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Stock returns volatility of select nse – Listed automobile and engineering sector Stocks: An empirical study

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Abstract
Stock returns volatility is a key factor influencing investment decisions, portfolio management, and risk assessment in financial markets. Global financial meltdowns have massive shock on different sectors as well as on scripts returns. The study examines the volatility of stock returns for selected automobile and engineering sector stocks listed on the National Stock Exchange (NSE) of India based on time series dataset taking into consideration of daily closing adjusted stock price from 2001-02 to 2015-16. The objective of this paper is to study volatility design of daily stock returns. These sectors play a crucial role in India's economic development and are highly sensitive to macroeconomic changes, policy decisions, and global market trends. The study employs statistical and econometric models**,** including Descriptive statistics, Generalized Autoregressive Conditional Heteroskedasticity (GARCH) models**,** T-GARCH and E-GARCH to examine historical stock price data of selected NSE-listed companies. Main findings suggest that time varying volatility behavior of Indian stock market may be due to recent global financial meltdown which is originated from US sub-prime crisis. Also effect captured by different models show that negative shocks have significant effect on conditional volatility. Findings from this research will provide valuable insights for investors, financial analysts, and policymakers by highlighting risk factors and volatility trends within these key sectors.

Keywords: Stock returns, volatility, nse, garch model, risk management

Introduction

Volatility is a key indicator of market risk and plays a crucial factor influencing investment decisions and portfolio management. Investors and financial analysts closely monitor volatility to assess risk and make informed investment choices. The National Stock Exchange (NSE) of India, being one of the largest stock exchanges in the world, hosts a diverse set of industries, including the automobile and engineering sectors, which play a significant role in India's economic growth. The automobile industry is a key contributor to India's GDP, driven by increasing consumer demand, government initiatives, and technological advancements. Similarly, the engineering sector, comprising heavy and light engineering companies, is vital for infrastructure development and industrial growth. Both these sectors are influenced by macroeconomic factors, global market trends, policy changes, and technological innovations, making them susceptible to fluctuations in stock prices. Volatility is the dispersion about central tendency and traditional knowledge says return and risk positively correlated (Pandey, 2010) [27]. However, some recent theoretical works consistently assent that stock market volatility has been found to be negatively correlated with stock returns. Considering the daily log returns of stock, the daily volatility is not directly observable from the return data because there is only one observation in a trading day. Volatility is a key parameter used in risk assets pricing. It refers to the ups and downs in the stock price returns. Stock returns are an integral part of market with bull and bear phases. Volatility is useful for superior returns. Higher volatility causes higher risk (Kumar, 2016) [13, 15]. Understanding the volatility of stock returns in these sectors is essential for investors, policymakers, and corporate managers. This research aims to measure the volatility of stock returns for selected automobile and engineering sector stocks listed on the NSE. The study will employ statistical and econometric models, such as standard deviation, beta analysis, and Generalized Autoregressive Conditional Heteroskedasticity (GARCH), T-GARCH and E-GARCH model to examine historical stock price data of selected NSE-listed companies.

Past Studies and Research Gap

Swati & Soundarya (2024) examined the returns and standard deviations of stocks from automotive companies listed on the NSE over a five-year period. The research aims to provide investors with insights into balancing risk and return in the automotive sector. Narayanaswamy *et al*. (2021) investigated the risk factors influencing stock market returns of various automobile companies listed on the NSE. It measures returns in terms of historical stock performance and evaluates risk using standard deviation and beta across different time frames. Sen, Mahtab and Dutta (2021) presented volatility models based on the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) framework for modeling the volatility of stocks from the auto and banking sectors listed on the NSE. Eryilmaz (2015) [8] investigated stock return volatility for BIST –100 indices. The study period was divided into three different time periods and used ARCH, GARCH, EGARCH and TGARCH models. According to this study, most suitable volatility model for return series is EGARCH (1,1) and

negative news have more effect to the stock market. Most of the research on the stock market volatility in India based on broad indices. In addition to previous studies, there is a need for further study on measurement of stock returns volatility in order to have perception of different automobile and engineering sectors stocks listed in major stock exchanges in India, like NSE and to explore how volatility of individual script changes with respect to different time period in respect to different economic policies, incident, etc. Keeping in mind of this research gap, specific objectives of the current study are set.

