MUTUAL FUND PORTFOLIOS SUCCESSIVE RETURN PERFORMANCE ON BASIS OF DOWNSIDE RISK MEASURES: AN EMPIRICAL STUDY OF SELECTED EQUITY DIVERSIFIED MUTUAL FUNDS

Ravneet Kaur Chawla[1] and Mohit Gupta[2]

The present study attempts to evaluate downside risk measures for the equity diversified mutual funds. The study randomly selected twelve equity diversified mutual funds and evaluated various downside risk measures namely Semi-Standard Deviation, Sortino Ratio, Upside Potential Ratio, Volatility Skewness and Hurst Index. An attempt is made to further create four portfolios of three mutual fund schemes, each on the basis of the results of downside risk measures. These portfolios are created for two years and are assessed on their average monthly return performance in order to assess the predictability of downside risk measures. None of the portfolios are found to be significantly different from each other, thereby, undermining the importance of downside risk measure as a predictable tool for mutual fund performance.

***Keywords**: Downside Risk, Mutual Funds*

JEL classification: D81, G20

1. Introduction

One of the most common and important financial innovations which has really helped the common man on the street to enjoy the same privileges as that of rich and elite, is the concept and design of mutual funds. They have proved to be one of the most catalytic instruments in generating investment growth in capital market. According to Securities and Exchange Board of India (SEBI), a mutual fund is defined as 'A fund established in the form of a trust to raise money through the sale of units to the public under one or more schemes for investing in securities, including money market instruments or gold or gold related instruments' (Taxmann, 2008).

The origin of mutual fund industry in India is linked with the establishment of Unit Trust of India in 1963, which later on expanded to include public sector mutual funds (Anjaria and Anjaria, 2001). Since FY 1997-98 to FY 2010-11, the assets under management have been growing at the rate of approximately 16% and as of 31st March, 2011, the total

[1]Ravneet Kaur Chawla, MBA student of School of Business Studies, Punjab Agricultural University, Ludhiana
[2]Dr. Mohit Gupta, Assistant Professor, School of Business Studies, Punjab Agricultural University, Ludhiana

assets under management touched seven billion rupees managed by 43 asset management companies (AMFI, 2011).

One of the most important virtues of investing through mutual funds is diversification, which is harder to achieve by an individual investor. Diversification assumes the key to successful investing in the stock market as shown by Markowitz (1959). It is a common fact that diversification does not increase the return but it reduces the risk and thereby, increases the risk adjusted returns, which is the main objective of the investor. The question arises what measures the risk? The answer points to the statistical measures of standard deviation or variance (Markowitz, 1959). One of the failures of standard deviation, as a measure of risk, is that it treats downside risk equal to upside risk. Psychologically, investors do not treat the equality as such. They like the upside movement and dislike the downside movement of asset prices. These notions gave rise to study of downside risk measures, their types and their assessment as true measures of risk.

Downside risk may be defined as the likelihood that a security or other investment will decline in price, or the amount of loss that could result from that potential decline or the potential losses that may occur if a particular investment position is taken. These risk measures are lower partial. Lower partial movement represents the whole gamut of human behaviour from risk seeking behaviour to risk neutral to risk aversion. A downside risk measure may also be defined as a function that aggregates the distribution of random variable such as of a future portfolio value into a real number. This real number is then supposed to indicate the riskiness of the random variable.

Why does the need of downside risk arise? Defining risk and the factors that affect required stock returns is difficult in developing markets and even more in emerging markets. This issue is hence critical for both companies and investors especially due to the fact of increased popularity of investing in emerging markets. Downside risk measures are needed mostly because they are closer match to how investors actually behave in investing situations. It is important for an investor to make a trade-off between risk and return. Moreover, in the moments of financial or market distress downside risk measures such as semi-standard deviation are more appropriate than the standard variance to characterize risk. The challenge of using downside risk measures as a constructor of portfolios and diagnostic device is their computational intensity.

