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A FRAMEWORK OF THREE FAMILIES OF PERFORMANCE MEASURES AGAINST A UNIVERSAL SHARPE MEASURE: KENDALL'S TAU RANK ORDER CORRELATION APPROACH

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ABSTRACT

The first objective of our paper is to formulate a framework of selective performance measures under three groups based on distinct risk levels (Caporin et al., 2014). The second objective is to incorporate the time effects e.g., length of the sampling period, distinct risk classes of mutual funds, etc. and identify if the choice of performance measures is irrelevant proposed earlier (e.g., Eling (2008), Eling & Schuhmacher (2007), Schuhmacher & Eling (2012)). The mean-variance analysis approach and Kendall's tau rank order correlation approach has been deployed across the length of the sample over four distinct time periods to confirm the degree of concordance among Sharpe ratio and alternative performance measures. On the generalized basis, the significant indifferent results do exist among the selective half of the alternative performance measures in relation to assessing the abnormal distributed return pattern.

Disciplinary: Management Sciences (Investment Analysis).

1. INTRODUCTION

In the investment world, the term 'Investment' can be addressed as an activity of compromising the current opportunities over a specific period of time compared to other uncertain opportunities in the future. The investors will happy to invest their part of funds, tied up together as a package, over a specific period of time in order to capture the added benefits in terms of the returns generated by comprising that specific time horizon. This is a human instinct that by nature humans are risk-averse, and for that majority of the investors prefer to go about to avail certain investment options which may offer some compensation against risk. This compensation package is known as a premium against the risk and it is demanded against the reduction in the potential benefits over an investment horizon. None the less, the risk is a general term and when it comes under the finance theory it helps in

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identifying the different portfolios of the investors belongs to specific risk class.

Table 1: Performance Measures selection on the basis of Relative, Absolute, and Density

Categories	Performance Measures	Level of Risk Measures	Author / Year
Relative-based Measures:	*Sharpe:* $SRp = \frac{E(rp)}{\sigma(rp)}$	μ - σ	Sharpe (1966)
	Modified Sharpe: $DS_p = E(rp)/\sigma(rp) \times \sigma Sp^{-1}$	μ – V-a-R	Morey and Vinod (2001)
	Sharpe Information: $IR_p = E(rp)/\sigma(rp) \times (T\,E\ r\,p\,,rB\ )^{-1}$	μ - β	Sharpe (1994)
	Treynor: $Tp = E[rp]/\beta p$	μ - β	Treynor (1965)
	Appraisal: $ARi = [\alpha i\ /\ \sigma(ui)]2$	μ - β	Treynor and Black (1973)
	Reward-to-V-a-R: $RVaRp = E[rp] \times |VaRr\,p\,,a| - 1$	μ – V-a-R	Dowd (2000)
	Gini: $Yip = E[rp] \times (Gp) - 1$; Where; $(Gp) = 1/2\,E[rp]$	μ - GI	Yitzhaki (1982)
	MAD: $ERMAD(Xi,t) = Ex[Xi,t]/Ex[|Xi,t - Ex[Xi,t]|]$	μ – absolute deviation	Konno and Yamazaki (1991)
	Range: $ERR(Xi,t) = E[Xi,t]/MaxX^{T}_{t=1}$-$Min\ X^{T}_{t=1}$	μ - Range	Caporin (2011)
	Calmar: $CR(Xi,t) = Ex[Xi,t]/-D[Xi,t]$	μ - drawdown	Young (1991)
	Sterling: $SR\ (Xi,t\ ;\ w) = Ex[Xi,t]\ \ /\ -1/w\ \sum_{j=1}^{w}\ \ D[Xi,t]$	μ - drawdown	Kestner (1996)
	Burke: $BR\ (Xi,t\ ;\ w) = Ex[Xi,t]\ /(\ -1/w\ \sum_{j=1}^{w}\ \ D[X_{i,t}]^2\ )^{1/2}$	μ - drawdown	Burke (1994)
	Ulcer: $UIPp = [E(rp) - rf\ ] * (UIp)^{-1}$; $UI_{p,t} = [1/t \sum (D_{p,i})^2]^{1/2}$	μ - drawdown	Martin and McCann (1989)
Absolute-based Measures:	*Jensen's Alpha:* $\alpha_p^J = E[r_p - \beta_p] = E[R_p] - [\beta_p E + (1 - \beta_p)R_f\ ]$	μ - β	Jensen (1968)
	Zero-Beta CAPM: $\alpha_p^{ZB} = [E(rp) - E(rz\ )] - [E(rm) - E(rz\ )] \times \beta_{rp}\ ,r_m$	μ – zero β	Black (1972)
Density-based Measures:	*Sortino:* $SORi(\tau) = (rid - \tau)\ /\ \sqrt[2]{LPM_2(\tau)}$	μ - LPM	Sortino and Van Der Meer (1991)
	Omega: $O_p = \frac{GHPMrp\,,\tau\,,\tau\,,1}{GLPMrp\,,\tau\,,\tau,1}$	HPM - LPM	Keating and Shadwick (2002)
	Gain-loss: $GL_p = \frac{[GHPMrp\,,r\,f\,,r\,f\,,1]}{[GLP\ Mrp\,,r\,f\,,r\,f\,,1]}$	HPM - LPM	Bernardo and Ledoit (2000)
	Kappa3: $Kn(\tau) = (rid - \tau)\ /\ \sqrt[n]{LPM_n(\tau)}$	μ - LPM	Kaplan and Knowles (2004)

