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VOLATILITY MODELLING FOR ENERGY SECTOR STOCKS IN NATIONAL STOCK EXCHANGE

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Abstract: *This paper look at the volatility of the energy sector stocks in National Stock Exchange (NSE) in India. The researcher has used the energy 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 Bharat Petroleum Corp Lt spot returns, Gail (India) Ltd spot returns, Hindustan Petroleum Corp spot returns, Hindustan Petroleum Corp futures returns, Indian Oil Corp Ltd spot returns, Oil and Natural Gas Corp.spot returns, Reliance Industries Ltd spot returns and Tata Power Co Ltd returns have the high volatility.*

Keywords: *energy sector stocks, ADF, GARCH*

INTRODUCTION

Volatility, in simple word, is the variation in the price of financial assets during a period. It is an amount by which the price of a financial asset such as a share of a company fluctuates or is expected to fluctuate during a period. Thus, it is clear that volatility measures variability or dispersion. In other words, it measures the deviation from its average past price. Greater the deviation, greater is the volatility. The volatility of the financial markets remains a concern for investors, policymakers and regulators. Volatility is closely associated with the notion of risk. In fact, volatility and risks are synonyms in the marketplace. Thus, the more volatile the stock is, the riskier it becomes. It is measured by the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model.

Before applying any AutoRegressive Conditional Heteroskedasticity (ARCH) or GARCH model it is important to check whether there is ARCH effect or not. The heteroskedasticity of ARCH test regresses the squared residual of the mean model on lagged square residual and a constant. It provides two statistics such as F-statistic value and Observed R squared value. In order to test whether the ARCH effect exists or not in the residuals of the return series, the

ARCH coefficient (αi) measures the impact of the previous period's squared residuals on current period volatility. A significant ARCH coefficient (αi) indicates that there is a significant impact of previous period's shocks (ε2t-i) on current period volatility (ht). The ARCH coefficient is also treated as 'recent news' component which explains that recent news has a significant impact on volatility, that is previous day's stock return information about today's volatility.

2. METHODOLOGY

This research describes the volatility of the energy sector stocks in NSE derivative segment. The energy stocks have been chosen on the basis of market capitalization and the stocks are taken from the Nifty 100 Index. The energy companies stocks are Bharat Petroleum Corp Lt, Gail (India) Ltd, Hindustan Petroleum Corp, Indian Oil Corp Ltd, NTPC Ltd, Oil and Natural Gas Corp, Petronet Lng Ltd, Power Grid Corp. Ltd, Reliance Industries Ltd and Tata Power Co 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. The researchers used ARCH and GARCH models to capture the volatility through the eview application.

3. FINDINGS OF THE STUDY

Stationary of Energy Sector Stocks Return-ADF Test

The oil that is produced by the oil Industry in India provides more than 35 per cent of the energy that is primarily consumed by the people of India. This amount is expected to grow further with both economic and overall growth. The energy sector industry is the largest upstream company in exploration and production. The energy sector stocks return have been analyzed by ADF. The null hypothesis is that there is no stationarity in the energy sector stock return. The result of the ADF test is presented in Table 1.

Table 1 Stationarity of Energy Sector Stocks Return-ADF Test

S. No	Name of the Companies	Spot Returns		Futures Returns	
		T-Statistics	P-Value	T-Statistics	P-Value
1	Bharat Petroleum Corp Lt	-41.9504	0.0000	-41.8333	0.0000
2	Gail (India) Ltd	-41.5266	0.0000	-41.7884	0.0000
3	Hindustan Petroleum Corp	-40.9912	0.0000	-41.0958	0.0000
4	Indian Oil Corp Ltd	-41.7727	0.0000	-41.411	0.0000
5	NTPC Ltd	-42.5737	0.0000	-42.2446	0.0000
6	Oil and Natural Gas Corp.	-40.9399	0.0000	-41.3351	0.0000
7	Petronet Lng Ltd	-43.7982	0.0001	-41.7105	0.0000
8	Power Grid Corp. Ltd.	-45.1191	0.0001	-41.8414	0.0000
9	Reliance Industries Ltd	-41.5385	0.0000	-41.3838	0.0000
10	Tata Power Co Ltd	-42.8182	0.0000	-41.6953	0.0000

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

Source: Computed Secondary Data

Table 1 describes the results of ADF of the energy sector stock returns. The ADF test t-statistic values are less than the critical values and it is significant with the corresponding p-values. Hence it can be concluded that the return series of all the energy sector stocks are stationarity at all levels. Henceforth, the null hypothesis has been rejected.

