IMPACT OF INTRODUCTION OF INDEX & STOCK FUTURE AND INDEX & STOCK OPTION ON VOLATILITY OF INDIAN STOCK MARKET

Richa Mathur[*]
Sanjay Kr. Garg[**]

ABSTRACT

This paper studies the volatility implication of introduction of derivative trading i.e. introduction of Index & Stock future and Index & Stock option on the volatility of Indian stock market. The data on which volatility is measured comprises of NSE 50 companies as on 1st April, 2014 and Nifty 50 Index. To account for heteroscedaticity i.e non constant error variance in the stock return series, the GARCH model with dummy variable was used in the conditional variance equation. The post results of introduction of Index & Stock future and Index & Stock option showed that there was no significant impact on volatility after the introduction of trading in Index & Stock future and Index & Stock option on the Indian stock market. Thus the nature of volatility pattern on Indian stock market has not altered after the introduction of Index & Stock future and Index & Stock option.

KEYWORDS: *Eteroscedaticity, Conditional Volatility, Market Efficiency, Stock Future, Stock Option.*

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Introduction

The last two decades in the India has witness major structural reforms in the Indian capital market, which include creation and empowerment of Securities and Exchange Board of India (SEBI), establishment of National Stock Exchange of India (NSEIL), National Securities Clearing Corporation (NSCCL), National Securities Depository Limited (NSDL), Central Securities Depository Limited (CDSL), abolition of Badla system and introduction of screen based trading, book building mechanism for public issues, index funds, exchange traded funds, hedge funds, margin trading, rolling settlement system etc. Such changes brought about reduction in transaction cost, which have helped the investors to lock in a deal faster. It has also helped in cleaning the system and provided safety to the investing public at large. Introduction of financial derivatives in the Indian capital market has been one of the most important episodes in such a reform process. The L. C. Gupta Committee after long deliberations came out with constructive guidelines for the introduction of financial derivatives, as a result of which major derivative products including index/stock futures, index/stock options and interest rate derivatives were introduced in a phased manner. The J.R. Verma committee was also set up in 1998 to develop measures for risk containment for derivatives. SEBI granted approval to NSE and BSE to commence trading of derivatives in May, 2000. Index futures were first introduced in India on NSE and BSE on June 12, 2000. It was followed by the introduction of Index options on June 4, 2001, Stock options on July 2, 2001 and Stock futures on November 9, 2001. The L. C. Gupta Committee cherished the experience of different markets

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[*]   Research Scholar, Department of Management, School of Commerce & Management, Central University of Rajasthan, Kishangarh, Ajmer, Rajasthan, India.

[**]   Assistant Professor, Department of Management, School of Commerce & Management, Central University of Rajasthan, Kishangarh, Ajmer, Rajasthan, India.

world over, where these products were already introduced and led to improvement in price discovery efficiency and liquidity and reduction in cash market volatility. Presence of derivative products provides a better leverage option to the traders which have been considered to be a strong force in building up the confidence of retail traders in the market. Although the introduction of equity derivatives in the Indian capital market is not very old yet it enjoys very good reputation among all peer markets. Recently Interest future and currency future trading was also started in India.

Review of Literature

Ahmed, M., Suliman, S. (2011) studied modeling stock market volatility using garch models on KSE of Sudan. Arch family models were used to examine volatility. The results told that asymmetric models better fit than the symmetric models, which confirms the presence of leverage effect. Thus high volatility of index return series is present in Sudan stock market over the sample period. The implication is that increase in volatility would increase returns and explosive volatility process is present in KSE index returns over the sample period.

Ramana Rao (2007) had investigated the impact of futures trading on the volatility of the corresponding S&P CNX Nifty index and found that the volatility has increased after the introduction of index futures.

Nath (2003) examined the behavior of volatility in the equity market in India, for the pre and post derivatives period, using conditional variance for the period of 1999-2003. He modeled conditional volatility using different method such as GARCH. He has considered 20 stocks randomly from the Nifty and Junior Nifty basket as well as benchmark indices itself. As result, he observed that for most of the stocks, the volatility came down in the post-derivative trading period. He suggested that the volatility of the market as measured by benchmark indices like S&P CNX Nifty and Nifty Junior have fallen in the post-derivatives period.

Ryoo and Graham smith (2003) argued that introduction of index futures trading have destabilized spot market. They used ARCH/ GARCH models to capture time varying nature of volatility phenomena in present data. The results shows futures trading increases the speed at which information impounded into the spot market prices, reduces the persistent of the information and increase the spot market volatility.