$|VaR_{r\,p\,,a}|$ = Absolute value indicator

$MaxX^{T}_{t=1}$-$Min\ X^{T}_{t=1}$ = Maximum and Minimum indicator

$X_{i,t}$ = Random Variable

A = Risk Averse Index

$Ex[X_{i,t}]$ = Expected value of Random variable X

r_p ,$r_{f,}$ $r_{B,}$ $r_{,}$ r_m, τ = Portfolio return, Risk-free rate, Benchmark return, Reserve, Market return, Threshold

MAR = Minimum acceptable returns.

$\sigma(r_p)$ = Standard deviation of portfolio return

$VaR_{rp,a}$ = a-value-at-risk of X

β_p = Beta as a measure of sensitivity of portfolio

$\sigma(u_i)$ = Standard error of i^{th} term

$D[X_{i,t}]$ = Drawdown of the random variable i

$[GLPMr_p, \tau, \tau, _1]$ = Generalized lower partial moment of order n with the minimum acceptable threshold τ

$[GHPMr_p, \tau, \tau, _1]$ = Generalized higher partial moment of order n with the minimum acceptable threshold τ

One of the most followed approaches to evaluate the funds' performances has been proposed by Sharpe (1966) which is widely accepted as a reward-to-risk performance measure and known as Sharpe ratio. This ratio is based on the theory of mean-variance because it can be applicable to produced results when the returns of the funds are normally distributed (see, e.g., (Tobin, 1969). The study on the open-end mutual funds has shown results with evidence of the persistence of the Sharpe ratio (Sharpe, 1966). It is hard to come by in assessing the risk associated with the invested portfolios, for instance, under mutual funds it has a distinct risk assessment measures when it is in the form of a single asset class like equity funds or otherwise the larger assets portfolios like income funds, mixed funds, etc.

When the mutual funds are being examined in isolation than the level of risk is higher and the investors demand a heavy premium to get compensated as compared to the larger portfolio of assets. The main objective of the mutual fund portfolio investment is to offset the risk associated with the combination of the two, three investment funds i.e. if the one fund's risk is high compared to rest, the total risk will be minimum with the relatively lower risks investments packages. The funds combined in such a way that it has the potential of compromising the risks to a minimum level and in the more specific term 'diversified'.

During the 1980s, an improved version of risk-adjusted returns measure had taken up the research in evaluating assets classes such as, Sortino ratio (Sortino & Forsey, 1996), which is a variation of the Sharpe index. The distinct feature of that measure is to assess the volatility after treating the negative standard deviation for measuring the respective volatility factor. demonstrates would also point out the fact that the investors should be more concerned about the downside risk and given less weight to upside volatility.

Description: Table 1 represents the selective performance measures pooled up in three separate categories namely relative, absolute and density. These measures have been classified at the respective risk level along with the author and year.

The first objective of our paper is to formulate a framework of selective performance measures aftercare full screening from the past literature and further group them into three categories. Table 1 represents the choice of appropriate performance measures, selected for this study, under three different groups' i.e. absolute, relative and density-based. The second objective of the paper is to

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incorporate the time effects e.g., length of the sampling period, distinct risk classes of mutual funds, etc. and identify if the choice of performance measures is irrelevant proposed earlier e.g. see (Eling and Schuhmacher, 2007, Eling, 2008). The study contributes to the existing body of knowledge by focusing on Kendall's rank-order approach to identify the existence of redundancy among the Sharpe ratio and alternative performance measures. The rest of the paper is consist of following sections i.e., section 2 – discuss about the Sharpe ratio and alternative performance measures being used in this study; section 3- discussed the dataset and the methodology of the study; section 4 – discussed about the study results and their analysis; section 5 – gives the discussion and section 6 – gives the conclusion.

2. LITERATURE REVIEW

The practitioners and the academics have used the various combinations of performance measures for assessing the mutual funds but there is still a gap to identify any individual or a combination of performance measures that can be used in all situations. In terms of investment, one cannot isolate the associate risk with the selected schemes of investment. One of the main reason is probably that there are various other factors that dictate the operationalize version of the risk. Thus, the most relevant performance measure must be that one which strongly associated with the characteristics of the investment schemes and the investor's attitude towards risk.

Sharpe ratio (Sharpe, 1966) made it possible to identify the potential benefits of the portfolio with respect to its underlying risk and the practitioners often used it as a performance measure model. The study by (Ackermann et al., 1999; Liang, 1999; Schneeweis et al., 2002) proposed that the Sharpe ratio means value could be used to rank the managed funds' portfolios. It generally possessed the main pitfalls of the mean-variance model i.e. it underestimates the portfolio total risk as it assumed that the return is Gaussian and where the investors' utility function is non-linear (Amin & Kat, 2003; Geman & Kharoubi, 2003). Also, Treynor (1965) proposed a ratio that established an understanding of how to do an evaluation on basis of proportion of leverage amount employed into the portfolio. The Treynor ratio implied the same understanding as the Sharpe ratio i.e. higher the better but with respect to only systematic risk or beta and not the total risk of the market. (Jensen, 1968) proposed the classical performance measure that evaluates the manager's ability to choose the best possible stocks and form a portfolio. Just as CAPM is delivered a benchmark portfolio, the Jensen's measure assesses the excess returns of the managed portfolio than that of the CAPM one.

