REGULATIONS AND DEVELOPMENT OF FINANCIAL DERIVATIVES MARKET IN INDIA SINCE 2000

ABSTRACT

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ABSTRACT

Introduction

Due to globalization and financial liberalization, the Indian Capital Market run through a major transformation structural changes and its practical functions because of the free flow of capital in ever increasing volume which opened the doors to more speculation, the formation of the new instrument like derivatives and improvement of old financial devices as a part of capital market reforms.

The capital market reforms helped in designing new investment opportunities, improving efficiency in spreading of information, better transparency in operations and barring unfair trade practices. Highly integrated financial markets also help to individuals and investors to assort their portfolio risk.

Risks are many; one of these risks is financial risk, which is caused by changes in stock market prices. By a high degree of volatility, the financial markets are noticeable. Therefore, it is essential for the corporate client, to keep their operating profit by shifting some unbearable financial risk to those who are interested to bear and manage it. Risk management is required due to high volatility in the present financial market.

The enlarged integration of domestic market with the international market as well as the increased volatility in financial markets has fuelled the development of derivatives market.

Derivatives can be used as hedging instrument in all environments that generate risk. Price risk, which arises due to fluctuations in asset prices, can be hedged by using appropriate derivative instruments. By locking in a certain price, derivatives remove price risk for the future purchase or sale of an underlying asset whose price fluctuate frequently. Physical commodities, foreign currencies, financial securities such as shares, bonds and stock indices may be the underlying assets. Hence, different derivatives such as commodity derivatives, stock derivatives, currency derivatives, index derivatives and interest rate derivatives etc. have developed.

Presently, all over the world, derivatives' trading has become an important economic activity. In India, the development and commencement of trading in derivatives is of recent origin.

However, there are some positive and negative views related to derivatives. In positive view, derivatives, as useful instruments, are having a positive impact on the economy and it's functioning. On the other hand derivatives trading as an undesirable activity with negative impact on economic efficiency. Derivatives are lauded as useful tools of risk management however, (Warren Buffet) considered derivatives as "weapons of mass destruction' in the economic system.

Derivatives' trading provides opportunity for speculative profit to interested parties while it is a hedging instrument. Hedgers and speculators are two wheels of a vehicle. They operate side-by-side supporting each other's requirements and activities in the derivatives market. The derivatives markets become active and dynamic because of the need-based activity of hedgers and profit-based activity of speculator. It improves the efficiency of the real assets markets, namely the commodity markets and the financial markets. Hence, Derivatives trading became an essential economic activity in the modern economic system.

Derivatives are supposed to be called financial instruments whose value is derived from the value of an underlying financial instruments and these instruments are treasury bill, a bond or a note or an individual equity or an equity index or an interest rate or a commodity (e.g. gold) or credit risk.

The legal framework for derivatives trading is a crucial part of derivative market. The regulation plays a key role to ensure the efficient functioning of markets and avoidance of systemic failures. The main purpose of regulations is to promote the efficiency and competition rather than hampering it.

The market culture is a main influential factor for success or failure of derivatives market, the underlying market includes its depth and liquidity and financial infrastructure consists the regulatory framework. The efficiency of derivatives market can be impaired through government interventions. The common regulatory objectives in all jurisdictions, like the financial integrity, efficiency, market reliability and customer protection are critical to the success of any financial market.

After the introduction of the derivative market, there are certain changes that occur in the financial sector of the economy. These changes are in the price volatility, reduction in the risk of the investors and increase in the stock market trading. Thus, the purpose of this study is to highlight the impact of regulations and the development of derivatives product on the Indian Stock Markets.

The ***Statement of Problem*** and ***Issues*** of the present study are that the common opinion of the researchers is that the major causes of the financial crisis are regulatory failure and high speculative activities though the regulations play a key role to ensure the efficient functioning of markets and avoidance of systemic failures. The main purpose of regulation is to promote the efficiency and competition rather than impeding it.

Market crisis is a difficult situation, which happened due to many reasons. Few researchers have a view that the derivatives work as dynamite for financial crises and its high growth in last few decades has made financial crises significantly more strong. Such opinion is also a part of the current debate about the desirability and undesirability of derivative instruments, which highlights that their use comprises a threat to financial market immovability. Derivatives may be caused for high speculative activity and high speculative activity increases the market volatility hence, it can be the cause of financial market instability.

Above argument can only be partially accepted as derivative trading is used as a hedging purpose but the rest part of this argument are blurred and are still open for debate. There are numbers of studies that have empirically examined the effect of futures trading on the stock market volatility but they produced mixed results. The first aim of my research work is to study the present regulatory framework, its loopholes and put forward suggestions as well as to examine the role of regulations with the help of analyzing the impact of regulatory changes on the market efficiency.

Another issue, which is closely related to the first aim, is to solve the above issues by clearing up the relationship between volatility and instability based on theory as well as analysis techniques to evaluate the impact of derivatives trading on stock market volatility. More than a decade has been passed since derivatives trading started in India and the markets have much developed, therefore this is an appropriate time to re-examine this issue.

The above discussion significantly verified that the volatility is an important factor of stock market. Regulators measure the performance of the market in terms of volatility. Speculator's high profit depends on high volatility thus they prefer high volatility so that they can earn more and more profit. On the other hand, for investor's point of view the volatility is considered as unwanted variations in the asset prices. A significant implication of volatility for investors and speculators is its impact on return. Therefore, relation between volatility and return has been an important area for research.

Every investor wants to earn more return on his investment and for this purpose he uses derivatives to increase his returns. Therefore, from investor's point of view, it is important to analyze the impact of volatility on return. By using econometric models, the present research work investigated such relationship in the context of India with reference to introduction of derivatives trading. The study evaluates both pre and post derivatives period to find out how derivatives trading has altered the structure of volatility. Thus, the impact of derivative trading on risk-return relationship is the third aim of this study.