Objectives of the Study

The objectives of the current study are as follows:

1. To explore the volatility characteristics of select NSE listed automobile and engineering sectors stocks using descriptive statistics;
2. To examine the presence of volatility in automobile and engineering sectors stocks daily return series using ARCH (1) model;
3. To analyse volatility in select NSE listed automobile and engineering sectors stocks using GARCH and TGARCH Model;
4. To measure the volatility in automobile and engineering sectors stocks daily returns series using E-GARCH Model.

Data and Methodology

Considering secondary data, daily adjusted closing share price of select NSE-listed Automobile & Engineering sector companies are collected from Capitaline corporate database and NSE official website as well. Daily stock price return series of each company and yearly stock returns volatility (Beta value) of them are calculated for the study. The sample design follows the judgment sample technique based on market capitalization of sample top companies. It tries to measure volatility of diversified sector's top market capitalization companies, which were listed and actively traded in NSE from 2000-01 to 2015- 2016. The study has been made considering the Global financial recession period, which includes the study period from 7th August, 2007 to 2nd April, 2009. Different statistical tools are used in this study as follows

Statistical Tools used	Analysis to address stated objectives of the study
Descriptive statistics	To identify whether there is any difference in mean value, S.D., Variance, Skewness and Kurtosis of individual securities.
ARCH Test	To examine the presence of ARCH effect in sample companies daily return series using ARCH (1) model (Decision Rule: If p- value <0.05, then H_0 is rejected and vice versa).
GARCH Model	To explain the stock market volatility (conditional variance) at the individual script level from the select sample companies (Decision Rule: If the sum of the two estimated ARCH & GARCH coefficient is equal to one, it indicates volatility shocks are quite persistent).
T-GARCH Model	To explain the stock market volatility (asymmetry or leverage effect) at the individual script level from the select sample companies (Decision Rule: If leverage term (γ) is significant and positive, negative shocks have a larger effect on conditional volatility than the positive shocks).
E-GARCH Model	To explain the stock market volatility (logarithmic expression of the conditional variability effect) at the individual script level from the selected sample companies adjusted daily return series (**Decision Rule:** If γ is significant and negative, leverage effect exists in return series).
Package Used	EViews 8.0

Results and Analysis

1. Descriptive Statistics results

To assess the distributional properties of the daily adjusted closing price of stock returns, various descriptive statistics are summarized in terms of Average Daily Returns (Mean), Standard Deviation (S.D.), Variance, Skewness, and Kurtosis is applied for all select NSE listed companies as follows:

Table 1: Descriptive Statistics Results of Different Companies (Global Recession Period)

Company Name	Mean	S. D.	Variance	Kurtosis	Skewness
Ashok Leyland	0.0017	0.027	0.0007	5.56	0.37
Exide Inds.	0.0019	0.026	0.0006	11.19	1.36
Eicher Motors	0.002	0.031	0.0009	9.58	1.03
Hero Motocorp	0.0013	0.024	0.0005	6.02	0.49
M & M	0.002	0.024	0.0005	5.01	0.12
Bosch	0.0018	0.02	0.0004	11.18	0.41
Tata Motors	0.0019	0.025	0.0006	4.25	0.12
HMT	0.003	0.051	0.0026	8.05	1.22
Motherson Sumi	0.0022	0.032	0.001	6.32	0.79
TVS Motors	0.0014	0.029	0.0008	7.16	0.39
Bharat Forge	0.0023	0.027	0.0007	7.2	0.39
ABB	0.002	0.021	0.0004	7.31	0.06
Larsen & Toubro	0.0021	0.023	0.0005	15	1.09
BHEL	0.0022	0.025	0.0006	9.51	-0.04
Thermax	0.0027	0.027	0.0007	7.31	0.65

The daily mean returns of the selected stock price returns in automobile & engineering Sector are majority lower. The S.D. and variance give support to the high variability of stock price changes. Skewness has been found to be lower and negative. Kurtosis indicate high pickedness (Leptokurtic) and clearly indicates unexpected return

distribution are not normal, where the presence of volatility in Automobile & Engineering Sector daily adjusted stock price return series.

2. Examining the presence of volatility in select NSE listed Automobile & Engineering Sector companies daily return series using ARCH (1) model

a. **Precondition for Performing ARCH Test**

(a) Assumption-1: Sample companies return series are not normal

Normality test is used to check whether the sample companies return series are distributed normally.