Black (1972) proposed a ratio, which related to the market equilibrium under two restrictions. Instead of risk-free assets, he assumed the risk-free borrowing and lending rate. The second one is about taking only long positions on the riskless assets. However, the investor can take both the positions on the riskier assets. This measure gave up the expression that the excess return evaluated by taking the difference of return of the zero-beta portfolio and the benchmark portfolio. The interpretation of the risk by the model is the combination of two portions of risk-one is coming from the proxy of the benchmark portfolio and the other part is the minimum-variance zero-beta portfolio. Other models with the similarity to that of the zero-beta model have incorporated in order to measure the performances of the portfolio after taking into account the tax effect and the investor's own preferences towards the skewed of the expected returns (Brennan, 1970; Leland, 1999).

Under the circumstances where the benchmark portfolio return is not mean-variance efficient. Treynor and Black (1973) had proposed a ratio known as the "Appraisal ratio". The understanding of it is that it explained the optimal individual security deviations from the benchmark holdings. Black and Treynor implied that this appraisal ratio is a reflection of the manager's access to the privately held information which is yet to be reached in the market. The major limitation of the model is that it totally neglected the idiosyncratic risk factor – idealized the unique factors like economic variables and exposure of the portfolio is constant over time.

Yitzhaki (1982) proposed a ratio, which was an alternative mean-variance measure model for evaluating the managed funds, known as the Gini ratio. Moreover, the model proposed by (Konno & Yamazaki, 1991) and Caporin and Lisi (2011) has introduced the performance models that have different risk assessment quantities, known as MAD and Range ratio respectively. Sortino and Satchell (2001) proposed a model, known as 'Reward-to-Lower Partial Moment ratio' that assess the skill level of the managers in terms of risk taken in managing the portfolio. There are other ratios which able to measure the downside deviations from the mean return, which further suggest how much heavy losses occurred for the fund managers (Gergaud & Ziemba, 2012; Kaplan & Knowles, 2004; Martin & McCann, 1989; Sortino & Van Der Meer, 1991).

Connor and Korajczyk (1986) proposed the ratio which is the generalized form of classical CAPM. This model inducted several risk factors before exploring further the performance of the managed fund. The modified version of CAPM has been proposed by researchers to evaluate the portfolio performance, by introducing skewness parameter, co-skewness, and co-kurtosis between the portfolio return and the market returns (Ang & Chua, 1979; Hwang & Satchell, 1998). The conditional model is an extension of the performance measurement proposed by Connor and Korajczyk (1986), which proposed the measure of risk sensitivity of the mutual fund portfolio over time. It includes the conditional betas with respect to the time-varying conditional expected returns. The market timing model is a quadratic regressive model proposed by Treynor and Mazuy (1966), which associated the reward of the manager that how effectively they can capture the market timing in terms of high returns.

Sharpe Information ratio proposed by the study i.e. (Sharpe, 1994), which addressed the tracking error volatility of actively managed portfolios. This measure has implied that in order to estimate the over-under performance of the managed fund one has to compare it with the benchmark portfolio, which demonstrates the investment skill of a manager i.e. if over-performed then the benchmark than it promises a greater reward for the fund manager in shape of excess returns. The gain-loss ratio model is a density-based model that specifically addressed the investment opportunity by taking into account the density of the portfolio returns (Bernardo & Ledoit, 2000). This is a gain-loss ratio of the expected return and can be obtained by dividing the positive moment of the excess returns by the negative moment of the portfolio return.

Dowd (2000) proposed a PM that estimated the excess returns of the fund managers by adjusting it through the a-value-at-risk (a-VaR) of the mean distributed returns of the portfolio. The main critic of the model being proposed by Dowd is that it didn't explain all the four comprehensive characteristics of "good" risk measure i.e. positive homogeneity; sub-additivity; translation

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invariance and monotonicity. However, few of the studies undertaken in the recent past have favored the modified version of VaR, along with the conditional VaR and the MiniMax criterion (Favre & Galeano, 2002).

Omega ratio proposed by Keating and Shadwick (2002), which is the generalized form of Gain-loss ratio, known as Omega measure. The uniqueness of this measure is that it left off the restriction of threshold constraint equal to the risk-free return of the portfolio. However, this measure has limitation as far as return distribution features are concerned. Since the respective features of underlying densities representing the abilities of the manager's ability to extract excess returns or negative returns, so there is the possibility of misspecification and estimation issues. Also, the issue of outliers implied the bias in interpreting the positive excess returns and negative excess returns, which therefore is making the gain-loss ratio sensitive.

3. DATASET AND METHODOLOGY

This section gives detail about the study dataset and the methodology proposed to accomplish relative objectives.

