TESTING OF RISK ANOMALIES IN INDIAN EQUITY MARKET BY USING MONTHLY AVERAGE RISK & RETURN

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ABSTRACT

The objective of the research work undertaken is to examine the Risk Anomaly on the scrips traded in National Stock Exchange. It is an approach which attempts to build a portfolio which maximizes returns for scrips while keeping volatility at minimum. The volatility in the research undertaken is determined by the standard deviation of the stock returns. The study is limited to those stocks whose derivatives are traded in the National Stock Exchange (NSE). The rationale behind selecting such scrips is that they are traded in large volumes. The findings established high risk-high returns paradigm is a fallacy in capital markets. The analysis gave higher average monthly rate of returns for low volatility stocks when compared with high volatility and market portfolios. The probability distribution function was asymmetric and left skewed with a fat tail indicated by kurtosis of less than three. Thus standard deviation which underestimates the potential down side risks was done away with the computation of VaR and LPSD. The cumulative histogram of VaR also established increased downside risks with higher probability for HV and market portfolio when compared with LV portfolio.

INTRODUCTION

Investment strategies have received lot of attention in the academic world. Researchers worldwide are persistently trying to explore newer methods of improving upon the investment yields. Traditional investment theory has established a direct correlation between the risk and returns. It is on this maxim that William Sharpe, John Lintner and Jan Mossin designed the phenomenal Capital Asset Pricing Model. However the researchers and investors all over the world are always looking for maximizing their yields while trying to keep the investment risk at minimum. The objective of the research work undertaken is to examine the Risk Anomaly on the scrips traded in National Stock Exchange. It is an approach which attempts to build a portfolio which maximizes returns for scrips while keeping volatility at minimum. The volatility in the research undertaken is determined by the standard deviation of the stock returns. The study is limited to those stocks whose derivatives are traded in the National Stock Exchange (NSE). The rationale behind selecting such scrips is that they are traded in large volumes. The paper is divided into seven sections. The first section lists literature review which is followed by objective and sampling method adopted in our study. Fourth section explains research methodology which is followed by analysis. Sixth section briefly explains research findings while making recommendations and the last section concludes our research.

LITERATURE REVIEW

Throughout the world there have been many examples of stock with low standard deviation giving higher risk adjusted return. One of such study conducted by **Robert Haugen (1967)** found an abnormality: portfolio with low risk provided superior returns to the supposedly efficient market portfolio. Recently **Roger Clarke, Harvin de Silva, and Steven Thorley (2006)** carried out an interesting study on the characteristics of minimum-variance (MV) portfolios. These authors found that MV portfolios, based on the 1,000 largest U.S. stocks over the period 1968-2005 achieved a volatility reduction of about 25% while delivering comparable or even higher average returns than the broad market portfolio. **Blitz et al (2007)** found that low volatility stocks have superior risk-adjusted returns relative to the FTSE World Development Index. Some of the studies tried to find out risk anomalies by using CAPM Model. **Blume (1970), Black, Jensen and Scholes (1972) and Blume and Friend (1973)** worked

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on portfolio returns. They found that the estimates of beta for diversified portfolios were more precise than estimates for individual securities. **Fama and MacBeth (1973)** estimated month-by-month cross-sectional regression of monthly returns on betas so as to address the problem caused by correlation of the residuals. Additionally they included (i) squared market betas to test whether the relationship between expected returns and beta is linear and (ii) standard deviation of least square residuals from regressions of expected returns on the market return to test whether the market beta is the only measure of risk. It was found that these additional variables did not add to the explanation of average returns provided by beta. **Keim, Donald B(1983)** examines, month-by-month, the empirical relation between abnormal returns and **market** value of NYSE and AMEX common stocks. Evidence is provided that daily abnormal return distributions in January have large means relative to the remaining eleven months, and that the relation between abnormal returns and size is always negative and more pronounced in January than in any other month - even in years when, on average, large firms earn larger risk-adjusted returns than small firms. In particular, nearly fifty percent of the average magnitude of the 'size effect' over the period 1963-1979 is due to January abnormal returns. **State Street (2009)** used the monthly returns for Russell 3000 Universe from December 1986 to October 2007 to study that how low beta stocks outperform high beta stocks. **Gharghori, Lee, and Veeraraghavan (2009)** investigated the size effect, book-to-market effect, earnings-to-price effect, cash flow-to-price effect, leverage effect and the liquidity effect. **Sarma, S.N.(2004)** examines the multiple indices for possible seasonality. An analysis of returns' pattern of multiple indices is helpful in identifying the presence or otherwise of the stock market seasonality associated with various portfolios and for testing the efficacy of investment game based on the observed patterns of the returns. **Bodla, B. S., Jindal, Kiran (2006)** found that that none of anomalies exist in the US market and thus this market can be considered as informationally efficient. On the other hand, the Indian stock market reveals turn of the month effect as well as semi-monthly effect but the day effect is not found.