The popularity of downside risk among investors is growing and downside risk measures in portfolio selection seem to oppress the familiar mean variance approach. One

reason for this success is that unlike in standard deviation based risk measures in which all uncertainty is considered to be risky, downside risk measures only consider returns that are below investor's goal to be risky.

2. Review of Literature

The discussions and academic studies on downside risk measures started with the study of Roy (1952) who developed the concept of safety first portfolios in which the investor aims for minimizing the probability of a dread event, which is identified with an outcome in the tail of the distribution of portfolio returns. The very popular mean variance frame work as propounded by Markowitz (1959), although stayed with the variance measure as it was computationally simpler. The semi-variance optimization models using a co-semi variance matrix require twice the number of data inputs than the variance model. Hence, Markowitz (1959) described variance or standard deviation as a common measure of risk. But several studies later on (Bollerslev, 1986) provided evidence that estimating volatility conditionally doesn't capture fat tailedness i.e. additional risk in asset prices, resulting in underestimating the value at risk approach (VaR)[3] at higher quantiles. This implied existence of additional downside risk that becomes more severe especially during the period of financial turmoil. This was also observed in the study by Pownall and Koedijk (1999) who observed that during the periods of financial turmoil, deviations from the mean variance framework become more severe resulting in periods with additional downside risk to investors. This happens because current risk management techniques fail to take this additional downside risk into account and underestimate the true VaR with greater severity during this period.

Harlow (1991) observed that the downside risk approach presents potential for portfolios more attractive than mean variance portfolios. Thus, downside risk approaches lower risk while improving upon the level of expected return offered by mean variance approaches. Under downside risk aversion, time effects have high impact on demand of risky assets. Downside risk aversion imply reverse time effects i.e. the investors invests more in risky assets as his horizon is shorter (Berkelaar and Kouwenberg, 2000).

Ang and Xing (2001) provided evidence that downside risk is important for explaining cross-section expected returns. The authors further showed that stocks having high downside risk have higher expected rate of returns than the stocks having lower downside risk, as economic compensation for disliking downside risk. Post and Vilet (2004) also found that

[3]In financial mathematics and financial risk management, Value at Risk (VaR) is a widely used risk measure of the risk of loss on a specific portfolio of financial assets.

Capital Asset Pricing Model (CAPM) based on mean semi-variance outperformed traditional CAPM in explaining the cross-sectional returns of US Stocks. Similar view was also echoed by Ang and Xing (2006) who found that cross-section of stock returns reflects a downside risk premium.

Investors' risk preferences were introduced into the performance measure with the study of Sortino and LeePrice (1994) wherein downside risk concept was introduced into the performance measure literature. Downside risk incorporates the risk preferences of the investor by introducing a minimal acceptable rate of return, which ultimately represents the investor's objective.

Studies like Estrada (2002) in emerging markets raised the correctness of using downside risk as a measure of risk. The various reasons cited for this are namely excellence of downside risk measure over standard risk measure on explaining the variability in cross-section of returns; standard deviation is only appropriate when distribution of returns is symmetric; standard deviation of returns as a risk measure is applied only on normal distribution. Behaviorally also downside risk assumes importance as reflected in the study by Unser (2002) who conducted experimental studies and demonstrated that one is often only interested in the evaluation of those outcomes which do not meet a target value; outcomes with values smaller than the target value are viewed as risky; and outcomes whose values are larger are interpreted as non-risky or rather required. In terms of Dhaene *et al.* (2003), downside risk is defined as a measure of distance between the risky situation and the risk free situation when only unfavorable discrepancies contribute to the risk.

