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An analytical study on return and volatility of Indian stock market

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Abstract
The current study has analyzed the volatility in the return of BSE sensex for period of 7 years from 1 November 2011 to 31 October 2018. It aims at describing the extent of volatility of BSE sensex and companies from specific indices. Statistical tools used for the purpose of study are written in the context of daily return on closing price and measure of volatility of intraday by mention open to open and close to close volatility and measure of intraday volatility. As index gives the idea of the aggregate performances of number of companies representing the market. The BSE sensex is considered for the study an individual stock of IT sector are also taken into the consideration. From the study it was found that highest volatility in BSE sensex was during 2011-12 with standard deviation of 1.06 constant from year 2012-13. The intraday stocks were found more volatile than the market index BSE sensex. However, intraday trading stocks are found less volatile in comparison with sensex. Stocks of IT sector were relatively less risky than Index and highest volatility was observed during the year 2011-12.

Keywords: return, volatility, stock market, BSE sensex

Introduction

The Indian stock market is a promising market with numerous opportunities for investors where majority of trading takes place at two major exchanges namely the Bombay Stock Exchange (BSE) and National Stock Exchange (NSE). The BSE is the foremost exchange in existence since 1875, whereas NSE came into existence in 1992. Trading at this exchange takes place as all the major firms of India are listed on this exchange. There is an existence of market efficiency, also reduced costs. The buyers and sellers in the Indian stock market are anonymous and enjoys the advantage of transparency there exists order driven market.

There are trading opportunities as the stock prices are not constant and they tend to change every day by the market. And this change is reflected by the behaviour of buyers and sellers as per their valuation of stock, in the simplest term the supply and demand of stocks. The more number of buyers greater would be the demand and higher stock prices, inversely when there are more sellers the supply increases and stock prices reduces. There comes the role of understanding stock market volatility.

Volatility in market is concerned with velocity of price changes, it could be either for stocks, commodities and forex market. However the increased volatility in the stock market indicates either market top or bottom. The traders bid higher prices on the reaction to a good news and short sell on bad news which drives prices down.

With the increase in stock market volatility there comes large stock price change either in terms of advances or decline. With the increase the risk of equity investment which requires shifting funds to less risky assets. In the recent times these issues of return and volatility have become very significant specially to regulators, brokers, investors, dealers, policy makers and researchers mainly after increased FIIs investment.

Volatility being is one of the most basic tools to measure statistical risk is used to measure market risk for both individual stocks and portfolio. Volatility is expressed in many ways with very basic is the variation of the stock return. And this study is concerned with analyzing the return and volatility of the Indian stock market. Where the volatility is observed in terms of inter- day volatility and intraday volatility. As the stock exchange index is the representation of the entire market scenario however the index Sensex representing the performance of foremost Bombay Stock Exchange is taken into consideration and also the individual stocks belonging from differential sectors forms a part of the study.

Hence, the objectives of the study are:

1. To analyse the return of BSE Sensex and it's leading companies.
2. To find out the volatility with respect to close to close, open to open and high to low.

Literature Review

B. Ramya (November 2014) conducted a study on stock market return and volatility analysis between Sensex with sectoral indices of Bombay stock exchange. The objective of this study was to analyze the return of S&P BSE Sensex index and its sectoral indices and to identify the volatility in sectoral indices and BSE Sensex index. The study was based on the secondary data. The data had been collected from daily reports of BSE Sensex and 13 sectoral Indices through Bombay stock Exchange official websites and journals. The indices selected for the study were BSE Sensex index, BSE Auto index, BSE Bank index, BSE healthcare index, BSE Metal index, BSE Gas index, BSE Teck index, BSE Realty index. The researcher has used logarithm to find return and volatility. The researcher used various tools to analyze the data like descriptive statistics,

Daily return and Volatility, Auto Correlation and Exponential Trend. The data was represented into a table and chart form. The study concluded that the correlation is significant for most of the indices except the BSE Auto index, BSE Power index, BSE PSU Bank Index and BSE Realty index and further found that the all index have more impact on Sensex.