Taking into consideration the above factors there is a need to study the impact of regulations and development of financial derivatives products in Indian stock market.

The aim of this study is to carry outlook to the ongoing debate about the role of regulations and the impact of introduction of future derivatives on Indian stock market. Thus, the main research questions of this study are:

'Whether the Regulatory changes of derivatives market has affected the market efficiency of underlying stocks?'

'Whether the Introduction of financial derivatives have a significant impact on the spot market volatility?'

*The **Review of Literature*** done sheds light on various **gaps** on the basis of the previous studies attempted in this area. The Researcher intends to put a sincere effort to provide her honest contribution in this regard.

The review of literature of this study focused on the two aspects. These are regulatory announcement effect and volatility effect of derivatives.

Regarding regulatory announcement effect, to the best of my knowledge, there is no comprehensive study available in the literature, which has examined the effect of announcement of regulation since a considerable time has passed (since year 2000) after the introduction of the derivatives in India. Few studies exclusively on futures market are based on US and other developed stock exchanges. It points out the necessity to have a study based on emerging economy like India.

In case of volatility effect, the previous studies provide mix results. Furthermore, in India there is lack of empirical work that examine the impact of financial derivatives on stock market volatility. Even the studies on volatility implication and other factors of derivatives in Indian market have largely been confined to indices giving little attention to individual stocks. In India, trading in futures Index derivatives and individual stocks derivatives has been in existence for the last fourteen years, which is a considerable time period to provide some major inputs on its pros and cons. In this backdrop it assumes significance to empirically examine the impact of futures derivatives on the stock market.

The reviews show that most of the studies have taken data only for two to five years before and after the introduction of derivatives. As the time span is very short, it may not give the better results. Hence, this study takes the data from January 1996 to June 2014, which is the maximum sample period to my knowledge ever used to study the volatility effect of derivatives in India.

Further the study has applied Event Study and GARCH (1, 1) model that was found more appropriate to describe the data.

Still, further research is needed to analyze the impact of regulation and development of derivatives on stock market volatility for an in-depth understanding about the behavioral characteristics of Indian capital markets and to fill the gap in the existing literature.

It is also one of the unexplored areas so it has been decided to do research work on this topic. Therefore, the present work offers a value addition to the existing literature and proves to be useful to the academicians, investors and regulators.

In the light of the above background, the major **objectives of the study** are as follows:

1. *To trace the trend of the movement of the financial derivatives for the period of 14 years from 2000 to 2014.*
2. *To study the features in the present regulatory structure, its loopholes and put forward suggestions.*
3. *To analyze, whether the regulatory changes in derivatives market has affected the efficiency of underlying market.*
4. *To evaluate, whether the introduction of futures derivatives has a significant impact on the spot market volatility of indices and that of underlying stocks.*
5. *To examine, whether the futures derivatives can alter the structure of spot market volatility alone or changes in volatility is due to some other controlling factors.*
6. *To suggest policy implications, thereof.*

Based on the objectives of the study, following **Null hypotheses** have been constructed to be proved:

H_01: *Regulatory announcement has not affected the market efficiency of underlying stock.*

H_02: *Introduction of futures derivatives does not affect the volatility of spot market and their indices as well as individual stocks.*

H_02a: *Introduction of Index futures does not affect the volatility of spot market.*

H_02b: *Introduction of Single Stock futures does not affect the volatility of spot market.*

H_03: *Futures derivatives do not alter the structure of spot market volatility alone of their indexes as well as individual stocks.*

H_03a: *Index futures do not alter the structure of volatility of spot market alone.*

H_03b: *Single Stock Futures do not alter the structure of volatility of spot market alone.*

The ***Scope of the Study*** mentioned below:

The Indian financial market is one of the closely watched investment avenues by the global investors. Derivatives are introduced to increase the efficiency and competitiveness of the Indian Financial Market. The present study is based on the various aspects of the futures trading. It solves the question of whether the announcement of regulation has influenced the Indian Stock Market. It deals with the problem of risk of the investors through the volatility effect. The present study also covers a theoretical knowledge about the various performances of the derivative market in India.

The present study is one of the first of its manner to address the effect of regulatory announcement and introduction of financial derivatives on stock market volatility.

In case of announcement effect of regulation, the findings of the present study has several implications for policy markers, investors and academicians etc. because the regulation play a significant and key role to make sure the efficient functioning of markets and avoidance of systemic failure. The regulators and policy makers eliminate the risk with the help of special policies of regulatory framework of derivatives market, which helps to put the investors on safer side of investment.

On the other hand, the second aspect of this study is concerned with the introduction of futures derivatives influences the volatility. It has been an appealing subject because greater volatility should lead to great risk premium and introduction of the futures trading has studied, alters the movement of the share price in the stock market.

Study being in the context of emerging market is considered to be more meaningful as guidance for following emerging markets.

Therefore, the present study is very important since it provide information regarding market efficiency to the investors, traders, regulators and academicians.

The Research Design & Methodology of the study are mentioned below:

The ***data*** for present study has been collected from the official website of NSE (National Stock Exchange) of India i.e. www.inseindia.com. Other sources of the collection of data include various books, newspapers, journals, & Internet.

The data set includes time series data on 15 individual stocks and 3 indices from NSE (National Stock Exchange) of India. NSE is the leading stock exchange of India and records highest trading volume in the derivatives segment. It covers 99% of total trade in India. It is one of the 3rd largest exchanges in the world in terms of number of Single Stock Futures contract traded during 2013-14 and has a 6th rank in the world in terms of Index Futures contracts traded during 2013-14.