X.F.He and Kwok (2007) tested six downside risk measures for distinguishing bankrupt portfolios. The study found that Sharpe Ratio, Downside Sharpe Ratio and Adjusted Sharpe Ratio were not effective measures. In contrast, Sortino Ratio, Upside Potential Ratio and Portfolio Performance Index were found to be of significance between both bankrupt and non bankrupt portfolios if the minimum acceptable return is zero. Further, in one of the recent studies on downside risk measures by Lohre *et al.* (2009) it became evident that reductions in downside risk are convincing for semi-variance, semi-deviation and loss penalty while VaR and measures related to skewness are useless for constructing the portfolios.

Very few studies in Indian context have been conducted on downside risk. Deb and Banerjee (2009) highlighted the significance of VaR as a measure of downside risk in equity mutual funds in case of India. Still not many studies have been performed on assessing the

predictive ability of downside risk measures. This study tries to cover this gap in the literature. The main objective of this study is to assess whether the portfolios formed on the basis of downside risk measure add value in terms of return performance as compared to the portfolios formed on the basis of traditional measures of risk. In other words, the study aims to see whether downside risk measures have any predictive ability?

3. Research Methodology

The present study is restricted to the diversified equity mutual funds which have operational history of at least 5 years as on 31st March, 2009. Of the total 248 equity diversified mutual funds, only 83 funds matched the criterion of operational history of 5 years. Twelve funds are randomly selected from these 83 funds (Refer to Table 1). The present study evaluates selected equity diversified mutual funds on basis of their performance with respect to downside risk measures over a period of three years starting from 2006-07 to 2008-09. The study calculates various downside risk measures for the selected diversified equity mutual funds using Net Asset Value (NAV)[4] data from 1st April, 2006 to 31st March, 2009.

Various downside risk measures including Semi-Standard Deviation, Sortino Ratio, Upside Potential Ratio, Volatility Skewness and Hurst Index are applied. In addition to these downside risk measures, standard deviation which is commonly used as a standard measure of risk is also calculated.

Semi-Standard Deviation (σ_D) takes into account, the variance on downside, it is calculated as follows:

$$\sigma_D = \sqrt{\sum_{i=0}^{n} \frac{\min\{(r_i - r_T), 0\}^2}{n}}$$

where, r_i = actual return, r_T = minimum target return and n = no. of observations.

The Sortino ratio (SR) is calculated to measure the reward per unit of downside risk. It is calculated as follows:

$$SR = \frac{(r_p - r_T)}{\sigma_D}$$

where, σ_D = downside risk standard deviation; r_T = minimum target return; an r_P = return of the portfolio.

[4]NAV= (Ending Value-Beginning Value) / Beginning Value. The NAV data was collected from www.amfiindia.com

The Upside Potential Ratio (UPR) is also used to rank portfolio performances and combines upside potential with downside risk in the following way:

$$\mathbf{UPR} = \sum_{i=1}^{i=n} \frac{\mathbf{max(r_i - r_T\ , 0)/n}}{\boldsymbol{\sigma}_D}$$

where, σ_D= downside risk standard deviation; r_T = minimum target return; r_i = actual return and n = no. of observations

Volatility Skewness (VS) refers to ratio between upside variance and downside variance as follows:

$$\mathbf{Volatility\ Skewness(VS)} = \frac{\boldsymbol{\sigma}_u^2}{\boldsymbol{\sigma}_D^2}$$

where, $\boldsymbol{\sigma}_u^2$ = upside variance; and $\boldsymbol{\sigma}_D^2$= downside variance

Hurst Index (H) is useful for detecting whether the portfolio returns are mean reverting (anti persistent) or totally random or persistent. It is calculated as follows:

$$\mathbf{H} = \frac{\mathbf{log(m)}}{\mathbf{log(n)}}$$

$$\mathbf{m} = \frac{\{\mathbf{max(r_i) - min(r_i)}\}}{\boldsymbol{\sigma}_p}$$

where , n = no. of observations, σ_p= standard deviation of portfolio

Value of Hurst Index between 0 and 0.5 suggests a portfolio manager's series of returns are mean-reverting (anti-persistent). A Hurst Index of 0.5 suggests the series of returns is totally random. A Hurst Index between 0.5 and 1 suggests the series of returns are persistent (i.e., there is memory in the return series).