3.1 DATASET

This section is based on the monthly returns of all the mutual funds' categories of Pakistan mutual funds i.e. open-ended, close-ended, pension and Sharia-compliant funds. The data comprises of sample period from 2004 to 2014 of overall composites of different asset classes of 213 mutual funds schemes. In the analysis section, the authors demonstrate the mutual funds' categories' return distribution and the correlation at the categorical level and investment policy level for the entire sample period and the sub-periods as per Figure 1.

The period-1 represents the sample period from (1/2004-12/2006), which demonstrates the bullish trend at the start and ended with a dip, and the relative risk-free rate showed steady upward growth during the whole period-1. Period-2 represents the sample period from (1/2007-12/2008), which demonstrates the financial crisis during the year 2008 that hits the stock exchange of Pakistan. Period-3 represents the sample period from (1/2009-12/2011), which demonstrates the recovery phase of the stock market index and interest-free rates.

Lastly, in period-4 the sample period comprises (1/2012-12/2014), which demonstrates an upward trend in KSE-100 index values with relatively stable interest rate. We analyse the ranking among the performance measures, not only at different risk levels but also on the basis of distributed returns' pattern of all the mutual funds' categories of both the sets of sample periods. It is vital to have two different approaches to taking the sample period and do the comparison among the results mainly to strengthen the study conclusion and for the robustness of the study.

3.2 METHODOLOGY

This section, following the methodology of Caporin and Lisi (2011), proposes further contributions. Firstly, selecting the performance measures after keeping in view different risks classes of assets invested under the mutual fund industry of Pakistan. For instance, when comparing the equity category with the money market, the equity fund category is riskier compared to the money market, since the risk is a relevant item. In this regard the authors have incorporated the performance

measures package and select total of 19 combinations of conventional and non-conventional measures from 3 main groups i.e. absolute, relevant and density-based.

For instance, the measures from the density-based category are based upon the partial moments, i.e. Gain-loss ratio, Omega ratio, Sortino, etc. and from the relative based category are based upon the loss aversions or drawdown i.e. Calmar ratio, Sterling ratio, Burke ratio. Moreover, this study proposes mutual fund categories of assets belong to diversified risk classes instead of any one category of the mutual fund.

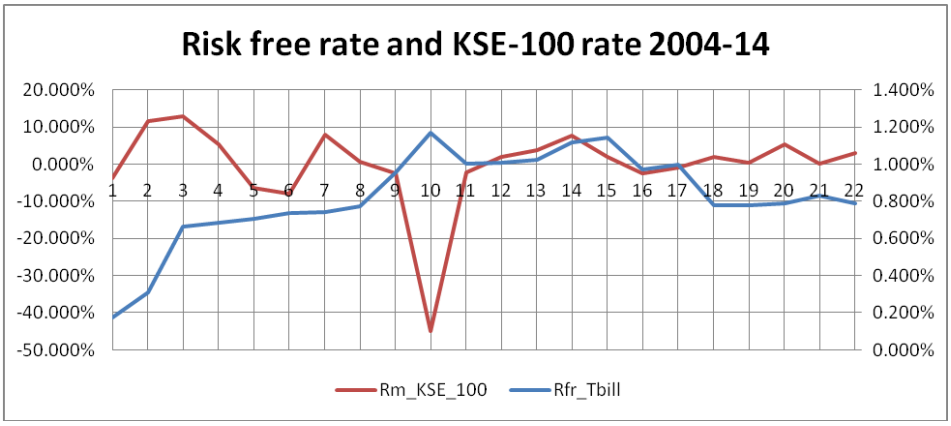

Figure 1: All Periods and sub-periods trend between Risk-free rate and the KSE-100 index.

Description: Table 1 reports the monthly returns of open-ended mutual funds from 2004-14. The calculation has been made on the basis of the equally-weighted average method. SD stands for standard deviation of respective funds.

Secondly, in this study, the Kendalls' tau test has been applied instead of spearman's rho correlation coefficient to measure the magnitude of the association between the performance measures selected not only at different risk levels but also at different time horizons. The main advantage of using this approach is the ease of interpretation as compared to particular value of spearman's rho coefficient, which is unclear. For instance, in the situation where we need to compare the two separate performance measures to evaluate the ranking of mutual funds, the question can be asked here is ' which two performance measures out of all produce same ranking order of mutual funds?' The Kendalls' tau test value can be expressed mathematically as; (2p – 1).

4. RESULTS AND ANALYSIS

4.1 MEAN-VARIANCE ANALYSIS

The standardized measure of the risk of return distribution of funds can be measured through the fundamental tool of measuring risk. When this risk measure applies to main categories of mutual fund operationalize in Pakistan, it presents interesting readings, as per Figure 2. For instance, the investment funds i.e. Money Market (Mm), Income (Inc), Equity (Eqt), Balance (Bal), pension and Sharia-compliant funds clearly dominates the other categories of mutual funds' investments in terms of mean-variance efficiency.

The choice of performance measure relates to the decisions of investments that the investor takes depends upon the distribution pattern of returns. This deviation from the mean can be assessed from

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the skewness values and thus it plays an important part in financial decision making. The results from mean-variance i.e. normal distribution pattern and mean-semi variance i.e. abnormal distribution pattern cannot be identical and thus it will have an impact on the decision made by the investors at the investment policy level (Agarwal & Naik, 2004; Farinelli & Tibiletti, 2008; Jarrow & Zhao, 2006).