The main data for the study is returns of the S&P CNX Nifty, Nifty Index Futures, Single Stock Futures and Nifty Junior. Nifty comprises of 50 liquid stocks, each stock being awarded a weight in proposition to its relative market capitalization. The constituent stock represents wide range of industries and their total market capitalization accounts for the 63% of the market capitalization of the equity market.

In order to estimate the effect of announcement of regulations of derivatives on efficiency of stock market, the daily closing prices have been used. The data has been taken from 3rd November 2003 to 4th November 2004. The whole study period is classified as below:

Analysis Period:	03rd November 2003 to 4th November 2004
Estimation Period:	03rd November 2003 to 21st September 2004
Event Window:	22nd September 2004 to 04th November 2004
Event Day:	12th October 2004
Pre Event Day:	22nd September 2004 to 11th October 2004
Post Event Day:	14th October 2004 to 04th November 2004

The event of Interest is defined as the "Amendment in Securities Contract (Regulation) Act 1956 (42 of 1956). The Amendment date was 12th October 2004 in SC(R) A 1956 (42 of 1956) which is considered to be the 'event day' and is defined as **t=0.** An **'Event Window'** of 31 days is estimated i.e. 15 day before and 15 days after the event day. Fifteen days before the event day are designated as **-15 to -1** and fifteen days after the event date are designated as **+1 to +15.** An **estimation window** of 226 days just before the event window is considered for computing expected returns using the market model to be explained below.

On the other hand, in order to estimate the impact of derivatives trading on stock market volatility the daily closing prices have been used. The data has been taken over *a span of 19 years* starting from 1st January' 1996 to 11th June' 2014. To study the impact of any policy implication, nineteen years is quite a good span of time. In order to study the impact of introduction of derivatives on Indian stock market volatility, the whole study period has been classified as follows:

For Index Futures:

Pre derivatives period: 1st January 1996 to 11th June 2000

Post derivatives period: 12th June 2000 to 11th June 2014

For Stock Futures:

Pre derivatives period: 1st January 1996 to 8th November 2001

Post derivatives period: 9th November 2001 to 11th June 2014

Derivatives trading started in Indian markets on NSE on 12th June 2000 with the launch of Index futures contract and Single Stock Futures started since 9th November 2001. Hence, 12th June 2000 and 9th November 2001 have been used as a cutoff date to study the impact of introduction of derivatives on volatility. Therefore, our whole study time span covers pre derivatives and post derivatives period. (To keep the uniformity in data collection, the data has been collected from the year 1996 onwards because the data for only few stocks are available before 1996).

The study has tested the impact of introduction of Index Futures and Single Stock Futures on volatility. So, the data comprises of two categories:

i) Data related to individual stocks

ii) Data related to indices

This study has been made on 3 indices and 15 individual stock futures. This has again been classified as:

a. 1. SSF Stocks: Stocks before the introduction of Single Stock Futures.

2. SSF Stocks: Stocks after the introduction of Single Stock Futures on which derivatives are available.

b. 1. Data related to index on which derivatives are available.

2. Data related to index on which derivatives are not available.

The **samples** have been selected using the following methodology:

This study relates to futures trading in India. The data for the study has been collected from NSE. The main data for the study is the returns of the S&P CNX Nifty, Nifty index futures, Single Stock Futures and CNX Nifty Junior. S&P CNX Nifty consists of 50 individual stock companies.

Considering the accessibility of longer time series data, 15 stocks have been selected randomly from all such stocks on which derivatives are traded at NSE. Out of 50 stocks, 15 sampled stocks happened to be part of Nifty 50 index since the beginning. The basis for the selection of these companies is the high market capitalization as on 10th May 2014.

A list of all sampled SSF stocks has been given in **A1 in Annexure A.**

Index on which derivatives are available:

In order to examine the volatility effect, as much as indices are concerned, an S&P CNX Nifty has been taken for the purpose of study. S&P CNX Nifty be a symbol of 23 sectors of the economy and include 50 most popular stocks which record highest trading volume and represents on an average about 67% of the Free Float Market Capitalization over the study period.

As a benchmark index, the Nifty Index can be treated as a true replica of the Indian derivatives market.

Index on which derivatives are not traded

In case of volatility effect analysis, the S&P CNX Nifty Junior is taken for this particular category. S&P CNX Nifty and the CNX Nifty Junior jointly represent 100 most liquid stocks in India.

The two indices are disjoint sets; i.e. a stock will never appear in both indices at the same time. CNX Nifty Junior includes those stocks which are the most liquid stocks excluded from the S&P CNX Nifty.

The CNX Nifty Junior Index represents approximately 12% of the free float market capitalization of the stocks listed on NSE.

The data has been analyzed by using **Eviews-7** and **Microsoft Excel Software.**

The following ***statistical tools*** have been used in the study:

Event Studies measure the relationship between an event that affects securities and the return of those securities. Some events, such as a regulatory changes or a stock opening, are specific to individual securities. Event studies are regularly used to test the efficient market hypothesis. For example abnormal returns that continue after an event occurs or abnormal returns that are associated with an expected event contradict the efficient market hypothesis. Apart from testing the market efficiency, event studies are valuable to measure the degree of an event's impact.

Using financial market data, an event study measures the impact of a specific event on the value of a firm. The usefulness of such study comes from the fact that, given rationality in market places, the effect of an event will be reflected immediately in security prices. Thus a measure of event's economic impact can be constructed using security prices observed over relatively short time period. Event study also serves an important purpose in capital market research as a way of testing market efficiency.

The event analysis technique examines whether any event has resulted in obtaining abnormal returns on the securities. Using ordinary statistical hypothesis testing procedures under the null hypothesis would draw assumptions about the abnormal returns due to an event.