Standard deviation (S) is a statistical measurement of dispersion around an average, which, for an investment, depicts how widely the returns varied over a certain period. It is calculated as follows:

$$\mathbf{S} = \sqrt{\frac{\mathbf{1}}{\mathbf{N-1}} \sum_{i=1}^{N} \mathbf{\{x_i - \bar{x}\}}}$$

where, N = no. of observations, x_i= a particular observation, $\bar{X}$ = mean of sample .

The above downside risk measures are applied on the selected mutual funds. On the

basis of performance on downside risk measures, four portfolios of mutual funds are created. Each portfolio consists of three mutual fund schemes. These portfolios are created in such a way that ranking of all mutual funds is done wherein top rank is given to the fund having lowest risk (i.e. lowest value of downside risk measure). The portfolios for the year 2007-08 and 2008-09 are formed on the basis of the results of the downside risk measures of 2006-07 and 2007-08 respectively. Then the average monthly return performance of the generated portfolios is examined and tested for the year under study.

In this study, we have used one-way ANOVA or one way classification test of significance. It is used for comparing the returns of portfolio and to find out whether there exists a significant difference between the returns of portfolios constructed on the basis of standard deviation and any other downside risk measure. The null hypothesis of the study is that there lies no significant difference between the returns of the portfolios based on different downside risk measures.

4. Results and Discussion

Table 2 depicts year-wise top three funds (lowest risk) according to different measures of risk and especially, downside risk. On critical analysis, it is found that according to all the measures of downside risk, the top three funds[*] for the year 2006-07 and 2007-08 are namely- SBPS, HDFC and ICICI; and HDFC, BPGF and KOTAK respectively. Three top funds for the year 2008-09 are namely BSDYP, DSPBR and HDFC. Overall top three funds are namely- KOTAK, BSDYP and HDFC.

Table 3 and Table 4 depict the formation of mutual fund portfolios for the year 2007-08 and 2008-09 on the basis of downside risk measures for the year 2006-07 and 2007-08 respectively.

Referring to Table 5, in year 2007-08, the return performance of mutual fund portfolios grouped on basis of Standard Deviation is not significantly different from each other at 5% level of significance. On the basis of grouping based on Semi-Standard Deviation, although Mutual Fund Portfolio I earned highest returns but the returns of all mutual fund portfolios are not showing significant difference at 5% level of significance.

Mutual Fund Portfolios grouped on the basis of Sortino Ratio depicted trend as per standard theory where risk derives the return. In this case, the riskiest mutual fund portfolios

[*]Sundaram BNP Paribas Select Mid-Cap (SBPS), HDFC Top 200 Fund (HDFC), ICICI Prudential Dynamic Plan (ICICI), Baroda Pioneer Growth Fund (BPGS), KOTAK 30 (KOTAK), Birla Sun Life Dividend Yield Plus (BSDYP), DSP Black Rock Top 100 Equity Fund (DSPBR).

(Portfolio III and Portfolio IV) earned highest returns but still the returns among different portfolios are not significantly different.

Similar trends are also observed for Upside Potential Ratio. Here also Portfolio III and Portfolio IV earned higher rates of return but not showing difference from other portfolios. Returns among the mutual fund portfolios created on the basis of Volatility Skewness and Hurst Index are also not statistically different at 5% level of significance.

Similarly, in the year 2008-09 mutual fund portfolios created on the basis of Standard Deviation and also on basis of Semi-Standard Deviation are not different on the basis of return at 5% level of significance. The mutual fund portfolios created on the basis of Sortino Ratio although depicted higher returns for Portfolio III and Portfolio IV but it is evident that risk derive returns, the returns here are not significantly different at 5% level of significance. Among the mutual fund portfolios created on the basis of Upside Potential Ratio, Portfolio IV generated highest returns but still not different from other portfolios at 5% level of significance. Similar trends are observed for the mutual funds categorized on the basis of Volatility Skewness and Hurst Index.

