MODERATING EFFECT OF FUND SIZE ON THE RELATIONSHIP BETWEEN PORTFOLIO DIVERSIFICATION AND EFFICIENCY OF MONEY MARKET FUNDS IN KENYA

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Abstract
Recent increases in market volatility, economic uncertainty and geopolitical tensions, have magnified investment risks. Therefore, fund managers need to adopt successful investments strategies and efficient operations so as to manage risks and protect investors' interest. Portfolio diversification as an investment strategy would facilitate the creation of an optimal portfolio resulting in fund efficiency. However, fund size influences resources availability, managerial compensation and operation costs which would affect a fund's ability to create well diversified portfolios and eventually a fund efficiency. Thus, the main objective of this study was to investigate the moderating effect of fund size on the relationship between portfolio diversification and fund efficiency. The study was anchored on modern portfolio theory, capital asset pricing theory, and economies of scale principle. Secondary data was collected from 25 money market funds (MMFs) over the period 2018 to 2024 yielding 122 fund year observations. Descriptive statistics were used to summarize fund characteristics. Inferential statistics and panel data regressions were utilized for testing of statistical hypotheses. A two-stage analysis was adopted whereby in the first stage, efficiency scores were computed using Data Envelopment Analysis and in the second stage, Generalized Method of Moment was used to determine the dynamic relationship among study variables. The findings revealed that, over the study period, MMFs were not 100% efficient. Further, portfolio diversification had a significant positive effect on fund efficiency (β=0.520, p-value<0.05). Fund size had a statistically significant moderating effect on the relationship between portfolio diversification and efficiency (β=0.522, p-value<0.05). The results implied that small funds are better placed in creating well diversified portfolios and achieving efficiency. The study recommends that fund managers should create well-diversified portfolios so as to maximize fund efficiency. Funds should operate at size whereby it is easy to manage and allocate resources and to keep operations at a low cost in order to achieve efficiency.

Key words: portfolio diversification, efficiency, fund size, assets under management, money market, unit trust funds, scale of operations.

Introduction

Recent increases in market volatility, economic uncertainty and geopolitical tensions, have magnified risks involved in investment. Therefore, fund managers need to adopt successful investments strategies and efficient operations so as to manage risks and protect investors' interest. Portfolio diversification as an investment strategy involves managing a portfolio by spreading investment among various assets, resulting in high returns at a reduced risk level (Jayeola *et al*., 2017). Thus, for a fund diversification is an important strategy in enhancing efficiency by managing risks and reducing transaction costs to obtain higher returns for investors (Kinini et al., 2023). However, Banko *et al.* (2010) pointed out that the size of a fund influences its investment objectives, transaction costs and eventually performance. Fund size refers to the total value of assets a fund has to manage (Basso & Funari, 2017). Growth in assets under management could be as a result of either increase in value of assets held in the fund or increase in flow of money from investors (Rao *et al*., 2017). Fund size influences the resources available for investment, ability to create optimal portfolios, speed of portfolio adjustment, managerial compensation and operation costs which eventually affects a fund's efficiency (Garcia *et al*. 2016; Pastor *et al*. 2018). Chen *et al*. (2003) noted that fund size determines the managers' ability to allocate monetary resources in assets, investment strategy and investment costs of a fund Therefore, the size of assets under management of a fund can influence the amount of resources available for spreading among various assets, transaction costs and costs involved in monitoring the portfolio which could either promote or hinder efficiency.

Various theories establish the link between portfolio diversification, fund size and efficiency. Modern portfolio theory (MPT) by Markowitz (1952) explains that through diversification, it is possible to construct an optimal portfolio that maximizes the expected rate of return for a given risk level thereby translating to fund efficiency. Economies of scale concept by Silberston (1972) argues that the average cost per unit of output decreases as a firm expands it activities. Hence, as a fund increases in size it should experience low cost in portfolio management which could enhance the fund efficiency. Similarly, Pastor *et al*. (2018) found that large funds can spread their resources across a wide variety of assets, potentially providing their investors with the benefits of diversification and low costs hence resulting to efficiency.

