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VOLATILITY MODELLING FOR AUTOMOBILE SECTOR STOCKS IN NATIONAL STOCK EXCHANGE

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Abstract: *This paper examines the volatility of the automobile sector stocks in National Stock Exchange (NSE) in India. The researcher has used the automobile sector spot and futures stocks daily closing price for the period of April 2010 to March 2017. The Augmented Dicky Filler test is used to check the stationarity of the data series. The GARCH model has been used to findout the extent of the volatility of the spot and futures stocks. The results suggest that the Ashok Leyland Ltd Spot and futures returns, Mahindra and Mahindra Ltd spot returns and Tata Motors Ltd spot returns have the high volatility.*

Keywords: *automobile sector, closing price, GARCH*

1. INTRODUCTION

Volatility is used to measure the changeability of the stock price. It is not easy to guess and estimate about the future trend of volatility in the market because it is affected by a large number of facets such as political stability, economic fundamentals, government budget, policies of the government, corporate performance and so on. The calculation of a historical volatility is a prediction that can be assumed about the future trend. The extent of variation in stock price is known as stock market volatility. A spiky and rapid movement in the stock prices may throw out the risk to turn away investors from the capital market and needs to be controlled. But the comprehension of economic activity must result into some movement in the stock prices; therefore, a desired level of volatility is also necessary for the appropriate allocation of resources. The automobile industry is keeping up with the growing demand; several industrialists have started investing heavily in this segment during the last few years. During the period April 2000 to June 2017 the automobile has attracted Foreign Direct Investment (FDI) worth US$17.4 billion[1]. Similarly, these kind investments are made instability of the automobile sector stocks in the spot and futures market on the National Stock Exchange (NSE) of India. Hence the researchers have made an attempt to measures the volatility of the automobile stocks in derivative segments in NSE. The traditional

methods of measuring volatility do not consider the time-varying property and volatility clustering in the stock price behaviour. The Engle has introduced Autoregressive Conditional Heteroskedasticity (ARCH) in 1982[2] for estimating time-varying volatility in financial time series data. Later in 1986, Bollerslev Generalized the ARCH model popularly known model by using lagged values of conditional variance and lagged values of squared disturbance of the series[3].

2. REVIEW OF LITERATURE

Goudarzi and C.S (2011)examined market volatility of Bombay Stock Exchange 500 stock index during the financial crisis of 2008-09. The researcher analysed the market effects by good and bad news about the market trend. The EGARCH and TGARCH models were shown in the BSE 500 indexes where volatility is increased by the bad news of the market.

Mehta and Sharma (2011) discussed that Indian stock market has witnessed various confrontations during last two decades resulting inoccurrence of alternate phases of the marketcycle. They documented that the Indian equity market has witnessed the prevalence of time-varying volatility where the past volatility has a more significant impact on the current volatility.

Nawazish and Mawal Sara (2012) examined the volatility patterns in Karachi Stock Exchange using GARCH framework between 2004 and 2012. This implies that all estimates of risk in this period based on standard deviations must be flawed and would have understated the actual risk. They proposed that higher order moments of returns should be considered for prudent risk assessment.

Abdalla and Suliman (2012) made an attempt to model volatility in Saudi stock market TAS Index. They applied various asymmetric GARCH models like EGARCH, TGARCH and PGARCH. He observed the persistence of conditional volatility and the results of their studies were in favourof 'positive correlation hypothesis' which established a positiverelationship between volatility and expected a stock return. Their studies also confirm the presence of leverage effect in market returns.

Kalu O and Stephen Friday (2012) analyzed the response of volatility to negative and positive news in Nigerian stock exchange (NSE) by using daily closing prices from January 2nd, 1996 to December 30th, 2011. Results of their study supported the presence of an asymmetric effect in the NSE stock returns but the study did not confirm the presence of

leverage effect. The study provides evidence in support of positive news producing higher volatility in the immediate future than negative news with the same magnitude.

Som Sankar and Tanmay (2012) attempted to find the asymmetry and leverage effect of Sensex. The outcome of the study expressed the returns of Sensex were serially correlated and there is volatility clustering in the study period.

Singhania and Anchalia (2013) have analyzed volatility in Asian stock markets and global financial crisis. They used EGARCH model. The analysis is done using time series data of daily returns for the period 2005-2011 of the major indices of these countries (Hang Seng, Nikkei 225, Shanghai Composite and Nifty for Hong Kong, Japan, Chinaand India, respectively). The results found that the sub-prime crisis had a positive impact on the volatility of returns of Japan, China and India while it had no impact on the volatility of returns of Hong Kong. In addition, it is interesting to see that the period of Eurozone debt crisis has had a negative impact on the volatility of already highly volatile stock returns of countries such as India and China.

Singhania and Prakash (2014) have conducted a study on cross-correlation of South Asian Association for Regional Cooperation (SARRC) countries stock returns. The data consist of stock indices from India, Bangladesh, Sri Lanka and Pakistan, the daily closing price covered from 2000 to 2011. Results indicate the presence of serial autocorrelation in stock market returns, implying dependence of current stock prices on stock prices of previous times and leads to rejection of Efficient-Market Hypothesis (EMH). Correlation between stock indices of SAARC economies is found to be low which is in line with intra-regional trade being one of lowest as compared to other regional groups. The study concluded towards greater need for economic cooperation and integration between SAARC countries. Greater financial integration leads to the development of markets and institutions, effective price discovery, higher savings and greater economic progress.