H0: AR=0

Systematically non-zero abnormal securities return that persists after a particular type of event is consistent of market inefficiency.

Before applying the models, the unit root properties for the time series data have been tested individually for all the stocks and indices by Graphical method & **ADF test statistic.** Graphical method provides a visual estimate of the stationarity of the series, which has been confirmed by ADF test statistic. Augmented Dickey fuller test is given by the following equation:

ADF: $\Delta y_t = \alpha y_{t-1} + \chi_t \delta + e_t$

Where α & δ are parameters to be estimated & e_t is white noise error term

The ADF tests the following hypothesis:

H_0: $\alpha = 0$ (series has a unit root)

H_1: $\alpha < 0$ (series does not have a unit root) and is calculated using t ratio.

AIC & SC criterion: It has been employed to choose the best-fit model

Akaike information criterion (AIC) = $-2(l/T) + 2(k/T)$

Schwarz Criterion (SC) = $-2(l/T) + k \log(T)/T$

Where;

l= value of the log of the likelihood function

k= No. of parameters estimated

T= No. of observations

The model with least AIC and SC is considered as best fit model

A ***Correlogram*** is graphical representation of Autocorrelation Function & Partial Autocorrelation Function, which describes about Auto Regressive and Moving Average characteristics of the time series. Therefore, it is used to check the stationarity of the time series.

ARCH LM test is a Lagrang multiplier (LM) test for autoregressive conditional heteroscedasticity (ARCH) in the residuals. The null hypothesis of this test is that

H_0: *There is no ARCH effect up to order q in the residuals.*

After that we run the normal AR (1) model (mean equation), we get the residuals. For testing ARCH effects the residuals are regressed upon their own values by using the following equation:

$$e_t^2 = \beta_0 + \left(\sum_{i=1}^{q} \beta_i e_{t-1}^2\right) + v_t$$

Where *e*= residual

ARCH LM test estimated Chi Square distribution with q degrees of freedom.

LM ~ χ_q (Chi-square with d. f. q).

Conditional Heteroscedastic Models of Volatility i.e. ARCH /GARCH Models which have been detailed below:

In ***ARCH model*** the "autocorrelation in volatility" is modeled by allowing the conditional variance of the error term, to depend on the immediately earlier value of the squared error. Therefore, the conditional variance is regressed on constant and lagged values of the squared error term acquired from the mean equation.

Let the mean equation of the ARCH model follow an AR (1) process, given by:

$$y_t = \alpha_0 + \alpha_1 \chi_t + e_t$$

$$e_t = v_t h_t^{1/2}$$

Where v_t is the white noise process with mean =0 and variance =1

The conditional variance h_t is given by:

$$h_t = \alpha_0 + \alpha_1 e_{t-1}^2$$

The above model is well known as ARCH (1), while the conditional variance depends on only single lagged squared error term. The model can be complete to the general case where the error variance depends on q lags of squared errors, which would be known as an *ARCH (q)* model:

$$h_t = \alpha_0 + \sum_{i=1}^{q} \alpha_1 \varepsilon_{t-i}^2$$

Using AIC and SC criterion conclude the suitable lag length "q". A Higher order ARCH; specification can be approximated by a (GARCH 1,1) process

GARCH models give details variance by two distributed lags, one on past squared residuals to detain high frequency effects or news about volatility from the previous period measured as the lag of the squared residual from mean equation, and second on lagged values of variance itself to capture long term pressure. In the GARCH (1.1) model, the variance expected at any given data is a combination of long run variance and the variance probable for the last period, adjusted to take into account the size of the last periods examined shock.

The GARCH model proposed by Bollerslev, (1986) has widely used in the finance literature to clearly capture these empirical features like time varying volatility, clustering volatility, leverage effects, mean reversion and skewness and excess kurtosis etc. The other model like standard regression parameters will not be able to examine the volatility or these stylized features. Particularly, the GARCH family methods are expected to give details the sufficient time variant volatility behavior of the cash index. Thus, GARCH model will be used to examine effects of the introduction of the financial derivatives trading on spot market volatility.

In this study, GARCH framework is used to examine any possible effects of the futures trading on the volatility of the spot market.

GARCH (1,1) model is given as:

$$\sigma_t^2 = \alpha_0 + \alpha_1 e_{t-1}^2 + \beta_1 \sigma_{t-1}^2$$

In the ARCH model the conditional variances at time t depend upon size of square error term at time t-1, thus the allowing the conditional variance to change over the time. Hence, the lagged values of the error term represent the ARCH term and the lagged values of the variance represents the GARCH term.

According to the need and relevance, the entire research work is ***organized into six chapters***.

The ***first chapter*** deals with the introductory background of the study along with the overview of the thesis. The comprehensive review of the relevant literature has been reviewed by the researcher followed by the statement of problem, which helps in finding out the Research Gap. This chapter also deals with the development of the objectives, hypotheses and research design verified and support by study based on the appropriate analytical tools along with some limitations.

The ***second chapter*** deals with the conceptual overview of financial derivatives market in India. The ***third chapter*** contains the present regulatory structure, its loopholes and put forward suggestions of the Indian derivatives market.

The historical background, growth and the development of derivatives market are being presented in the ***fourth chapter.***

The ***fifth chapter*** deliberates upon the methodological issues and empirical results of the each research objectives.

The ***sixth chapter*** is the concluding part of the entire study, which gives detailed account of the findings of the research analysis, conclusion, suggestions and recommendations for further research.