. However, small funds may have more concentrated portfolio due to access to a lesser number of resources. Further, Mentel and Horváthová (2016) noted that large funds can benefit from the advantages of economies of scale since management cost remain relatively constant as fund size increases.

On the other hand, Hu *et al*. (2014) claimed that the benefits of diversification can disappear when funds hold too many assets due to increased monitoring costs. Nguyen *et al*. (2018) and Pablo *et al*. (2020) noted that small funds are more efficient than large funds which could be attributed to low costs and flexibility in change of investment strategies allowing them to respond quickly to new investment opportunities. Farid and Wahba (2022), noted that large funds experience poor performance resulting from diseconomies of scale and due to inability of fund managers to efficiently allocate large amount of funds flow. Moreover, large new inflows dilute the overall performance of the fund because fund managers may not efficiently invest the new available cash (Garcia *et al*., 2016). Similarly, Yadav (2018) pointed out that funds are reluctant to diversify as they grow in size and tend to invest in the same securities, they already own and this limitation erodes performance. Past studies present mixed results on the relationship between portfolio diversification, fund size and efficiency of funds. Despite global evidence, limited research exists on how fund size influences the relationship between portfolio diversification and efficiency of money market unit trust funds in Kenya.

In Kenya, MMFs are the most dominant funds and have experienced a dramatic increase in size of assets under management held by MMFs by 383.9% from sh 51 billion in 2018 to sh 246.8 billion in 2024. According to Capital Market Authority Report (CMA), 2023, the growth can be attributed to heightened interest by investors in MMFs largely attributed to advertising by fund managers. Due to the rapid growth of MMFs and considering managerial compensation is tied to assets under management, concerns are high among stakeholders, whether the funds are being managed efficiently. Operational efficiency is a crucial determinant of the long-term success and survival of funds. Efficient funds can achieve optimal outcomes such as high returns, low costs, better risk management and outperformance of benchmarks while inefficiency implies poor resource allocation, increased costs, poor risk management and low returns (Ruslan *et al*. 2018; Zafar, *et al* 2012). One of the perceived advantages of MMFs is the presence of economies of scale resulting from fund size, such that as the size of the fund increases it experiences low costs of operation. However, studies have reported inconsistent results with economies of scale concept and most of the studies have been done on the direct effect of size on fund efficiency (Basso & Funari, 2017; Farida & Wahba, 2022) but less attention has been expended on when size alters the relationship between diversification and fund efficiency. From the study findings, fund managers will be able to know if the size of the fund influences the relationship between portfolio diversification and efficiency. Also, how size of assets under management influences the efficiency of money market funds. The research findings will contribute to the existing theoretical and empirical body of knowledge. Therefore, this study sought to evaluate the moderating effect of fund size on the relationship between portfolio diversification and efficiency of money market unit trust funds in Kenya.

Methodology

Research Design

The study adopted a multi-dimensional research design that involved causal and longitudinal research designs. A causal design was used to infer the cause effect relationship of the moderating effect of fund size on the relationship between portfolio diversification and efficiency. A longitudinal design was adopted because it involved collecting data from all the money market unit trust funds in Kenya across 7 years to capture the long-term effects and dynamic relationship of the study variables.

Population of the Study and Sampling Procedure

The target population for the study comprised of money market funds approved by the Capital Market Authority (CMA). As at December 2024, there were 29 registered money market funds in operation in Kenya. Filtering process was done to include only those funds that met the selection criteria in the sample. Consequently 4 funds were excluded due to missing data and lack of consistent reporting. Thus, 25 MMFs were included in the study and a census approach was adopted due to the small number of funds. Money market unit trust funds were the preferred study population because they are the most popular unit trust funds in Kenya and have experienced remarkable growth since inception.

Research Instrument

This study relied on secondary data from audited financial reports of money market funds, CMA annual reports and Collective Investment Schemes (CIS) annual reports. A data collection sheet was used as the instrument for collecting data. The instrument was designed to capture relevant aspects of the variables of study such as return, unit holders' balances, operational expenses, amount of funds invested in each asset in the portfolio, total value of asset under management. Validity and reliability of data was ascertained by obtaining data from authentic sources such as CMA, CIS and MMFs website. Money Market funds are required to submit audited annual reports to the regulator (CMA) containing a summary of financial activities and performance of MMFs. This encourages accuracy and timeliness of the data presented in the financial reports. Further, financial reporting, valuation of assets and performance measurement of MMFs is in accordance to CIS regulation of 2001 and 2013 this promotes standardization of the reports and ensures consistency in the annual report preparation across UTFs.

