CHAPTER 6

VOLATILITY OF THE INDIAN STOCK MARKET WITH RESPECT TO SOME ECO-POLITICAL FACTORS
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6.1 Introduction:

Perhaps, the most successful and innovative financial instrument in the financial world has been the derivatives contracts. Having been introduced in Chicago, the U.S.A. in the year 1982, it has spread all over the world like a blaze. Soon after its introduction in the 80’s, derivatives contracts took the major financial centers world over by a storm e.g. Australian Stock market started trading futures contract in 1983, London started in the year 1984, the Hong Kong Stock market started in 1986 and many more. Although, it was not as early as the developed nations did but India finally launched the futures contracts in June, 2000. Post liberalization in the early nineties, Indian stock market and the economy as a whole showed immense potential as becoming a financial power house. Considering the exponential growth of the Indian stock markets, Indian stock market watch dog Securities Exchange Board of India (SEBI) decided to introduce the futures contracts in the National Stock Exchange (NSE) and Bombay Stock Exchange (BSE). Integrating the Indian financial markets with the other developed financial markets and improvising market efficiency were the major objectives behind the introduction of derivatives in the Indian financial market. This was possible due to the recommendation provided by the L.C. Gupta Committee. The investors in capital markets have independence of bearing a certain amount of risk beyond which the risk can be hedged away only in case of derivatives and so it was absolutely imperative to introduce futures and
options contracts in the Indian financial markets. The efficiency of a stock market is complemented by the efficiency of the derivatives market of the same country. Manipulators, arbitrageurs and the hedgers are the main information seekers and these information seekers actually got benefitted on the introduction of the derivatives market and they also helped to improve the efficiency of the derivatives market and the stock markets simultaneously. Many researchers have found that there is a significant effect of listing derivatives on the cash markets of the countries like Japan, the U.S.A. and the U.K. (Gulen and Mayhew, 2000) on the other hand, some researchers have also found that introduction of derivatives has no impact on the volatility of the stock market. However, some researchers concluded that the major contributions of derivatives are the hedging and price discovery which results in influencing the stock market (Rahman, 2001). Although, introduction of derivatives may have significant impact on the volatility of the stock market but there are other potential factors, which can equally impact the volatility of the stock market, as well. The primary objective of this chapter is to analyze the effect of some of the economic and political variables on the volatility of the Indian stock market. The proxy variable for the Indian stock market has been taken to be the NSE S&P CNX Nifty. Three dummy variables have been constructed for introduction of futures markets in India, announcement of union budget every year and the occurrence of Loksabha elections, respectively. It has been assumed that the financial investors are a bit skeptical about investing in stocks in the period commencing from one month prior and one month after the union budget has been announced. Hence, there
is a chance that during this period every year, there is a change in the volatility of stock markets and so the dummy variable for budget has been made accordingly. Similarly for the Loksabha elections also, the dummy variable has been constructed accordingly.

6.2 Objective of the Study:

From the literature survey, it can be deciphered that there is still a scope to analyze whether the introduction of derivatives has a long term effect on the volatility of the stock market. It is also noticed that there is a paucity of research in analyzing the effect of Loksabha elections on the volatility of the Indian stock market. Moreover, the impact of announcement of union budget on the volatility of the Indian stock market has not been studied yet. So, the objectives of this chapter are to analyze the impact of introduction of derivatives, commencement of Loksabha elections and announcement of union budgets on the volatility of the Indian stock market. It is also to be studied whether the futures prices are cointegrated with the stock prices or not.

6.3 Data:

The proxy variable for the Indian stock market has been taken as the daily closing prices of S&P CNX Nifty for the period from 1st January, 1994 to 31st December, 2012. FUTIDX CNX Nifty with three months expiration has been taken for the period from 12th June, 2000 to 31st December, 2012. Since, the index futures was introduced in India on 12th June, 2000 so, a dummy variable for the introduction of the futures has been constructed by taking ‘1’ if the date is after 12th June, 2000 and ‘0’ elsewhere. It is assumed that the investors are a
little skeptical about investing in stock market one month before and after the announcement of the union budget every year. So, the dates on which the union budget was announced in the financial years 1994-1995 to 2012-2013 have been searched for and then a dummy variable is constructed such a way that if the day is within one month ahead from the day of announcement of union budget or within one month after the announcement of union budget then a ‘1’ is taken and for that particular year a ‘0’ is taken elsewhere and it is repeated for each and every financial years taken under our study. It has also been assumed that when the Loksabha elections are nearby, the investors hold their money for some time and then decide whether to disburse the money for the investment or not, depending on the result of the Loksabha election. So, another dummy variable has been constructed for the commencement of Loksabha elections also. It has been found that 27th April – 7th May, 1996, 16th February – 28th February, 1998, 5th September – 3rd October, 1999, 20th April – 10th May, 2004 and 16th April – 13th May, 2009 are the time periods when the Loksabha elections took place. This dummy variable has been constructed such a way that a ‘1’ is assigned for the year 1996 if the day is within the period April-May, 1996 and ‘0’ otherwise, similarly, for the year 1998, if the day is within the period February-March, 1998 then a ‘1’ and ‘0’ otherwise and so on. In this way we have got three dummy variables $\delta_1$, $\delta_2$ and $\delta_3$ for introduction of derivatives, announcement of union budget and commencement of Loksabha elections respectively.
6.4 Methodology:

6.4.1 Returns:

The return series for the Nifty prices has been calculated as following:

\[ r_t = \ln \left( \frac{N_t}{N_{t-1}} \right), \]

where \( r_t \) is the return on the \( t^{th} \) day, \( N_t \) and \( N_{t-1} \) are the Nifty prices on the \( t^{th} \) and the \( (t-1)^{th} \) day respectively. Then the return series has been checked, by using an Augmented Dickey Fuller (ADF) test, whether this is stationary or not.

6.4.2 Johansen’s Cointegration test:

Before applying the Johansen’s cointegration test, the lag of each of the tests are to be decided on the basis of three information criterions which are Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC) and Hannan-Quinn (HQ) information criterion. The results of the lag specification are tabulated in Table 7.2. After specifying the lag order of the models, Johansen’s cointegration test is applied on each of the pairs of indices of stock markets of different countries (\( y_t \)). Johansen’s methodology is defined by using the concept of Vector Autoregression (VAR) of order \( p \) given by

\[
y_t = \mu + A_1 y_{t-1} + \ldots + A_p y_{t-p} + \epsilon_t \ldots \quad \text{Equation 6.4.2.1}
\]

where \( y_t \) is an \( nx1 \) vector of variables that are integrated of order one – commonly denoted I(1) – and \( \epsilon_t \) is an \( nx1 \) vector of residuals. Here \( y_t \) s are the returns of the stock market indices of different countries. This VAR can be re-written as

\[
\Delta y_t = \mu + \Pi y_{t-1} \prod_{i=1}^{p-1} (- \prod_{j=t+1}^{p} A_j) \Delta y_{t-1} + \epsilon_t \ldots \quad \text{Equation 6.4.2.2}
\]
Where $\Pi = \sum_{i=1}^{p} A_i - I$.

If the coefficient matrix $\Pi$ has reduced rank $r < n$, then there exist $nxr$ matrices $\alpha$ and $\beta$ each with rank $r$ such that $\Pi = \alpha \beta'$ and $\beta'y_t$ is stationary. And $r$ is the number of cointegrating vectors, the elements of $\alpha$ is known as the adjustment parameters in the vector error correction model and each column of $\beta$ is a cointegrating vector. Johansen proposes two different likelihood ratio tests of the significance of these canonical correlations and thereby the reduced rank of the $\Pi$ matrix: the trace test and maximum eigenvalue test, as following:

$$J_{\text{trace}} = - T \sum_{i=r+1}^{n} \ln(1 - \lambda'_i)$$  \hspace{1cm} \text{Equation 6.4.2.3} \\
$$J_{\text{eigen}} = - T \ln(1 - \lambda'_{r+1})$$ \hspace{1cm} \text{Equation 6.4.2.4}

Where $T$ is the sample size and $\lambda'_i$ is the $i^{th}$ largest canonical correlation. The null hypothesis for the trace test is given by $H_0$: $r$ cointegrating vectors or rank = $r$ against the alternative hypothesis $H_1$: $n$ cointegrating vectors or rank = $n$ whereas the null hypothesis for the maximum eigen value test is given by $H_0$: $r$ cointegrating vectors against the alternative hypothesis $H_1$: $r+1$ cointegrating vectors. Neither of these tests follows a chi square distribution however asymptotic critical values can be seen in Johansen and Juselius (1990).

\textbf{6.4.3 ADF test:}

$$\Delta r_{t-1} = \alpha_0 + \alpha_1 t + \beta_0 r_{t-1} + \sum_{i=2}^{k} \beta_i \Delta r_{t-i} + \epsilon_{t-1}$$ \hspace{1cm} \text{Equation 6.4.3.1}

Where $\Delta$ is the first order forward difference operator defined as $\Delta r_{t-1} = r_t - r_{t-1}$; $t$ is the time trend; $k$ denotes the number of lags used and $\epsilon_{t-1}$ is the error term; $\alpha$'s
and β’s are parameters. The null hypothesis that series is non-stationary can be rejected if β₀ is statistically significant with a negative sign. The optimal lag k is chosen by using the Akaike Information Criterion (AIC). The series has been found to be stationary.