Yao and Yao (2016) have studied the impact of the future stock index on spot market volatility. The researcher used GARCH model with dummy variables. The dataset comprised of CSI index from 2005 50 2015. The result indicates that after the launch of the CSI 300 index futures, the stock market volatility increased in the past five years. Policy measures such as improvement of both spot and futures market are necessary to contain the risks.

G. Arivalagan and S. Rajamohan (2015) have captured the volatility pattern of the BSE index of Sensex. The researchers have taken Sensex closing price of Sensex for the period of 1997 to 2016. The required data have been retrieved from the official website of BSE. There are three models are used to test the volatility of the Sensex. The models are such as ARCH, GARCH and TGARCH. Hence, among these three models, TGARCH is the suitable model to identify the volatility of Sensex. Overall results present that the BSE Sensex returns have the volatility and previous day news affects the next day returns.

3. METHODOLOGY

This research describes the volatility of the automobile sector stocks in NSE derivative segment. The automobile stocks have been chosen on the basis of market capitalization and the stocks are taken from the Nifty 100 Index. The automobile companies stocks are Ashok Leyland Ltd Limited (Ltd), Bajaj Auto Ltd, Hero Motocorp Ltd, Mahindra and Mahindra Ltd, Maruti Suzuki India Ltd. and Tata Motors Ltd. The required data were collected from the NSE India website for the period of April 2010 to March 2017. The raw data was converted to returns by natural logarithm method. The researchers used ARCH and GARCH models to capture the volatility through the eview application.

4. FINDINGS OF THE STUDY

4.1 Stationarity of AutomobileSector Stocks Return-ADF Test

The automobile sector stocks are selected for the purpose of capturing the volatility before estimating the volatility to check the stationarity of data series necessary among spot and futures segment. The selected stocks are Ashok Leyland Ltd Limited (Ltd), Bajaj Auto Ltd, Hero Motocorp Ltd, Mahindra and Mahindra Ltd, Maruti Suzuki India Ltd. and Tata Motors Ltd. The outcome of the Augmented Dickey-Fuller (ADF) results is presented in Table 1. The null hypothesis is that there is no stationarity movement in the auto sector stocks returns.

Table 1 Stationarity of Automobile Sector Stocks Return- ADF Test

S. No	Name of the Companies	Spot Returns		Futures Returns	
		T-Statistics	P-Value	T-Statistics	P-Value
1	Ashok Leyland Ltd	-40.1329	0	-40.7753	0
2	Bajaj Auto Ltd	-40.5567	0	-40.8795	0
3	Hero Motocorp Ltd	-39.718	0	-39.8453	0
4	Mahindra and Mahindra Ltd	-42.8295	0	-41.7408	0
5	Maruti Suzuki India Ltd.	-40.8495	0	-41.64	0
6	Tata Motors Ltd	-39.816	0	-41.6807	0

	Test critical values	
	1% level	-3.43391
	5% level	-2.862999
	10% level	-2.567594

Source: Computed Secondary Data

Table 1 explains the stationarity of the spot and futures returns of the automobile sector stocks. All the companies' spot and futures stock returns are possessed the stationarity at 5 per centlevel in ADF test because the p-value is less than 0.05. Hence the null hypothesis is rejected which indicates that there is no stationarity in the stock returns.

4.2 Heteroskedasticity Effect of the Automobile Sector Stocks Return

The Indian auto industry is one of the largest in the world. The researcher has selected six companies in this sector to test the volatility such as Ashok Leyland Limited (Ltd), Bajaj Auto Ltd, Hero Motocorp Ltd, Mahindra and Mahindra Ltd, Maruti Suzuki India Ltd and Tata Motors Ltd. In order to test the existence of heteroskedasticity effect of the stock returns, the ARCH model has been used. The null hypothesis is that there is no ARCH effect in the residuals of return series of automobile sector stocks returns.

Table 2 Heteroskedasticity Effect of the Automobile Sector Stocks Return

S. No	Name of the Companies	Vale of F-statistics	Prob. Value of F	Observed R squared values	Prob. chi-square values
1	Ashok Leyland Ltd Spot Returns	4.324474	0.0377	4.318695	0.0377
2	Ashok Leyland Ltd futures returns	4.612035	0.0319	4.60511	0.0319
3	Bajaj Auto Ltd Spot Returns	13.73839	0.0002	13.64618	0.0002
4	Bajaj Auto Ltd futures returns	10.12946	0.0015	10.08227	0.0015
5	Hero Motocorp Ltd spot returns	7.340528	0.0001	21.79532	0.0001
6	Hero Motocorp Ltd futures returns	7.482925	0.0063	7.459393	0.0063
7	Mahindra and Mahindra Ltd spot returns	8.989891	0.0028	8.95388	0.0028
8	Mahindra and Mahindra Ltd futures returns	1.126782	0.2886	1.127349	0.2883
9	Maruti Suzuki India	32.78026	0.000	32.2095	0.000