Data Collection
The study employed secondary data obtained from download requests of the CMA and respective money market fund websites. Secondary data was appropriate especially for longitudinal studies that involve describing trends or examining relationships among variables across time (Pederson *et al*., 2020). A document analysis was done on the audited annual financial reports for a period of seven years from 2018 to 2024. The study period was selected because it captures a period of rapid growth for MMFs, regulatory changes and significant macroeconomic events that would affect the functioning of MMFs.

Data Analysis
Data analysis involved descriptive statistics and inferential statistics. A two-stage analysis was adopted whereby first, efficiency scores of the MMFs were computed using the DEA methodology. Secondly, panel data regression analysis was used to determine the, moderating role of fund size on the relationship between portfolio diversification and efficiency of MMFs. In the presence of endogeneity bias, a dynamic panel model Generalized method of Moments (GMM) was used to estimate the parameter coefficients. A significant correlation between the error term and the regressors was used to establish the presence of endogeneity in the data. The GMM model controls for endogeneity bias, serial correlation and heteroscedasticity through transformations and use of instrument variables. Specifically, system GMM model by Arellano and Bover (1995) and Blundell and Bond (1998) was used to analyze data and draw inferences about the relationship that exists among the variables. The validity of system GMM model estimation was determined by Arellano and Bond (1991) test for second order serial correlation of the disturbances. Also, Hansen and Sargan test for overidentifying restrictions were used to check for the validity of instrument variables. The research hypotheses were tested at 5% level of significance using t statistics and probability values in order to make inferences and conclusions. Data analysis was done using STATA version 18 software.

Efficiency Estimation using Data Envelopment Analysis
Data Envelopment Analysis a non-parametric, linear programming model was used to compute the efficiency scores of money market funds. Specifically, the input-oriented, Banker Charnes and Cooper (BCC) model that assumes variable returns to scale (VRS) was adopted. The input- oriented approach indicates how much a firm can minimize it's input for a given level of return. The DEA model is considered as a superior tool for evaluating efficiency because first, it does not require the assumption of an underlying functional form relating inputs to outputs. Secondly, it incorporates multiple inputs and outputs that can be expressed in different units of measurement. The inputs selected for the study were risk as measured by standard deviation, operational expenses and unit holders' balance while output was annual return obtained by the fund. The efficiency score ranges from 0 to 1 whereby an efficiency score of 1 implies that the fund is 100% efficient while a score of less than 1 implies the fund is relatively inefficient.

After obtaining the efficiency scores, the second stage of analysis involved regressing the efficiency scores with the explanatory variables. However, directly regressing DEA efficiency scores on explanatory variables can result in unreliable results and incorrect statistical inference. Therefore, to correct the bias and dependence in DEA efficiency scores, a bootstrapping procedure of 2000 replications was done. Simar and Wilson (1998) proposed a bootstrapping approach to correct the inherent bias in DEA procedure and estimate confidence intervals for the efficiency scores resulting to biased corrected efficiency scores. Fitting the biased corrected efficiency scores into the regression model leads to the estimation of more accurate standard errors for the regression coefficient and reliable statistical inferences.

Measure of Variables
The study employed several key variables to assess fund performance, with each variable measured using established methods from prior empirical research. The operational definitions and corresponding reference studies are summarized in Table 1.