6.4.4 Granger Causality Test:

If yᵢ and xᵢ are two stationary time series then Ganger Causality test is used to test the null hypothesis H₀: xᵢ does not Granger cause yᵢ against the alternative xᵢ Granger causes yᵢ. First the proper lag value is found out by fitting an Auto Regression model on yᵢ as following:

\[ yᵢ = α₀ + α₁ yᵢ₋₁ + α₂ yᵢ₋₂ + ... + α_p yᵢ₋p + εᵢ \]  \hspace{1cm} \text{Equation 6.4.4.1}

and then this model is extended by including the lagged values of xᵢ as following:

\[ yᵢ = α₀ + α₁ yᵢ₋₁ + α₂ yᵢ₋₂ + ... + α_p yᵢ₋p + β₁ xᵢ₋₁ + β₂ xᵢ₋₂ + β₃ xᵢ₋₃ + ... + β_q xᵢ₋q + uᵢ \]  \hspace{1cm} \text{Equation 6.4.4.2}

t statistic is calculated for the coefficients of the variables and an F statistic is calculated for understanding the significance of the model.

6.4.5 TGARCH (1,1) model with dummy variables:

Now a TGARCH (1,1) model with dummy variables is fitted to the series with the three dummy variables which were constructed for the purpose of this study.

TGARCH (1,1) model is described as following:

\[ rᵢ = α + β rᵢ₋₁ + εᵢ₋₁ \]  \hspace{1cm} \text{Equation 6.4.5.1}

\[ hᵢ² = ω + α₁ hᵢ + β₁ εᵢ₋₁ + γ₁ Iᵢ₋₁ εᵢ₋₁ + γ₂ Iᵢ₋₁ εᵢ₋₁ + γ₃ δ₁ + γ₄ δ₂ + γ₅ δ₃ \]

\hspace{1cm} \text{Equation 6.4.5.2}
Where, $\delta_1$, $\delta_2$ and $\delta_3$ are the dummy variables for introduction of derivatives, announcement of union budget and commencement of Loksabha elections respectively

\[
\text{where } I_{t-1} = 1 \text{ if } \epsilon_{t-1} < 0 \\
= 0 \text{ if } \epsilon_{t-1} \geq 0.
\]

And $I^*_{t-1} = 0 \text{ if } \epsilon_{t-1} < 0 \\
= 1 \text{ if } \epsilon_{t-1} \geq 0.$

This model is performed with the following null hypotheses:

$H_{01}$: $\omega = 0$ against $H_{11}$: $\omega \neq 0$, $H_{02}$: $\alpha_1 = 0$ against $H_{12}$: $\alpha_1 \neq 0$, $H_{03}$: $\beta_1 = 0$ against $H_{13}$: $\beta_1 \neq 0$, $H_{04}$: $\gamma_1 = 0$ against $H_{14}$: $\gamma_1 \neq 0$, $H_{05}$: $\gamma_2 = 0$ against $H_{15}$: $\gamma_2 \neq 0$, $H_{06}$: $\gamma_3 = 0$ against $H_{16}$: $\gamma_3 \neq 0$, $H_{07}$: $\gamma_4 = 0$ against $H_{17}$: $\gamma_4 \neq 0$, $H_{08}$: $\gamma_5 = 0$ against $H_{18}$: $\gamma_5 \neq 0$.

6.5 Results:

6.5.1 Result of Johansen Cointegration Procedure:

Table 6.1:

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Eigen Value Statistic</th>
<th>Trace Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rank = 0</td>
<td>55.67***</td>
<td>59.14***</td>
</tr>
<tr>
<td>Rank ≤ 1</td>
<td>3.48</td>
<td>3.48</td>
</tr>
</tbody>
</table>

*** $H_0$ for rank 0 is rejected at 0.001% level of significance.

Hence, it can be said from the Johansen Cointegration test (Table 6.1) that the Stock market and the derivatives market are cointegrated in the long run.
6.5.2 Result of the ADF Test:

The observed value of the ADF test statistic for the return of Nifty is -39.2781 for the lag length 2 and the p-value is 0.01. Hence, the return series of the Nifty is found to be stationary.