Heteroskedasticity Effect of the Energy Sector Stocks Return

The oil and gas sector is among the six core industries in India and plays a major role in influencing decision making for all the other important sections of the economy. The Government of India has adopted several policies to fulfil the increasing demand. The government has allowed 100 per cent FDI in many segments of the sector, including natural gas and petroleum products. The energy sector stocks movements are based on the global market demand and supply. Its price is unbalanced in the spot and futures market and the volatility of the stock returns has been measured by the GARCH model. To estimate the GARCH model we have to check the heteroskedasticity effect on the return series of energy sectoral stocks. The null hypothesis is that there is no ARCH effect in the residuals of return series of energy sector stocks. The calculated values are displayed in Table 2.

Table 2 Heteroskedasticity Effect of the Energy Sector Stocks Return

S.No	Name of the Companies	Value of F-statistics	Prob. Value of F	Observed R squared values	Prob. chi-square values
1	Bharat Petroleum Corp Ltd spot returns	12.86466	0.0003	12.78464	0.0003
2	Bharat Petroleum Corp Ltd futures returns	0.933478	0.3341	0.934052	0.3338
3	Gail (India) Ltd spot returns	8.726097	0.0032	8.692418	0.0032
4	Gail (India) Ltd futures returns	0.643255	0.4226	0.643758	0.4224
5	Hindustan Petroleum Corp spot returns	22.58319	0.0000	22.31857	0.0000
6	Hindustan Petroleum Corp futures returns	26.83412	0.0000	26.45545	0.0000
7	Indian Oil Corp Ltd spot returns	15.56501	0.0001	15.44426	0.0001
8	Indian Oil Corp Ltd futures returns	0.786035	0.3754	0.786585	0.3751
9	NTPC spot returns	3.409454	0.065	3.406688	0.0649
10	NTPC futures returns	0.645419	0.4219	0.645923	0.4216

11	Oil and Natural Gas Corp. spot returns	18.84669	0.0000	18.66534	0.0000
12	Oil and Natural Gas Corp. futures returns	0.305317	0.5806	0.305616	0.5804
13	Petronet Lng Ltd spot returns	30.70228	0.0000	30.20348	0.0000
14	Petronet Lng Ltd futures returns	0.771713	0.3798	0.772259	0.3795
15	Power Grid Corp. Ltd. spot returns	5.528736	0.0188	5.517534	0.0188
16	Power Grid Corp. Ltd. futures returns	0.736835	0.3908	0.737371	0.3905
17	Reliance Industries Ltd spot returns	6.626897	0.0101	6.609302	0.0101
18	Reliance Industries Ltd futures returns	0.025033	0.025061	0.8743	0.8742
19	Tata Power Co Ltd spot returns	23.8759	0.0000	23.57878	0.0000
20	Tata Power Co Ltd futures returns	0.511245	0.4747	0.511684	0.4744

Source: Computed Secondary Data

Table 2 shows the results of residual diagnostics test for all the selected stocks of the energy sector of NSE. The calculated F-statistic values of all the ten stocks are compared with the observed R squared values and it is found that the null hypothesis has been rejected. The rest of the stocks accepted. The null hypothesis such as Bharat Petroleum Corp Lt futures returns, Gail (India) Ltd futures returns, Indian Oil Corp Ltd futures returns, NTPC spot and futures returns, Oil and Natural Gas Corp. futures returns, Petronet Lng Ltd futures returns, Power Grid Corp. Ltd. futures returns, Reliance Industries Ltd futures returns and Tata Power Co Ltd futures returns. The calculated F statistics values of these stocks are lower than the critical values and the p values are more than5 per cent. It is concluded that these stocks are not eligible for further volatility estimation model.

