VOLATILITY AND CORRELATION OF STOCK INDICES ON INDIAN STOCK MARKET

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ABSTRACT

The concept of risk and return plays a vital role in the investment process, business organization, economic, political, and technological issues/problems. In the paper, three levels have been taken to measure the performance of the Stock Indices. In the first level, the Return (Log Mean), Risk (Standard Deviation), Skewness, Kurtosis and Value at Risk (VaR) have been calculated. In the second level, ranks have been allotted to the Stock Indices based on their return and risk performance using the performance Measures (Sharpe, Treynor, and Jensen). The correlation among the Indices performance has been calculated in the third level. Based on the analysis of results all the indices have been observed to be highly volatile in the year 2008-09, the indices VaR was also high in the year 2008-09.

Based on the performance measure results FMCG, Consumer Durables and Auto industry have been placed in the top position compared to all other indices. The indices of Metal, IT and Oil & Gas Industries were placed among the last positions on the basis of performance measure ratios. The Correlation results show that the IT industry and Tech industry have a high Positive correlation and Auto and Metal, Bank and Oil & Gas, Bank and Tech, Oil & Gas and Tech industries have a positive correlation on the basis of last seven years daily returns.

KEYWORDS: Value at Risk, Performance Measures, Individual Investors

INTRODUCTION

The concept of risk and return plays a vital role in many of the investor, business organization, economic, political, and technological issues/problems. It is important to calculate the Return, Risk and Correlation among the Securities/Stocks and Indices to manage risk efficiently and for efficient portfolio construction. Stock analysts, Market participants and Academicians have used different methods to calculate the return and risk of Securities/Stocks. The present paper estimates the Return, Risk, Beta, Value at Risk, Performance Measures (Sharpe, Treynor and Jenson) and Correlation of nine Stock Indices on Bombay Stock Exchange (BSE), India for seven years from 1st April 2005 to March 31st 2012. In this paper three levels have been taken to measure the performance of the Stock Indices.

In the first level the Return (Log Mean), Risk (Standard Deviation), Skewness, Kurtosis and Value at Risk (VaR) have been calculated. In the second level using the performance Measures (Sharpe, Treynor, and Jensen), ranks were given to the Stock Indices based on their return and risk performance. The correlation among the Indices performance has been calculated in the third level.

LITERATURE

In the present scenario most of the authors and academicians are using the econometrics models to calculate the risk and return. In this paper the traditional methods have been used for calculating the risk and return of the stock indices.

Andersen, T et al. (2006) examined the current industry of market risk management practices by using one of two respective approaches historical simulation or Risk Metrics. The results suggest that better results may be obtained by separately measuring and modeling the part of the realized volatility attributable to "jumps" in the price process through so-called realized bi-power variation measures.

Robert F et al (2001) forecasts the volatility of Dow Jones industrial index daily closes over a period of 1988 to 2000, and compare these results with 30 industrial companies. He concentrates that the good volatility model by its ability to forecast and capture the commonly held stylized facts about conditional volatility.

Andrew Ang et al (2006) examined the pricing of aggregate volatility risk in the cross-section of stock returns. They found that stocks with high sensitivities to innovations in aggregate volatility have low average returns. Stocks with high idiosyncratic volatility have abysmally low average returns. Andrew Ang et al (2006) measured downside risk by correlations conditional on downside moves of the market, and they concluded that the average rate of return on stocks with the greatest downside risk exceeds the average rate of return on stocks with the least downside risk, and also concluded that the downside risk important for explaining the cross-section of expected returns.