6.5.3 Result of the Granger causality test for lag 3:

Table 6.2:

<table>
<thead>
<tr>
<th>F Statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.127</td>
<td>0.000000 ***</td>
</tr>
</tbody>
</table>

*** H_0 is rejected at 0.001% level of significance.

Hence, from Table 6.2, it can be said that the FUTIDX for three months expiry Granger causes the behavior of Nifty.

6.5.4 The result of TGARCH with dummy variables:

Table 6.3:

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>Estimate</th>
<th>Std. Error</th>
<th>t value</th>
<th>p-value</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>ω</td>
<td>-0.000287</td>
<td>0.000002</td>
<td>-179.974</td>
<td>0.00000</td>
<td>***</td>
</tr>
<tr>
<td>α_1</td>
<td>0.034340</td>
<td>0.000105</td>
<td>327.78</td>
<td>0.00000</td>
<td>***</td>
</tr>
<tr>
<td>β_1</td>
<td>0.000019</td>
<td>0.000014</td>
<td>1.345</td>
<td>0.178787</td>
<td></td>
</tr>
<tr>
<td>γ_1</td>
<td>-0.000076</td>
<td>0.000023</td>
<td>-3.386</td>
<td>0.000715</td>
<td>***</td>
</tr>
<tr>
<td>γ_2</td>
<td>0.0000762</td>
<td>0.0000225</td>
<td>3.386</td>
<td>0.000715</td>
<td>***</td>
</tr>
<tr>
<td>γ_3</td>
<td>-0.000007</td>
<td>0.000000</td>
<td>-24.438</td>
<td>0.00000</td>
<td>***</td>
</tr>
<tr>
<td>γ_4</td>
<td>0.000001</td>
<td>0.000000</td>
<td>2.838</td>
<td>0.004562</td>
<td>**</td>
</tr>
<tr>
<td>γ_5</td>
<td>-0.000002</td>
<td>0.000001</td>
<td>-3.252</td>
<td>0.001153</td>
<td>**</td>
</tr>
</tbody>
</table>

R^2 = 0.9639  
F-statistic: 20880.00  
With 6 and 4699 DF  
p-value: 0.00000***
*** Null Hypothesis is rejected at 0.001% level of significance.

** Null Hypothesis is rejected at 0.01% level of significance.

From Table 6.3, it can be seen that today's conditional volatility of Nifty is driven by its own conditional volatility of yesterday. It has also been observed that the negative and the positive shocks have significant effect on the volatility of the Indian stock market. It can also be seen that the introduction of Futures contract has a significant effect on the conditional volatility of Nifty. The announcement of union budget influences the volatility of the stock market positively whereas the Loksabha election does it in negative direction.

6.6 Conclusion:

Introduction of index futures in India has played a significant role in controlling the volatility of the Indian stock market. This chapter concludes that the union budget plays a significant role on the conditional volatility of the Indian stock market. This chapter also highlights that there is a significant effect of political uncertainties on the volatility of the Indian stock market. It is also noted that the volatility of the Indian stock market is unstable during and one month after the Loksabha elections. Although, it has been found from the result of TGARCH model that introduction of Futures has a significant role to control the volatility of the Indian stock market, but it is also studied whether the movement of the index futures and the movement of stock index is correlated or not. For this, a granger causality test and Johansen's Cointegration test have been used and it is found that they are cointegrated with each other. So, it is also concluded that not only
the introduction of index futures is influencing the volatility of the Indian stock market but after the introduction also it has an impact on the volatility.

This chapter brings to the table, certain policy implications which are as following:

i. Government of India should be more vigilant about financial markets during and one month after the Loksabha elections; and

ii. The investors should keep in mind the fact that the degree of financial uncertainties tends to be much higher during the Loksabha elections and one month before and one month after the union budget of the country is announced.

Hence, proper risk assessment should be undertaken before investing in the financial markets during these periods. However, it is also to be noted that political elections or union budget announcements do not give rise to financial crises. Since volatility is increased during these periods so, the derivatives should be priced accordingly rather than taking the market volatility as constant.

The hypotheses stated in 1.5.4 as

\( H_{0l.1} \): The introduction of the derivatives has no impact on the volatility of the Indian stock market.

\( H_{0l.2} \): The announcement of the union budget has no impact on the volatility of the Indian stock market.

\( H_{0l.3} \): Loksabha election of the country has no impact on the
volatility of the Indian stock market. were successfully tested by using some methodologies and it was found that all of the above hypotheses are rejected on the basis of those statistical tests.

The scope of the study is limited to the fact that it has only considered the Loksabha election as the proxy variable for the political uncertainties and the announcement of union budget as the proxy for the financial uncertainty in the country. Differences in policies of different political parties, coalition government etc may also be considered for future studies.