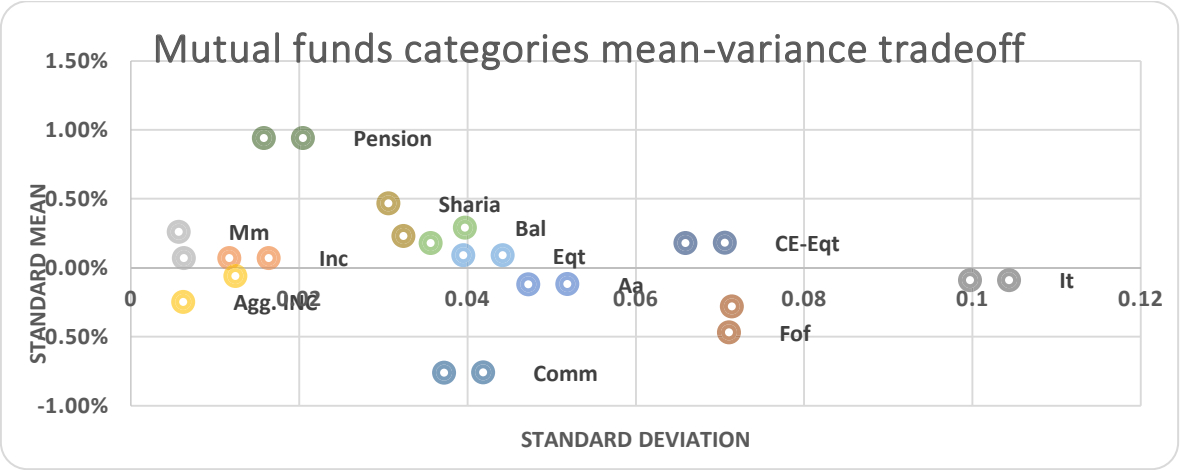

Figure 2: Risk-return tradeoff between selected mutual fund categories.

Description: The mean-variance efficiency between the respective categories of mutual funds such as Equity, Income, Aggressive income, Balance growth, Money Market, Commodity, Close-ended Equity, Fund of funds, Index tracker for the data ranging from 2004 till 2010. The respective x-axis and y-axis contain the standard mean and standard deviation values respectively.

4.2 DESCRIPTIVE ANALYSIS

The above findings validate the facts only if the observed distributions of funds' returns are normal. Hence, it is important to find out either the observed funds of investment categories show a normal distribution pattern or not. For that we need to get the statistic results from the values of skewness and kurtosis. After analyzing the respective categories of the mutual funds of Pakistan from 2004 till 2014, we find out that 2 open-ended mutual fund categories i.e. balanced and commodity funds, 3 sub-categories of pension funds i.e. Equity, debt and commodity and one sub-category of Sharia-compliant fund i.e. capital protected fund display normally distributed returns for the whole sample period which can be confirmed by the statistical value of Jarque Bera too. These findings are consistent with past findings in terms of hedge funds as well Prokop (2012) and confirmed from the Jarque-Bera test statistic values given in Table 2.

Figure 3 contains the detail information about the distribution pattern of the elective classes from the open-ended, pension and Sharia categories mutual funds. At the x-axis, there is also placed the respective box-plots of the classes of mutual funds supporting the normality of the dataset. The trend ranges from 12% to -8% in general returns showed that the magnitude of variation during the period 2004-14 in the Pakistan mutual funds.

On the general understanding, there is a fallacy in implementing the universal performance measure i.e. Sharpe ratio, from the for assessing the investment funds where there is an existence of abnormal behavior in returns distribution, like in case of Pakistan mutual fund industry given in Table 3. The practitioners are definitely likely to use those risk-adjusted performance measures which can

bear the abnormal pattern of returns distribution and thus helps them to analyze these resulted probability-based losses and thus propose appropriate strategies as well.

Figure 4 contains the detail information about the distribution pattern of the remaining classes from the open-ended, close-ended, pension and Sharia categories mutual funds under study. At the x-axis, there are the fraction of distance values to the midpoints above and below the line. The values showed above or below that linear line indicates that the dataset contains the return distribution pattern as non-normal trend. Clearly the respective classes of mutual funds categories deviate from the normality curve and thus should be treated separately.

In the reflection of these findings, it is an utmost need to allocate performance measures according to the respective returns distribution of mutual funds categories under study. However, we understand the risk attitude of investors towards different investment policies also relevant issue and due to this, we take into account the responses of chosen performance measures at certain levels of risks. This will further boost up the final conclusion and discussion in proposing the policies for the practitioners to get guidance and assess the end performances accordingly.