Hypothesis	♦ H_0: Return series of select stocks are normal; ♦ H_1: Return series of select stocks are not normal.
Statistical Test	Jarque-Bera test
Test Statistic	Chi–Square
DF	n–1, where n= 2
Level of Significance	5%
Decision Rule	If P–Value is less than 0.05, H_0 is not accepted and vice versa

Table 2: Normality Test Result of Daily Adjusted Stock Price Returns

Automobile & Engineering Sector	Second Period		Decision Rule	Decision on H_0	Data series Normality
	J-B	P–Value			
Ashok Leyland	544.94	0.000	P–Value<0.05	Rejected	Not normal
Exide Inds.	62.19	0.000	P–Value<0.05	Rejected	Not normal
Eicher Motors	702.9	0.000	P–Value<0.05	Rejected	Not normal
Hero Motocorp	15.42	0.000	P–Value<0.05	Rejected	Not normal
M & M	635.63	0.000	P–Value<0.05	Rejected	Not normal
Bosch	7010.73	0.000	P–Value<0.05	Rejected	Not normal
Tata Motors	149.6	0.000	P–Value<0.05	Rejected	Not normal
HMT	233.34	0.000	P–Value<0.05	Rejected	Not normal
Motherson Sumi	717.36	0.000	P–Value<0.05	Rejected	Not normal
TVS Motors	93.87	0.000	P–Value<0.05	Rejected	Not normal
Bharat Forge	100.09	0.000	P–Value<0.05	Rejected	Not normal
ABB	129.32	0.000	P–Value<0.05	Rejected	Not normal
Larsen & Toubro	15.69	0.000	P–Value<0.05	Rejected	Not normal
BHEL	16.52	0.000	P–Value<0.05	Rejected	Not normal
Thermax	160.74	0.000	P–Value<0.05	Rejected	Not normal

It is observed that H_0 is rejected for all return series of select NSE listed Automobile and Engineering Sector stocks. Since, the JB test is significant at 1% level that means daily returns series are not normally distributed. The majority companies return series are not normally distributed. J-B Test for normality is consistent with the outcome provided by both statistical results of kurtosis and skewness.

(b) Assumption 2: Stationarity exists in Sample Companies' Daily Return Series

The Augmented Dickey Fuller (ADF) test is employed to infer the stationarity of the stock daily return series.

Unit Root Test for Stationarity Test

Hypothesis	❖ Null Hypothesis (H_0): Daily stock return series has unit root; ❖ Alternative Hypothesis (H_1): Daily stock return series has no unit root.
Test Statistics	Augmented Dickey Fuller (ADF) Test
Underlying Distribution	t- Test
Decision Rule	When t- statistics is lower than critical values and p- value <0.05, then, H_0 is rejected and vice versa.

Table 3: The Augmented Dickey-Fuller (ADF) Test results At Level (Global Recession Period)

Automobile & Engineering Sector	None		Decision Rule	Null Hypothesis (H_0)	Data series stationarity
	t-Statistics & Prob.	C.V. (5%)			
Ashok Leyland	-17.83 (0.000)	-1.94	More negative test statistics than C.V. and P–Value<0.05	Rejected	Stationary series
Exide Inds.	-22.96 (0.000)	-1.94	More negative test statistics than C.V. and P–Value<0.05	Rejected	Stationary series
Eicher Motors	-18.36 (0.000)	-1.94	More negative test statistics than C.V. and P–Value<0.05	Rejected	Stationary series
Hero Motocorp	-19.12 (0.000)	-1.94	More negative test statistics than C.V. and P–Value<0.05	Rejected	Stationary series
M & M	-12.08 (0.000)	-1.94	More negative test statistics than C.V. and P–Value<0.05	Rejected	Stationary series
Bosch	-20.25	-1.94	More negative test statistics than C.V. and	Rejected	Stationary series

	(0.000)		P–Value<0.05		
Tata Motors	-15.84 (0.000)	-1.94	More negative test statistics than C.V. and P–Value<0.05	Rejected	Stationary series
HMT	-16.55 (0.000)	-1.94	More negative test statistics than C.V. and P–Value<0.05	Rejected	Stationary series
Motherson Sumi	-24.81 (0.000)	-1.94	More negative test statistics than C.V. and P–Value<0.05	Rejected	Stationary series
TVS Motors	-19.99 (0.000)	-1.94	More negative test statistics than C.V. and P–Value<0.05	Rejected	Stationary series
Bharat Forge	-20.07 (0.000)	-1.94	More negative test statistics than C.V. and P–Value<0.05	Rejected	Stationary series
ABB	-18.63 (0.000)	-1.94	More negative test statistics than C.V. and P–Value<0.05	Rejected	Stationary series
Larsen & Toubro	-17.49 (0.000)	-1.94	More negative test statistics than C.V. and P–Value<0.05	Rejected	Stationary series
BHEL	-18.75 (0.000)	-1.94	More negative test statistics than C.V. and P–Value<0.05	Rejected	Stationary series
Thermax	-17.37 (0.000)	-1.94	More negative test statistics than C.V. and P–Value<0.05	Rejected	Stationary series

