

# Testing the Volatility Behaviour (GRACH Model) of Indian Stock Market Indices and Sample Companies: A Study with Special Reference to National Stock Exchange

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## Abstract

*Nowadays, in our country take part in an important role about the various sectors economic development. These sectors attain their earning of money from the public, like stock markets. Volatility is a measure of the price movements of financial instruments. It is the relative rate at which the price of a security moves up and down in the stock market. If the price of stock moves up and down rapidly over a short time, it has high volatility and if the price changes at lesser rate, it has low volatility. In daily share price returns are influenced by various factors like government policy, economic, social, political, etc.. Besides, the investors do not have any idea about price movement and volatility in Indian stock markets. Hence, this study aims to investigate the volatility behaviour of Indian sectoral indices and sample companies are included in following indices i.e., NSE Bank Index and Financial Services Index. The volatility of select indices of NSE was tested with the help of Descriptive Statistics, Autocorrelation and GARCH (1, 1) model. The GARCH model indicated that two indices and stocks did not record high volatility during the study period. The present study would help the retail investors to invest the money in the best performing index. This study shows that the NSE Bank Index earned better returns during the study period and the investors, who invested in these indices, earned maximum returns in the stock market operations. Hence this study suggests that investors of the Indian stock markets may focus on these indices for better return in future. Further, investors should watch the market movement before investing their money in stock markets.*

**Keywords:** Indian Stock Market, NSE, Bankex, Financial Services Index and GARCH (1, 1)

## Introduction

Stock Markets refer to a market place where investors buy and sell stocks. The price at which buying and selling transaction takes place is determined by the market forces. A stock market or equity market is a public entity for the trading of company’s stock (shares) and derivatives at an agreed price and these are securities listed on a stock exchange. A Stock Exchange provides trading facilities to trade equity stocks and other securities. It also provides facilities for

the issue and redemption of securities as well as other financial instruments. The securities traded on a stock exchange include shares issued by companies, indices pooled investment products and bonds. There are 23 stock exchanges which comprise of two national entities - BSE, NSE and over 21 other regional exchanges. The BSE and NSE are the most influential Stock Exchanges in India. The National Stock Exchange of India was originally established in the City of Mumbai 18 years ago in 1992. NSE is the largest stock exchange in India in terms of daily turnover and trading volume in both equity and derivative trading. NSE is mutually owned by a set of leading financial institutions, banks, insurance companies and other financial intermediaries in India but its ownership and management operate as separate entities.

### **Volatility**

Volatility refers to the amount of uncertainty or risk about the size of changes in a security's value. A higher volatility means that a security's value can potentially be spread out over a larger range of values. This means that the price of the security can change dramatically over a short time period in either direction. A lower volatility means that a security's value does not fluctuate dramatically but changes in value at a steady pace over a period of time. To study the volatility, Garch Model was used.

### **Leading Stock Exchanges in India**

The India stock market is steered on by the two exchanges namely, Bombay Stock Exchange (BSE) and national stock Exchange (NSE). The trade and business of the entire country is dependent on the performance of these two main stock exchanges.

### **Bombay Stock Exchange (BSE)**

It is the oldest stock exchange in Asia and was established as "The Native Share and Stock Brokers Association" in 1875. It is the first stock exchange in the country to obtain permanent recognition in 1956 from the Government of India under the Securities Contracts Regulation Act 1956.

### **National Stock Exchange (NSE)**

The National Stock Exchange of India Limited has genesis in the report of the High Powered Study Group on Establishment of New Stock Exchanges. It recommended promotion of a National Stock Exchange by financial institutions (FIs) to provide access to investors from all across the country on an equal footing. Based on the recommendations, NSE was promoted by leading Financial Institutions at the behest of the Government of India and was incorporated in November 1992 as a tax-paying company unlike other stock exchanges in the country.

National Stock Exchange (NSE) operates a nation-wide, electronic market, offering trading in Capital Market, Derivatives Market and Currency Derivatives segments including equities, equities based derivatives, Currency futures and options, equity based ETFs, Gold ETF and Retail Government Securities. NSE is committed to operate a market ecosystem which is transparent and at the same time offers high levels of safety, integrity and corporate governance, providing ever growing trading & investment opportunities for investors.