Dr. G. Shanmugasundram and D. John Benedict (August 2013) conducted a research on volatility of the Indian sectoral indices with reference to National Stock Exchange. The objective of study was to provide an empirical support to identify the risk factors in sectoral indices and CNX Nifty index and also to see the risk relationship in different time intervals. The study used secondary data which covered the time period of 8 years from 1st January 2004 to 30th April 2012 letterhead taken from the official website of NSE. The data collected was analysed using one way anova between subjects has used to identify any difference in the distribution of risk related to various sectoral indices. The study concluded that there is no difference across in the standard deviation among the various sectoral indices.

Dr. Sandeep R Podar (January 2017) conducted a study on volatility of stock traded on BSE Sensex. The main objective of this study was to study the volatility of securities listed in BSE, to find out the various factor which are responsible for volatility, to suggest better investment decision on calculated beta of six companies, to analyze better returns from those selected companies. The methods used in this research was sample size chosen, sample description, data collection, statistical tool was used to analyze the data were beta, standard deviation coefficient correlation basically. The data were taken from secondary source which were available on website of BSE. The study concluded that the IT sector are more volatatile and their investors exhibits bias behavior with regard to their internal movements, where as in banking sector the external factor does not show much volatility over when inflation or other factors attack the market, investors are open to change.

Bordoloi and Shiv Shankar (June 2012) analyzed volatility in the stock market. The objective behind the study was to estimate volatility in the Indian equity market return. The study was conducted on 30 script of BSE and 100 script stock indices from BSE along with it S&P CNX from NSE. Observation from the beginning of January 2000 tooctober 2007 was taken as sample. Volatility was assessed using GARCH model or indices and S&P CNX500, while. The result of their study derived the evidence of increase in volatility due to certain negative factors has been found in all the equity markets. The estimates of the volatility for all the indices were found to move through the application of spectral analysis.

Venkataramanaiah Malepati (January 2016) conducted a study on volatility in Bombay Stock Exchange Limited. The objective of the study was to access the volatility in the price of securities of the BSE and to study the disposition in the price of stock of Sensex and select sectoral indices of the BSE and evaluate volatility on the price of stock of Sensex and select sectoral indices of the BSE. The secondary data was used which covered the time period of 10 years from 2001 to 2010. The data was collected from the website of BSE journal and magazine. The researcher used Karl Pearson correlation to find the relationship between Sensex and sectoral indices. The study concluded that the dispersion in the Sensex and other sectoral indices is increased gradually over time and has less volatility in comparison with other sectoral indices leaving a few expections. Further the study found that there was a positive relationship among all the indices.

Amita Batra (March 2004) conducted a study on stock market return volatility pattern in India. The objective of the study was to analyse the time variation volatility in Indian stock market during the period of 1979 to 2003. The study used secondary data which was collected from official source such as SEBI RBI and BSE. The daily closing price of the stock Sensex were used as a source data to arrive at monthly data. The researcher used naive model, conditional variance and augmented GARCH model to analyse the data. The data was represent in table and graph form. The study concluded that time varying pattern of stock return volatility in Bull faces is also higher. The study also found that the stock market cycles diamond in the recent past validity has declined in the past liberalisation face for both the bull and bear face of the stock market cycle.

Research Methodology

Problem Statement

Financial market over certain year have significantly contributed towards economic development in which equity plays a vital role but there has been high volatility rate as well, which impacts the firm's financial growth hence there arises a need to study volatility of stock market.

Research Design

The study is based on analytical research design as it is concerned with analyzing available information in order to evaluate and discover findings. As it is involved understandings relationship between return and volatility, also it provides evidence to support the findings.

Data Used

The daily closing prices are collected from the official website of www.BSEIndia.com for the period of seven years from 1st November 2011 to 30th October 2018.

Statistical Tools

The study involved estimation of risk that is volatility hence it is calculated using standard deviation and beta. Also the return is calculated from daily price movement.

Return

Return is calculated on daily closing price of Sensex and shares as percentage of difference between two days price.