Table 1: Measure of variables

Variable	Measure	Related Studies
Fund size	Natural log of total assets under management (Log AUM)	Nguyen *et al*. (2018) Singh and Tando (2021)
Portfolio Diversification	Modified Herfindahl -Hirschman Index $1-\sum_{i=1}^{n} W_i^2$	Adem (2022) Rodriguez (2018)
Efficiency	Efficiency score by DEA $\frac{\text{Weighted sum of output}}{\text{Weighted sum of input}}$	Abate (2021) Galagadera and Silvapulle (2002)
Output	Annual Return $[\frac{NAV_t - NAV_{t-1} + Income}{NAV_{t-1}}]^{\chi}100$	Bodie *et al.* (2024)
Inputs	Risk as measured by standard deviation, $\sigma_i = \sqrt{\frac{\sum_{t=1}^{n}(R_t - \bar{R})^2}{n}}$ Operational expenses and unit holders' balances	Murthi *et al* (1997) Riley and Brown (2000) Baghdadabad *et al.* (2013)

Dynamic Panel Model Specification

Dynamic panel regression models capture the persistence in behavior of outcome variable and the contemporaneous relationship of the explanatory variables (Piper, 2014). Past studies by Garcia and Vidal (2021), Cohen *et al.* (2019), Tripathy (2017) and Budiono (2009) contend that funds exhibit persistence in efficiency. Moreso, the study involved collecting data from 25 money market funds for 7 years hence meeting the GMM specification of small T and large N (N>T). The GMM model incorporated a lagged value of efficiency score as an explanatory variable to account for the possibility that past efficiency can influence the current level of efficiency. The study adopted the two-step system GMM model for analysis. System GMM improves significantly the estimates' accuracy and enlarges efficiency when the lagged dependent variables are considered as poor instruments in the first-differenced regressors (Greene, 2003; Baltagi, 2002). Moreover, system GMM is more appropriate in the use of unbalanced panel data and gives more robust results than the first difference GMM (Bond *et al*., 2001).

The moderating effect of fund size involved two steps as determined by the following equations. The first step was to run a regression before the moderation effect (Model 1)

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$$VRS_{it} = \beta_o + \beta_1 VRS_{it-1} + \beta_2 DIV_{it} + \mu_i + \varepsilon_{it}$$

…… Model 1

The second step was to expand the equation to include the moderator (fund size) and its interaction term (Portfolio diversification * fund size).

$$VRS_{it} = \beta_o + \beta_3 VRS_{it-1} + \beta_4 DIV_{it} + \beta_5 AUM_{it} + \beta_6 DIV^* AUM_{it} + \mu_i + \varepsilon_{it}$$

……Model 2

Where;

VRS_{it} = Bias corrected efficiency scores of fund i at time t

VRS_{it-1} = Lagged bias corrected efficiency score (dependent variable)

DIV_{it} = Portfolio diversification of fund i at time t

AUM_{it} = size of fund i at time t

$DIV^* AUM_{it}$ = interaction term

$\beta_1 \ldots\ldots \beta_6$ = regression coefficients

Moderation is determined via the interaction between the moderator and the independent variable. The presence of moderation was tested by assessing the significance of the interaction term. If the coefficient of interaction term is significant then moderation is supported. Prior to multiplication of variables of interest and model estimation centering was done. The reason for centering is that the main effect (DIV and AUM) is likely to be highly correlated with interaction term (DIV*AUM) and this will produce estimation problems caused by collinearity, resulting to poor estimates of regression coefficients, large standard errors and reduced power of the statistical test of the interaction (Hayes, 2018). Therefore, centering was done to eliminate the possibility of multicollinearity among the study variables and the interaction term.

Results and Discussion

Descriptive statistics were used to summarize fund characteristics and they included mean, standard deviation, maximum and minimum. Inferential statistics are mainly concerned with estimation of population parameters and testing of statistical hypotheses. Inferential statistics involved correlation analysis and linear regression analysis.