It is found that H_0 is rejected for daily stock return series of Automobile & Engineering Sector and there is no unit root in return series of select NSE listed companies for global recession period presented in Table no. – 3. Augmented Dickey-Fuller (ADF) test have been made considering the following three sub-periods and full sample period. Since, the ADF test is performed (using neither in the test regression or none) at level is significant at 5% level i.e., it is observed that the computed all test statistics are lower than critical values. Select NSE listed automobile & engineering sector stocks return series for three sub-periods and full sample period are stationary at level.

b. ARCH Test (Test for Heteroskedasticity)

ARCH effect means heteroskedasticity, which is modelled as conditional variance of squared residuals obtained from mean equation as from AR (1) model. The results are as follows

Table 4: Heteroskedasticity Test Results – ARCH (1) for Global Recession Period

Companies	F-statistic	Prob. F	Obs* R-squared	Prob. Chi-Square	Decision on Ho	ARCH effects are present or not
Ashok Leyland	12.04	0.0129	11.75	0.0129	Rejected	ARCH effects are present
Exide Inds.	5.56	0.05	5.51	0.05	Accepted	No ARCH effects
Eicher Motors	66.50	0.0004	57.38	0.0005	Rejected	ARCH effects are present
Hero Motocorp	14.91	0.000	14.45	0.000	Rejected	ARCH effects are present
M & M	9.25	0.002	9.09	0.002	Rejected	ARCH effects are present
Bosch	0.053	0.817	0.053	0.817	Accepted	No ARCH effects
Tata Motors	40.19	0.000	36.73	0.000	Rejected	ARCH effects are present
HMT	10.57	0.001	10.35	0.001	Rejected	ARCH effects are present
Motherson Sumi	0.57	0.44	0.57	0.44	Accepted	No ARCH effects
TVS Motors	18.48	0.000	17.76	0.000	Rejected	ARCH effects are present
Bharat Forge	26.49	0.000	25.11	0.000	Rejected	ARCH effects are present
ABB	10.59	0.001	10.37	0.001	Rejected	ARCH effects are present
Larsen & Toubro	10.06	0.001	9.86	0.001	Rejected	ARCH effects are present
BHEL	2.46	0.11	2.46	0.11	Accepted	No ARCH effects
Thermax	25.62	0.001	24.21	0.001	Rejected	ARCH effects are present

ARCH results comprise of F value, Probability of F value, obs. R squared value and probability of χ^2 value. If p value of T. R^2 statistics is less than 0.01 or 1%, null hypothesis (H_0) is rejected. Hence, it can be stated that there is in existence of ARCH effect. However, it is found the existence of ARCH effect of all sample stocks excepting Exide Industries, Bosch, Motherson Sumi, BHEL in global recession period. M & M, Motherson Sumi, ABB stocks do not have ARCH effect in post-global recession period. During the global recession period, many stocks return is low and negative and no ARCH effect in their return series is found.

3. Analyzing Volatility in select NSE listed Automobile & Engineering Sector Companies using GARCH Model

The present study has employed GARCH (1, 1) technique to capture the conditional volatility in the return series. The results are as follows:

Table 5: GARCH Model (Global Recession Period)

Company Name/ Sectors	Estimated Model with values				AIC	SIC	Log Likelihood	Decision (Decision Rule: Volatility of shocks is highly persistence when $\alpha_j+\beta_i=1$)
First Period - Coefficients - GARCH (1, 1)								
Automobile & Engineering	α_0	α_1	β_1	$\alpha_j+\beta_i$				