Measure of volatility

- **Inter-day Volatility:** It consists of close to close and open to open volatility.
- **Close to Close Volatility:** Close-to-Close volatility measures the price variability of an asset. It is represented by the standard deviation of the prices on a given observation period. For computing close to close volatility, the closing values of the Sensex and shares are taken. Close to close volatility (standard Deviation) is

measured with the following formula

$$SD = \sqrt{\frac{\sum (r_i - r_{avg})^2}{n-1}}$$

Where
Ri – the return observed in one period (one observation in the data set)
Ravg – the arithmetic mean of the returns observed n – the number of observations in the dataset

Open to Open Volatility: - Open to open volatility is necessary for many market participants because opening prices of shares and the index value reflect any positive or negative information that shows after the close of the market and before the start of the next day's trading.

$$SD = \sqrt{\frac{\sum (r_i - r_{avg})^2}{n-1}}$$

Where
Ri – the return observed in one period (one observation in the data set)
Ravg – the arithmetic mean of the returns observed n – The number of observations in the days.

Intra-Day Volatility: - The variation in share price return within the trading day is called intra– day volatility. It shows how the indices and shares behave in a particular day. Intra–day volatility is calculated with the help of Parkinson Model.

$$\sigma = \bar{k}\sqrt{1/n\Sigma lo(H-L)^2}$$

Where
σ =high-low volatility K=0.601
H= High price on the day L= Low price on the day n= Number of trading days

Beta

$$\beta = Covariance(r_i, r_m)/Variance(r_m)$$

Beta is also calculated on the stocks which represents systematic risk. This will represent the volatility of companies and sectoral indices in comparison to BSE Sensex.

Scope of the study
This study describes the extent of volatility of BSE sensex and companies from selected indices. There are various other factors that could affect the market movement leading to volatility which could be discovered.

Limitations of the study
1. This study is applicable only to BSE sensex & selected companies.

The time period of study is limited restricted to only measuring return and volatility.

Analysis
Mean of BSE Sensex and IT Companies

MEAN						
YEAR	BSE SENSEX	HCL	INFY	TCS	WIPRO	TECHM
2011-12	17158.68	243.82	321.01	606.78	197.00	176.18
2012-13	19398.31	399.67	337.05	783.39	202.78	272.27
2013-14	23401.78	712.00	431.26	1143.63	272.17	492.56
2014-15	27699.04	907.73	530.91	1281.04	289.67	607.04
2015-16	26237.25	802.28	560.45	1224.36	269.27	487.79
2016-17	29753.56	846.32	480.03	1202.41	258.03	443.75
2017-18	35032.84	955.00	604.02	1689.16	292.09	630.55

The above table shows the mean value of BSE Sensex and stocks of IT sector. Mean being calculated by using the closing price of stocks and index. The highest value of mean for BSE Sensex as well as stock is observed for the year 2017-18, with and height as compared to previous year mean. Where is the lowest meal for both the index and stock was observed in the year 2011-12. However the mean value continuously increasing during initial year is observed reducing for all the stocks including Sensex except INFY during the year 2015-16 and even in the year 2016-17 for certain stocks.

Standard Deviation of BSE Sensex and IT Companies

S.D						
YEAR	BSE SENSEX	HCL	INFY	TCS	WIPRO	TECHM
2011-12	852.3076	29.06	26.67	38.56	14.53	29.19
2012-13	617.3692	76.46	40.19	130.76	24.49	46.77
2013-14	2417.378	83.02	30.40	103.53	16.11	63.97
2014-15	971.9161	73.93	30.50	33.67	17.93	72.77
2015-16	1514.891	47.45	34.83	55.98	14.87	37.27
2016-17	2132.334	34.95	19.10	59.40	23.98	35.96
2017-18	1571.437	66.94	75.48	279.13	20.40	83.03

The above table shows the standard deviation for BSE Sensex and stocks of IT sector calculated by using the daily closing price of Sensex and stocks. Again the highest standard deviation in BSE sensex was observed in the year 2013-14 being 2417.378 respectively. Lower standard deviation was observed in the stocks of it when compared to the stocks of other sector which suggest that the stocks are safer than the stocks of automobile comma where the highest standard deviation was observed in the stocks of TCS more volatile value being 279.13 for the year 2017-18. Lowest S.D observed in the stock of INFY in the year 2016-17.