After applying appropriate econometric and statistical tools researcher concluded certain valuable ***results and findings*** associated to the regulatory announcement effect and volatility effect of derivative market. The main results and finding are as below:

In order to examine the ***impact of regulatory announcement of derivatives on market efficiency of underlying stock***, the standard risk adjusted Event Study is being conducted. The event analysis technique examines whether any event has resulted in obtaining abnormal returns on the securities. Using ordinary statistical hypothesis testing procedures under the null hypothesis would draw assumptions about the abnormal returns due to an event.

H0: AR=0

Abnormal returns of stock prices show the impact of particular event on the stock prices after getting the values of alpha and beta. The expected return has been calculated and this has been further compared with the actual return. The actual return and expected average return within the event period should differ.

The results of 15 sample stocks indicated that the amendments in derivatives market regulation i.e. Securities Law (Amendment) Act 2004 has not been affected the efficiency of underlying stocks. Here major concern is whether abnormal return around the event date (i.e. day = 0) is statistically significant or not.

The result concerning of all 15 sample stocks show that even though there are positive or negative returns, none of the abnormal returns are statistically significant on the event day (i.e. day =0). Since 1% level of significance the critical value of t-stat. is 2.528, the t-values of all the sampled stocks are less than the critical value. Thus, the null hypothesis that *abnormal returns are equal to zero* is **not rejected.**

Hence, it is concluded that the shareholders of the sampled stocks were not be able to earn abnormal return neither on announcement date nor day as defined by event period. This will lead to **accept** the null hypothesis that *Regulatory announcement has not affected the market efficiency of underlying stocks.*

The researcher concluded that the market for underlying stocks remains efficient in semi strong form even after the amendment in derivatives market regulation i.e. Securities Law (Amendment) Act 2004.

The present study also analyzed the ***impact of introduction of futures derivatives trading on the Indian stock market volatility***. This has been discussed in two sections:

- Section-1 analyzed the impact of futures derivatives trading on Stock market volatility of indices and that of underlying stocks.
- Section 2. Examined the impact of futures derivatives on stock market volatility after controlling the macroeconomic factor.

Every section has further separated into two parts. First part of analysis is related to Index Futures and second part of analysis is related to Single Stock Futures.

Section -1 (a) Impact of Index Futures on Stock Market Volatility:

GARCH (1,1) model has been applied to analyze the impact of derivatives trading on stock market volatility of indices by using daily closing prices of S&P CNX Nifty & Nifty Futures. The data has been taken from 01st January 1996 to 11th June 2000 for pre introduction period and from 12th June 2000 to 11th June 2014 for post introduction period. Data for analysis have been collected from the official website of the NSE i.e. www.nseindia.com.

As a first step, daily closing prices have been used for calculating the lognormal returns.

In order to examined the pre and post effect of Index Futures, the descriptive statistics is used A comparison of standard deviation of the Nifty return is estimated both before and after the introduction of Index Futures. The result presents that standard deviation has fallen from 0.018270 in the pre futures period to 0.015575 in the post

futures period. It can be concluded that Nifty volatility calculated by Standard Deviation describes the volatility in the post- futures is less than the volatility of the pre introduction of the futures. After that, for checking the stationarity of data, the researcher performed the ADF test with the null hypothesis of non-stationarity. The Null hypothesis of the Augmented Dickey-Fuller test assuming a unit root in daily Nifty & Nifty futures log returns have been rejected at 5% level of significance implying that daily Nifty and Nifty Futures log returns are stationary. The result of ADF has been showed that the p-value is less than the 5% level of significance. Hence, the null hypothesis of the ADF test assuming a unit root in daily Nifty log returns and Nifty futures log returns have been rejected at 5% significance level indicating that daily nifty log returns and Nifty futures log returns are stationary.

After that the mean equation has been formulated using Box Jenkins methodology as AR (1) model. The result of AR (1) model shows that the ARCH effect is present in the series.

After mean equation have been formulated as AR (1) model, the residuals of the model have been tested for the presence autocorrelation and heteroskedasticity or ARCH effect through the graph which indicated that small fluctuations are causing another small fluctuation for a long time and big fluctuation is causing another big fluctuation for a long time. It means small volatility is causing another small volatility and big volatility is causing another big volatility for a long time. Thus, with this feature of volatility the researcher can introduce ARCH & GARCH model.

Further, a best GARCH family model will be chosen for analysis. A GARCH model will be best based on three assumptions. These three assumptions should be acceptable. These assumptions are:

- There is no serial correlation.
- Residuals are normally distributed.
- There is no ARCH effect.

By using Ljung Box Q statistics researcher tried to check ACF (Autocorrelation function) and PACF (Partial Autocorrelation Function) of the residuals. The ACF and PACF showed significant correlation among the error term, which indicated that the

mean equation is efficient enough to capture the dynamics of the time series. These residuals were than squared & Ljung Box Q statistic at lag 36 has been used again to test the ACF & PACF of the square residuals for any correlation. The results show that the p-value is more that 5% level of significance indicating, that there is no serial correlation.

To examine the second assumption that residuals are normally distributed some basic descriptive statistics of daily NSE Nifty log returns have been used. Some deviations from normal distribution also confirms through the histogram of nifty returns. The results indicated that the excess kurtosis and a small skewness in the distribution of daily nifty returns compared to a normal distribution. The highly significant value of the Jarque Bera test statistics presents rejection of the null hypothesis of a normal distribution of Nifty log-return at 5% level of significance.

Further, the ARCH LM test has been used for testing the third assumption that there is no ARCH effect with the null hypothesis of no heteroskedasticity. The result shows that the p-value of chi-sq. is 0.2626 which is more than 0.05 at 5% level of significance which indicated that the null hypothesis of a normal distribution i.e. there is no ARCH effect; will be accepted. Thus, the result of ARCH LM Test at lag 36 defined that there is no ARCH effect. Error terms are not heteroskedastic.

