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# ARE SHARPE, ADJUSTED SHARPE AND SORTINO RANKING OF EQUITY FUNDS DIFFERENT?

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## ABSTRACT

*There are more than 100 performance measurement ratios in the literature for evaluating the performance of the investment instruments. One of the most commonly used one is the Sharpe ratio. However, Sharpe ratio assumes that the returns of the portfolios have normal distribution which doesn't need to be the case all the time and it takes into account all returns positive and negative. Adjusted Sharpe ratio considers non-normal distributed returns and Sortino ratio considers downside risk. Therefore, these ratios were used in this study to compare possible different scenarios.*

*In this paper it was investigated that whether Sharpe, Adjusted Sharpe and Sortino ratios reveal similar rankings or not when measuring the performances of equity funds. Spearman correlation coefficient was used to examine the ranking of each ratio. An investment simulation was created to see the differences in the returns of the portfolios that were created according to each ratio.*

*Results indicate that Sharpe, Adjusted Sharpe and Sortino (when minimum target return is selected as zero) ratios give similar rankings when evaluating the performances of equity funds. However, selecting different minimum target return, as mean or zero, when calculating the Sortino ratio, creates a difference. Therefore, investors should be careful in selecting the proper minimum target return for the Sortino ratio.*
**Keywords:** Sharpe, Adjusted Sharpe, Sortino ratio, equity funds, ranking, performance evaluation

## 1. INTRODUCTION

There are over 100 risk adjusted return ratios which are developed for measuring the performance of the investment instruments. Sharpe ratio which was developed by William Sharpe in 1966, is one of the the most commonly used measures. It shows average return of the portfolio with the each excess risk taken. However, lots of academicians in the literature claimed that Sharpe Ratio does not give correct results especially when returns of the funds display non-normal distributions. Hence, variety of rules and ratios were developed to overcome this issue. Adjusted Sharpe Ratio that was developed by Peizer and White in 2006 is one of them. They included skewness and kurtosis in their formula which is a modification of Sharpe Ratio, to measure the performances of the mutual funds whose returns are not normally distributed. Moreover, especially after the financial crisis 2008, investors have become more concerned about the risk of declining the value of their portfolios instead gaining value. This lead the creation of ratios which considers downside risk. Those ratios investigate the relation between the returns and the risks which are coming from the negative side of pre-determined threshold. Sortino Ratio which was developed by Sortino and Van Der Meer in 1991 is one of them. It replaces standard deviation in the Sharpe Ratio with the downside risk to investigate the returns which are coming from bad risk.

In this study, it is investigated if Adjusted Sharpe Ratio and Sortino ratio gives different rankings than the Sharpe Ratio. Furthermore, the correlation between those ratios is investigated. Moreover, an investment simulation was executed to see whether these ratios create same portfolios or not.

## 2. LITERATURE REVIEW

Treynor (1965), developed an index which takes average return and market risk into account while measuring the performance of the portfolios. The index attempts to explain return of each unit of excess risk on portfolios. [13] Sharp, extended Treynor's ratio by taking variability into account. He defined a new ratio which considers average return and variability instead of market risk to calculate the excess return coming from each unit of risk taken. He found out that when undiversified portfolios are included, results could have been significantly different than Treynor's ratio. [11] Sharpe stated that Sharpe Ratio does not take correlation of a fund with the other assets in a portfolio into account. Hence, Sharpe Ratio does not include the scenarios where just one return of investment is considered. [12] Harding claimed that Sharpe ratio may be misleading since it requires stationary and parametric investment decisions whereas not all the portfolios reflect attributes of stationary processes. [6] Brooks and Kat and Lo pointed out the shortcomings of the Sharpe Ratio when measuring the performances of the hedge funds. [2,8] Dowd developed a new rule of generalization of the Sharp Ratio to overcome with the problems which arise from correlation. Furthermore, Dowd showed that Generalized Sharpe Ratio and Traditional Sharpe Ratio gives different results. [5] Christie, used GMM (Generalized Method of Moments) for estimating Sharp ratio and obtain statistical results in order to see whether Sharpe Ratio is useful for asset allocation or not. He argued that Sharpe Ratio is not useful for delivering more useful information. [4] Peizer and White, developed a new alternative risk adjusted measure to Sharpe Ratio, namely Adjusted Sharp Ratio, to overcome the problems that arise from using Sharpe ratio where returns exhibit attributes of kurtosis or skewness. Adjusted Sharp Ratio is derived from Taylor series expansion of expected utility with an exponential utility function. It includes a factor which lower the result in the case of excess kurtosis and negative skewness. [10] Keating and Shadwick introduced a gain-loss ratio which incorporates higher moment information in the distribution of the return as well as sensitivity to the returns. They applied Omega ratio to hedge funds and showed that it gives different rankings than Sharpe Ratio. [7] Sortino and Van Der Meer developed a new performance ratio, Sortino Ratio. It is a modification of the Sharpe Ratio in a way that it includes downside deviation instead standard deviation. Downside deviation only includes the deviations from the mean or a minimum return threshold which are negative. [14]