Descriptive Statistics for Inputs and Outputs used in Data Envelopment Analysis

According to the results in Table 2, the overall mean return was 10.465% with a standard deviation of 2.888 implying that the returns on investment portfolios were widely spread out from the mean

Table 2: Descriptive statistics for inputs and outputs used in DEA

Variable	N	Mean	Std. Dev.	Min	Max
Annual return	122	10.465	2.888	3.5	17.7
Unit holders' balances	122	6,285	12,471	5.14	68,182
Operational expenses	122	20.688	39.095	0.045	204,912
Volatility of returns	122	0.687	0.571	0.01	2494

The overall mean for unit holders' balances was Ksh 6.285 billion with a standard deviation of Ksh 12.47 billion suggesting that funds manage diverse unit holders' balances due to new deposits and withdrawals by investors. For operational expenses, an overall mean of Ksh 20.7 million with a standard deviation of Ksh 39.1 million implied that the fund's operational expenses were widely spread out from the mean. The overall mean for risk measure was 0.687 with a standard deviation of 0.571 implying the level of risk was moderately low. The moderate risk could be as a result the investment strategy adopted by fund managers in an effort to reduce the possibility of loss due to variations in returns. Notably, the minimum risk level was 0.01 indicating that the degree of risk for some funds was low. On the other hand, the maximum risk level was 2.494 indicative of high total risk levels probably due to increased firm level volatility.

Efficiency Scores by Data Envelopment Analysis

Table 3 provides a summary for overall technical efficiency score, pure technical efficiency scores, scale efficiency scores and bias corrected efficiency scores.

Table 3: Efficiency scores

Efficiency Score	Mean	Std. dev.	Minimum	Maximum
Overall technical efficiency Score	0.302	0.329	0.002	1
Pure technical efficiency score	0.52	0.375	0.003	1
Scale efficiency score	0.607	0.349	0.004	1
Bias corrected efficiency score	0.468	0.336	0.039	1

As per the results in Table 3, over the seven- year period, the average OTE, PTE and SE scores were less than 1 meaning that MMFs were not 100% efficient. The mean OTE score was 30.2% implying that funds input utilization and scale of operations can be increased by 69.8% to achieve 100% efficiency. The average PTE score was 52% signifying managerial underperformance in input utilization. Thus, the efficiency level can be increased by 48% if managers utilize the fund's resources efficiently. The SE score of 60.7% shows that funds are affected by their size or scale of operations, to achieve 100% efficiency the funds need to adjust their scale of operations by 39.3%. The SE score suggests that funds are either operating at increasing returns to scale or decreasing returns to scale hence there is need to either scale down or increase scale of operations so as to operate at the optimal scale. Upon estimating the bias corrected efficiency sores, the mean declined to 46.8% with a standard deviation of 33.6%. The 46.8% mean efficiency score suggest that for money market funds to achieve 100% efficiency they need to reduce their input utilization by 53.2%. In the second stage of analysis, the study adopted the bias corrected efficiency scores as the dependent variable in the regression analysis.

Descriptive Statistics for Portfolio Diversification and Fund Size

Table 4: Summary of Descriptive Statistics for Portfolio Diversification and Fund Size

Variables	N	Mean	Std. Dev	Min	Max
Portfolio Diversification	122	0.509	0.151	0.000	0.792
Fund Size	122	6,339	12,502	9	68,332

Statistics in Table 4 shows that the mean for portfolio diversification over the study period was 0.509 with a standard deviation of 0.151 indicative of moderately diversified portfolios and differences in the kind of portfolios held the MMFs. The overall minimum of 0.000 revealed that some funds concentrated their investment in one asset, hence potentially exposing the investment to both unsystematic and systematic risk. The overall maximum of 0.792 is an indication that some funds were highly diversified which supports the MMFs investment objective of creating diversified portfolios due to the skills and ability of professional fund managers.

The overall mean for fund size was 6.339 billion with a standard deviation of 12.502 billion signifying that the values for fund size were widely distributed around the mean. Considering the year 2024, the minimum fund size was 9 million whereas the maximum fund size was 68 billion an indication that some funds are small in size whereas others are large as determined by AUM.

Correlation Analysis of Portfolio Diversification, Fund Size and Fund Efficiency

The study sought to investigate the moderating effect of fund size on the link between portfolio diversification and efficiency. A correlation analysis was performed to determine the strength and direction of the linear relationship between the variables. The results are portrayed in Table 5.