On the basis of above three assumptions, All the distribution models like the Normal Gaussian distribution, the Student-t with fixed degree of freedom and GED with fixed parameters gives the same results i.e. there is no serial correlation, No ARCH effect in the residuals. This is good sign but residuals are not normally distributed. The weakness of these three distributions is non-normality of residuals but many econometricians suggests that non-normality in the residuals may not be the serious problem as estimators are still consistent. Hence, we have selected the student-t with fixed parameter as the best model for this analysis.

Therefore, GARCH (1,1) model has been used after examining the nature of data i.e. autocorrelation & heteroskedasticity in the error terms. For testing the impact of Index Futures on the volatility of Stock market, the GARCH (1, 1) equation has been increased with a dummy variable taking value of '0' & '1' in pre and post derivatives period respectively.

The result shows that all the co-efficient in the conditional variance equation are significant at 5% level of significance including dummy variable as p-value being zero. The value of dummy variable coefficient is negative i.e. (-3.48E-05) which is indicating a decline in the volatility after the introduction of the index futures. Though, the degree of decline is only marginal. The sum of ARCH+GARCH term is very high. The sum comes to (0.167337+0.608543) 0.77 approximately. As a result, the rate of decay of particular shock on volatility is slow and volatility persists for a longer period of time.

The result indicates that the effect of introduction of index futures trading on Indian stock market may have impacted per se the volatility of the Nifty are confirmed. This is presented by the significance of the dummy variable. Furthermore, the measures of the effect due to the introduction of the Index futures trading (the value of the co-efficient dummy) has negative sign indicating that onset of the stock index futures results in reducing stock market volatility.

The conditional volatility Graph is also presented that the volatility has declined. The argument looks to confirm the decrease in volatility as a result of the activity in stock index futures.

So, we **reject the Null Hypothesis** that Index Futures does not impact on stock market volatility.

Section-1 (b) Impact of Single Stock Futures on Stock Market Volatility:

GARCH (1,1) model has been used to observe the impact of introduction of Single Stock Futures on Stock Market volatility. The daily closing prices of S&P CNX Nifty & all 15 sampled Single Stock Futures have been taken from 01st January 1996 to 8thNovember 2001 for pre introduction period and from 9th November 2001 to 11th June 2014 for post introduction period. Daily closing prices have been used for calculating the lognormal returns.

The descriptive statistics have been used to analysis the pre and post effect of Single Stock Futures. A comparison of standard deviation of the Nifty Return is estimated both before and after the introduction of Single Stock Futures. Result shows that that standard deviation has fallen from 0.017803 in the pre stock futures period to in the

post stock futures period 0.015495. It is concluded that the volatility of Nifty in post-futures is less than the volatility of the pre introduction of the futures.

Further, for checking the stationarity of data, the ADF test has been conducted by the researcher. The result of ADF test shows that the calculated value of t-statistic is greater than the critical value and p-value is less than the 5% level of significance. Hence, the null hypothesis of the **ADF test** assuming a unit root in daily Single Stock futures log returns has been rejected at 5% significance level indicating that daily nifty futures log returns are stationary. The similar results have been achieved for all the sampled stocks

After that, the mean equation has been formulated, using Box Jenkins methodology as AR (1) model. AR (1) model has been used, as it is a preferred as the baseline model for formulating mean equation. For all SSF stocks, the same model has been used to maintain uniformity. The result indicated that the p-value is less than the 5% level of significance indicating that ARCH effect is presented. The similar results have been achieved for all sampled stocks.

After mean equation have been formulated as AR (1) model, the residuals of the model have been tested for the presence autocorrelation and heteroscedasticity or ARCH effect through the residual graph also. The graph shows that with this feature of volatility researcher can introduce ARCH & GARCH model.

Further, a best GARCH family model will be selected for analysis. A GARCH model will be best based on three assumptions. These assumptions are:

- There is no serial correlation.
- Residuals are normally distributed
- There is no ARCH effect.

By using Ljung Box Q statistics the researcher check the ACF (Autocorrelation function) and PACF (Partial Autocorrelation Function) of the squared residuals. The ACF and PACF presented insignificant correlation among the error term, which justifies that the mean equation is efficient enough to capture the dynamics of the time series. The high p-value indicates that there is no serial correlation. The similar results have been achieved for all the sampled stocks.

Further, for analyzing the second assumption the basic descriptive statistics have been used. Some deviations from normal distribution also confirms through the histogram of nifty returns. The result shows that the excess kurtosis and a small skewness in the distribution of daily log return series compared to a normal distribution. The highly significant values of the Jarque Bera test statistics shows rejection of the null hypothesis of a normal distribution of log-return at 5% level of significance. The histogram of nifty returns also indicates some deviation from normal distribution, which shows that the returns on the stock in the sample are not normally distributed. The results find that the return on all the stocks in the sample is not normally distributed.

The third assumption is that there is no ARCH effect, tested by using ARCH LM test, testing the null hypothesis of no heteroscedasticity. The result shows that the p-value of chi-sq. is 0.9950 which is more than 0.05 at 5% level of significance which showed that there is no ARCH effect present in the error term supporting the use of ARCH/GARCH class model to capture such characteristics. The results of all sampled stocks are same and significant at 5% level of significance.