OBJECTIVE:

1. To study the risk return trade of situation in Indian equity market.
2. To examine Indian capital market for the existence of risk anomaly
3. To construct portfolios and demonstrate empirically the phenomenon of risk anomaly

SAMPLING

Selection of Stocks

1) Only those stocks whose derivatives are traded in the National Stock Exchange are considered for the research work. It gave a list of 222 stocks in NSE website.
2) Data for twelve years, for a period between May 2000 and April 2012 was considered for research purpose. Thus 51 stocks were finally shortlisted for the purpose of research.
3) To compute market returns, CNX Nifty is used as an index

RESEARCH METHODOLOGY

The methodology involves a two stage process of portfolio construction and measures adopted in evaluating the portfolios for demonstrating prevalence of risk anomaly.

Daily closing prices of all the selected stocks for the entire twelve year period are downloaded from the official website of NSE. Monthly average stock prices are then computed using the Pivot table tools in the MS Excel utility software. Average evens out any extra ordinary fluctuations in the scrip during the month. The monthly average stock prices of each of fifty one scrips so obtained are then used to compute returns. Monthly logarithmic returns for each of the shortlisted stock are calculated using the formula:

$$\%\ logarithmic\ returns = \ln\left(\frac{P_1}{P_0}\right)$$

where P_0 = average stock prices of the previous month, P_1 = average stock prices of the current month. Logarithmic return is used to overcome the problem of base effect, if any. It gives a better measure of returns than the normal returns.

The stocks are arranged in the descending order of their volatility and in this case it is measured by the standard deviation of the stock returns over the past thirty six months. The intention of this concept is to construct portfolios characterized by different levels of volatility. The risk return nature of portfolios is then measured. The volatilities so obtained are then arranged in a descending order. The top ten scrips i.e. 20%, are selected to formulate a high volatility portfolio. Likewise bottom ten stocks characterized by low volatility are also selected to formulate a low volatility portfolio. Thus monthly portfolios are designed for the period between May 2003 and April 2012. For each of the month in the said time period will have two- high volatility and low volatility- portfolios. The average

returns for each of the portfolio in their respective months are then calculated using the formula:

$$P_1 = (S_1 + S_2 + S_3 + S_4 + \cdots .. + S_{10})/10$$

Where P_1 is the average monthly return of the first portfolio. S indicates the stock return and the subscript indicates the stock number. These portfolio returns are analyzed in the next section to understand the phenomenon of risk anomaly. The portfolios are also compared against market returns (CNX NIFTY). Logarithmic monthly market returns are computed using the formula mentioned above for calculating stock returns.

To determine Sharpe ratio for measuring portfolio performance, annualized rate of return is required. Thus, effective annual rate is computed from the monthly portfolio returns using the formula:

$$EAR = (1 + R_{m1}) * (1 + R_{m2}) * \ldots * (1 + R_{m12}) - 1$$

Where EAR is Effective Annual Rate, R_{m1} is the portfolio return in first month. Annualized standard deviation for a portfolio is calculated using the built in Excel function for standard deviation multiplied with square root of twelve. Sharpe ratio is determined using the formula:

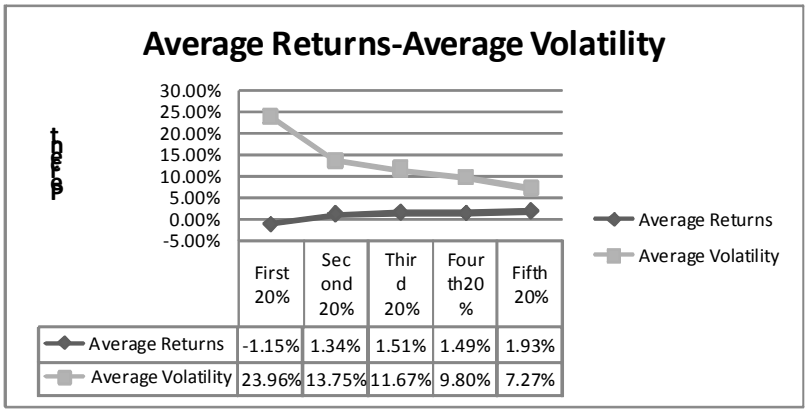
$Sharpe\ Ratio = (EAR - R_f)/ASD$ where, R_f is the risk free rate and ASD is annualized standard deviation. The above measure is a ratio of risk premium to volatility, an essential measure used by analysts to evaluate the portfolio performance. In our research we have considered Repo rate as risk free rate.