Wiesinger investigated whether Sharpe Ratio and other main risk adjusted performance measures give correlated results or not. He showed that there is a high correlation in the results. [14] Mistry and Shah investigated whether Sharpe Ratio, Adjusted Sharpe Ratio and Modified Sharpe ratio gives similar results or not when applied to mutual funds. They stated that in many cases, the correlation between the Sharpe Ratio and Adjusted Sharpe Ratio or Modified Sharpe Ratio is low. In certain cases, the results are highly correlated between them and between each other. [9] Chaudhry and Johnson executed a simulation study in order to find the optimal existing performance measure within Sharpe Selection ratio, Sortino ratio, Decay measure and Student's t-test. They saw that when the excess returns have skewed distribution, Sortino ratio is superior to Selection Sharpe ratio. [3]

## 3. DATA AND METHODOLOGY

In this study, 57 equity funds for years between 2014 to 2017 was used. The daily net asset value data was retrieved from Rasyonet. The data contains all equity funds as of 2018 with four years of observation. Performances of the equity funds were calculated using Sharpe, Adjusted Sharpe and Sortino ratios. Sharpe ratio is calculated as follows;

$$SR = \frac{r_P - r_F}{\sigma_P} \qquad (1)$$

where $r_P$ is portfolio return normally annualized. $r_F$ is risk free rate and $\sigma_P$ is portfolio return standard deviation.

Adjusted Sharpe Ratio is calculated by taking skewness and kurtosis into account. The formula for the Adjusted Sharpe Ratio can be seen below where K is the kurtosis and S is the skewness.

$$AdjSharpe = Sharpe * \left[1 + \left(\frac{S}{6}\right) * Sharpe - \left(\frac{K-3}{24}\right) * Sharpe^{\wedge}2\right] \qquad (2)$$

Sortino Ratio is a modification of the Sharpe Ratio since it uses downside standard deviation instead of standard deviation in the denominator. It only considers deviations which are negative from the

pre-determined minimum threshold or mean. [15] In this paper, two Sortino ratios, namely mean-Sortino (minimum threshold is taken as mean) and zero-Sortino (minimum threshold is taken as zero), were calculated. The formula for Sortino Ratio can be seen below.

$$Sortino = \frac{r_P - r_{Benchmark}}{\sigma_{downside}} \qquad (3)$$

### 3.1. Spearman Correlation

Funds were ranked according to the four ratios. First, it was investigated whether Sharpe, Adjusted Sharpe and Sortino ratios rank funds different from each other or not. In order to do that, the correlation between each pair of ratios was investigated using Spearman correlation coefficient. Significant coefficient values at Table 1 indicate that the correlation of the rankings of two ratios are similar, thus they rank the equity funds similarly.