Hetamsaria and Swain (2003) examined the impact of the introduction of index futures on the volatility of stock market in India applying regression analysis. They have used Nifty 50 index price data for the period of Jan 1998 - March 2003. They found that the volatility of the Nifty return has declined after the introduction of index futures.

Data and Methodology

In India trading in Index option started in 01-06-2001,Index future in 09-06-2000,Stock option 09-07-2001 and Stock future 09-11-2002.NSE accounts for about 99.5 % of the total trading in derivative market therefore for analysis purpose we have considered impact of derivative trading on Nifty 50 Index and NSE 50 companies as on 1st April ,2014. the study uses daily closing price of nifty 50 index and NSE 50 companies for index & stock option and Index and stock future. The data is from January 1998 – February 2016 and is collected from CMIE prowess database. For the purpose of analysis the daily closing data were converted into daily compounded returns by taking the first log difference. Return Rt at time t is calculated by using the following formula Rt = ln (Pt/Pt-1)*100 where Pt is the daily closing price for day t.

Econometrics Techniques

It is assumed that stock market returns have conditional and unconditional variances .Conditional variances are related to short term shocks and are not constant over the time whereas unconditional variances are assumed to be constant over the time. The error term in stock time series data shows varying variances and thus requires heteroscedasticity as a solution. In 1982(Engle) proposed ARCH process (auto regressive conditional heteroscedasticity) as a model for conditional variance. Later in 1986 (Bollerslev) suggested Generalized auto regressive conditional heteroscedasticity model, in order to include lag known as GARCH (p,q) model. Here "p" refers lag on h_t i.e variance and "q" refers lag on e^2_{t-1} i.e. squared error term or disturbance term.

For the analysis purpose GARCH model with dummy variable was sued in order to find the impact of introduction of trading in Index & Stock future and Index & Stock option on the volatility of Indian stock market. For this the period of 4 years has been taken to test the impact i.e. 2 years before the introduction of trading in Index & Stock future and Index & Stock option and 2 years post introduction of

trading in Index & Stock future and Index & Stock option from the date of introduction of above reform. In analysis the results of introduction of index and stock option are computed together as the date of these reforms are having less than a week difference and thus the results of them may not vary. The GARCH model with dummy variable is represented by equation in the following way:

The calculation of the return has been done with the help of the following equation:

$$Y_t = \alpha_0 + \alpha_i Y_{t-1} + \delta D_t + \epsilon_t$$

The calculation of volatility by using GARCH model is done by the use of following equation:

$$\sigma_t^2 = \alpha_0 + \alpha_1 u_{t-1}^2 + \beta \sigma_{t-1}^2 + \gamma D_t$$

Where, D_t represents the time dummy of reform and γ represents the change in volatility if any after the introduction of reform in the stock volatility.

The first equation represents the conditional mean equation and second equation represents the conditional variance equation.

Where,

Y_t = Return

Y_{t-1} = Lagged Return to correct for serial correlation

D_t = Dummy Variable (taking the value 0 for pre reform period and 1 for post reform period)

ε_t = Error residuals

Testing of Non-stationary behavior of Stock/Index Prices

It is well known fact that most of the financial time series are non-stationary which means they contain unit root. If a time series is not found to be stationary it is said to be non-stationary time series. Hence, in order to generalize results, the non-stationary financial times series should be transformed into stationary series, the most popular transformation is converting stock prices into continuously compounded returns. In this research study the compounded returns of the selected companies are tested with the help of Augmented Dickey–Fuller test (ADF) to find is series stationary or non stationary. The results of unit root tests with the help of Augmented Dickey–Fuller test (ADF) test is shown below in the table 1.