Table 2: Descriptive statistics of monthly returns of pension, open-ended and Sharia mutual funds

Schemes	Mean	Med	Max.	Min.	SD	Skewness	Kurtosis	J-B	*P*-value
Pension Equity	0.0138	0.019	0.1255	-0.1075	0.047	-0.4342	2.949	2.99	22%
Pension Debt	0.0073	0.007	0.0196	-0.0052	0.004	0.3846	3.9913	6.23	4%
Pension Commodity	-0.0002	-0.0056	0.0601	-0.0572	0.034	0.0573	2.1391	0.53	76%
Open ended Balanced	0.0018	0.0037	0.099	-0.0995	0.035	-0.4981	3.6396	7.64	2%
Open ended Commodity	-0.0076	-0.0163	0.0631	-0.0993	0.037	-0.0591	3.4085	0.16	92%
Islamic Capital Protected	0.013	0.016	0.0292	-0.0075	0.014	-0.3164	1.5722	0.91	63%

* *p*-value 1% is a level of significance

Description: Table 2 reports the monthly returns of open-ended mutual funds from 2004-14. The calculation has been made on the basis of the equally-weighted average method. SD stands for standard deviation of respective funds categories with respective measures of central tendency and location of measures.

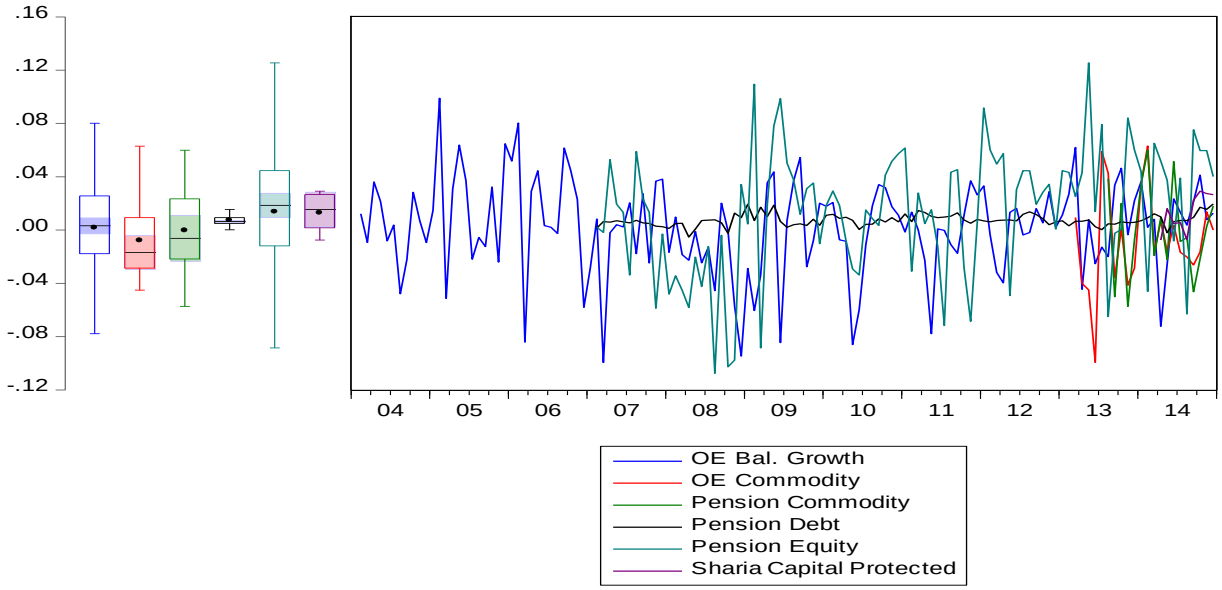

Figure 3: Normality trend in the distribution pattern of selective mutual funds from the period 2004 till 2014.

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Description: Figure 3 contains the returns distributed pattern of the mutual funds' classes showing normal trends such as open-ended, pension and Sharia categories. The respective x-axis and y-axis contain the selected data comprises of years and values in returns. Also, on the y-axis, there are multiple box-plots showing the normality check of data.

Table 3: Descriptive statistics of monthly returns of open, close-ended and Sharia compliance mutual funds

Schemes	Mean	Med	Max.	Min	SD	Skewness	Kurtosis	JB	P-value
Money Market	0.66%	0.007	0.011	-0.019	0.3%	-5.123	38.883	5512.2	*0%
Islamic Debt	0.65%	0.006	0.026	-0.009	0.5%	0.673	7.356	75.3	*0%
Islamic Money market	0.75%	0.006	0.153	0.000	1.6%	8.938	82.265	23934.0	*0%
Equity	0.09%	0.008	0.076	-0.158	4.0%	-1.164	5.198	56.0	*0%
Income	0.07%	0.001	0.024	-0.057	1.2%	-1.541	8.297	205.0	*0%
Money Market	0.07%	0.001	0.015	-0.031	0.6%	-2.703	13.254	526.3	*0%
Aggressive Income	-0.06%	0.003	0.018	-0.051	1.2%	-1.944	7.468	157.8	*0%
Asset Allocation	-0.12%	0.005	0.171	-0.274	4.7%	-1.459	13.708	579.9	*0%
Fund of Funds	-0.28%	0.012	0.110	-0.476	7.1%	-3.332	20.264	1555.3	*0%
Index Tracker	-0.09%	0.012	0.362	-0.498	10.0%	-1.906	13.133	498.1	*0%
Sharia Compliant	0.23%	0.004	0.147	-0.127	3.2%	0.297	8.416	162.1	*0%
Close ended Equity	0.18%	0.011	0.195	-0.324	6.6%	-1.268	8.661	173.1	*0%
Islamic Equity	0.11%	0.008	0.199	-0.177	5.3%	-0.470	5.783	47.1	*0%
Islamic Income	0.03%	0.002	0.024	-0.027	0.9%	-1.201	4.980	41.6	*0%
Islamic Money Market	0.05%	0.002	0.009	-0.025	0.8%	-1.469	4.567	30.5	*0%
Islamic Aggressive Income	0.03%	0.005	0.059	-0.087	1.8%	-1.650	9.942	211.7	*0%
Islamic Asset Allocation	0.19%	0.004	0.136	-0.120	3.3%	-0.145	6.990	62.7	*0%
Islamic Balanced	0.28%	0.012	0.140	-0.164	4.9%	-0.793	4.753	27.9	*0%
Islamic Fund of Funds	-0.03%	0.019	0.262	-0.470	9.9%	-2.298	11.084	299.1	*0%