Ashok Leyland	0.0006	0.294	0.156	0.45	-4.36	-4.35	3288.1	Comparatively low persistence value
Eicher Motors	0.0002	0.41	0.47	0.88	-4.17	-4.15	3139.9	Very high persistence value
Hero Motocorp	5.35	0.183	0.727	0.91	-4.66	-4.64	3508.8	Comparatively low persistence value
M & M	4.84	0.135	0.825	0.96	-4.68	-4.66	3525.6	Very high persistence value
Tata Motors	3.83	0.123	0.853	0.976	-4.61	-4.59	3467.8	Very high persistence value
HMT	0.0001	0.057	0.87	0.927	-3.29	-3.27	2469.8	Comparatively low persistence value
TVS Motors	0.001	0.255	0.025	0.28	-4.33	-4.31	3262.1	Comparatively low persistence value
Bharat Forge	3.47	0.17	0.81	0.98	-4.52	-4.5	3402.9	Very high persistence value
ABB	5.38	0.199	0.748	0.947	-4.98	-4.96	3753.1	Comparatively low persistence value
Larsen & Toubro	5.98	0.169	0.790	0.959	-4.86	-4.85	3611.2	
Thermax	5.26	0.119	0.831	0.95	-4.45	-4.43	3351.1	Comparatively low persistence value

Our GARCH test results found to be significant. It implies that coefficient of constant (α_0), ARCH term (α_1) and GARCH term (β_1) are highly significant at 1% level of significant. In the conditional variance equation, the estimation β_1 coefficient is considered to be greater than α_1 coefficient which resembles that the market has a memory longer than one period and volatility is highly dependable on its assumed lag values. GARCH model depicts effects of new surprise in the market values due to price sensitive information. It depicts the nature of persistence in the volatility. The sizes of parameter α_1 & β_1 determine the volatility in time series. The sum of α_1 & β_1 coefficient is close to unity. In the other words, volatility from the previous periods has a power of explaining the current volatility condition. Thus, the sum of coefficient of α_1 & β_1 in GARCH model is a measure of persistence of volatility shocks. If the results of α_1 & β_1 are close to unity (i.e. one), then the possibility of more persistent is the stock to conditional variance in return. However, it appears from the above table of GARCH in global recession time zones that the $(\alpha+\beta)$ is around one, which indicates that the return series have both attributes, such as volatility clustering and persistent. During the global financial recession period, highest and lowest ARCH and GARCH combined value out of fifteen scripts return series ranges from 0.280 to 0.976.

4. Analyzing Volatility in select NSE listed Automobile & Engineering Sector Companies using T-GARCH Model

T-GARCH model has been used to know that positive and negative shocks of equal magnitude have a different impact on stock market volatility, which may be attributed to 'leverage effect'. The results are as follows:

Table 6: T-GARCH Model (Global Recession Period)

Company Name	**Estimated Model with values**				**AIC**	**SIC**	**Log Likelihood**	**Decision**
First Period - Coefficients - GARCH (1, 1) with Threshold order 1								
Automobile & Engineering	α_0	α_1	γ	β_1				
Ashok Leyland	0.0001	0.033	0.15	0.76	-4.38	-4.36	3299	Positive γ which implies negative shocks is larger effect on volatility
Eicher Motors	0.0002	0.27	0.27	0.48	-4.17	-4.15	3140.68	Positive γ which implies negative shocks is larger ffect on volatility
Hero Motocorp	5.31	0.113	0.117	0.738	-4.63	-4.64	3512.19	Positive γ which implies negative shocks is larger effect on volatility
M & M	3.69	-0.003	0.22	0.86	-4.69	-4.66	3531.11	Positive γ which implies negative shocks is larger effect on volatility
Tata Motors	3.20	0.05	0.09	0.87	-4.61	-4.59	3469.37	Positive γ which implies negative shocks is larger effect on volatility
HMT	0.0001	0.065	-0.032	0.86	-3.29	-3.26	2471.02	Positive γ which implies negative shocks is larger effect on volatility
TVS Motors	0.001	0.112	0.306	0.036	-4.33	-4.31	3263.51	Positive γ which implies negative shocks is larger effect on volatility
Bharat Forge	3.79	0.014	0.05	0.80	-4.52	-4.5	3404.66	Positive γ which implies negative shocks is larger effect on volatility
ABB	5.25	0.091	0.198	0.758	-4.98	-4.96	3753.17	Positive γ which implies negative shocks is larger effect on volatility
Larsen & Toubro	5.78	0.081	0.158	0.804	-4.87	-4.84	3613.24	Positive γ which implies negative shocks is larger effect on volatility
Thermax	5.35	0.125	-0.018	0.831	-4.45	-4.43	3351.52	Positive γ which implies negative shocks is larger effect on volatility

T-GARCH results show that coefficient of leverage (δ) is positive in maximum cases and significant at 1% level, which led that negative shocks or bad news have a greater effect on the conditional variance than the positive shocks or good news. The coefficient of leverage (δ) is positive in many cases and significant at 1% level here.