Table 1: Testing of Unit Root

Nifty 50 Index/Companies	Intercept		Trend & Intercept		None	
	t stat	prob	t stat	prob	t stat	prob
Nifty 50 Index	-58.780	0.000	-58.773	0.000	-58.735	0.000
A C C Ltd.	-201.840	0.000	-201.761	0.000	-201.836	0.000
Adani Ports & Special Economic Zone Ltd.	-44.070	0.000	-44.070	0.000	-44.081	0.000
Ambuja Cements Ltd.	-49.498	0.000	-49.494	0.000	-49.466	0.000
Asian Paints Ltd.	-67.806	0.000	-67.808	0.000	-67.638	0.000
Axis Bank Ltd.	-63.571	0.000	-63.574	0.000	-63.495	0.000
Bajaj Auto Ltd.	-40.431	0.000	-40.468	0.000	-40.344	0.000
Bank of Baroda	-61.145	0.000	-61.139	0.000	-61.141	0.000
Bharat Heavy Electricals Ltd.	-48.501	0.000	-48.507	0.000	-48.502	0.000
Bharat Petroleum Corpn. Ltd.	-63.037	0.000	-63.036	0.000	-63.028	0.000
Bharti Airtel Ltd.	-44.831	0.000	-44.907	0.000	-44.767	0.000
Bosch Ltd.	-67.029	0.000	-67.030	0.000	-66.937	0.000
Cairn India Ltd.	-47.620	0.000	-47.684	0.000	-47.631	0.000
Cipla Ltd.	-62.493	0.000	-62.507	0.000	-62.434	0.000
Coal India Ltd.	-35.849	0.000	-35.835	0.000	-35.862	0.000
Dr. Reddy's Laboratories Ltd.	-65.344	0.000	-65.341	0.000	-65.288	0.000
G A I L (India) Ltd.	-66.720	0.000	-66.712	0.000	-66.718	0.000
Grasim Industries Ltd.	-35.545	0.000	-35.542	0.000	-35.520	0.000
H C L Technologies Ltd.	-26.175	0.000	-26.253	0.000	-26.167	0.000
H D F C Bank Ltd.	-50.008	0.000	-50.009	0.000	-49.884	0.000
Hero Motocorp Ltd.	-42.407	0.000	-42.415	0.000	-42.324	0.000

Nifty 50 Index/Companies	Intercept		Trend & Intercept		None	
	t stat	prob	t stat	prob	t stat	prob
Hindalco Industries Ltd.	-62.057	0.000	-62.061	0.000	-62.064	0.000
Hindustan Unilever Ltd.	-65.698	0.000	-65.699	0.000	-65.684	0.000
Housing Development Finance Corpn. Ltd.	-34.125	0.000	-34.125	0.000	-34.004	0.000
I C I C I Bank Ltd.	-60.253	0.000	-60.261	0.000	-60.232	0.000
I T C Ltd.	-67.901	0.000	-67.895	0.000	-67.860	0.000
Idea Cellular Ltd.	-45.136	0.000	-45.126	0.000	-45.146	0.000
Indusind Bank Ltd.	-47.908	0.000	-47.924	0.000	-47.880	0.000
Infosys Ltd.	-47.786	0.000	-47.822	0.000	-47.704	0.000
Kotak Mahindra Bank Ltd.	-58.836	0.000	-58.836	0.000	-58.756	0.000
Larsen & Toubro Ltd.	-37.285	0.000	-37.281	0.000	-37.257	0.000
Lupin Ltd.	-64.829	0.000	-64.832	0.000	-64.763	0.000
Mahindra & Mahindra Ltd.	-59.274	0.000	-59.273	0.000	-59.253	0.000
Maruti Suzuki India Ltd.	-53.559	0.000	-53.561	0.000	-53.467	0.000
N T P C Ltd.	-52.942	0.000	-52.972	0.000	-52.947	0.000
Oil & Natural Gas Corpn. Ltd.	-62.965	0.000	-62.963	0.000	-62.962	0.000
Power Grid Corpn. Of India Ltd.	-43.920	0.000	-43.911	0.000	-43.928	0.000
Punjab National Bank	-55.402	0.000	-55.539	0.000	-55.379	0.000
Reliance Industries Ltd.	-63.710	0.000	-63.710	0.000	-63.686	0.000
State Bank of India	-61.329	0.000	-61.325	0.000	-61.321	0.000
Sun Pharmaceutical Inds. Ltd.	-63.292	0.000	-63.301	0.000	-63.131	0.000
Tata Consultancy Services Ltd.	-34.209	0.000	-34.207	0.000	-34.107	0.000
Tata Motors Ltd.	-60.986	0.000	-60.984	0.000	-60.984	0.000
Tata Power Co. Ltd.	-49.457	0.000	-49.461	0.000	-49.449	0.000
Tata Steel Ltd.	-63.340	0.000	-63.342	0.000	-63.344	0.000
Tech Mahindra Ltd.	-43.477	0.000	-43.468	0.000	-43.474	0.000
Ultratech Cement Ltd.	-52.019	0.000	-52.016	0.000	-51.955	0.000
Vedanta Ltd.	-61.996	0.000	-61.993	0.000	-61.989	0.000
Wipro Ltd.	-61.473	0.000	-61.500	0.000	-61.442	0.000
Yes Bank Ltd.	-36.440	0.000	-36.436	0.000	-36.400	0.000
Zee Entertainment Enterprises Ltd.	-61.399	0.000	-61.399	0.000	-61.379	0.000