Other descriptive statistical measures like Kurtosis and Skewness are determined for critical analysis of portfolio returns. Kurtosis is a measure of the degree of fat tails. Standard deviation is an appropriate measure of risk, when the returns are normally distributed i.e. symmetrical distribution. Skewness is a measure of symmetry/asymmetry of the distribution of portfolio returns. In practice, it happens that the rate of returns of stock portfolios is not normally distributed, and that as a result, standard deviation may not adequately measure risk. Thus two measures, widely popular in industry- Value at Risk (VaR) and Lower Partial Standard Deviation (LPSD)- are computed for a more holistic analysis of risk-returns. VAR is determined using the historical method. The method simply reorganizes returns from worst to best and then a cumulative frequency histogram is plotted. Another risk measure used in our research is LPSD. The monthly high, low and market portfolio returns are negative in many instances. Thus LPSD using only negative return values to compute standard deviation.

ANALYSIS:

The table below gives details about the portfolio returns. The stocks are arranged in descending order of their volatility. Portfolios are constructed based on their volatilities. 'HV' and 'LV' indicates high volatility and low volatility. It clearly indicates that risk measured by volatility has no relation with returns. While portfolio with a high volatility of nearly 24% yields an average return of -1.15% while low volatility portfolio of 7.27% gives a return of 1.93%.

		Avg Returns	Avg Volatility
HV	First20%	-0.01	0.24
	Second20%	0.01	0.14
	Third 20%	0.02	0.12
	Fourth20%	0.01	0.10
LV	Fifth 20%	0.02	0.07



The chart above graphically indicates average returns and average volatility. The volatility curve follows a downward trend varying from 23.96% down to 7.27%. The average returns curve follows an upward trend varying from -1.15% to 1.93%. A total of 108 monthly portfolios are constructed between May2003 and April2012. In 64 of such cases, low volatility portfolios have yielded higher return than high volatility portfolios. Likewise in 55 of cases low volatility portfolio have yielded higher returns than market portfolio.

Sharpe ratio named after its founder William

Sharpe is a ratio of risk premium to volatility. It should ideally be higher for high volatility portfolio. In a span of ten years between 2003 and 2012, the ratio is higher for HV portfolio only thrice when compared with LV portfolio. The ratio for LV portfolio is higher than that of market portfolio in 8 out of 10 times in the past ten years. It thus indicates existence of inefficient market and thus presence of risk anomaly in Indian capital markets.

	Sharpe Ratio		
Year	HV	LV	Market
2003	7.70	6.48	5.64
2004	-0.97	1.07	0.32
2005	-0.96	4.71	2.14
2006	-0.92	1.05	1.29
2007	1.06	2.11	1.92
2008	-1.66	-1.78	-1.93
2009	2.12	4.52	2.65
2010	0.35	1.03	0.69
2011	-1.95	-2.11	-1.94
2012	0.18	0.33	0.07

However volatility indicated by standard deviation alone may not be appropriate when the probability distribution is not symmetric as indicated by skewness in the below table. A normal distribution should have a skewness of 0, indicating perfect symmetry. A negative skewness as listed below reflects the cubed values of negative returns dominating the distribution. Further, kurtosis of all three sets of portfolios is less than 3, indicating that the distribution is mesokurtic, i.e. distribution has fat tails. It shows that there is more probability mass in the tails of the distribution than predicted by the normal distribution. As the distribution is left skewed, it shows that there is more probability mass in the left tail. Thus the standard deviation would underestimate the possible losses.