Return of BSE Sensex and IT Companies

YEAR	BSE SENSEX	BSE INFORMATION TECNOLOGY				
		HCL	INFY	TCS	WIPRO	TECHM
2011-12	0.03	0.13	-0.09	0.06	-0.04	0.17
2012-13	0.06	0.22	0.11	0.18	0.09	0.19
2013-14	0.12	0.14	0.07	0.08	0.05	0.19
2014-15	-0.01	0.02	0.03	-0.02	0.00	-0.09
2015-16	0.02	-0.07	-0.06	-0.03	-0.10	-0.12
2016-17	0.07	0.03	-0.04	0.03	0.09	0.03
2017-18	0.01	0.06	0.13	-0.06	0.03	0.12

The above table shows the average return in percentage of BSE Sensex along with the stocks of Information Technology sector. Table shows that the highest return for BSE Sensex was during the year 2013 at 0.12% where the stocks of IT also generated return with good performance in concerned with that year with TECHM at 0.19%. However during past years the stocks were seen rising and generating highest return in the year 2012 where HCL was at 0.22% highest among all stocks during past 7 years, followed by TECHM at 0.19%. Stocks of automobile generated negative return many times but the only year when all stocks were observed with small amount of negative return was 2015 with Wipro at – 0.10% and TECHM was -0.12% biggest fall among the stocks of it during this past 7 years. HCL was consistently generating positive return except for the year 2015 with the negative return at -0.07%. Year 2017 also observed good return for the stocks except TCS with negative return of – 0.06% and for Wipro the return was generated but with decreased rate.

Volatility

Close to Close Volatility of BSE Sensex and IT Stocks

YEAR	BSE SENSEX	BSE INFORMATION TECNOLOGY				
		HCL	INFY	TCS	WIPRO	TECHM
2011-12	1.06	1.58	1.81	1.65	1.57	1.96
2012-13	1.06	1.28	2.42	1.53	2.01	1.75
2013-14	0.83	1.77	1.60	1.64	1.57	1.57
2014-15	1.02	2.07	1.65	1.30	1.46	1.98
2015-16	0.91	1.44	1.50	1.32	1.22	1.69
2016-17	0.01	1.22	1.46	1.37	1.16	1.74
2017-18	0.75	1.64	1.40	7.36	1.28	1.83

The above table shows the standard deviation of BSE Sensex and the stocks of Information Technology in percentage which indicates the fluctuation in prices of these stocks. Table shows the highest value of standard deviation of BSE Sensex was at 1.06 % in 2011 which was consistent for the year 2012 where the stock of IT more volatile as Sensex is a summarized representative index. The highest rate of standard deviation in the stocks of TCS was 2.42% for the year 2012. HCL and WIPRO also crossed the 2% band with HCL at 2.07 % in 2014 and Wipro at 2.01 % in 2012. Stocks of TCS were comparatively consistent which in the year 2017 reached the volatility rate of 7.36% highest among all stocks during past 7 years. For the year 2016 when standard deviation of BSE Sensex was as low as 0.01% the stocks of IT were observed with high standard deviation where INFY was at 1.46% Wipro was observed comparatively less volatile among other stocks of IT where the standard deviation was 1.16% for the year 2016 which is the lowest deviation rate among all stocks.