The table 1, reports the results of unit root test. It can be noted that while the null hypothesis for the Augmented Dickey–Fuller test (ADF) is that the financial time series contains the unit root which means the series is non stationary (the series is random). As reported in the above table, the t statistics for ADF are highly significant. This implies that the null hypothesis of unit root cannot be accepted. The series was found to be stationary at level, there was no unit root therefore the series was, stationary. This indicates that the mean and variance of these series are constant with time. In order to achieve the stated objectives of the research, this series is appropriate to be used as it is already stationary and can be used for analysis in case of nifty 50 index and NSE companies.

Analysis and Results

The GARCH Analysis

As we have stated, in order to measure the impact of the introduction of trading in Index & Stock future and Index & Stock option on the volatility of Indian stock market, we introduce a dummy variable into the conditional variance equation. A significantly positive/negative coefficient is an indication of an increase/decrease in volatility as a result of introduction of trading in Index & Stock future and Index & Stock option on the volatility of Indian stock market. The results of GARCH (1,1) estimates with dummy variable are reported in table no 2,3,and 4.

Impact of Introduction of Trading in Index Future on Volatility of Indian Stock Market

This section of the study analyzes the impact of Index future on the volatility of the daily returns on the selected stocks as well as Nifty 50 index. A GARCH (1, 1) model with dummy variable is applied to test the impact on volatility. The null hypothesis of the GARCH (1, 1) model applied is that there exists no change in the volatility of stock and index returns after the introduction of trading in Index future in Indian stock market.

Table 2: Impact of Introduction of Trading in Index Future on Volatility of Indian Stock Market

Nifty 50 Index/ Companies	Co-efficient of event dummy	t statistic	Probability	Remarks
Nifty 50 Index	0.000	-10.850	0.000	Significant increase in Conditional Heteroskedasticity
Asian Paints Ltd.	0.000	-5.506	0.000	Significant Decrease in Conditional Heteroskedasticity
Bank of Baroda	0.000	-3.191	0.001	Significant Decrease in Conditional Heteroskedasticity
Bosch Ltd.	0.000	-4.301	0.000	Significant Decrease in Conditional Heteroskedasticity
Cipla Ltd.	0.000	-3.046	0.002	Significant Decrease in Conditional Heteroskedasticity
Dr. Reddy's Laboratories Ltd.	0.000	-3.233	0.001	Significant Decrease in Conditional Heteroskedasticity
G A I L (India) Ltd.	0.000	-2.844	0.005	Significant Decrease in Conditional Heteroskedasticity
Grasim Industries Ltd.	0.000	-3.699	0.000	Significant Decrease in Conditional Heteroskedasticity
H D F C Bank Ltd.	0.000	-5.537	0.000	Significant Decrease in Conditional Heteroskedasticity
Hindalco Industries Ltd.	0.000	-3.958	0.000	Significant Decrease in Conditional Heteroskedasticity
Housing Development Finance Corpn. Ltd.	0.000	-4.244	0.000	Significant Decrease in Conditional Heteroskedasticity
I C I C I Bank Ltd.	0.000	-2.173	0.030	Significant Decrease in Conditional Heteroskedasticity
I T C Ltd.	0.000	-2.262	0.024	Significant Decrease in Conditional Heteroskedasticity
Indusind Bank Ltd.	0.000	-6.332	0.000	Significant Decrease in Conditional Heteroskedasticity
Kotak Mahindra Bank Ltd.	0.000	-4.508	0.000	Significant Decrease in Conditional Heteroskedasticity
Larsen & Toubro Ltd.	0.000	-2.966	0.003	Significant Decrease in Conditional Heteroskedasticity
Lupin Ltd.	0.000	-2.308	0.021	Significant Decrease in Conditional Heteroskedasticity
Mahindra & Mahindra Ltd.	0.000	-2.063	0.039	Significant Decrease in Conditional Heteroskedasticity
Oil & Natural Gas Corpn. Ltd.	0.000	-2.290	0.022	Significant Decrease in Conditional Heteroskedasticity