Banz and Rolf W. (1981) examine the empirical relationship between the return and the total market value of NYSE common stocks. They found that smaller firms have had higher risk adjusted returns, on average, than larger firms. This 'size effect' has been in existence for at least forty years and is evidenced that the capital asset pricing model is mispriced. The size effect is not linear in the market value; the main effect occurs for very small firms while there is little difference in return between average sized and large firms. Cumby, R. E and J. D. Glen (1990) examined the performance of fifteen U.S based internationally diversified mutual funds between1982 to 1988 using two performance measures the Jensen measure and the positive period weighting measures and concluded that there is no evidence that the funds, either individually or as a whole, provide investor with performance that surpasses that of a broad, international equity index over this sample period. Amromin et al (2005) studied the stock market beliefs and portfolio choices of individual investors. He concluded that the overall results lend support to the equity valuations are lower during recessions and subsequent returns are higher because of undue pessimism about future returns, rather than high risk aversion.

OBJECTIVE

The main objective of this paper to know the performance of Stock Indices based on Volatility and Correlation and performance evaluation ratios (Share, Treynor and Jensen).

The specific objectives are:

- Calculating the yearly wise return, risk, Skewness, Kurtosis, beta and Value at risk for seven years.

- Allocating ranks for Stock indices based on the yearly wise performance.

- Calculating the Correlation among the Indices on the basis of seven years daily return.

METHODOLOGY

Data & Sample

The required sample data of nine stock indices have been collected from the Bombay Stock Exchange and Internet/Web sources. The daily adjusted closing prices for seven years (01-04-2005 to 31-03-2012) of each Stock Indices and Bombay Stock Exchange have been used for this study. The year wise calculations 252 working days have been considered for each year calculation of return and risk.

Data Analysis

Mean

The log mean or average considers all the sample observations to calculate the value of mean value. The mean value is equal to the sum of all observations divided by the total number of observation/sample. The formula for calculating the Arithmetic mean is,

$$\bar{\chi} = \frac{\Sigma logX}{N}$$

Where $\bar{\chi}$ = log mean or Mean or Average

$\Sigma log\ X$ = Sum of values of all the observations/Sample

N = Number of Observations/sample.

Standard Deviation

The standard deviation is used to measure variability of observations. It indicates the degree to which most data scores cluster around the mean. If the standard deviation is small relative to the mean, then we can say that the data scores reasonably cluster around the mean. On the contrary, a large standard deviation will indicate that the scores are distributed farther from the mean. The standard deviation thus indicates the shape of the distribution of the data scores.

The calculation of standard deviation involves the following formula. Let x1, x2….xn, be 'n' data scores. Let their mean be X–.. We find the deviation of all these values from the mean say,

$$X_1 - \bar{X}, X_2 - \bar{X}, \dots \dots, X_n - \bar{X}$$

Then the standard deviation (σ) also called Sigma $= \sqrt{\frac{\Sigma X - \bar{X}}{n}}$

Value at Risk (VaR)

VaR is defined as a threshold value such that the probability that the mark-to-market loss on the portfolio over the given time horizon exceeds this value at the given probability level. It is a statistical technique used to measure and quantify the level of financial risk within a firm or investment portfolio over a specific time frame. Value at risk is used by risk managers in order to measure and control the level of risk which the firm undertakes. The risk manager's job is to ensure that risks are not taken beyond the level at which the firm can absorb the losses of a probable worst outcome.

$$VaR_{\propto}(L) = \inf\{l \in R : (L > l) \le 1 - \propto \} = \inf\{l \in R : F_L(l) \ge \propto\}$$

Correlation

Correlation is a statistical technique that can show whether and how strongly pairs of variables are related. In statistics, dependence refers to any statistical relationship between two random variables or two sets of data. Correlation refers to any of a broad class of statistical relationships involving dependence. In loose usage, correlation can refer to any departure of two or more random variables from independence, but technically it refers to any of several more specialized types of relationship between mean values.

$$corr(X,Y) = \frac{E[(X-\mu_X)(Y-\mu_Y)]}{\sigma_X \sigma_Y}$$

Performance Measures

- **Sharpe Ratio**

Sharpe ratio was developed by Nobel laureate William F. Sharpe to measure risk-adjusted performance. The Sharpe ratio is calculated by subtracting the risk-free rate and dividing the result by the standard deviation of the portfolio returns. The Sharpe ratio tells us whether a portfolio's returns are due to smart investment decisions or a result of excess risk.