* *p*-value 1% is a level of significance

Description: Table 3 reports the monthly returns of open-ended mutual funds from 2004-14. The calculation has been made on the basis of the equally-weighted average method.

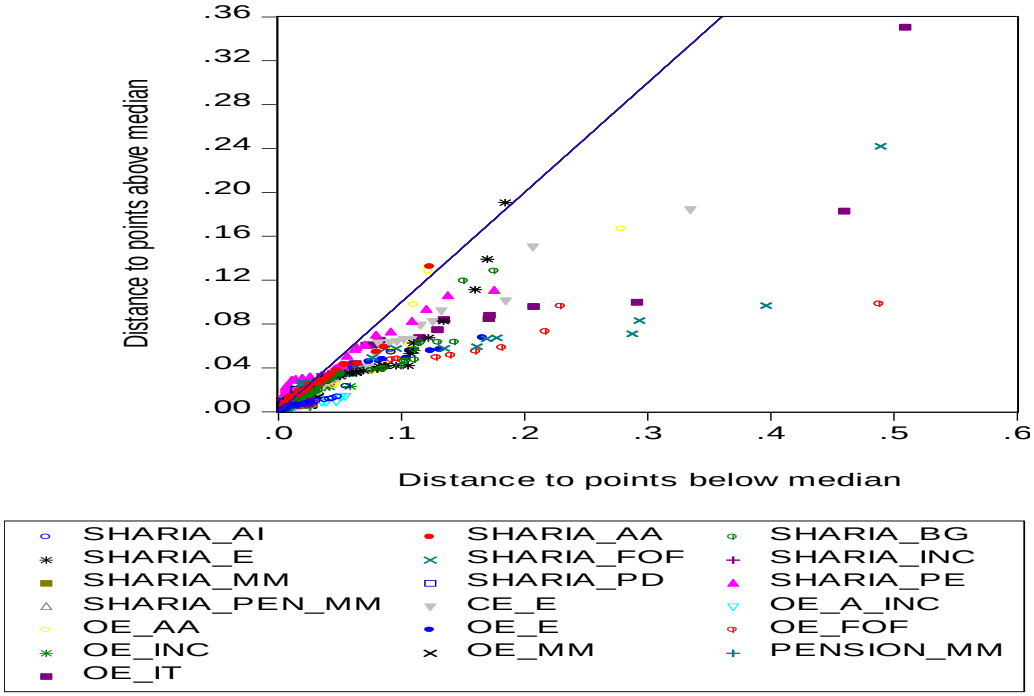

Figure 4: Non-normality trend in the distribution pattern of selective mutual funds classes from the period 2004 till 2014.

Description: Figure 4 contains the returns distributed pattern of the mutual funds' classes showing non-normal trends such as open-ended, close-ended, pension and Sharia categories. The respective x-axis and y-axis contain the selected data comprises of distance to points below and above values with respect to the normal linear line.

4.3 KENDALL'S TAU RANK ORDER CORRELATION ANALYSIS

The rank order correlations are the commonly used approach in order to identify whether the various performance measures produce separate rank order with respect to standard performance measure, here Sharpe ratio. The most common approach is to study the relationship between two alternative measures through the statistical value of coefficient of correlation and thus by doing so assess the significance between the two. The well-known measure of assessing the significance level is the spearman's rank-order correlation, as addresses in recent finance literature (Caporin & Lisi, 2011; Eling, 2008; Eling & Schuhmacher, 2006, 2007; Prokop, 2012). However in the same perspective for ranking approach Kendall's rank correlation coefficient can also be considered a vital source for addressing the issue under discussion which has given a little attention (Zakamulin, 2010a). Following a similar approach, in this study Kendall's rank-order correlation applies to the chosen performance measures, with the benefit of its easy interpretation of results. Moreover, there found no theoretical base of giving preference to spearman's rho coefficient over Kendall's tau statistical values (Noether, 1981).

4.3.1 DISTRIBUTION PATTERN OF RETURNS ANALYSIS

In this section of the study, the ranking order of chosen performance measures with respect to the universal measure Sharpe ratio is closely seeing with the respective riskier categories of mutual funds of Pakistan. The mutual funds' categories, with larger Sharpe ratio, generate greater deviations of ranking order among the alternative performance measures, and with respective returns distribution pattern too. In the simple word if the Sharpe ratio is larger when the mutual funds show the abnormal pattern than the alternative performance measures have the largest sensitivity to it due to its higher moments of the distribution. To produce the rank order in the true spirit of the study it is a need of time to divide the performance measures on the basis of return distribution order of the funds i.e. normal and abnormal distribution and apply to the respective categories or the investment schemes of mutual funds sample.