Nifty 50 Index/ Companies	Co-efficient of event dummy	t statistic	Probability	Remarks
Reliance Industries Ltd.	0.000	-4.135	0.000	Significant Decrease in Conditional Heteroskedasticity
State Bank of India	0.000	-2.983	0.003	Significant Decrease in Conditional Heteroskedasticity
Sun Pharmaceutical Inds. Ltd.	0.000	-2.871	0.004	Significant Decrease in Conditional Heteroskedasticity
Tata Steel Ltd.	0.000	-3.122	0.002	Significant Decrease in Conditional Heteroskedasticity
A C C Ltd.	0.000	-3.063	0.002	Significant Decrease in Conditional Heteroskedasticity
Ambuja Cements Ltd.	0.000	0.127	0.899	Insignificant change in Conditional Heteroskedasticity
Bharat Heavy Electricals Ltd.	0.000	-1.630	0.103	Insignificant change in Conditional Heteroskedasticity
Bharat Petroleum Corpn. Ltd.	0.000	-0.953	0.340	Insignificant change in Conditional Heteroskedasticity
Hero Motocorp Ltd.	0.000	-1.628	0.104	Insignificant change in Conditional Heteroskedasticity
Hindustan Unilever Ltd.	0.000	-0.836	0.403	Insignificant change in Conditional Heteroskedasticity
Infosys Ltd.	0.000	1.526	0.127	Insignificant change in Conditional Heteroskedasticity
Tata Motors Ltd.	0.000	-1.530	0.126	Insignificant change in Conditional Heteroskedasticity
Tata Power Co. Ltd.	0.000	0.788	0.431	Insignificant change in Conditional Heteroskedasticity
Vedanta Ltd.	0.000	-1.802	0.072	Insignificant change in Conditional Heteroskedasticity
Wipro Ltd.	0.000	1.662	0.097	Insignificant change in Conditional Heteroskedasticity
Zee Entertainment Enterprises Ltd.	0.000	1.136	0.256	Insignificant change in Conditional Heteroskedasticity

The result table 2, of GARCH (1, 1) with dummy variable in the model indicates that in case of nifty 50 index, the p value of t statistics is less than 5 percent level of significance and slope of coefficient of time dummy variable is positive, thus the volatility of nifty 50 index increased significantly after the introduction of trading in index future in Indian stock market.

In case of companies, out of 34 companies, probability value of t statistics of 23 companies is less than 5 percent level of significance. In addition to this the slope of co efficient of dummy variable of all the 23 companies was found to be negative indicating that their exist significant decrease in the volatility of these stocks after the introduction of trading in index future in Indian stock market. In case of 11 companies, no significant change is found in volatility as the p value was more than 5 percent level of significance.

Hence with 95 percent confidence level the null hypothesis of no significant change in the volatility after the introduction of trading in Index future cannot be accepted. Thus, it can be concluded in case of companies and nifty 50 index that after the introduction of trading in index future in Indian stock market, there exist significance change in the volatility and it was also found that volatility has decreased in case of all 23 companies.

Impact of Introduction of Trading in Index & Stock Option on Volatility of Indian Stock Market

This section of the study analyzes the impact of Introduction of Index & stock option on the volatility of the daily returns on the selected stocks as well as Nifty 50 index. A GARCH (1, 1) model with dummy variable is applied to test the impact on volatility. The null hypothesis of the GARCH (1, 1) model applied is that there exist no change in the volatility of stock and index returns after the Introduction of Index & stock option and VAR based margining system on volatility of Indian stock market.

Table 3: Impact of Introduction of trading in Index & stock option on Volatility of Indian Stock Market