This measurement is very useful because although one portfolio or fund can reap higher returns than its peers, it is only a good investment if those higher returns do not come with too much additional risk. The greater a portfolio's Sharpe ratio, the better its risk-adjusted performance has been. A negative Sharpe ratio indicates that a risk-less asset would perform better than the security being analyzed. The Sharpe ratio formula is:

$$Sharpe\ measure = \frac{E_r - R_f}{\sigma}$$

$$E_r = Expected\ Return$$

$$R_f = Risk\ Free\ Return$$

$$\sigma = Stock\ Standard\ Deviation/Volatility$$

- **Treynor Ratio**

Treynor ratio was developed by Jack Treynor and measures returns earned in excess of that which could have been earned on a riskless investment per each unit of market risk. In other words, the Treynor ratio is a risk-adjusted measure of return based on systematic risk. It is similar to the Sharpe ratio, with the difference being that the Treynor ratio uses beta as the measurement of volatility. It is also known as the "reward-to-volatility ratio".

The Treynor ratio is calculated as:

$$Treynor\ ratio = \frac{E_r - R_f}{\beta}$$

$$E_r = Expected\ Return$$

$$R_f = Risk\ Free\ Rate$$

$$\beta = Beta\ of\ the\ Stock$$

- **Jensen Ratio**

A risk-adjusted performance measure that represents the average return on a portfolio over and above that predicted by the capital asset pricing model (CAPM), given the portfolio's beta and the average market return. This is the portfolio's alpha. In fact, the concept is sometimes referred to as "Jensen's alpha." The basic idea is that to analyze the performance of an investment manager you must look not only at the overall return of a portfolio, but also at the risk of that portfolio. Jensen's measure is one of the ways to help determine if a portfolio is earning the proper return for its level of risk. If the value is positive, then the portfolio is earning excess returns.

Jensen measure calculated as:

$$Jensen\ Measure = E_r - [R_f + \beta(R_m - R_f)]$$

$$E_r = Stock\ return$$

$$R_f = Risk\ free\ Return$$

$$\beta = Beta\ of\ Stock$$

$$R_m = Market\ Return$$

RESULTS

- In the year 2005-06 the Consumer Durable Index had shown higher return of 91.04% with a higher volatility of 33.17% and the positive VaR percentage at 1% level was 13.88%. Followed by the FMCG Index with a return of 87.59%, volatility of 22.37% and a higher positive VaR percentage of 35.54% compared to all other Indices. The Bank Index showed 36.57% of less return with a volatility of 23.42% and the VaR percentage of -17.92%. In this year the Metal Index shows the least VaR percentage of -26.09% whereas the market return was 63.57%. The results of performance evaluation ratios FMCG, Auto and Consumer Durables indices had shown higher returns with less volatility indices respectively.

- In the year 2006-07 the Oil and Gas Index shown the higher return of 29.65%. It was higher than the market return of 17.05%, with a less VaR percentage of -40.75% followed by Tech index with a return of 28.93%, volatility of 31.49% and the VaR percentage was -44.33%. In this year the FMCG index had shown a negative return of -22.72% and the Metal Index had shown a higher Negative VaR Value of -100.02%. Oil and Gas, Tech and Bank Indices have shown a higher return with least Volatility based on the performance evaluation ratios.

- In the year 2007-08 the Metal Index had shown the higher return of 65.46% with a higher volatility of 44.09%. This return is more than double compared with the market return of 27.99%. The IT index had shown the higher losses of -22.52% and the VaR percentage also low comparatively other Indices that is -100.60%. The other indices like Auto and Health care also had shown losses of -7.27%, -4.57% respectively in this year. The performance evaluation ratios shown that the Metal, oil and Gas and FMCG indices were providing higher returns with a lower volatility of the indices.