### **Role of NSE in Indian Securities Market**

National Stock Exchange of India Limited (NSE) was given recognition as a stock exchange in April 1993. NSE was set up with the objectives of (a) establishing a nationwide trading facility for all types of securities, (b) ensuring equal access to all investors all over the country through

an appropriate communication network, (c) providing a fair, efficient and transparent securities market using electronic trading system, (d) enabling shorter settlement cycles and book entry settlements, and (e) meeting the international benchmarks and standards. Within a short span of life, above objectives have been realized and the Exchange has played a leading role as a change agent in transforming the Indian Capital Markets to its present form.

NSE has set up infrastructure that serves as a role model for the securities industry in terms of trading systems, clearing and settlement practices and procedures. The standards set by NSE in terms of market practices, products, technology and service standards have become industry benchmarks and are being replicated by other market participants. The Exchange currently operates three market segments, namely Capital Market Segment, Wholesale Debt Market Segment and Futures & Options segment.

### **Review of Literature**

An attempt has been made in this section to review the earlier research works undertaken in the area of capital market efficiency to understand the research gap and methodology adopted by researchers and findings of earlier studies.

**Campbell R. Harvey and Robert E. Whaley** (1992) investigated the dynamic behavior of market volatility. The study observed that after transaction costs, a trading strategy based upon out-of-sample volatility changes did not generate economic profits. The study supported the notion that S & P 100 index option market is allocationally efficient. **Dimitrios Tsoukalas** (2000) examined the predictability and volatility in three major stock markets (US, UK and Japan). It was found that the stock returns were predictable. Besides, there was persistence in the variance of stock returns and predictability and the persistence was attributed to common sources of information. **Kin-Yip Ho and Albert K C Tsui** (2004) probed the applicability of volatility behavior of aggregate indices to the Sectoral Indices. The study found the leverage effects of equity returns in the market. **Haitham Al-Zoubi and Bashir Kh.Al-Zubi** (2007) examined the market efficiency and studied asymmetric effect and time varying risk return relationship for daily stock return of Amman Stock Exchange (ASE). The result showed that the stock return followed an ARMA (1, 1) stochastic process with significant serial correlation. **Prabahar R, et.al** (2008) studied the return and risk element of investing in the shares of Indian Information Technology Industry. It was found that the daily average mean returns of the six companies were lower than the daily mean return of the indices. Besides, the volatilities of the stock returns over the study period were much higher than that of indices. According to this study, the unsystematic risk of the IT stocks was higher than the systematic risk. **Joseph Anbarasu D and Srinivasan S** (2009) examined whether the Indian Stock Market, during the time of financial crisis and the meltdown across the world, adjusted to the new information or not. The study found that there existed fatter tail and greater risk of extreme outcomes. **Som Sankar Sen** (2010) analysed daily time series data of S & P CNX NIFTY. The study attempted to fit the data into GARCH (1,1) model to find conditional variances. According to this study, there were some macroeconomic variables which could influence the market volatility and the scrip level analysis was useful to capture the influence of company specific factors on scrip level volatility. **Pasupuleti Venkata Vijay Kumar and Piyush KumarSingh** (2011) examined the liquidity of the sectoral indices and market index on the basis of price returns. The liquidity measure on the basis of Market Efficiency Coefficients (MEC), found that the indices of sectors like health care, consumer durables and the auto recorded high long term variance in the returns whereas oil and gas sectors recorded a lower value. **Santhosh Kumar and Lagesh M.A** (2011) investigated price volatility and hedging of four commodity futures indices. GARCH (1, 1) Model was employed to measure the spot return volatility of respective indices. The analysis of volatility

was based on GARCH models by employing hedged return and variance reduction approaches. **Usha Rajagopalan et.al** (2013) examined the factors that influenced volatility in the equity market as these factors would give a more realistic picture surrounding volatility. The results of this study show that there was no significant correlation between the equity market volatility and institutional arrangements.

### Statement of the Problem

The Capital Market is a vital institution as it facilitates economic development. It is true that so many parties are interested in knowing the efficiency of the Capital Market. The small and medium investors could be motivated to save and invest in the capital market only if their securities in the market are appropriately priced. But more number of peoples does not know how to invest the money in correct indices in Indian Share Market. Besides, the investors do not have any idea about which company and which indices are best in India. The previous studies tested the efficiency and volatility in global stock market, namely, Ghana Stock Market, Palestinian Stock Market, Russian Stock Market and also tested the random walk for various popular indices. But in India, few studies have examined the daily values, weekly values and monthly values of the stock market in particular stock indices, like S&P CNX Nifty, BSE 100 Index, and Nifty Junior etc. It is to be noted that no researcher has used the daily returns in previous studies. So the main problem of the investors is that they do not know how to invest the money in returns- earning indices. Besides, there was no comprehensive study carried out to test the volatility behavior of the different sectors and stocks of a stock exchange in the Indian Context. Hence, the present study aims to investigate the volatility of selected stocks in NSE Bank Index and selected stocks in financial services Index using the daily returns.