Further, for analyzing the impact of Single Stock Futures on Stock market volatility the GARCH (1,1) model has been applied. The dummy variable has been included in the variance equation with the value of '0' & '1' in pre and post derivatives period respectively. A significant positive coefficient points towards an increase in volatility, due to derivatives & vice versa. The result of GARCH (1, 1) model indicated that coefficient of dummy variable is negative in case of 10 out of 15 sampled stocks and is significant and same is insignificant and negative in case of 5 out of 15 sample Single Stock futures. Thus, percentage of sampled stock shows that the volatility has been decreased which is significant at 67% and volatility has been decreased which is not significant at 33%. Hence, volatility has been decreased in case of 100% stocks. The coefficient of dummy variable is negative (whether significant or not) in all 15 sampled stocks indicating decline in volatility after the introduction of SSFs. The sum of ARCH+GARCH term is quiet high. The sum comes from 0.92 to 0.97 approximately. As a result, the rate of decay of particular shock on volatility is slow and volatility persists for a longer period of time.

Thus, it is concluded that volatility of stock market has been decreased after the introduction of Single Stock Futures.

Therefore, We **Reject the Null Hypothesis** that *Introduction of Single Stock Futures does not affect the volatility of spot market.* The decrease in stock market volatility after the introduction of derivatives period has been reported for Index Futures & Single Stock Futures as well, which leads to reject the null hypothesis of ***Introduction of futures derivatives does not affect the volatility of spot market of their indices as well as underlying stocks.***

Section-2: ***To analyze, whether the futures derivatives can alter the structure of stock market volatility alone or changes in volatility is due to some other controlling factors.***

Section 2(a) Index Futures can alter the structure of stock market volatility alone.

For this purpose, the Daily closing price of the data has been used from the range of 1st January 1996 to 12th June 2014. The daily closing price has been converted into lognormal returns for making the data stationary.

After that, by using the ADF test with the null hypothesis of non-stationarity has checked the stationarity of data. The result shows that the calculated value of t-statistic is greater than the critical value and p-value is less than 5% level of significance indicating that daily nifty log returns are stationary.

Then, we have introduced a control variable in the mean equation to separate the effect of derivatives from other macro economic factors. The mean equation has been extended with returns on nifty junior index.

Thus, the error terms from the mean equation will be indicated the impact of derivatives trading only. After that, these error terms will be formed in the variance equation to get the volatility coefficients.

By using box Jenkins methodology, the mean equation has been formulated as AR (1) model. After mean equation have been formulated as AR (1,) model, the residuals of the model have been tested for the presence autocorrelation and heteroskedasticity or ARCH effect through graph. The result shows that low p-value of AR (1) model indicating that ARCH and GARCH model has been introduced.

These residuals were than squared & Ljung Box Q statistic at lag 36 has been used to test the ACF & PACF of the square residuals for any correlation. The high p-value indicates that there is no serial correlation.

For examining the second assumption that residuals are normally distributed some basic descriptive statistics of daily NSE Nifty log returns have been used. Some deviations from normal distribution also confirms through the histogram of nifty returns. Result indicated that the excess kurtosis and a small skewness in the distribution of daily nifty returns compared to a normal distribution. The highly significant values of the Jarque Bera test statistics shows rejection of the null hypothesis of a normal distribution of Nifty log-return at 5% level of significance. The histogram of nifty returns also indicates some deviation from normal distribution.

After that, the third assumption that there is no ARCH effect has been tested by using ARCH LM test; the result indicated that the p-value of chi-sq. is 0.6631 which is more than the0.05 at 5% level of significant presenting that there is no ARCH effect. Hence, error terms are not heteroskedastic. On the basis of three assumptions, the GED (Generalized Error Distribution) parameter is the best model for this analysis.

Therefore, after analyzing the nature of data i.e. autocorrelation & heteroskedasticity in the error terms, GARCH (1,1) model has been used. With the purpose of testing the impact of Index Futures alone on the volatility of Stock market , the GARCH (1, 1) equation has been augmented with a dummy variable taking value of '0' & '1' in pre and post derivatives period respectively.

The result of GARCH (1,1) model indicated that the coefficient of dummy variable after controlling the impact of other macroeconomic factor is -5.29E-06 while it was -3.48E-05 before controlling the impact of other macroeconomic factors. Hence, even after controlling the market wide variable, the coefficient of dummy variable is negative and significant indicating a decrease in volatility as a result of Index Futures trading only but the decline is only marginal.

Therefore, on the basis of above results **THE NULL HYPOTHESIS** that *Index futures do not alter the structure of volatility of spot market alone* ***WILL BE REJECTED.***

Section 2(b): Single Stock Futures can alter the structure of stock market volatility alone

Similar procedure has been adopted to analyze whether the Single Stock Futures alter the structure of stock market volatility alone. The mean equation for all 15-sample stocks has been augmented with the logarithmic returns on nifty junior index. This has separated the effect of derivatives from other controlling factors. As a result, the error terms from the mean equation indicate the impact of Single Stock Futures alone. The mean equation has been formed as AR (1) model. The result shows that the p-value is below 0.05 at 5% level of significance indicating the presence of ARCH effect or heteroskedasticity. After AR (1) model, the residuals of the model have been tested for the presence of autocorrelation and heteroscedasticity or ARCH effect through graph. The Graph shows that the small volatility is causing another small volatility and big volatility is causing another big volatility for a long time. Hence, with this feature of volatility the researcher can introduce ARCH & GARCH model.

Then, a best GARCH family model will be chosen for analysis. A GARCH model will be best based on above three assumptions.

The Ljung Box Q statistics has been used to check ACF (Autocorrelation function) and PACF (Partial Autocorrelation Function) of the squared residuals. The result indicated that the p-value is more than 0.05 at 5% level of significance indicating that there is no serial correlation.

For examining the second assumption that residuals are normally distributed some basic descriptive statistics of daily NSE Nifty log returns have been applied. The histogram is also used for confirming some deviation from the normal distribution. The result shows that the excess kurtosis and a small skewness in the distribution of daily log return series compared to a normal distribution. The highly significant values of the Jarque Bera test statistics shows rejection of the null hypothesis of a normal distribution of log-return at 5% level of significance. The histogram of nifty returns also indicates some deviation from normal distribution, which shows that the returns on all the sampled stock are not normally distributed.