5. Conclusion

In this study, on the basis of different downside risk measures, four mutual fund Portfolios (having three mutual fund schemes each) are created in such a way that Portfolio I and Portfolio IV have three least risky and most risky mutual fund schemes each respectively. These portfolios are later assessed for their monthly average returns in the next year. Significant differences are observed for portfolio returns; however it is found that statistically there is no difference among the mutual fund returns categorized on basis of various downside risk measures. This leads to the conclusion that downside risk measure does not have predictability of mutual fund performance and refutes the results of earlier studies in favor of downside risk measure, at least in the Indian context.

Within the limited scope of this study, we undermine the use of various downside risk measures in case of equity diversified mutual funds but further research may be conducted with other measures such as Raw Return, Tracking Error, Treynor's Ratio, Sharpe's Ratio and Jensen's Alpha to get a comprehensive view.

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Table 1: List of Selected Mutual Funds

S.No.	Name of Mutual Fund Scheme	Symbol
1	Baroda Pioneer Growth fund	BPGF
2	Birla Sun Life Dividend Yield Plus	BSDYP
3	CanaraRobeco Equity Diversified Fund	CRED
4	DSP BlackRock Top 100 Equity Fund	DSPBR
5	HDFC Top 200 Fund	HDFC
6	ICICI Prudential Dynamic Plan	ICICI
7	Kotak 30	KOTAK
8	Reliance Growth Fund	RGF
9	SBI Magnum Multiplier Plus 93 Scheme	SBI
10	Sundaram BNP Paribas Select Mid cap	SBPS
11	Tata Pure Equity Fund	TPE
12	Templeton India Growth Fund	TEMP

Table 2: Year-Wise Top Three Funds Selected on Basis of Different Risk Measures

Risk Measure	2006-07	2007-08	2008-09	Overall
Standard Deviation (Measure of risk)	SBPS	ICICI	BSDYP	DSPBR
	KOTAK	HDFC	DSPBR	BSDYP
	HDFC	BPGF	KOTAK	ICICI
Semi-Standard Deviation (Measure of downside risk)	SBPS	BPGF	BSDYP	DSPBR
	KOTAK	HDFC	DSPBR	KOTAK
	HDFC	KOTAK	HDFC	BSDYP
Sortino Ratio (Measure of downside risk)	BSDYP	BSDYP	SBPS	SBPS
	CRED	SBPS	RGF	BSDYP
	BPGF	ICICI	SBI	CRED
Upside Potential Ratio (Measure of downside risk)	SBPS	BPGF	HDFC	KOTAK
	RGF	KOTAK	ICICI	RGF
	ICICI	HDFC	BSDYP	HDFC
Volatility skewness (Measure of downside risk)	SBPS	KOTAK	HDFC	HDFC
	RGF	BPGF	TEMP	KOTAK
	ICICI	HDFC	BSDYP	TEMP
Hurst Index (Measure of downside risk)	BSDYP	CRED	TPE	KOTAK
	DSPBR	BSDYP	ICICI	TEMP
	HDFC	TPE	DSPBR	CRED

Table 3: Mutual Fund Portfolios for the Year 2007-08
(on the basis of Risk Measures of 2006-07)