Nifty 50 Index/Companies	Co-efficient of event dummy	Std Error	t statistic	Probability	Remarks
Nifty 50 Index	0.000	0.000	-8.686	0.000	Significant increase in Conditional Heteroskedasticity
ACC Ltd.	0.000	0.000	-3.738	0.000	Significant Increase in Conditional Heteroskedasticity
Ambuja Cements Ltd.	0.000	0.000	-4.028	0.000	Significant Increase in Conditional Heteroskedasticity
Asian Paints Ltd.	0.000	0.000	-6.504	0.000	Significant Increase in Conditional Heteroskedasticity
Axis Bank Ltd.	0.000	0.000	-2.057	0.040	Significant Increase in Conditional Heteroskedasticity
Bank of Baroda	0.000	0.000	-4.366	0.000	Significant Increase in Conditional Heteroskedasticity
Bharat Heavy Electricals Ltd.	0.000	0.000	-3.621	0.000	Significant Increase in Conditional Heteroskedasticity
Bharat Petroleum Corp. Ltd.	0.000	0.000	-3.680	0.000	Significant Increase in Conditional Heteroskedasticity
Cipla Ltd.	0.000	0.000	-3.449	0.001	Significant Increase in Conditional Heteroskedasticity
Dr. Reddy's Laboratories Ltd.	0.000	0.000	-2.733	0.006	Significant Increase in Conditional Heteroskedasticity
GAIL (India) Ltd.	0.000	0.000	-5.077	0.000	Significant Increase in Conditional Heteroskedasticity
Grasim Industries Ltd.	0.000	0.000	-5.799	0.000	Significant Increase in Conditional Heteroskedasticity
HDFC Bank Ltd.	0.000	0.000	-4.932	0.000	Significant Increase in Conditional Heteroskedasticity
Hindalco Industries Ltd.	0.000	0.000	-5.000	0.000	Significant Increase in Conditional Heteroskedasticity
Hindustan Unilever Ltd.	0.000	0.000	-2.765	0.006	Significant Increase in Conditional Heteroskedasticity
Housing Development Finance Corporation Ltd.	0.000	0.000	-5.584	0.000	Significant Increase in Conditional Heteroskedasticity

Nifty 50 Index/Companies	Co-efficient of event dummy	Std Error	t statistic	Probability	Remarks
I T C Ltd.	0.000	0.000	-3.243	0.001	Significant Increase in Conditional Heteroskedasticity
ICICI Bank Ltd.	0.000	0.000	-4.119	0.000	Significant Increase in Conditional Heteroskedasticity
IndusInd Bank Ltd.	0.000	0.000	-3.189	0.001	Significant Increase in Conditional Heteroskedasticity
Infosys Ltd.	0.000	0.000	-2.209	0.027	Significant Increase in Conditional Heteroskedasticity
Kotak Mahindra Bank Ltd.	0.000	0.000	-4.211	0.000	Significant Increase in Conditional Heteroskedasticity
Larsen & Toubro Ltd.	0.000	0.000	-3.495	0.001	Significant Increase in Conditional Heteroskedasticity
Mahindra & Mahindra Ltd.	0.000	0.000	-3.820	0.000	Significant Increase in Conditional Heteroskedasticity
Oil & Natural Gas Corp. Ltd.	0.000	0.000	-2.797	0.005	Significant Increase in Conditional Heteroskedasticity
Reliance Industries Ltd.	0.000	0.000	-3.580	0.000	Significant Increase in Conditional Heteroskedasticity
State Bank of India	0.000	0.000	-3.337	0.001	Significant Increase in Conditional Heteroskedasticity
Sun Pharmaceutical Industries Ltd.	0.000	0.000	-3.809	0.000	Significant Increase in Conditional Heteroskedasticity
Tata Motors Ltd.	0.000	0.000	-2.892	0.004	Significant Increase in Conditional Heteroskedasticity
Tata Power Co. Ltd.	0.000	0.000	-3.407	0.001	Significant Increase in Conditional Heteroskedasticity
Tata Steel Ltd.	0.000	0.000	-3.753	0.000	Significant Increase in Conditional Heteroskedasticity
Vedanta Ltd.	0.000	0.000	-1.981	0.048	Significant Increase in Conditional Heteroskedasticity
Wipro Ltd.	0.000	0.000	-2.590	0.010	Significant Increase in Conditional Heteroskedasticity
Zee Entertainment Enterprises Ltd.	0.000	0.000	-2.681	0.007	Significant Increase in Conditional Heteroskedasticity
Bosch Ltd.	0.000	0.000	-1.813	0.070	Insignificant Change in Conditional Heteroskedasticity
Hero MotoCorp Ltd.	0.000	0.000	-1.236	0.217	Insignificant Change in Conditional Heteroskedasticity
Lupin Ltd.	0.000	0.000	-1.529	0.126	Insignificant Change in Conditional Heteroskedasticity

The result of table 3, of GARCH (1, 1) with dummy variable in the model indicates that in case of nifty 50 index the p value of t statistics is less than 5 percent level of significance and slope of coefficient of time dummy variable is positive, thus the volatility of nifty 50 index increased significantly after the introduction of Index & stock option and VAR based margining system reform.

