} + \varepsilon_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (x)$$

Here, *TR* is the Treynor Ratio and the rest of the components are the same as equation *vii*.

Results and Discussions

This section discusses the descriptive statistics, correlation matrix and regression analysis of panel data using the random effect model. After that, additional regression analysis is performed as a robustness test to justify the results of the random effect model.

Descriptive Statistics

Table 1 shows that the standard deviation (SD), total risk measure, has a mean value of 0.0782. The upside and lower side deviation is 0.0312, and the maximum and minimum values are 0.0245 and 0.1808. Beta has a mean value of 0.7324, and the standard deviation is 0.6004. The maximum and minimum values of beta are 2.7055 and -1.2423. the risk-adjusted return Sharpe ratio with a mean value of -0.6036 and a standard deviation of 0.9837. The maximum and minimum values are 2.6343 and -3.8428. The Treynor ratio has a mean value of -0.1064, and the upside and lower side deviation is 2.2426. The maximum and minimum values are 7.2791 and -7.4930.

Table 1: Descriptive Statistics

	No. Obs.	Mean	Std. Dev	Minimum	Maximum
Standard Dev.	1944	0.0782	0.0312	0.1808	0.0245
Beta	1944	0.7324	0.6004	-1.2423	2.7055
Sharpe Ratio	1944	-0.6036	0.9837	-3.8428	2.6343
Treynor Ratio	1944	-0.1064	2.2426	-7.4930	7.2791
Deposit Rate	1944	4.85	0.5714	3.4412	6.2820
Export	1944	3431.23	778.54	1508.54	5372.46
Import Payment	1944	4930.93	1184.60	2005.39	7884.70
Remittance	1944	13348.60	3235.36	5358.50	21415.72
Broad Money (M2)	1944	1637475.09	300289.69	893441.73	2308679.88
GDP Growth Rate	1944	6.4671	1.0933	3.7672	9.1931

Notes: This table shows descriptive statistics which includes no. of observation, mean, standard deviation, minimum and maximum value for all variables using monthly data from January 2017 to December 2022 for 27 mutual funds. Here, GDP and broad money are converted to monthly data from yearly data using Denton method (Bikker, Daalmans & Mushkudiani, 2010).

Table 1 also shows the descriptive statistics of macroeconomic factors. Here, monthly mean deposit rate is 4.85%. Moreover, export and import have monthly mean values of 3431.23 and 4930.93 million dollars, respectively. This indicates that there is a trade deficit in Bangladesh. Moreover, the monthly mean of remittance is 13348.60 million dollars which can support balancing the trade deficits. Lastly, the GDP growth rate has a monthly mean value of 6.4771%.

Correlation Matrix

The correlation matrix shows the interrelation between two variables. Table 2 shows that there is a statistically significant relationship exists between each of the risk measures (SD and Beta) with macroeconomic factors. Moreover, a statistically significant relationship exists between risk-adjusted return measures (Sharpe ratio and Treynor ratio) and macroeconomic factors. The correlation matrix primarily indicates that macroeconomic factors are related to risk and risk-adjusted return measures. Additionally, this correlation matrix shows little chance of a multicollinearity problem as none of the pairs shows a correlation coefficient of more than 0.80 (Bohrnstedt & Carter, 1971).

Table 2: Correlation Matrix

	SD	BETA	SR	TR	DR	EXP	IMP	REM	BM	GDP
SD	1.00									
BETA	0.46***	1.00								
SR	0.34***	0.15***	1.00							
TR	0.17***	0.08***	0.66***	1.00						
DR	-0.11***	0.20***	-0.14***	-0.06**	1.00					
EXP	-0.09***	-0.23***	0.02	0.02	-0.50***	1.00				
IMP	-0.08***	-0.29***	0.02	0.05**	-0.53***	0.78***	1.00			
REM	0.10**	-0.22***	0.08***	0.02	-0.36***	0.47***	0.40***	1.00		
BM	-0.01	-0.28***	-0.02	-0.06***	-0.51***	0.60***	0.60***	0.77***	1.00	
GDPGR	-0.04*	-0.01	0.05**	0.05**	-0.22***	0.15***	0.23***	-0.28***	-0.26***	1.00

, **, * indicate statistical significant at the 5%, 1% and 0.1% level, respectively.*

Notes: This table is the Pearson correlation coefficient using monthly data of 27 conventional mutual funds collected from January 2017 to December 2022. Here SD stands for Standard Deviation, Beta is systematic risk, SR is Sharpe Ratio, TR is Treynor Ratio, DR is Deposit Rate, EXP is Exports, IMP is Import Payments, REM is Remittance, BM is Broad Money and GDPGR is Gross Domestic Product Growth Rate.

Results of Regression Analysis

The diagnostic testing of panel data analysis is performed before conducting the research. At first, it is found that data is normally distributed, which is confirmed by performing the Kolmogorov-Smirnova test. Results show that all variables have a p-value of 0.20 or above, which is higher than a 0.05 significance level (Berger & Zhou, 2014). There is no multicollinearity among the independent variables because all variables have a value of less than 10, and the VIF mean value is 2.64, which is also less than 10 (Schroeder, Lander, & Levine-Silverman, 1990). There is no heteroscedasticity problem among the variables, which is performed by using the Breusch-Pagan/Cook-Weisberg test because the p-values are higher than 0.05 significance level (Glejser, 1969). Finally, the result of the Durbin-Watson test explains that there is an autocorrelation problem in data because all variables have a value between 1.50 to 2.50 (Hasan & Islam, 2023).