### Objectives of the Study

1. The objectives of the present study are as follows.
2. To study the returns of the sample stocks in NSE Bank Index and Financial Services Index
3. To analyse the normality distribution about the sectoral indices and selected stocks in NSE Bank Index and Financial Services Index.
4. To tested the volatility behavior in the returns of sectoral indices and selected stocks in NSE Bank Index and Financial Services Index.

### Hypotheses of the Study

The present study tests the following null hypothesis.

**NH1.** There is no normality distribution in the returns of the Sectoral Indices and selected stocks in NSE Bank Index and Financial Services Index.

**NH2.** There is no risky volatile in the returns of the Sectoral indices and selected stocks in NSE Bank Index and Financial Services Index.

### Methodology of the Study

#### Selection of the Sample

The study attempts to test the volatility behavior of sectoral indices and selected stocks in daily bank index and financial services index returns. The sample bank stocks and financial services stocks were taken from NSE Bank Index and financial services Index. There are totally 12 banks listed in NSE Bank Index and 15 stocks listed in NSE Financial Services Index as on. 31<sup>st</sup> December 2018. Out of those stocks, top five banks from NSE Bank Index and top five stocks from NSE Financial Services Index. The details of selected stocks are given in **Table-1**.

### Source and Collection of Data

The study mainly depended on secondary data. The required data regarding daily stocks returns of NSE Bank Index and NSE Financial Services Index were collected from the CMIE PROWESS Corporate Database and www.nseindia.com. The other required data were collected from various books, journals and magazines.

### Period of the Study

The study analyzed the daily stocks returns of volatility of sectoral analysis listed in NSE Bank Index and NSE Financial Services Index for five years from 1<sup>st</sup> January 2013 to 31<sup>st</sup> December 2018.

### Tools Used for Analysis

For the purpose of analysis of sectoral analysis in Indian Stock Market, the following tools were used.

#### (i) Descriptive Statistics

##### (a) Mean

The mean is calculated by using following formula.

$$\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$$

##### (b) Standard Deviation

The standard deviation of a random variable  $X$  is defined as:

$$\begin{aligned}\sigma &= \sqrt{E((X - E(X))^2)} = \sqrt{E(X^2) - (E(X))^2} \\ &= \sqrt{\text{Var}(X)}\end{aligned}$$

Where,

$E(X)$  is the expected variable of  $X$ , and

$\text{Var}(X)$  is the variance of  $X$ .

##### (c) Skewness

Skewness is a measure of symmetry, or more precisely, the lack of symmetry. A distribution or data set is symmetric if it looks the same to the left and right of the centre point. The skewness for a normal distribution is zero, and any symmetric data should have skewness near zero. Negative values for the skewness indicate data that are skewed left and positive values for the skewness indicate data that are skewed right. The skewness is calculated as follows,

$$\text{skewness} = \frac{\sum_{i=1}^N (Y_i - \bar{Y})^3}{(N - 1)s^3}$$

Where,

$\bar{Y}$  is the mean,

$S$  is the standard deviation and

$N$  is the number of data points.

**(d) Kurtosis**

Kurtosis is a measure of whether the data are peaked or flat relative to a normal distribution. That is data sets with high kurtosis tend to have a distinct peak near the mean, decline rather rapidly, and have heavy tails. Data sets with low kurtosis tend to have a flat top near the mean rather than a sharp peak. A uniform distribution would be the extreme case. The kurtosis is defined as,

$$kurtosis = \frac{\sum_{i=1}^N (Y_i - \bar{Y})^4}{(N - 1)s^4}$$

Where,

$\bar{Y}$  is the mean,

S is the standard deviation and

N is the number of data points.