In case of companies, out of total 35 companies, probability value of t statistics of 32 companies is less than 5 percent level of significance. In addition to this the slope of co efficient of dummy variable of all the 32 companies was found to be positive indicating that their exist significant increase in the volatility of these stocks after the introduction of Index & stock option and VAR based margining system reform in Indian stock market. In case of 3 companies i.e. Bosch Ltd, Hero Motocorp Ltd. and Lupin Ltd, no significant change is found in volatility as the p value was more than 5 percent level of significance. Hence with 95 percent confidence level the null hypothesis of no significant change in the volatility cannot be accepted. Thus, it can be concluded, in case of companies and nifty 50 index, that introduction of Index & stock option and VAR based margining system reform, has significance impact on the volatility.

Impact of Introduction of Trading in Stock Future on Volatility of Indian Stock Market

This section of the study analyzes the impact of introduction of trading in stock future on the volatility of the daily returns on the selected stocks as well as Nifty 50 index. The null hypothesis of the GARCH (1, 1) model applied is that there exist no change in the volatility of stock and index returns after the Introduction of stock future on volatility of Indian stock market. The following table depicts the impact of introduction of trading in Stock future on Indian stock market performance on volatility of nifty 50 index and individual stocks is as under:

Table 4: Impact of Introduction of Trading in Stock Future on Volatility of Indian Stock Market

Nifty 50 Index/Companies	Co efficient of event dummy	Std. Error	t-Statistic	Probability	Remarks
Nifty 50 Index	0.000	0.000	4.699	0.000	Significant increase in Conditional Heteroskedasticity
Asian Paints Ltd.	0.000	0.000	-3.389	0.001	Significant Increase in Conditional Heteroskedasticity
Axis Bank Ltd.	0.000	0.000	7.746	0.000	Significant Increase in Conditional Heteroskedasticity
Bank of Baroda	0.000	0.000	5.748	0.000	Significant Increase in Conditional Heteroskedasticity
Bharat Heavy Electricals Ltd.	0.000	0.000	-3.996	0.000	Significant Increase in Conditional Heteroskedasticity
Bharat Petroleum Corporation Ltd.	0.000	0.000	-5.034	0.000	Significant Increase in Conditional Heteroskedasticity
Bosch Ltd.	0.000	0.000	-4.688	0.000	Significant Increase in Conditional Heteroskedasticity
Cipla Ltd.	0.000	0.000	2.970	0.003	Significant Increase in Conditional Heteroskedasticity
H C L Technologies Ltd.	0.000	0.000	-4.578	0.000	Significant Increase in Conditional Heteroskedasticity
Hindalco Industries Ltd.	0.000	0.000	-3.493	0.001	Significant Increase in Conditional Heteroskedasticity
I C I C I Bank Ltd.	0.000	0.000	-3.195	0.001	Significant Increase in Conditional Heteroskedasticity
I T C Ltd.	0.000	0.000	-5.728	0.000	Significant Increase in Conditional Heteroskedasticity
Kotak Mahindra Bank Ltd.	0.000	0.000	-7.204	0.000	Significant Increase in Conditional Heteroskedasticity