- In the year 2008-09 all the Indices showed losses. The FMCG index has shown a loss of -8.23% with a volatility of 27.94%. Consumer Durables had shown the higher losses of -80.79%. The Metal index had a higher volatility

of 57.85%. The seven indices VaR percentage was more than 100%, importantly the Metal index VaR percentage is -207.73%. In this year the market return is -39.53%. This year the Market had shown the higher losses in each index.

- In the year 2009-10 market recovered and showed positive results. Mainly the Metal and Consumer Durables had shown a positive return of more than 100% that is 126.73% and 102.46% respectively. The Metal Index shown higher volatility of 44.16% followed by Bank index 38.18%. The Oil and Gas index shown the VaR performance ratio of -37.92%. The market return was also comparatively high in this year that is 63.76%. Health care, Consumer Durable and Auto Indices have shown higher return with a lower volatility based on performance evaluation ratios.

- In the year 2010-11 the Consumer Durable Index had shown a return of 40.15% with a volatility of 24.50% and the value at risk of -16.85%. The Metal index had shown the negative return of -8.40%, with a higher volatility of 26.52%. The VaR percentage was also higher than the other Indices at -70.10%. The Metal index Beta was also higher than the other indices at 1.28. The performance efficiency ratios have shown that Consumer Durables, FMCG and IT performance is better than the return risk point of view these indices are providing higher return with a lower risk.

- In the year 2011-12market return was negative at -9.16%, but the FMCG index showed the positive return of 23.50% with a volatility of 15.14%. The Metal index has shown the higher loss of -32.74%, with a higher volatility of 30.57% and the VaR percentage was also high that is -103.85%. FMCG, Health Care and Auto Industries are respectively giving higher returns with lower losses based on the performance evaluation ratios.

- The overall performance (Seven years performance) of Industry returns shown that the Consumer Durables Industry shown a higher return compared to other Industry returns, Metal Industry has shown a higher volatility of 40.94% followed by Bank industry with 36.39%. Metal industry VaR percentage is also shown to have a negative value of -78.69%. Based on performance measures, FMCG, Consumer Durables and Auto industry have shown higher return with a lower risk.

CONCLUSIONS

The risk, return concept is very useful to the different market participants. This paper helps understand the performance of the Stock Indices based on the return and risk. Based on the analysis of results, all the indices are highly volatile in the year 2008-09; the indice's Based on the performance measure results FMCG, Consumer Durables and Auto industries have been placed in the top position compared to all other indices.

The indices like Metal, IT and Oil and Gas Industries were placed in the last position on the basis of performance measure ratios. The Correlation results show that the IT industry and Tech industry had a perfect Positive correlation; Auto and Metal, Bank and Oil & Gas, Bank and Tech, Oil & Gas and Tech industries have a less than a positive correlation on the basis of last seven year's daily returns. It is suggested that, the diversification gain is very less for these companies, hence not good candidates to include in the portfolio.