	Ltd spot returns				
10	Maruti Suzuki India Ltd futures returns	1.057094	0.304	1.057668	0.3037
11	Tata Motors Ltd spot returns	31.18595	0.000	30.67061	0.000
12	Tata Motors Ltd futures returns	0.675384	0.4113	0.675899	0.411

Source: Computed Secondary Data

The calculated coefficient values and the probability values show that they are statistically significant except the Mahindra and Mahindra Ltd, Maruti Suzuki India Ltd and Tata Motors Ltd futures returns are insignificant and these stocks do not suitable for volatility estimation. The remaining stocks calculated F statistic values are higher than the observed R square values which is a necessary condition to reject the null hypothesis. Hence it is proved that there is a heteroskedasticity - ARCH effect in the time series of the selected auto sector stocks and which requires the application of GARCH model to estimate the volatility of the stocks.

4.3 Estimation of GARCH (1, 1) Model and ARCH-LM test of the Auto Sector Stocks Return

The automobile industry sector stocks fluctuate in the Indian market the stock price movements are captured here in GARCH model. Heteroskedasticity effect, it is necessary to apply ARCH–LM test by using the residuals estimated from GARCH (1, 1) model. Hence the null hypothesis framed as there is no ARCH effect exist in the residuals of the return series of automobile sector stocks returns' and the results obtained are exhibited in Table 3

Table 3 Estimation of GARCH (1, 1) Model and ARCH-LM test of the Auto Sector Stocks Return

S. No	Name of the Companies	Constant Ω	ARCH α	GARCH B	ARCH+GARCH α+β	ARCH-LM test		
						Value of F-statistics	Observed R squared values	P-values
1	Ashok Leyland Ltd Spot Returns	6.26E-05	0.10624	0.788254	0.894494	0.108589	0.108707	0.7416
2	Ashok Leyland Ltd futures	6.70E-05	0.112238	0.774229	0.886467	0.204223	0.204434	0.6512

	returns							
3	Bajaj Auto Ltd Spot Returns	0.000162	0.199454	0.169027	0.368643	0.495833	0.496263	0.4811
4	Bajaj Auto Ltd futures returns	0.000156	0.157761	0.217142	0.375059	0.36376	0.364103	0.5462
5	Hero Motocorp Ltd spot returns	7.82E-05	0.158068	0.588607	0.746675	0.352994	1.06078	0.7865
6	Hero Motocorp Ltd futures returns	9.02E-05	0.163277	0.527596	0.690873	0.976906	0.977482	0.3228
7	Mahindra and Mahindra Ltd spot returns	6.53E-06	0.038051	0.941262	0.979313	1.300753	1.301277	0.254
8	Maruti Suzuki India Ltd spot returns	0.000189	0.1939	0.178118	0.372018	0.096797	0.096904	0.7556
9	Tata Motors Ltd spot returns	5.87E-05	0.077615	0.8179	0.895515	2.07073	2.070646	0.1502

Source: Computed Secondary Data

The α and β indicate that news about volatility from the previous periods has an explanatory power on current volatility. The coefficient of α is lesser than β which shows that there is more impact of past volatility on the current volatility in comparison to the impact of past shocks or news on the conditional volatility. The sum of the two estimated ARCH and GARCH coefficients; α+ β (persistence coefficients) in the GARCH (1,1) is 0.979313 for Mahindra and Mahindra Ltd spot returns close to one then the large sum of these coefficient values which it implies that a large positive or a large negative impact on return. Ashok Leyland Ltd Spot Returns (0.894494), Ashok Leyland Ltd futures returns (0.886467), Hero Motocorp Ltd spot returns (0.746675), Hero Motocorp Ltd futures returns (0.690873)

and Tata Motors Ltd spot returns (0.895515) these stocks return having significant persistence in volatility. The Bajaj Auto Ltd Spot Returns (0.368643), Bajaj Auto Ltd futures returns (0.375059) and Maruti Suzuki India Ltd spot returns (0.372018) coefficient value are not closest to one then it is implying the smaller positive or negative impact on these stocks returns. ARCH LM test result expressed the ARCH effect of the residual after estimating the GARCH (1, 1) model. All the calculated F statistics values are lesser than the observed R square values and the probability values are greater than 0.05, the null hypothesis of 'No ARCH effect' in the residuals are accepted and confirms the absence of ARCH effect in the residuals of the return series after the estimation of (GARCH 1,1) model.

5. CONCLUSION

This study analysed the volatility of the automobile sector stocks in the derivative segment in NSE. From the results, the Ashok Leyland Ltd Spot and futures returns, Mahindra and Mahindra Ltd spot returns and Tata Motors Ltd spot returns have the high volatility. The Hero Motocorp Ltd spot and futures returns and Maruti Suzuki India Ltd spot returns having the lowest volatility and the Hero Motocorp Ltd spot and futures returns having the moderate volatility during the study period. Hence the researchers suggest that both market returns have the volatility so the investors can use the hedging technique to reduce the investment risk.

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