Nifty 50 Index/Companies	Co efficient of event dummy	Std. Error	t-Statistic	Probability	Remarks
Larsen & Toubro Ltd.	0.000	0.000	4.070	0.000	Significant Increase in Conditional Heteroskedasticity
Lupin Ltd.	0.000	0.000	-7.758	0.000	Significant Increase in Conditional Heteroskedasticity
Mahindra & Mahindra Ltd.	0.000	0.000	-2.509	0.012	Significant Increase in Conditional Heteroskedasticity
Oil & Natural Gas Corpn. Ltd.	0.000	0.000	-3.002	0.003	Significant Increase in Conditional Heteroskedasticity
Reliance Industries Ltd.	0.000	0.000	-2.523	0.012	Significant Increase in Conditional Heteroskedasticity
State Bank of India	0.000	0.000	-2.523	0.012	Significant Increase in Conditional Heteroskedasticity
Sun Pharmaceutical Inds. Ltd.	0.000	0.000	3.593	0.000	Significant Increase in Conditional Heteroskedasticity
Tata Motors Ltd.	0.000	0.000	-2.046	0.041	Significant Increase in Conditional Heteroskedasticity
Tata Power Co. Ltd.	0.000	0.000	-2.046	0.041	Significant Increase in Conditional Heteroskedasticity
Vedanta Ltd.	0.000	0.000	2.720	0.007	Significant Increase in Conditional Heteroskedasticity
Wipro Ltd.	0.000	0.000	-4.768	0.000	Significant Increase in Conditional Heteroskedasticity
Zee Entertainment Enterprises Ltd.	0.000	0.000	-5.219	0.000	Significant Increase in Conditional Heteroskedasticity
A C C Ltd.	0.000	0.000	-0.738	0.460	Insignificant Change in Conditional Heteroskedasticity
Ambuja Cements Ltd.	0.000	0.000	-0.169	0.866	Insignificant Change in Conditional Heteroskedasticity
Dr. Reddy's Laboratories Ltd.	0.000	0.000	-1.716	0.086	Insignificant Change in Conditional Heteroskedasticity
G A I L (India) Ltd.	0.000	0.000	-0.321	0.748	Insignificant Change in Conditional Heteroskedasticity
Grasim Industries Ltd.	0.000	0.000	-0.180	0.857	Insignificant Change in Conditional Heteroskedasticity
H D F C Bank Ltd.	0.000	0.000	1.137	0.256	Insignificant Change in Conditional Heteroskedasticity
Hero Motocorp Ltd.	0.000	0.000	-0.699	0.485	Insignificant Change in Conditional Heteroskedasticity
Hindustan Unilever Ltd.	0.000	0.000	-0.192	0.848	Insignificant Change in Conditional Heteroskedasticity

Nifty 50 Index/Companies	Co efficient of event dummy	Std. Error	t-Statistic	Probability	Remarks
Housing Development Finance Corpn. Ltd.	0.000	0.000	1.713	0.087	Insignificant Change in Conditional Heteroskedasticity
Indusind Bank Ltd.	0.000	0.000	0.376	0.707	Insignificant Change in Conditional Heteroskedasticity
Infosys Ltd.	0.000	0.000	-1.239	0.215	Insignificant Change in Conditional Heteroskedasticity
Tata Steel Ltd.	0.000	0.000	-1.614	0.107	Insignificant Change in Conditional Heteroskedasticity

The result table 4, of GARCH (1, 1) with dummy variable in the model indicates that in case of nifty 50 index the p value of t statistics is less than 5 percent level of significance and slope of coefficient of time dummy variable is positive, thus the volatility of nifty 50 index increased significantly after the introduction of trading in Stock future. In case of companies, out of total 36 companies 24 companies probability value of t statistics is less than 5 percent level of significance. In addition to this the slope of co efficient of dummy variable of all 24 companies was found to be positive indicating that their exist significant increase in the volatility of these stocks after the introduction of trading in Stock future in Indian stock market. In case of 12 companies no significant change is found in volatility as the p value was more than 5 percent level of significance.

Hence with 95 percent confidence level the null hypothesis of no significant change in the volatility cannot be accepted. Thus, it can be concluded in case of companies and nifty 50 index that after the introduction of trading in Stock future, there exist significance change in the volatility.

Conclusion

With the objective of analyzing the impact of the introduction of trading in Index & Stock future and Index & Stock option on the volatility of Indian stock market, we have examined that with the use of Volatility models, the results showed that there was an impact of introduction of capital market reforms on volatility of the market at index level and volatility have decreased after the introduction of the capital market reforms. The reforms namely Introduction of trading in Index future, Introduction of trading in Stock & Index option and Introduction of trading in stock future showed that there was significant impact on volatility on index due to introduction of capital market reforms. Thus the volatility has reduced with the introduction of capital market reform namely Index & Stock future and Index & Stock option.

But at individual stock level, it was found that there was no impact of introduction of capital market reforms on volatility of the market due to introduction of trading in Index & Stock future and Index & Stock option. The results of the above study are similar as detected by other researchers namely Trennepohl and Dukes(1979), and peter and Rafael (2002) .thus our results is similar to majority of results obtained throughout the world.

Thus, we conclude that introduction of trading in Index & Stock future and Index & Stock option has not brought the desired outcome of decline in the volatility of Indian stock market. Based on our results we can say that the decline in volatility in the Indian stock market is not due to introduction of trading in Index & Stock future and Index & Stock option but may be other factors such as better regulatory activities and increased trust among investors, more transparency in operation ,effective government policies and reduction in fraudulent activities etc. Thus, further research must be done in area of reforms to know that, is different capital market reforms have impact on volatility of Indian stock market or not.

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