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APPENDICES

Analysis

Table 1: Performance of Stock Indices

S. No	Sector	Year	Risk Free Return*	Market Return*	Industry Return	Volatility	Beta	Kurtosis	Skewness	VaR 10%	VaR 5%	VaR 1%
1	Auto	Overall	**8.12%**	**18.5%**	**23.3%**	**27.2%**	**0.78**	**5.35**	**0.00**	**-11.6%**	**-21.5%**	**-40.0%**
		2011-12	8.12%	-9.2%	10.7%	22.4%	0.92	-0.11	0.17	-18.0%	-26.2%	-41.4%
		2010-11	5.75%	10.9%	21.1%	20.6%	0.97	1.45	-0.09	-5.3%	-12.8%	-26.8%
		2009-10	3.24%	63.8%	99.5%	30.9%	0.79	3.53	0.74	59.8%	48.6%	27.5%
		2008-09	7.06%	-39.5%	-33.2%	34.5%	0.65	2.25	-0.56	-77.4%	-90.0%	-113.5%
		2007-08	6.07%	28.0%	2.3%	1.6%	0.69	4.60	-0.74	0.2%	-0.3%	-1.5%
		2006-07	7.22%	17.0%	-7.3%	31.4%	0.98	9.98	0.77	-47.5%	-58.9%	-80.3%
		2005-06	5.60%	63.6%	80.7%	19.6%	0.87	0.84	-0.37	55.7%	48.6%	35.2%
2	Bank	Overall	**8.12%**	**18.5%**	**22.8%**	**36.4%**	**1.13**	**5.29**	**0.37**	**-23.8%**	**-37.0%**	**-61.8%**
		2011-12	8.12%	-9.2%	-8.0%	27.8%	1.19	0.00	0.28	-43.5%	-53.6%	-72.6%
		2010-11	5.75%	10.9%	24.2%	23.7%	1.19	0.08	-0.10	-6.2%	-14.8%	-30.9%
		2009-10	3.24%	63.8%	94.2%	38.2%	1.14	15.25	1.99	45.3%	31.4%	5.4%
		2008-09	7.06%	-39.5%	-39.0%	56.8%	1.19	0.61	0.15	-111.9%	-132.5%	-171.2%
		2007-08	6.07%	28.0%	30.8%	39.2%	1.14	3.03	-0.01	-19.4%	-33.7%	-60.3%
		2006-07	7.22%	17.0%	26.6%	33.3%	0.94	2.20	0.21	-16.0%	-28.1%	-50.8%
		2005-06	5.60%	63.6%	36.6%	23.4%	1.02	1.48	-0.05	6.6%	-2.0%	-17.9%
3	Consumer Durable	Overall	**8.12%**	**18.5%**	**26.8%**	**33.7%**	**0.81**	**5.25**	**-0.04**	**-16.3%**	**-28.5%**	**-51.5%**
		2011-12	8.12%	-9.2%	5.1%	25.2%	0.73	0.46	-0.15	-27.1%	-36.3%	-53.4%
		2010-11	5.75%	10.9%	40.2%	24.5%	0.94	1.85	-0.46	8.7%	-0.2%	-16.9%
		2009-10	3.24%	63.8%	102.5%	34.2%	0.75	5.92	1.24	58.6%	46.2%	22.9%
		2008-09	7.06%	-39.5%	-80.8%	43.5%	0.72	2.83	-0.17	-136.5%	-152.3%	-181.9%
		2007-08	6.07%	28.0%	18.8%	36.5%	0.82	3.17	-0.54	-28.0%	-41.3%	-66.1%
		2006-07	7.22%	17.0%	15.7%	34.3%	0.90	9.08	-0.60	-28.3%	-40.8%	-64.2%
		2005-06	5.60%	63.6%	91.0%	33.2%	1.12	5.08	0.91	48.5%	36.5%	13.9%
4	FMCG	Overall	**8.12%**	**18.5%**	**24.3%**	**24.2%**	**0.59**	**6.53**	**0.32**	**-6.7%**	**-15.4%**	**-31.9%**
		2011-12	8.12%	-9.2%	23.5%	15.1%	0.46	0.04	0.05	4.1%	-1.4%	-11.7%
		2010-11	5.75%	10.9%	25.3%	17.1%	0.67	1.30	0.22	3.4%	-2.8%	-14.5%
		2009-10	3.24%	63.8%	37.2%	23.8%	0.47	2.69	0.84	6.7%	-2.0%	-18.2%
		2008-09	7.06%	-39.5%	-8.2%	27.9%	0.45	0.99	-0.20	-44.0%	-54.2%	-73.2%
		2007-08	6.07%	28.0%	34.6%	27.1%	0.63	2.74	-0.50	-0.1%	-9.9%	-28.3%
		2006-07	7.22%	17.0%	-22.7%	31.2%	0.94	12.18	1.19	-62.8%	-74.1%	-95.4%
		2005-06	5.60%	63.6%	87.6%	22.4%	0.87	1.72	0.28	58.9%	50.8%	35.5%