Risk Measure	Portfolio I	Portfolio II	Portfolio III	Portfolio IV
Standard Deviation	SBPS	KOTAK	HDFC	BPGF
	BSDYP,	DSPBR	SBI	TEMP
	TPE	ICICI	RGF	CRED
Semi-Standard Deviation	SBPS	KOTAK	SBI	HDFC
	RGF	DSPBR	BSDYP	ICICI
	BPGF	TEMP	TPE	CRED
Sortino Ratio	BSDYP	CRED	BPGF	TPE
	TEMP	HDFC	KOTAK	RGF
	DSPBR	SBI	ICICI	SBPS
Upside Potential Ratio	BSDYP	CRED	BPGF	TPE
	TEMP	HDFC	DSPBR	KOTAK
	SBI	ICICI	RGF	SBPS
Volatility Skewness	BPGF	TPE	CRED	TEMP
	BSDYP	DSPBR	HDFC	KOTAK
	SBI	ICICI	RGF	SBPS
Hurst Index	SBPS	KOTAK	BPGF	RGF
	SBI	CRED	ICICI	TPE
	TEMP	HDFC	DSPBR	BSDYP

Table 4: Mutual Fund Portfolios for the Year 2008-09
(on basis of Risk Measures of 2007-08)

Risk Measure	Portfolio I	Portfolio II	Portfolio III	Portfolio IV
Standard Deviation	ICICI	HDFC	BPGF	TPE
	KOTAK	DSPBR	SBI	TEMP
	RGF	CRED	BSDYP	SBPS
Semi-Standard Deviation	BPGF	HDFC	ICICI	KOTAK
	TPE	TEMP	DSPBR	CRED
	SBI	RGF	BSDYP	SBPS
Sortino Ratio	BSDYP	SBPS	ICICI	RGF
	SBI	CRED	DSPBR	TPE
	HDFC	TEMP	KOTAK	BPGF
Upside Potential Ratio	BSDY	SBPS	SBI	RGF
	SBI	DSPBR	CRED	TEMP
	TPE	HDFC	KOTAK	BPGF
Volatility Skewness	SBPS	BSDYP	SBI	RGF
	ICICI	DSPBR	TPE	TEMP
	CRED	HDFC	BPGF	KOTAK
Hurst Index	SBI	BPGF	HDFC	SBPS
	RGF	KOTAK	DSPBR	TPE
	ICICI	TEMP	BSDYP	CRED

Table 5: Mutual Funds Portfolio Return Performance

Risk Measure (Basis)	Portfolio I	Portfolio II	Portfolio III	Portfolio IV	F Value	P value
Year 2007-08						
Standard Deviation	0.015 (0.071)	0.012 (0.073)	0.015 (0.075)	0.007 (0.075)	0.061	0.980
Semi-Standard Deviation	0.016 (0.074)	0.015 (0.074)	0.011 (0.071)	0.014 (0.079)	0.018	0.997
Sortino Ratio	0.011 (0.076)	0.015 (0.074)	0.017 (0.075)	0.014 (0.072)	0.030	0.993
Upside Potential Ratio	0.011 (0.076)	0.015 (0.074)	0.017 (0.074)	0.014 (0.074)	0.029	0.993
Volatility Skewness	0.014 (0.077)	0.013 (0.076)	0.016 (0.072)	0.014 (0.074)	0.007	0.999
Hurst Index	0.015 (0.072)	0.014 (0.079)	0.015 (0.073)	0.012 (0.073)	0.009	0.999
Year 2008-09						
Standard Deviation	0.025 (0.075)	0.029 (0.084)	0.028 (0.087)	0.022 (0.091)	0.014	0.998
Semi-Standard Deviation	0.025 (0.075)	0.031 (0.084)	0.027 (0.087)	0.022 (0.093)	0.023	0.995
Sortino Ratio	0.019 (0.085)	0.026 (0.089)	0.027 (0.082)	0.032 (0.083)	0.047	0.986
Upside Potential Ratio	0.019 (0.085)	0.026 (0.086)	0.029 (0.087)	0.030 (0.080)	0.040	0.989
Volatility Skewness	0.022 (0.091)	0.024 (0.081)	0.029 (0.087)	0.030 (0.080)	0.027	0.994
Hurst Index	0.028 (0.080)	0.026 (0.090)	0.024 (0.079)	0.026 (0.088)	0.004	0.999

Source: Computed Results of SPSS