5. Measuring Volatility in select NSE listed Automobile & Engineering Sector Companies using E-GARCH Model

The Exponential GARCH model is a GARCH variant that models the logarithm of the conditional variance process. In addition to modelling the logarithm, this model has additional leverage terms to capture asymmetry in volatility clustering. The results are as follows

Table 7: E-GARCH Model (Global Recession Period)

Company Name/ Sector	Estimated Model with values				AIC	SIC	Log Likelihood	Decision (Decision Rule: If γ is significant & negative, then leverage effect exists in return series.)
First Period - Coefficients - GARCH (1, 1)								
Automobile & Engineering	α_0	α_1	γ	β_1				
Ashok Leyland	-3.72	0.42	-0.09	0.49	-4.38	-4.36	3303.5	Leverage effect exists
Eicher Motors	-1.92	0.54	-0.07	0.77	-4.17	-4.15	3142.6	Leverage effect exists
Hero Motocorp	-1.57	0.36	-0.05	0.82	-4.66	-4.64	3514.69	Leverage effect exists
M & M	-0.37	0.136	-0.16	0.96	-4.68	-4.66	3529.36	Leverage effect exists
Tata Motors	-0.40	0.20	-0.08	0.96	-4.6	-4.58	3462.78	Leverage effect exists
HMT	-0.82	0.09	0.08	0.87	-3.3	-3.28	2479.28	Leverage effect not exist
TVS Motors	-9.32	0.52	-0.22	-0.36	-4.32	-4.3	3257.14	Leverage effect exists
Bharat Forge	-0.57	0.27	-0.04	0.94	-4.52	-4.5	3409.9	Leverage effect exists
ABB	-0.86	0.33	-0.114	0.916	-4.99	-4.96	3756.54	Leverage effect exists
Larsen & Toubro	-0.72	0.28	-0.08	0.92	-4.86	-4.84	3607.99	Leverage effect exists
Thermax	-0.63	0.24	-0.001	0.93	-4.45	-4.42	3348.55	Leverage effect exists

One stock leverage coefficient is not significant due to higher 'p' value. The asymmetric effect captured by parameter (γ) in EGARCH model is negative and statistically significant at 1% level of significance providing the presence of leverage effect. Leverage effect indicates that positive shocks have less effect on conditional variance when compared to the negative shocks.

Conclusion

In GARCH model, it appears that the combined value or sum of coefficient of ARCH and GARCH value is around one, it indicates volatility clustering and persistency. However, T-GARCH model indicates that negative shocks or bad news have a greater effect on the conditional variance than the positive shocks or good news, and E-GARCH model indicates that positive shocks have less effect on conditional variance when compared to the negative shocks.

References

1. Ali I. Stock market volatility and returns: A study of NSE & BSE in India, International Journal of Humanities & Social Science Studies,2016:2(4):202–211.
2. Anbukarasi M, Nithya B. Return and volatility analysis of the Indian sectoral indices – with special reference to NSE, EPRA International Journal of Economic and Business Review,2014:2(8):90–97.
3. Banumathy K, Azhagaiah R. Modelling stock market volatility: Evidence from India, Managing Global Transitions,2015:13(1):27–42.
4. Bhaumik SK. Principles of Econometrics: A Modern Approach Using E-views (1st Ed.), Oxford University Press, New Delhi, 2015.
5. Binny AB. Analysis of stock market volatility: A comparative study of India and China, Apeejay Journal of Management and Technology,2014:9(2):8–17.
6. Dash M, Duuta A, Sabharwal M. Seasonality and market crashes in Indian stock markets, Asian Journal of Finance & Accounting,2011:3(1):174–183.
7. Ekta R. GARCH based volatility modeling in bank's stock, Researchers World,2013:4(4):95–102.
8. Eryilmaz F. Modelling stock market volatility: The case of BIST–100, ABP,2015:1(5):37–47.
9. Ezzat H. The application of GARCH and EGARCH in modeling the volatility of daily stock returns during massive shocks: The empirical case of Egypt, IRJFE,2012:1(96):153–164.
10. John A, Oduro FT, Prah JA. Modelling volatility and the risk–return relationship of some stocks on the Ghana stock exchange, American Journal of Economics,2016:6(6):281–299.
11. Kothari CR. Research Methodology: Methods and Techniques (2nd Ed.), New Age International Publishers, New Delhi, 2010.
12. Kumar R, Debroy B, Ghosh J, Mahajan V, Seeta Prabhu K. Global financial crisis impact on India's poor – some initial perspectives, United Nations Development Programme (UNDP) India,2009:8–25.
13. Kumar B, Singh P. The dynamic relationship between stock return, trading volume and volatility: Evidence from Indian stock market, Research Gate,2016:1–49.
14. Kumar B, Singh P. Volatility modeling, seasonality and risk return relationship in GARCH-in-mean framework: The case of Indian stock and commodity markets, Indian Institute of Management, Ahmedabad, Working Paper,2008:1–31.
15. Kumar NS. Study on volatility of stock market data of selected companies engaging in retail finance in India, PIJMIS,2016:5(1):1–13.
16. Kumar R, Gupta H. Volatility in the Indian stock market: A case of individual securities, JARE,2009:1(1):43–53.