Table 1: Contd.,

No	Sector	Period										
5	Health Care	Overall	8.12%	18.5%	16.1%	20.9%	0.55	6.28	-0.34	-10.6%	-18.2%	-32.4%
		2011-12	8.12%	-9.2%	10.0%	13.4%	0.47	0.00	-0.11	-7.2%	-12.1%	-21.2%
		2010-11	5.75%	10.9%	12.8%	14.0%	0.55	1.41	-0.28	-5.2%	-10.3%	-19.9%
		2009-10	3.24%	63.8%	68.6%	21.1%	0.48	5.15	0.87	41.6%	34.0%	19.6%
		2008-09	7.06%	-39.5%	-28.1%	25.6%	0.44	2.93	-0.63	-60.9%	-70.2%	-87.6%
		2007-08	6.07%	28.0%	10.8%	23.1%	0.58	5.29	-1.09	-18.8%	-27.2%	-43.0%
		2006-07	7.22%	17.0%	-4.6%	26.5%	0.79	7.18	-0.01	-38.6%	-48.2%	-66.3%
		2005-06	5.60%	63.6%	48.0%	17.9%	0.72	1.30	-0.29	25.0%	18.5%	6.3%
6	IT	Overall	8.12%	18.5%	16.8%	31.4%	0.84	4.02	0.33	-23.4%	-34.8%	-56.2%
		2011-12	8.12%	-9.2%	-3.8%	25.6%	0.92	2.12	-0.31	-36.6%	-45.8%	-63.3%
		2010-11	5.75%	10.9%	21.8%	19.6%	0.80	0.65	0.26	-3.4%	-10.5%	-23.9%
		2009-10	3.24%	63.8%	87.9%	31.9%	0.75	6.97	0.75	47.0%	35.5%	13.7%
		2008-09	7.06%	-39.5%	-35.1%	45.3%	0.81	0.20	0.08	-93.2%	-109.7%	-140.6%
		2007-08	6.07%	28.0%	-22.5%	33.6%	0.76	2.25	0.62	-65.5%	-77.7%	-100.6%
		2006-07	7.22%	17.0%	21.8%	32.5%	0.99	9.31	1.03	-19.7%	-31.5%	-53.6%
		2005-06	5.60%	63.6%	48.4%	23.7%	1.07	0.95	-0.22	18.1%	9.5%	-6.7%
7	Metal	Overall	8.12%	18.5%	16.6%	40.9%	1.21	4.50	0.04	-35.9%	-50.8%	-78.7%
		2011-12	8.12%	-9.2%	-32.7%	30.6%	1.29	0.36	0.33	-71.9%	-83.0%	-103.8%
		2010-11	5.75%	10.9%	-8.4%	26.5%	1.28	0.85	0.05	-42.4%	-52.0%	-70.1%
		2009-10	3.24%	63.8%	126.7%	44.2%	1.21	4.01	0.60	70.1%	54.1%	24.0%
		2008-09	7.06%	-39.5%	-73.1%	57.9%	1.13	0.67	-0.13	-147.3%	-168.3%	-207.7%
		2007-08	6.07%	28.0%	65.5%	44.1%	1.21	3.39	-0.65	8.9%	-7.1%	-37.1%
		2006-07	7.22%	17.0%	3.5%	44.5%	1.32	9.04	0.57	-53.5%	-69.7%	-100.0%
		2005-06	5.60%	63.6%	39.2%	28.1%	1.17	2.94	0.21	3.2%	-7.0%	-26.1%
8	Oil and Gas	Overall	8.12%	18.5%	19.3%	32.5%	1.00	8.57	0.04	-22.3%	-34.1%	-56.3%
		2011-12	8.12%	-9.2%	-20.7%	23.7%	0.94	-0.27	0.07	-51.0%	-59.6%	-75.7%
		2010-11	5.75%	10.9%	1.7%	19.2%	0.86	-0.23	-0.02	-22.9%	-29.8%	-42.9%
		2009-10	3.24%	63.8%	40.4%	33.7%	0.98	25.43	2.81	-2.8%	-15.0%	-37.9%
		2008-09	7.06%	-39.5%	-27.5%	49.1%	1.02	2.04	-0.43	-90.5%	-108.3%	-141.8%
		2007-08	6.07%	28.0%	60.7%	40.0%	1.19	3.72	-0.58	9.4%	-5.1%	-32.4%
		2006-07	7.22%	17.0%	29.6%	30.3%	0.91	4.45	-0.10	-9.1%	-20.1%	-40.7%
		2005-06	5.60%	63.6%	54.1%	19.0%	0.86	1.47	-0.09	29.7%	22.8%	9.8%
9	Tech	Overall	8.12%	18.5%	19.2%	31.1%	0.92	5.60	0.36	-20.7%	-32.0%	-53.2%
		2011-12	8.12%	-9.2%	-5.3%	22.3%	0.88	1.03	-0.18	-33.9%	-42.0%	-57.2%
		2010-11	5.75%	10.9%	16.3%	17.8%	0.81	0.11	0.06	-6.5%	-12.9%	-25.0%
		2009-10	3.24%	63.8%	50.9%	29.1%	0.82	12.73	1.84	13.6%	3.1%	-16.7%
		2008-09	7.06%	-39.5%	-42.0%	42.1%	0.87	0.55	-0.02	-96.0%	-111.3%	-140.0%
		2007-08	6.07%	28.0%	-6.6%	29.7%	0.84	2.45	0.25	-44.6%	-55.4%	-75.6%
		2006-07	7.22%	17.0%	28.9%	31.5%	1.01	9.61	0.91	-11.4%	-22.9%	-44.3%
		2005-06	5.60%	63.6%	52.8%	21.5%	1.04	1.41	-0.46	25.2%	17.4%	2.7%