To determine the appropriate model for panel data analysis, the pooled ordinary least square method (OLS), the fixed effect, and the random effect models are three important techniques. This research applies the Breusch-Pagan Lagrange Multiplier Test and Hausman Test. Breusch-Pagan Lagrange Multiplier Test identifies an appropriate model between pooled OLS and random effects methods. Results show that the p-value of this method for all models is less than 0.05 significance level, which indicates that the pooled OLS method is inappropriate but random effects model is appropriate for this research. Then to choose an appropriate model between random effect model and the fixed effect model, the Hausman test is performed. The results of the Hausman test show that the random effect method is appropriate for this panel data analysis because the p-value for all models is higher than the 0.05 significance level, which indicates to rejection of the fixed effect model (Nguyen & Nguyen, 2019).

The random effect model is utilized following the Breusch-Pagan Lagrange Multiplier and Husman tests (Kothari, 2015; Dougherty, 2011). Overall regression analysis results show that macroeconomic factors influence the risk-adjusted returns of Bangladeshi mutual funds (Table 3). The result for panel data regression using the random effect model is given in the following Table 3:

Table 3: Results of Regression Analysis Using Random Effect Model

	Model-01	**Model-02**	**Model-03**	**Model-04**
	Standard Dev. (T- Value)	**Beta (T- Value)**	**Sharpe Ratio (T- Value)**	**Treynor Ratio (T- Value)**
Deposit Rate	-0.014***	0.026	-0.383***	-0.426***
	(-10.299)	(0.948)	(-7.678)	(-3.715)
Export	-0.00001***	0.00001*	-0.000	-0.000
	(-4.409)	(1.724)	(-0.542)	(-0.247)
Import	-0.00001**	-0.00001***	0.000	0.00001***
	(-1.966)	(-5.989)	(0.217)	(3.507)
Remittance	0.00001***	-0.000	0.00001***	0.00001***
	(8.981)	(-1.327)	(6.582)	(5.138)
Broad Money	-0.00001***	-0.00001***	-0.00001***	-0.00001***
	(-6.176)	(-3.518)	(-6.808)	(-7.642)
GDP Growth Rate	-0.001*	-0.005	-0.013	-0.093
	(-1.918)	(-0.389)	(-0.508)	(-1.602)
Constant	0.191***	1.593***	2.085***	3.892***
	(14.951)	(6.321)	(4.661)	(3.785)
R^2	0.2820***	0.2018***	0.1528***	0.2347***
Chi^2	216.83***	249.71***	107.88***	69.66***
Obs.	1944	1944	1944	1944

, **, * indicate statistical significant at the 5%, 1% and 0.1% level, respectively.*

Notes: This table shows the result of the random effect model for panel data analysis using monthly data of 27 conventional mutual funds prepared from January 2017 to December 2022. Here, columns present risk measures (standard deviation, beta) and risk-adjusted return measures (Sharpe ratio and Treynor ratio) which are used as dependent variables of the regression equations. Moreover, rows present macroeconomic factors which are used as independent variables of the regression equations.

Model 1 of Table 3 shows that all macroeconomic factors have a statistically significant negative relationship with standard deviation, except remittances, which has a significant positive relationship with standard deviation. This indicates that overall, macroeconomic factors influence the total risk of mutual funds.

For beta (Model-02), the coefficients of exports and import payments have a statistically significant positive relationship with beta. However, broad money has a statistically significant negative relation with beta. Furthermore, the deposit rate, remittances, and GDP growth rate have a statistically insignificant relationship with beta. Overall beta results indicate mixed evidence regarding the impact of macroeconomic factors on the systematic risk of mutual funds.

In the case of risk-adjusted return, the coefficients of deposit rate and broad money have a statistically significant negative relationship with the Sharpe ratio (Model 3, Table 3). However, remittances have a statistically significant positive relationship with Sharpe ratio. Moreover, exports, import payments and the GDP growth rate have a statistically insignificant relationship with Sharpe ratio. Therefore, there is mixed evidence about the impact of macroeconomic factors on Sharpe ratio or performance of mutual funds..

Model 04 of Table 3 shows that the coefficients of import payments and remittances have a statistically significant positive relationship with the Treynor ratio; however, deposit rate and broad money supply have a statistically significant negative relationship with the Treynor ratio. Furthermore, exports and GDP growth rates have a statistically insignificant relationship with the Treynor ratio. Overall, the findings suggest that macroeconomic factors impact the Treynor ratio or risk-adjusted performance of mutual funds.

Therefore, it is argued that macroeconomic factors generally impact the risk and risk-adjusted return of Bangladeshi mutual funds. These findings are aligned with the previous studies conducted other than Bangladeshi mutual funds (e.g., Kariuki (2014); Singh et al. (2011); Hussain (2017); Humpe & Macmillan, (2009); Imsar et al. (2022)).