Then, the ARCH LM test has been used to check the third assumption that there is no ARCH effect, testing the null hypothesis of no heteroskedasticity. The result indicated

that the p-value of chi-sq. is more than 0.05 at 5% level of significance indicating that the null hypothesis of a normal distribution i.e. there is no ARCH effect; will be accepted. Hence, the result of ARCH LM Test at lag 1 confirmed that there is no ARCH effect and error terms are not heteroskedastic, supporting the use of GARCH class models to model the variance.

The GARCH (1, 1) equation has been augmented with a dummy variable taking value of '0' & '1' in pre and post derivatives period respectively.

To examine whether the SSF's can alter the structure of volatility of stock market alone the coefficient of dummy variable has been included in the variance equation. A significant positive coefficient points towards an increase in volatility, due to derivatives & vice versa. The result of GARCH (1, 1) model of all sampled stocks indicated that in case of 11 out of 15 sampled stocks the coefficient of dummy variable is negative and significant and in case of 4 out of 15 sampled stocks the coefficient of dummy variable is negative but insignificant. The percentage of stocks showing a decline in volatility that is significant at 73% and insignificant at 27%. Hence, the volatility has been decrease in 100% stocks, whether it is significant or not. The coefficient of dummy variable is negative (whether significant or not) in all 15 sampled stocks indicating decrease in volatility causing the introduction of SSFs only. The sum of ARCH+GARCH term is quiet high. It is sum up to 0.92 to 0.98 approximately. As a result, the rate of decay of particular shock on volatility is slow and volatility persists for a longer period of time.

The result indicates that the structural changes in the volatility of the Nifty due to Single Stock Futures are confirmed. Thus, we concluded that volatility of stock market has been decreased after the introduction of Single Stock Futures only.

The decrease in stock market volatility after the introduction of derivatives period has been reported for Index Futures & Single Stock Futures as well. Hence, We **Reject the Null Hypothesis** that *futures derivatives do not alter the structure of stock market volatility alone of their indexes as well as individual stocks.*

The ***Suggestions and Recommendations*** are as follows:

After the analysis of data, the researcher found that the market for underlying stocks remains efficient in semi strong form even after the amendment in derivatives market

regulations and the structural changes in volatility due to futures derivatives are confirmed, which indicated that derivatives ensure better market efficiency. On the basis of such results, researcher has given some fruitful suggestions which are as below:

- There was a point of debate in the L.C. Gupta Committee report on the introduction of separate derivatives exchange. But after analyzing, it has been found out that the present situation of the market is not relevant for introducing separate exchange for derivatives as the current arrangement and structure enable to carry out the trades efficiently. Therefore, there is no need to introduce a separate derivatives exchange presently.
- A strong single clearing corporation should be set up under exchange to clear all trades. This would help control settlement of trades in an efficient and transparent manner controlling to lower defaults in delivery and payment in multiple markets.
- The decline in the volatility after introduction of futures should relieve the worry of market participants especially that of market regulators. Therefore, this research work unties the strong relationship between stock and futures market and it suggested to adopt a microstructure perspective in dealing with the functioning of the modern capital markets.
- Rules and regulations related to investment in derivatives segment should be made easy for investors.
- New regulatory policies should be introduced in the market for the development of the market integrity and efficiency because of the lack of regulatory monitoring and pitiable disclosure practice could be the cause of market inefficiency.
- For reducing the speculative trade practices in the market it is important for regulators that they should improve the payment and settlement system for derivatives trading.
- To have a reliable method of accounting for losses and gains from the derivatives trading, an appropriate framework to account for derivatives requires to be developed.

- The market structure, margin requirements, contracts design, and other measures should be constructive to all categories of investors to participate in these markets.

- Strong effects have to be measured to bring different participants to the market in order to attain minimum liquidity and strength of the market.

- The government should carry on its efforts to make stronger stock exchanges and execution of awareness programs among investors and other market participants for increasing participation in derivatives markets.

- The transparency has been increased by the growth of distribution of price and volume information. The price and volume data has been improved the risk management efficiency. Hence, it provides great degree of protection to the investors.

- No appropriate accounting and taxation policy has been formed for derivatives trade in India. All States have not yet uniformly executed the VAT announced in the country in 2005, it is causing the variation in the prices. Hence it is clear that taxation policy should be uniformly formed so that a truly national market can be developed for derivatives.

The researcher suggests the following core areas for the purpose of ***Further Research*** related to derivatives market.

- Current research work is based on futures market only while most of the derivatives and equity markets are based on exchange rate on a large scale and they are highly fluctuating in nature. Hence, further research work will be done on exchange rate.

- The present study is limited to small sample companies. By using large sample companies; future research may shed much more interesting results.

- Event Study Analysis has been conducted to analyze the announcement effect of regulation. For further research, other econometric and statistical tools can be used for any event.

- The daily data of near month is only used in this study instead of high frequency data. For future research, the high frequency data can be used for near month, middle month and far month.
- For analyzing the volatility effect, the GARCH (1, 1) model has been applied while there are various advance statistical tools and econometric models present, which can be provide better results.
- Study is limited to Indian Stock market. For future research, the researcher should concern to take a broad view about other stock markets.
- The Eviews-7 has been used in this study. For further research the more advanced software can be used for analysis for getting better results.
- This study focused only futures market instead of other financial derivatives products. The further research can be done by taking index options, stock options, interest rate derivatives and currency derivatives also.
- Further research can be done by analyzing the hedging effectiveness of derivatives trading as it helps investors to take investment decisions.