***Note:** Overall means the seven years performance from 01-04-2005 to 31-12-2012

Market return is based on the Bombay Stock Exchange performance

Table 2: Performance Evaluation Ratios

Rank	Overall		
	Sharpe Ratio	**Treynor Ratio**	**Jensen Ratio**
Rank 1	FMCG	FMCG	Consumer Durable
Rank 2	Auto	Consumer Durable	FMCG
Rank 3	Consumer Durable	Auto	Auto
Rank 4	Bank	Health Care	Bank
Rank 5	Health Care	Bank	Health Care
Rank 6	Tech	Tech	Tech
Rank 7	Oil and Gas	Oil and Gas	Oil and Gas
Rank 8	IT	IT	IT
Rank 9	Metal	Metal	Metal
Rank	**2011-12**		
	Sharpe Ratio	**Treynor Ratio**	**Jensen Ratio**
Rank 1	FMCG	FMCG	FMCG
Rank 2	Health Care	Health Care	Auto
Rank 3	Auto	Auto	Health Care
Rank 4	Consumer Durable	Consumer Durable	Consumer Durable
Rank 5	IT	IT	Bank
Rank 6	Bank	Bank	IT
Rank 7	Tech	Tech	Tech
Rank 8	Oil and Gas	Oil and Gas	Oil and Gas
Rank 9	Metal	Metal	Metal
Rank	**2010-11**		
	Sharpe Ratio	**Treynor Ratio**	**Jensen Ratio**
Rank 1	Consumer Durable	Consumer Durable	Consumer Durable
Rank 2	FMCG	FMCG	FMCG
Rank 3	IT	IT	Bank