Robustness Analysis

In this section, robust random effects model of panel data analysis is performed in addition to the random effect model to check the authenticity of the results that are shown in the previous section. The results of robust random effects model (Table 4) are similar to the random effect model (Table 3). The results of robust panel data regression are given in the following Table 4:

Table 4: Results of Regression Analysis Using Robust Random Effects Model

	Model-01	**Model-02**	**Model-03**	**Model-04**
	Standard Dev. (T- Value)	**Beta (T- Value)**	**Sharpe Ratio (T- Value)**	**Treynor Ratio (T- Value)**
Deposit Rate	-0.014***	0.026	-0.383***	-0.426***
	(-5.68)	(0.31)	(-12.25)	(-3.57)
Export	-0.00005***	0.00004*	-0.00003	-0.00003
	(-7.62)	(1.65)	(-0.88)	(-0.29)

Import	-0.00001*	-0.00011***	0.000	0.00026***
	(-1.70)	(-5.55)	(0.30)	(4.03)
Remittance	0.00002***	-0.00007	0.00007***	0.00013***
	(6.32)	(-0.76)	(6.84)	(5.62)
Broad Money	-0.00001***	-0.00002**	-0.00009***	-0.00002***
	(-4.79)	(-2.24)	(-7.83)	(-9.37)
GDP Growth Rate	-0.001	-0.005	-0.013	-0.093
	(-0.92)	(-0.23)	(-0.75)	(-1.47)
Constant	0.191***	1.593**	2.085***	3.892***
	(8.11)	(2.26)	(8.20)	(3.59)
R^2	0.1820***	0.1918***	0.1728***	0.2323***
Chi^2	30.01***	34.94***	21.16***	15.63***
Obs.	1944	1944	1944	1944

Note:,**,*** indicate statistical significant at the 5%, 1% & 0.1% level, respectively.*

Notes: This table shows the results of robust random effects model using monthly data of 27 conventional mutual funds collected from January 2017 to December 2022. Here, columns present risk measures (standard deviation, beta) and risk-adjusted return measures (Sharpe ratio and Treynor ratio), which are used as dependent variables of the regression equations. Moreover, rows present macroeconomic factors which are used as independent variables of the regression equations.

Conclusion

The purpose of the study is to identify the risk and risk-adjusted return of mutual funds and show the effect of macroeconomic factors on the risk and risk-adjusted return of mutual funds in Bangladesh. The monthly closing price data for 27 mutual funds out of 37 mutual funds of the Dhaka stock exchange are collected to utilize this study. During the data collection period, 10 mutual funds were excluded because those funds were established after 2017. Though the data collection period started in December 2015, the monthly returns are calculated from January 2016 to December 2022. Using the monthly return, the variables, i.e., standard deviation, beta, Sharpe ratio, and Treynor ratio, are calculated from January 2017 to December 2022 using the 12-month rolling window method. Furthermore, six macroeconomic factors, such as deposit rate, export, import, remittance, broad money, and GDP growth rate, are considered for this study. The GDP growth rate and broad money supply are yearly data, but they are converted to monthly data by applying the proportional Denton method "*dentonmq'* using the EViews software.

The random effect model of panel data analysis is applied to identify the effects of macroeconomic factors on risk and risk-adjusted return. The result shows that the macroeconomic variable deposit rate has a negative effect on standard deviation (total risk) but is insignificant with beta (systematic risk). Export has a significant negative effect on total risk and a positive with systematic risk. Import

payments have a statistically significant negative effect on total risk and systematic risk. Total risk is statistically significant, but the systematic risk is insignificant with remittance. Broad money has a statistically significant negative relation with total risk and systematic risk. And lastly, the GDP growth rate has a significant effect on total risk but is insignificant with systematic risk.

It also has been found that deposit rate has a significant relationship with risk-adjusted performance Sharpe ratio and Treynor ratio. On the other hand, export has a statistically insignificant effect on risk-adjusted return. Import payment is also statistically insignificant with the Sharpe ratio and significant with the Treynor ratio. On the other hand, remittance has a statistically significant positive relation with risk-adjusted performance. Broad money also has a significant negative effect on the Sharpe ratio and Treynor ratio. At last, the GDP growth rate has a statistically insignificant relation with the Sharpe and Treynor ratios. Therefore, fund managers and investors in Bangladesh can benefit from the results of this study and be able to identify the effects of macroeconomic factors on the risk and risk-adjusted return.

In the future, anyone who wants to study the risk and risk-adjusted return of mutual funds can use other macroeconomic factors like exchange rate, inflation, etc., to identify their effect on the risk and risk-adjusted return. Furthermore, future researchers and practitioners may also apply the 12-month rolling window method to compute the risk and risk-adjusted return to get the best picture. Finally, panel data analysis methods could be applied to capture the effects of both time and units to get the best scenario on the effects of macroeconomic and microeconomic factors on mutual fund risk and return. Future researchers can also include the weekly or daily data to make the study and increase the period from 10 to 20 years. Researchers may also replicate the model of this study in other areas of stock market analysis.

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