17. Lakshmi PS. Volatility patterns in various sectoral indices in Indian stock market, Global Journal of Management and Business Studies,2013:3(8):879–886.
18. Mall M, Mishra S, Mishra PK, Pradhan BB. A study on relation between India VIX and NIFTY returns, IJBIF,2014:1(3):1–7.
19. Mail M, Pradhan BB, Mishra PK. Volatility of India's stock index futures market: An empirical analysis, Researchers World,2011:2(3):119–126.
20. Maqsood A, Safdar S, Shafi R, Lelit NJ. Modeling stock market volatility using GARCH models: A case study of Nairobi securities exchange (NSE), Open Journal of Statistics,2017:1(7):369–381.
21. Malhotra NK. Marketing Research: An Applied Orientation (3rd Ed.), Pearson Education Asia, New Delhi, 2003.
22. Najjar DA. Modelling and estimation of volatility using ARCH/GARCH models in Jordan's stock market, Asian Journal of Finance & Accounting,2016:8(1):152–167.
23. Naveen S, Mallikarjunappa T. A study on comparative analysis of risk and return with reference to stocks of CNX BANK NIFTY, International Journal of Scientific Research and Modern Education,2016:1(1):737–743.
24. Padhi P. Stock returns volatility: A case study of pharmaceuticals and computer software in India, Journal of Academic Research in Economics,2006:1(1):1–13.
25. Padhi P. Stock market volatility in India: A case of select scripts, Journal of Academic Research in Economics,2006:1(1):1–54.
26. Palit A. South Asia – Beyond the Global Financial Crisis, World Scientific Publishing Co. Pvt. Ltd., 2011.
27. Pandey A. Capital Market & Financial System in India (1st Ed.), New Century Publications, 2010.
28. Rakesh HM. A study on volatility of FMCG and Auto Indices of National Stock Exchange, IJCBM,2014:3(4):618–622.
29. Sainy R. A study of factors affecting stock price volatility: Perception of stock brokers, Intercontinental Journal of Finance Research Review,2016:4(2):1–10.
30. Shankar C, Ramulu K. Volatility and correlation of stock indices on Indian stock market, IJRBM,2014:2(4):17–26.
31. Shannmugasundran G, Benedict J. Volatility of the Indian sectoral indices – A study with reference to National Stock Exchange, IJMFSMR,2013:2(8):1–11.
32. Tripathy T, Alana LAG. Suitability of volatility models for forecasting stock markets returns: A study on the Indian National Stock Exchange, AJAS,2010:7(11):1487–1494.
33. Tsay RS. Analysis of Financial Time Series (2nd Ed.), Wiley–Blackwell, USA, 2016.
34. Tripathy TK. Modelling volatility of daily stock returns: Evidence from NSE listed computer software & multimedia scripts, IJACMSS,2020:3(3):141–148.
35. Tripathy TK. Modelling volatility of daily stock returns: Evidence from select banking and finance companies in India, Business Studies,2021:43(12):1–25.
36. Yadav S. Impact of derivatives trading on the volatility of stock market in India: A review, Asian Journal of Management Research,2016:6(3):567–579.
37. Retrieved from https://www.crestmontresearch.com/docs/stock-volatility-perspective.pdf.
38. Retrieved from https://www.nseindia.com/education/content/prs_publications.htm.