Table 2: Contd.,

Rank 4	Bank	Auto	IT
Rank 5	Auto	Bank	Auto
Rank 6	Tech	Tech	Tech
Rank 7	Health Care	Health Care	Health Care
Rank 8	Oil and Gas	Oil and Gas	Oil and Gas
Rank 9	Metal	Metal	Metal
Rank	**2009-10**		
	Sharpe Ratio	**Treynor Ratio**	**Jensen Ratio**
Rank 1	Auto	Health Care	Consumer Durable
Rank 2	Health Care	Consumer Durable	Metal
Rank 3	Consumer Durable	Auto	Auto
Rank 4	Metal	IT	IT
Rank 5	IT	Metal	Health Care
Rank 6	Bank	Bank	Bank
Rank 7	Tech	FMCG	FMCG
Rank 8	FMCG	Tech	Tech
Rank 9	Oil and Gas	Oil and Gas	Oil and Gas
Rank	**2008-09**		
	Sharpe Ratio	**Treynor Ratio**	**Jensen Ratio**
Rank 1	FMCG	FMCG	Oil and Gas
Rank 2	Oil and Gas	Oil and Gas	Bank
Rank 3	Bank	Bank	FMCG
Rank 4	IT	IT	IT
Rank 5	Tech	Tech	Tech
Rank 6	Auto	Auto	Auto
Rank 7	Health Care	Metal	Health Care
Rank 8	Metal	Health Care	Metal
Rank 9	Consumer Durable	Consumer Durable	Consumer Durable
Rank	**2007-08**		
	Sharpe Ratio	**Treynor Ratio**	**Jensen Ratio**
Rank 1	Oil and Gas	Metal	Metal
Rank 2	Metal	Oil and Gas	Oil and Gas
Rank 3	FMCG	FMCG	FMCG
Rank 4	Bank	Bank	Bank
Rank 5	Consumer Durable	Consumer Durable	Consumer Durable
Rank 6	Health Care	Health Care	Health Care
Rank 7	Tech	Auto	Auto
Rank 8	IT	Tech	Tech
Rank 9	Auto	IT	IT
Rank	**2006-07**		
	Sharpe Ratio	**Treynor Ratio**	**Jensen Ratio**
Rank 1	Oil and Gas	Oil and Gas	Oil and Gas
Rank 2	Tech	Tech	Tech
Rank 3	Bank	Bank	Bank
Rank 4	IT	IT	IT
Rank 5	Consumer Durable	Consumer Durable	Consumer Durable
Rank 6	Metal	Metal	Metal
Rank 7	Health Care	Auto	Health Care
Rank 8	Auto	Health Care	Auto
Rank 9	FMCG	FMCG	FMCG
Rank	**2005-06**		
	Sharpe Ratio	**Treynor Ratio**	**Jensen Ratio**
Rank 1	Auto	FMCG	FMCG
Rank 2	FMCG	Auto	Auto
Rank 3	Consumer Durable	Consumer Durable	Consumer Durable
Rank 4	Oil and Gas	Health Care	Health Care
Rank 5	Health Care	Oil and Gas	Oil and Gas
Rank 6	Tech	Tech	Tech
Rank 7	IT	IT	IT
Rank 8	Bank	Bank	Bank
Rank 9	Metal	Metal	Metal

Table 3: Overall Stock Indices Correlation

Sector	Auto	Bank	Consumer Durable	FMCG	Health Care	IT	Metal	Oil and Gas	Tech
Auto	1.00								
Bank	0.09	1.00							
Consumer Durable	0.14	0.62	1.00						
FMCG	0.63	0.02	0.05	1.00					
Health Care	0.09	0.64	0.65	0.02	1.00				
IT	-0.04	0.59	0.52	-0.07	0.58	1.00			
Metal	0.75	0.08	0.13	0.60	0.09	-0.07	1.00		
Oil and Gas	0.05	0.73	0.62	-0.03	0.67	0.61	0.08	1.00	
Tech	-0.01	0.71	0.61	-0.05	0.68	0.93	-0.02	0.73	1.00