Table 5: Pairwise Correlations

Variables	(1)	(2)	(3)	(4)
(1) VRS	1.0000			
(2) VRS (-1)	0.3857***	1.0000		
	(0.0001)			
(3) DIV	0.2259***	0.2037**	1.0000	
	(0.0123)	(0.0454)		
(4) Log AUM	-0.4834***	-0.5710***	-0.0935	1.0000
	(0.0000)	(0.0000)	(0.3058)	

P-values in parenthesis, ***p < .01, **p<.05, *p<1

Results in Table 6 indicate a negative and significant relationship between fund efficiency and fund size (r=-.0.4834, p- value >0.05). A possible indication that as a fund grows in size its efficiency decreases. The relationship between fund size and portfolio diversification was negative but insignificant (r= -0.0935, p-value= 0.3058) an indication that it is possible to isolate the impact of each variable on efficiency. The relationship between fund size and the lagged efficiency score was negative and significant (r= -0.571, p-value <0.05) meaning there is a co-movement but in different directions.

Diagnostic Tests

Diagnostic tests were done to determine whether the assumptions of regression for model 1 and model 2 had been met. They included omitted variable and model misspecification test, multicollinearity, heteroscedasticity, autocorrelation and stationarity tests. The diagnostic tests confirmed that the models were correctly specified, the absence of multicollinearity, heteroscedasticity and autocorrelation. Further all panels were stationarity at level. Hence, it was possible to obtain efficient and reliable results due to the robustness of the estimated models.

Endogeneity Test

Endogeneity problem occurs when one or more of the regressors correlate with the error term. Endogeneity test was done to determine if the residuals are significantly correlated with the explanatory variables. The test results are presented in Table 6.

Table 6: Endogeneity Test

Variables	(1)	(2)	(3)	(4)	(5)	(6)
(1) Residual	1.000					
(2) VRS	0.894***	1.000				
	(0.000)					
(3) VRS (-1)	0.560***	0.386***	1.000			
	(0.000)	(0.000)				
(4) DIV	0.213**	0.226**	0.204**	1.000		
	(0.036)	(0.012)	(0.045)			
(5) Log. AUM	-0.755**	-0.483***	0.571***	-0.093	1.000	
	(0.000)	(0.000)	(0.000)	(0.306)		
(6) DIV*AUM	0.0230	-0.015	0.013	-0.073	-0.025	1.000
	(0.821)	(0.870)	(0.897)	(0.422)	(0.787)	

According to the results in Table 6, significant correlation exists between the residuals and some of the variables at 5% level of significance. Correlation coefficient between the residual and efficiency score was positive and significant (r= 0.894, p value<0.05). Correlation coefficient between the residual and lagged efficiency score was positive and significant (r= 0.56, p-value <0.05). Correlation coefficient between the residual and portfolio diversification was positive and significant (r= 0.213, p-value <0.05). Correlation coefficient between the residual and fund size was negative and significant (r= -0.755, p-value <0.05). The correlation coefficient between the residual and the interaction term was positive but insignificant (r=0.023, p-value <0.000). The existence of a significant correlation between the residuals and the regressors' means there is presence of endogeneity hence it was appropriate to fit a dynamic panel model- GMM that controls for endogeneity.

Dynamic Panel Model

Considering the dynamic nature of funds efficiency, a Generalized Method of Moment model was estimated and the results are shown in Table 7.

Table 7: Generalized method of moment model

	Model 1	Model 2
Efficiency	(GMM-sys)	(GMM-sys)
VRS (-1)	0.1620	0.0579
	(0.076)	(0.2070)
DIV	0.520***	0.5063***
	(0.000)	(0.0040)
Constant	0.088	0.2314**
	(0.243)	(0.0170)
AUM		-0.3700***
		(0.0000)
DIV*AUM		0.5220***
		(0.0050)
Observations	74	74
No. of instruments	6	15
AR1 (p-value)	0.013	0.014
AR2 (p-value)	0.377	0.448
Hansen-J (p-value)	0.193	0.222
Sargan Test (P-value)	0.1901	0.002

p-values in parentheses *p <0.05, ***p< 0.01

The validity of the system GMM for model 1 and model 2 was checked by the test for second order serial correlation AR (2), Sargan and Hansen test. The test for AR (2) yielded a p- values>0.05 implying no presence of autocorrelation in the disturbances of the first difference equation. Both Hansen and Sargan tests for overidentifying restrictions were not significant (p-values >0.05) hence a conclusion was made that the instruments used in the models are valid.