For the period of 2016-2017, results reveal that mean-Sortino ratio is not correlated with any other ratios. It gives different rankings than the other ratios. However, if the minimum threshold selected as zero, as it was done while calculating zero-Sortino ratio, the result is highly correlated with Sharpe and Adjusted Sharpe ratios, they give similar results. It can be said that an investor may be indifferent in choosing Sharpe, Adjusted Sharpe and zero-Sortino ratios. S/he should be careful selecting the proper minimum target return when calculating the Sortino Ratio since the results are different from each other.

*Table 1 Results of Spearman Correlation Analysis*

| Ratios | Period | Spearman correlation coefficient | Period | Spearman correlation coefficient | Period | Spearman correlation coefficient |
|---|---|---|---|---|---|---|
| Sharpe & Adjusted Sharpe | 07.11.2016-07.11.2017 | 0,954* | 06.11.2015-06.11.2016 | 0,999* | 06.11.2014-06.11.2015 | 0,999* |
| Sharpe & mean-Sortino | 07.11.2016-07.11.2017 | 0,043 | 06.11.2015-06.11.2016 | -0,656* | 06.11.2014-06.11.2015 | -0,418* |
| Sharpe & zero-Sortino | 07.11.2016-07.11.2017 | 0,976* | 06.11.2015-06.11.2016 | 0,956* | 06.11.2014-06.11.2015 | 0,805* |
| Adjusted Sharpe & mean-Sortino | 07.11.2016-07.11.2017 | -0,073 | 06.11.2015-06.11.2016 | -0,677* | 06.11.2014-06.11.2015 | 0,414* |
| Adjusted Sharpe & zero-Sortino | 07.11.2016-07.11.2017 | 0,972* | 06.11.2015-06.11.2016 | 0,957* | 06.11.2014-06.11.2015 | 0,805* |

\* indicates correlation is significant at the 0.01 level (2-tailed).

In 2014-2015 and 2015-2016 periods, all the ratios are correlated to each other, they give similar rankings.

### 3.2. Portfolio Simulation

Furthermore, an investment simulation was executed to examine whether the portfolios perform different following different ratios. Top five funds were selected each period using Sharpe, Adjusted Sharpe, Sortino ratios and momentum investment strategy (where top five performers of previous period are selected) and equally weighted portfolios were simulated separately. It was assumed 100.000 TL was invested. Portfolios according to different ratios and momentum investment strategy can be seen in the Table 6.

*Table 2 Portfolio Returns*

| Ratio Used for Ranking | Portfolio Return |
|---|---|
| Sharpe | 162,339 |
| Adjusted Sharpe | 162,649 |
| mean-Sortino | 137,373 |
| zero-Sortino | 159,958 |
| Momentum Investment Strategy | 162,737 |

Results indicate that the portfolios that were generated according to Sortino ratios are quite different from each other. Therefore, benchmark selection is a vital point for Sortino ratio since it changes the results dramatically. Overall, results indicate that the returns of the portfolios which were generated according to Sharpe, Adjusted Sharpe, zero-Sortino ratios give very similar results to each other.

## 4. CONCLUSION

First, the correlations between the ratios were investigated. The results indicate that all four ratios are highly correlated with each other and give similar rankings apart from the year 2016-2017. In 2016-2017, mean-Sortino ratio is not correlated with any of other ratios. This indicates the ratios may lead to different rankings.

Second, portfolios were simulated with the funds which has highest Sharpe, Adjusted Sharpe, mean-Sortino, zero-Sortino ratios and Momentum investment strategy. It was seen from the results that the portfolios which were generated according to Sharpe, Adjusted Sharpe, zero-Sortino ratios and Momentum Investment Strategy have very similar portfolio returns even though the funds they include are not exactly the same with each other. However, it was stated that the portfolio which was generated according to mean-Sortino ratio has much lower return compared the other ratios. This suggest that, selecting the proper minimum target return when calculating the Sortino ratio is vital since it changes results significantly. Therefore, investors should be careful while selecting the appropriate minimum target return.

Overall, Sharpe, Adjusted Sharpe and zero-Sortino ratios give similar rankings when evaluating equity funds. However, selecting different minimum target returns when calculating Sortino ratio leads different portfolio results. Thus, it should be carefully selected.

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