4.3.2 NORMAL DISTRIBUTION PATTERN OF RETURNS

Table 4 represents Kendall's rank-order distribution of performance measures with respect to the Sharpe ratio at the respective investment horizon and sub-periods of sample period. The choice of performance measures is based on the normal return distributed pattern of mutual funds at respective levels of risk. Initially Table has not able to report any values because of the insufficient data sample in the 1st investment phase with respect to the normal distribution pattern shown by the funds under study. In relation to the persistence of performance only 1 performance measure has been able to pass the validity criteria namely, Calmar performance measure in every sub-period reported. This dictates that the Calmar ratio is the only persistent performance measure which can be used to assess the funds' performances based on normally distributed pattern across the timeline. It has been seen that

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almost all of the alternative ratios have significantly changed their ranking as there is evidence of changing in the signs from +ve to –ve.

4.3.3 NORMAL DISTRIBUTION PATTERN OF RETURNS

The statistics on the basis of Kendal's tau approach has been presented in Table 5 on the basis of abnormal distribution of returns of funds. Interestingly all the performance measures have shown satisfactory results as far as similarity in the signs is considered, over the investment horizon. For instance, at the extended risk level, there is a Sortino measure; at the extended risk and return level, there is a Gain-loss measure and at the Extreme risk level, there is a Modified Sharpe measure.

Table 4: Kendall's rank-order non-normal distribution (NND) of performance measures

Performance Measures	Horizon, years			
	Period 1 2004-2006	Period 2 2007-2008	Period 3 2009-2011	Period 4 2012-2015
SR	N/A	1	1	1
Alpha	N/A	1	0.3	0.5
Appraisal	N/A	-0.3	1	0.5
Treynor	N/A	-0.3	0.3	0.2
Zero Beta	N/A	-1	1	-0.1
IR	N/A	-1	1	0.3
Calmar	N/A	1	0.3	0.3
Range	N/A	1	-0.3	0.2
MAD	N/A	0.3	-0.3	-0.2
UR	N/A	-0.3	0.3	0.6
BR	N/A	-0.3	0.3	0.5
Sterling	N/A	0.3	-0.3	-0.5
Gini	N/A	-1	0.3	0.3

Description: Table 4 represents Kendall's rank-order correlation between the rankings according to the alternative performance measures (PMs) and the ranking according to the Sharpe ratio for the respective investment horizon. The respective performance measures calculate the normally distributed return categories of mutual funds of Pakistan.

Table 5: Kendall's rank-order normal distribution (ND) of performance measures

Performance Measures	Horizon, years			
	Period 1 2004-2006	Period 2 2007-2008	Period 3 2009-2011	Period 4 2012-2015
SR	1	1	1	1
Kappa 3	0.2	0.3	0.6	0.7
Sortino	0.9	0.9	0.9	0.8
Omega	0.8	0.3	0.5	0.6
Gain Loss	0.9	0.8	0.8	0.8
Mod. Var	-0.2	-0.7	-0.6	-0.5
Mod. SR	0.3	0.4	0.4	0.5

Description: Table 5 represents Kendall's rank-order correlation between the rankings according to the alternative performance measures (PMs) and the ranking according to the Sharpe ratio for the respective investment horizon. The respective performance measures calculate the abnormally distributed return categories of mutual funds of Pakistan.

5. DISCUSSION

The mean-variance analysis applies to main categories of mutual fund in Pakistan the results showed that Money Market (Mm), Income (Inc), Equity (Eqt), Balance (Bal), pension and Sharia-compliant funds clearly dominates the other categories of mutual funds' investments in terms of mean-variance efficiency. We, then, calculated Kendall's rank-order distribution of performance measures with respect to the Sharpe ratio, as a universal standard measure, as proposed by (Zakamulin, 2010b), over the time period of 11 years. The purpose of study is to ascertain the time invariability of alternate performance measures based upon both normal and abnormal distribution. When results of the alternate performance measures based upon the normal distribution were analyzed we concluded that the alternate measures failed to show persistent time invariability and majority of the measures had variably factor, only two showed weak sort of time invariability but the results were not encouraging.

In order to prove this point of view, the same test was performed on the alternate performance measures based upon the abnormal distribution, without changing the standard. Our results showed almost opposite as the majority of the alternate measures showed great time invariability with respect to the Sharpe ratio. This clearly shows that abnormal distribution prevails in the mutual fund industry of Pakistan, which is in line with the actual results from developed and as well as developing countries.

6. CONCLUSION

On a generalized basis, the persistent performance does exist among the selective half of the alternative performance measures that supposed to assess the abnormal distributed return pattern. The encouraging factor is that all of the performance measures that have shown the invariability across the timeline, do have the ability to make assessment at every single level of risk. For instance, at the extended risk level, there is a Sortino measure; at the extended risk and return level, there is a Gain-loss measure and at the Extreme risk level, there is a Modified Sharpe measure.

7. AVAILABILITY OF DATA AND MATERIAL

Data can be made available by contacting the corresponding author.

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