According to the results of system GMM for model 1 that determined the effect of portfolio diversification on fund efficiency, the lagged efficiency score was not significant (β= 0.162, p-value >0.05) meaning that over the sampled period, the past level of fund efficiency does not influence the current level of fund efficiency. Portfolio diversification had a positive and significant effect (β =0.52, p-value < 0.05) implying that as a portfolio gets more diversified fund efficiency increases.

Model 2 was used to determine the moderating effect of fund size on the relationship between portfolio diversification and fund efficiency. From the results, the intercept term was significant (β=0.2314, p-value <0.05), the lagged efficiency score was positive but not significant (β=0.0579, p-value >0.05). Portfolio diversification had a significant positive effect (β=0.5063, p-value<0.05) meaning that diversification strategy was beneficial to the funds because it enhances efficiency. Fund size had a significant negative effect (β=-0.37, p-value <0.05) on efficiency implying that as the size of a fund increases, the efficiency of the fund decreases. Further the coefficient of the interaction term was significant (β=0.522, p value < 0.05) at 5% level of significance. The introduction of the interaction term seems to have lessened the effect of diversification on efficiency of funds. Holding all other factors constant, fund size moderates the relationship between portfolio diversification and level of efficiency of MMFs.

Conclusion

From the findings, the study concluded that portfolio diversification has a significant positive effect on efficiency of money market funds. Thus, as a fund's portfolio gets more diversified its efficiency increases. Empirical results suggest that diversified portfolios facilitate efficiency of funds through optimum utilization of monetary resources to generate maximum returns at a certain level of risk. The study findings align with modern portfolio theory by Markowitz (1952) which underscores the value of risk dispersion in maximizing returns. Consistent with the present finding, Kinini *et al*. (2023) and Jayeola et al. (2017) noted that diversification of funds is associated with lowering overall risk and improving fund's efficiency. However, the finding contradicts that of Hu *et al*. (2014), who reported that diversification strategies negatively impact fund efficiency.

The results on moderation suggest that fund size influences the strength of the relationship between portfolio diversification and fund efficiency. Although, introduction of the interaction term seems to have lessen the effect of diversification on efficiency of funds. This implies that small funds are better placed in creating well diversified portfolios and achieving efficiency while large funds experience difficulties in creating well diversified portfolios which reduces their efficiency. It therefore implies that probably large funds experience liquidity problems, inability to quickly change portfolio composition, increased fees and expenses and scarcity of good investment ideas which translates to inefficiency. Prior studies that relate with the present findings include Farid and Wahba (2022), who observed that large funds may experience poor performance as a result of diseconomies of scale and fund managers' inability to efficiently allocate substantial fund inflows. Nguyen *et al*. (2018) and Pablo *et al*. (2020) noted that small funds are more efficient than large funds and in general, they provide higher returns which his could be attributed to the low costs and flexibility in change of investment strategies. The findings contradict the economies of scale theory and supports the diseconomies of scale concept. Therefore, fund managers security selection advantage may diminish as the fund becomes large while operation and transaction costs increase hence resulting to inefficiency.

Recommendations

Portfolio diversification positively influences the efficiency of funds, fund managers should therefore adopt diversification strategy and evaluate the covariance of the returns of assets held in the fund portfolio in order to achieve a higher risk adjusted return for investors. Given the finding that fund size moderates the relationship between portfolio diversification and efficiency. The results suggest that the ability of funds to construct diversified portfolios and achieve efficiency is influenced by fund size. Therefore, it is recommended that fund managers of MMFs should operate within an optimal size that is easy to create a well- diversified portfolio and less costly to manage. At an optimal size it is less costly to manage the fund and easy to allocate resources and monitor portfolios. Regulators should assess the size and scale of operations of the MMFs by tracking the pattern of net asset value of the fund and performance against its benchmark to find out if the fund's size is suitable for its investment objective and earning capability. These measures can ensure that a fund's size does not become so large to limit its investment strategy or becomes problematic to manage.

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