**(ii) GARCH (1,1) Model**

A deficiency of ARCH (q) models is that the conditional standard deviation process has high frequency oscillations with high volatility coming in short burst. GARCH models (p, q) permit a wider range of behavior, in particular more persistent volatility. **Bollerslev (1986)** proposed a more generalized form of the ARCH (m) Model appropriately termed the GARCH Model which has two equations. Numerous parametric specifications for the time varying conditional variance have been proposed in the literature. This is the formula to calculate the GARCH Model:

$$\sigma_t^2 = \alpha_0 + \alpha_1 u_{t-1}^2 + \alpha_2 u_{t-2}^2 + \dots + \alpha_q u_{t-q}^2 + \beta_1 \sigma_{t-1}^2 + \beta_2 \sigma_{t-2}^2 + \dots + \beta_p \sigma_{t-p}^2$$

**Limitations of the Study**

The study suffers from the following main limitations.

1. The study covered a period of only five years from 2013 to 2018.
2. The study was based only on secondary data, and hence it is riddled with certain limitations, which are bound to be connected with the secondary data.
3. This study focused only on NSE Bank Index and Financial Services Index.
4. All the limitations associated with various tools like Summary Statistics, GARCH model are applicable to this study also.

**Analysis of Stocks in NSE Bank Index and Financial Services Index**

For the purpose of this study, the analysis of Volatility was arranged as follows:

8.1 Summary Statistics for Sectoral Indices and Selected Stocks in NSE Bank Index and Financial Services Index

8.2 Volatility of daily returns using GARCH (1, 1) Model for Sectoral Indices and Selected stocks in NSE Bank Index and Financial Services Index.

**Summary Statistics for Sectoral Indices and selected stocks in NSE Bank Index and Financial Services Index**

**Table-2** depicts the normality of daily returns using Descriptive Statistics for the sample stocks in NSE Bank Index and Financial Services Index taken for this study. As stated earlier, the Mean, Standard Deviation, Skewness and Kurtosis were used for analysis of normality of daily returns. It is to be noted from the analysis of the Table that the mean average daily returns were positive for all sample stocks in NSE Bank Index namely, Axis Bank, HDFC Bank, ICICI Bank Ltd, SBI and Yes Bank Ltd. However, the daily mean return was high for SBI (0.0010), compared to the other sample

stocks in both indices. NSE Bankex earned high return (0.0004) while NSE Financial Services Index accounted for the lowest return (0.0003) during the study period. The SBI earned the highest standard deviation (0.03256) in both indices, like NSE Bank Index and NSE Financial Services Index, which indicates the highest risk. The analysis of standard deviation in the returns of NSE Bank Index was 0.0157 and NSE Financial Services Index was 0.0148. It is clearly understood that the NSE Bank Index was highest standard deviation and it indicate highly risk. It is clearly understood from the analysis of skewness for the daily returns for two indices and selected stocks were registered positive values. According to the analysis of Kurtosis, recorded values were positive for all selected stocks and both indices during the period of study. It is seen that out of five stocks in NSE Bank Index, all the stocks earned a value above the level of 3 except one stock like SBI (2.404). The values of four stocks in Financial Services Index [Axis Bank (3.051), HDFC Bank (6.423), ICICI Bank (3.419) and Reliance Capital Ltd (4.140) as shown in the Table, were more than 3 and they were leptokurtic. The value of only one stock in Financial Services Index [SBI (2.404)] as clearly indicate that the Table, were below the value of three, it's indicate that the platykurtic. It is clearly understood from the anlaysis of kurtosis that one index was below the value of three, namely NSE Bank Index (1.985) and the other index of NSE Financail Services Index was more than the value of three. It is to be noted that the maximum number of stocks are not normally distributed during the study period. Hence the Null Hypothesis (NH1) “**There is no normality distribution in the returns of the Sectoral Indices and selected stocks in NSE Bank Index and Financial Services Index**” is accepted.

### **Volatility of daily returns using GARCH (1, 1) Model for Sectoral Indices and Selected stocks in NSE Bank Index and Financial Services Index.**

**Table-3** shows the results for daily share price returns of NSE sample sectoral indices during the study period from 01.01.2013 to 31.12.2018. It is to be noted that the NSE Bank Index, out of five banks four banks, like Axis Bank, HDFC Bank, ICICI Bank and Yes Bank did not volatile at the high level. The remaining one bank, namely, SBI (1.468863) indicate that the high level of volatile during the study period. At the same time the NSE Bank Index was not more volatile. According to the analysis of GARCH Model, the values ( $\alpha + \beta$ ) of all selected stocks were not more than the value of one, except one stock (SBI). It is seen that out of five sample stocks, the values of ( $\alpha + \beta$ ) four sample stocks were 0.892095 (Axis Bank), 0.351796 (HDFC Bank), 0.599744 (ICICI Bank) and 0.957334 (Reliance Capital). The value for SBI was 1.46863, which was higher than the value of one. Its indicate that the highly volatile. It is important that the value of  $\alpha + \beta$  for NSE Financial Services Index is less than the value of one, its low volatile during the study period.