Open to Open volatility of BSE Sensex and It Stocks

YEAR	BSE SENSEX	HCL	INFY	TCS	WIPRO	TECHM
2011-12	1.06	1.64	1.79	1.59	1.45	2.15
2012-13	1.06	1.92	1.87	1.65	1.97	1.84
2013-14	0.83	1.75	1.48	1.63	1.67	1.61
2014-15	1.02	2.06	1.64	1.34	1.35	1.88
2015-16	0.91	1.77	1.53	1.35	1.35	1.77
2016-17	0.01	1.48	1.57	1.42	1.22	1.78
2017-18	0.75	1.70	1.44	7.33	1.74	1.89

The above table shows the open to open volatility of BSE Sensex and stocks of IT sector calculated by taking into consideration the open prices of stocks and index. It is a medium of calculating intraday volatility observed in the stocks the important for many participants. Again the stocks of it I found more volatile with higher risk Association when compared to index of BSE Sensex, which means in intraday trading stocks seems more risky then index. Also the stocks are less parallel to the movement of the index BSE Sensex with less similar movement in terms of volatility.

High to Low Volatility of BSE Sensex and IT Stocks

	HIGH TO LOW					
YEAR	BSE SENSEX	HCL	INFY	TCS	WIPRO	TECHM
2011-12	1.4	0.47	0.49	0.67	0.40	0.43
2012-13	1.41	0.61	0.47	0.74	0.45	0.54
2013-14	1.41	0.74	0.53	0.82	0.47	0.62
2014-15	1.51	0.83	0.63	0.82	0.48	0.71
2015-16	1.46	0.73	0.62	0.79	0.39	0.64
2016-17	1.41	0.73	0.56	0.80	0.40	0.61
2017-18	1.49	0.80	0.66	0.90	0.49	0.75

The above table shows the high to low volatility of BSE Sensex and the stocks of IT sector calculated by using intraday high and low prices of the stocks and index. This is a medium of determining intraday volatility. Again the intraday volatility in BSE Sensex is observed much higher than volatility in the individual stocks of IT sector. The year 2017-18 had the highest intraday volatility for BSE Sensex as well as individual stocks of IT sector where volatility at was observed in the stocks of TCS and 1.49 for BSE Sensex respectively. However the lowest volatility for the year 2011-12 was observed for both stocks and Index.

Beta value of IT Stocks with respect to BSE Sensex

YEAR	BSE INFORMATION TECNOLOGY				
	HCL	INFY	TCS	WIPRO	TECHM
2011-12	0.147182	0.219304	0.261306	0.280527	0.205817
2012-13	0.159875	-0.00619	0.028653	-0.06577	-0.14393
2013-14	0.229836	0.133845	-0.02567	0.03655	0.162969
2014-15	0.585853	0.681466	0.1819	0.213219	0.041533
2015-16	0.133817	0.161133	0.083402	0.11786	0.141041
2016-17	0.410138	0.800216	0.498586	0.387123	0.713555
2017-18	0.465672	0.573559	-0.5719	0.325285	0.622195

The above table shows the Beta value of stocks of BSE Information technology with respect to BSE Sensex. Table shows that in 2011 to 2018, Beta values of all stocks are less than 1 it tends to be less volatile than the market BSE Sensex. Investors who prefer safety of principal for their investments can invest in these stocks as stocks are less risky than the market BSE Sensex.

Findings

Highest volatility was observed in BSE Sensex during the year 20111-12 with S.D at 1.06 consistent for the year 2012-13.

Stocks of Information technology found with highest return in the year 2012-13.

In the year 2015-16, Stocks of IT generated small amount of negative return, whereas BSE Sensex generated positive return.

TCS was found highly volatile with the Standard deviation

of 7.36 in the year 2017-18. For inter-day trading individual stocks are found more volatile than index whereas in Intra-day stocks are found less volatile compared to index.
Stocks of IT are less risky when compared to BSE Sensex.
In inter-day the stocks was observed high volatile when compared to intra-day volatility.

Conclusion

A study found highest positive return on stock and BSE sensex was during the year 2013-14 and fallen to small amount negative IT stocks could not perform or generate return in 2015-16 at IT stood with negative return. The least volatility was observed during the year 2016-17. Different volatility exists for intraday and intraday teading. In intraday trading stocks were more volatile whereas index was more volatile in intraday trading. However, it was found that stocks of IT sector was less risky compared to BSE Sensex with risk measure B<1 which suggest that there would be less volatility in stock price movement than the movement in Index. Trading in securities is less risky in intraday and relatively more riskier in Intraday trading.

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