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

India's economic growth is closely related to energy demand; therefore, the need for oil and gas is projected to grow more, thereby making the sector quite conducive to investment. The government also take some innovative projects in the energy sector for fulfilling the domestic demand independently. These are government activities reflected in the energy sector stock price in the market so that energy sector stock returns are analysed by the GARCH (1,1) model. To check whether the selected model was the right choice to address the same, it is necessary to check the adequacy of the model. In order to check the adequacy, ARCH–LM model is applied and the results obtained from the test are used to

check the null hypothesis constructed as 'no ARCH effect exists in the residuals of the return series of energy sectoral stocks' and the calculated values are mentioned in Table 3.

Table 3 Estimation of GARCH (1,1) Model and ARCHLM test of the Energy Sector Stocks Return

S. No	Name of the Companies	Constant Ω Values	ARCH α Values	GARCH β Values	ARCH+GARCH α+β Values	ARCH-LM test		
						Value of F-statistics	Observed R squared values	P-values
1	Bharat Petroleum Corp Lt spot returns	2.02E-05	0.05604	0.89604	0.952081	0.817018	0.817575	0.3659
2	Gail (India) Ltd spot returns	8.00E-06	0.030224	0.942743	0.972967	2.261885	2.261543	0.1326
3	Hindustan Petroleum Corp spot returns	3.93E-05	0.048658	0.87556	0.924218	1.52382	1.524238	0.217
4	Hindustan Petroleum Corp futures returns	4.17E-05	0.055645	0.864635	0.92028	1.694875	1.695173	0.1929
5	Indian Oil Corp Ltd spot returns	2.25E-05	0.104652	0.839615	0.944267	0.543491	0.543948	0.4608
6	Oil and Natural Gas Corp. spot returns	1.71E-05	0.069206	0.879964	0.94917	0.018773	0.018794	0.891
7	Petronet Lng Ltd spot returns	4.44E-05	0.099494	0.788551	0.888045	0.523188	0.523633	0.4693
8	Power Grid Corp. Ltd. spot returns	3.45E-05	0.178055	0.657905	0.83596	1.070661	1.071234	0.3007
9	Reliance Industries Ltd spot returns	1.33E-05	0.047204	0.903541	0.950745	0.025033	0.025061	0.8742
10	Tata Power Co Ltd spot returns	7.66E-06	0.060842	0.918993	0.979835	0.816011	0.816568	0.3662

Source: Computed Secondary Data

Table 3 shows that the coefficient values of all the parameters (ω, α and β) are greater than zero which is a necessary condition to reveal that the GARCH (1,1) model is well distinct to understand the volatility pattern of the selected stocks of energy sector returns. The positive values of lagged squared residual coefficients (α) and the lagged conditional variance coefficients (β) are significant at five per cent level, and this indicates that the past volatility of the stock returns is significantly influencing the present volatility. The sum of ARCH and GARCH coefficients values (α + β) of all the selected stocks are closer to unity (1) except Petronet Lng Ltd spot returns (0.888045) and Power Grid Corp. Ltd. spot returns (0.83596) which explains that there is the high persistence of volatility in these stocks during the study period. ARCH-LM test guideline accepted the null hypothesis of 'No ARCH effect' exists in the return series; all the calculated coefficient values of F statistics are lesser than

the observed R square values and the probability values are greater than 0.05. It indicates that the results obtained from test do not show any additional ARCH effect acquired in the residuals of the GARCH (1,1) model.

CONCLUSION

This study examined the volatility of the energy sector stocks in the spot and derivative segment in NSE. From the results, the Bharat Petroleum Corp Lt spot returns, Gail (India) Ltd spot returns, Hindustan Petroleum Corp spot returns, Hindustan Petroleum Corp futures returns, Indian Oil Corp Ltd spot returns, Oil and Natural Gas Corp.spot returns, Reliance Industries Ltd spot returns and Tata Power Co Ltd returns have the high volatility. Hence the researchers suggest the investors can use the risk diversification technique in order to reduce the investment risk.

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