Hence, the Null Hypothesis (NH3), namely, “**There is no risky volatile in the returns of the Sectoral indices and selected stocks in NSE Bank Index and Financial Services Index**” is accepted.

### **Findings of the Study**

The following are the important findings of the study.

All the selected stocks for this study earned positive returns. Especially the SBI earned a highest return (0.0003) in NSE Bank Index and NSE Financial Services Index.

The analysis of standard deviation was recorded the highest risk in SBI (0.03256).

The results of Autocorrelation for SBI and Yes Bank in NSE Bank Index revealed significant returns at 5% level and SBI in NSE Financial Services Index regarded 5% significant level.

The analysis of autocorrelation indicate that the two sample indices were significant at 5% level, but not at the majority period.

According to the analysis of GARCH (1,1) Model, the values for sample indices for NSE bank Index and NSE Financial Services Index were less than the value of one during the study period.

The analysis of volatility by using GARCH (1, 1) Model confirms the fact that based on daily return, the stock market (NSE) in India was not more volatile during the study period.

### Conclusion

The study analyzed the returns of Sectoral Indices and selected stocks listed in NSE Bank Index and NSE Financial Services Index. It is found that the returns of two indices NSE bank Index were well performed during the study period. It is analyzed the market efficiency of those indices and selected stocks were did not market efficient in weak form. The analysis of GARCH Model showed that the daily returns of sectoral indices and selected stocks recorded some fluctuations in the Indian Stock Market, but not at the highly fluctuate movement.. It is to be noted that the analysis from the Table indicates that the daily return movements of sectoral indices and selected stocks in NSE Stock Index and NSE Financial Services Index were not high, except one stock like SBI in both the indices during the study period

**Table 1 List of the Selected Stocks in NSE Bank Index and NSE Financial Services Index**

Sl.No	Name of the Stocks
<b>NSE Bank Index</b>	
1	Axis Bank
2	HDFC Bank
3	ICICI Bank
4	SBI
5	Yes Bank
<b>NSE Financial services Index</b>	
1	Axis Bank
2	HDFC Bank
3	ICICI Bank
4	Reliance Capital
5	SBI

Source: collected from www.nseindia.com

**Table 2 Descriptive Statistics of Sectoral Indices and selected stocks in NSE Bank Index and NSE Financial Services Index**

Name of the Stocks	Mean	Standard Deviation	Skewness	Kurtosis
NSE Bank Index	0.0004	0.01579	0.190	1.985
Axis Bank	0.0000	0.03202	0.578	3.051
HDFC Bank	0.0001	0.02718	0.594	6.423
ICICI Bank	0.0004	0.03057	0.291	3.419
SBI	0.0010	0.03256	0.925	2.404
Yes Bank	0.0007	0.03200	0.727	3.527



NSE Financial Services Index	0.0003	0.01183	0.109	3.629
Axis Bank	0.0000	0.03202	0.578	3.051
HDFC Bank	0.0001	0.02718	0.594	6.423
ICICI Bank	0.0004	0.03057	0.291	3.419
Reliance Capital Ltd	0.0000	0.02813	0.079	4.140
SBI	0.0010	0.03256	0.925	2.404

**Source:** Computed by using SPSS

**Table 3 Results of Volatility using GARCH (1, 1) Model for NSE Bank Index and NSE Financial Services Index**

Name of the Indices and Stocks	$\alpha$	$\beta$	$\alpha+\beta$
NSE Bank Index	0.049561	0.929991	0.979552
Axis Bank	0.001616	0.890479	0.892095
HDFC Bank	0.313948	0.037848	0.351796
ICICI Bank	0.002292	0.597482	0.599774
SBI	0.780497	0.688366	1.468863
Yes Bank	0.069178	0.901673	0.970851
NSE Financial Services Index	0.036541	0.432651	0.969192
Axis Bank	0.001616	0.890479	0.892095
HDFC Bank	0.313948	0.037848	0.351796
ICICI Bank	0.002292	0.597482	0.599774
Reliance Capital	0.061290	0.896044	0.957334
SBI	0.780497	0.688366	1.468863

**Source:** Computed by using E-views.

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