	HV	LV	MR(Nifty)
LV>=HV	64	-	-
LV>=MR	-	-	55
Minimum	-42.06%	-17.49%	-27.03%
Maximum	32.88%	11.31%	18.15%
Kurtosis	0.84	2.06	2.58
Skewness	-0.62	-1.05	-0.91

Since the rates of return of stock portfolios are not quite normally distributed, therefore, two other measures are used for a better and a more holistic understanding of portfolio performance. They are Value at Risk (VaR) and Lower Portfolio Standard Deviation (LPSD). Since during sizable times, the portfolios gave negative returns, we computed LPSD as shown below, by considering only negative return values. However the LPSD values for HV, LV and Market are less than the conventionally computed standard deviation. Hence LPSD has little significance in our analysis.

Lower Partial Standard Deviation (LPSD)

HV	0.105369
LV	0.042954
Market	0.05431

The second measure in our analysis is VaR. It is a risk measure that highlights the potential loss from extreme negative returns. The major downside of a volatility measure is that it is silent about the direction of returns. Investors will be upbeat if the jump is positive. However risk is about the odds of losing money. VaR gives the picture of worst case scenario. The frequency histogram for high volatility, low volatility and market portfolios are shown below. There is almost 13% chance that the high volatility portfolio will yield less than -20% returns. A 33% chance of a negative return and a 2% chance of worst case scenario i.e. less than -35% return. Likewise there is a 14% chance of negative return in case of a low volatility portfolio and a further only 3% chance of a worst case scenario of less than -12%. There is an

aggregate of 17% chance for portfolio returns to be less than zero. A 1.85% chance of worst case scenario i.e. returns less than -13%.

Value at Risk (VaR)

FINDINGS AND RECOMMENDATIONS:

The research findings addressed all the research objectives. The findings established high risk-high returns paradigm is a fallacy in capital markets. The analysis gave higher average monthly rate of returns for low volatility stocks when compared with high volatility and market portfolios. The probability distribution function was asymmetric and left skewed with a fat tail indicated by kurtosis of less than three. Thus standard deviation which underestimates the potential down side risks was done away with the computation of VaR and LPSD. The cumulative histogram of VaR also established increased downside risks with higher probability for HV and market portfolio when compared with LV portfolio.

CONCLUSION

On the basis of this study it can be inferred that due diligence is required while investing in high risk equity stocks. The traditional belief in high risk high return philosophy could lead to significant losses. Over a long duration, it can be recommended with certainty that portfolio of low risk stocks would yield higher returns. The risky assets could be beneficial in a short run but it still suffers from significant probability of yielding negative returns when compared to market and less risky assets. The inefficiency of Indian stock market is clearly established through our study.

The findings of the research work are in sync with the study conducted by Mayank Josipura and Rohan Laxmichand Rambia "Exploring risk anomaly in Indian equity market. The study negates the popularly held assumption of high risk-high return in a capital market. Thus the presence of risk-return anomaly further proves the existence of inefficient or imperfect Indian capital market, as suggested by numerous other studies.

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ANNEXURE:

	Monthly Portfolio Returns			Jun-06	-23.66%	-16.29%	-16.49%
	HV	LV	MR	Jul-06	-34.02%	3.58%	5.90%
May-03	10.23%	4.67%	-0.19%	Aug-06	6.69%	7.90%	6.68%
Jun-03	18.81%	8.35%	10.38%	Sep-06	8.10%	5.92%	5.49%
Jul-03	9.22%	7.79%	7.34%	Oct-06	-12.69%	2.77%	4.41%
Aug-03	22.34%	5.50%	9.22%	Nov-06	4.49%	5.26%	5.83%
Sep-03	7.83%	2.50%	8.21%	Dec-06	-0.15%	0.50%	1.07%
Oct-03	12.30%	6.61%	9.54%	Jan-07	9.72%	2.81%	3.19%
Nov-03	7.08%	4.41%	4.79%	Feb-07	2.43%	-0.32%	1.15%
Dec-03	10.97%	10.07%	9.65%	Mar-07	-11.12%	-8.18%	-9.03%
Jan-04	3.93%	9.83%	9.11%	Apr-07	3.12%	4.74%	5.63%
Feb-04	-12.95%	-3.77%	-3.05%	May-07	8.29%	6.13%	5.83%
Mar-04	-10.10%	-2.25%	-3.81%	Jun-07	-0.55%	4.07%	0.90%
Apr-04	7.95%	3.94%	3.79%	Jul-07	8.48%	4.27%	5.80%
May-04	-23.40%	-3.57%	-11.95%	Aug-07	-4.66%	-1.18%	-3.94%
Jun-04	-23.09%	-5.94%	-8.53%	Sep-07	-13.56%	7.53%	8.01%
Jul-04	-19.94%	2.49%	4.03%	Oct-07	6.48%	11.15%	15.78%
Aug-04	6.79%	1.95%	2.97%	Nov-07	13.58%	4.15%	5.21%
Sep-04	9.89%	5.58%	4.64%	Dec-07	19.77%	2.46%	3.67%
Oct-04	8.63%	1.47%	5.91%	Jan-08	-7.31%	0.31%	-3.54%
Nov-04	4.33%	5.66%	4.30%	Feb-08	-29.79%	-7.21%	-10.13%
Dec-04	9.62%	8.06%	7.60%	Mar-08	-10.38%	-6.04%	-8.67%
Jan-05	-2.81%	1.92%	-2.21%	Apr-08	4.61%	1.59%	2.74%
Feb-05	0.34%	5.88%	4.43%	May-08	4.14%	-0.27%	2.55%
Mar-05	-4.63%	2.62%	1.39%	Jun-08	-14.72%	-12.65%	-11.92%
Apr-05	-2.17%	-1.76%	-5.35%	Jul-08	-11.84%	-4.30%	-7.90%
May-05	4.97%	2.11%	0.76%	Aug-08	10.19%	9.55%	6.85%
Jun-05	6.40%	4.78%	6.38%	Sep-08	-8.83%	-2.04%	-4.88%
Jul-05	8.54%	7.64%	4.69%	Oct-08	-42.06%	-17.49%	-27.03%
Aug-05	-8.64%	5.92%	5.26%	Nov-08	-24.27%	-7.24%	-12.44%
Sep-05	-1.45%	6.08%	6.33%	Dec-08	-4.87%	2.04%	2.13%
Oct-05	-26.31%	-0.85%	-1.00%	Jan-09	-1.47%	2.50%	-1.44%
Nov-05	-0.59%	4.14%	3.47%	Feb-09	-6.94%	-0.81%	-1.24%
Dec-05	4.19%	7.09%	7.41%	Mar-09	0.51%	-2.99%	-0.60%
Jan-06	5.86%	3.87%	4.24%	Apr-09	32.88%	11.31%	18.15%
Feb-06	2.35%	5.36%	4.28%	May-09	24.38%	8.35%	16.38%
Mar-06	2.22%	5.74%	6.94%	Jun-09	28.09%	9.93%	11.41%
Apr-06	9.52%	6.35%	7.66%	Jul-09	0.65%	5.09%	-2.12%
May-06	-0.72%	-1.40%	-1.63%	Aug-09	10.65%	4.47%	5.12%

Sep-09	7.06%	4.42%	6.11%	Jan-11	-20.12%	-4.51%	-3.21%
Oct-09	-10.62%	6.12%	2.74%	Feb-11	-14.79%	-6.13%	-6.83%
Nov-09	-3.14%	2.30%	-0.82%	Mar-11	-2.26%	-0.31%	2.51%
Dec-09	3.57%	4.04%	2.91%	Apr-11	9.09%	5.75%	5.29%
Jan-10	6.61%	-1.70%	1.10%	May-11	-6.70%	-0.50%	-6.12%
Feb-10	-4.55%	-2.40%	-6.34%	Jun-11	0.47%	0.60%	-0.36%
Mar-10	5.24%	1.72%	6.76%	Jul-11	-24.68%	1.62%	2.24%
Apr-10	-2.33%	1.11%	2.23%	Aug-11	-22.14%	-4.78%	-9.75%
May-10	-5.77%	3.49%	-4.67%	Sep-11	0.94%	-2.12%	-1.21%
Jun-10	4.13%	7.20%	2.63%	Oct-11	-37.92%	0.11%	0.88%
Jul-10	8.17%	5.35%	3.26%	Nov-11	-21.02%	-1.88%	-1.11%
Aug-10	7.58%	0.68%	1.80%	Dec-11	-10.66%	-4.37%	-4.54%
Sep-10	-5.26%	1.23%	6.29%	Jan-12	5.25%	0.35%	2.84%
Oct-10	8.06%	1.90%	4.78%	Feb-12	11.91%	7.65%	9.48%
Nov-10	-1.52%	-1.04%	-0.67%	Mar-12	-2.77%	1.86%	-2.07%
Dec-10	-5.81%	-1.58%	-1.40%	Apr-12	-2.01%	1.58%	-0.83%