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### RESEARCH ARTICLE

#### “VOLATILITY EFFECTS OF INDEX OPTIONS TRADING ON THE UNDERLYING SPOT INDEX”

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#### Abstract

This study has been undertaken to make an empirical investigation of volatility effects of index options trading on the underlying spot index. In order to achieve the objectives of the study, the researchers have taken relevant intraday data of underlying spot index from the national stock exchange of India (NSE). The reference period of the study comprises of twelve years from 1995 to 2006 and the Sample Index is S&P NIFTY-50. After the thorough analysis, the findings put forth by the study confirm that the introduction of index options contracts on the sample index has resulted into increased volatility throughout post-derivatives period compared to pre-derivatives period.

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#### Introduction:-

Capital markets discharge an important function of allocating the funds from the surplus units to the deficit units, thereby, facilitating the economy in meeting the need for the funds, resulting in the stable and smooth economic growth. Hence, capital markets play a significant role in the overall economy which always prompts the regulators to ensure stability in the market. It is against this backdrop that capital markets all over the globe has witnessed revolutionary changes through the introduction of innovative instruments so as to provide stable and controlled environment to the participants, resulting into higher confidence among the participants in the capital markets. Now-a-days derivatives instruments has assumed pivotal position in every capital market throughout the globe for they facilitate the investors in the protection of their investments against volatile phases of the market by providing hedging facility.

Financial derivatives, most notably forwards, futures and options came into spot-light in the post-1970s period by reason of growing instability in the financial markets which was the reflection of high volatility in exchange rates and interest rates. Thus, the first index futures contracts were traded at Kansas City Board of Trade. Currently, the most popular index futures contract in the world is based on S&P 500 Index traded on Chicago Mercantile Exchange.

In this direction, the first step towards the introduction of derivatives trading in India was the promulgation of the securities laws (amendments) ordinance, (1995) that withdrew the prohibition on options in securities. The Bombay Stock Exchange made the first mark and created history on 9<sup>th</sup> June 2000 by launching the first index derivatives contracts i.e. Index futures contracts on the capital market benchmark index-the BSE Sensex. In the sequence of the Product innovation, the exchange commenced trading in the index Options on Sensex on 1<sup>st</sup> June 2001. Stock options were introduced on 31 stocks on 9<sup>th</sup> July 2001 and single stock futures were launched on 9<sup>th</sup> November

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2002. Meanwhile, 13<sup>th</sup> September 2004 marked another milestone in the history of Indian capital markets, the day on which the Bombay Stock Exchange launched weekly options, a unique product unparalleled in derivatives markets, both domestic and international.

The National Stock Exchange of India also followed the path of product innovation process with the introduction of derivatives trading. The derivatives trading on NSE commenced with S&P CNX Nifty index futures on 12<sup>th</sup> June 2000. The trading in index options commenced on 4<sup>th</sup> June 2001 and trading in options on individual securities commenced on 2<sup>nd</sup> July 2001. Single stock futures were launched on 9<sup>th</sup> November 2001. Today both in terms of volume and turnover, NSE stands as the largest derivative exchange in India because it has a wide network all over the country. Currently, the derivatives contracts have a maximum of three-month expiration cycles. Three contracts are available for trading, with one-month, two-month and three-month expiry. The National Stock Exchange (NSE) admits members on its derivatives segment in accordance with the rules and regulation of the exchange and the norms specified by the Securities Exchange Board of India (SEBI). Besides, the basket of instruments has widened considerably and trading in futures and options is based not only on S&P CNX Nifty Index but also on other indices viz., CNX IT Index and Banex Index as well as options and futures on individual stocks. Since the inception of these derivatives instruments, they have registered consistent growth in terms of volumes, Mohi-ud-din Sangmi et.al (2013).

### **Review of Literature:-**

The studies undertaken so far has provided a lot of literature dealing with the impact of index options on the liquidity and volatility of underlying index. However, the researcher has undertaken the review of some significant studies which is given below.

Sahlstorm, Petri (2001) undertake a study to analyse the impact of options listing on risk and return characteristics in Finland. The study documents that impact of stock option listing on underlying stocks volatility, bid-ask spread and autocorrelation structure of return series. the findings of the study provides an evidence which affirm that options listing causes decrease in the volatility and bid-ask spread of the underlying stock market. Hamill Philip; A. Kwaku; K. Opong and Pat McGregor, (2002) make a study on the options listing in the united kingdom to ascertain its impact on the underlying equity market. The study comes up with the findings that put forth that the impact of options listing event has diminished over time and this support the market completion hypothesis.

Shenbagaraman (2003) made an investigation to study the impact of futures and options trading on the volatility of spot market. The study validated that the introduction of derivatives products does not bring much change in the volatility levels of the spot market. Ganai, K, A, (2019) the comparative findings of the study affirm a significant correlation between index futures and underlying volatility (Spot Index) as the level of the volatility throughout the post-derivatives period has had a considerable decline.

Nicolas, P. Bollen (1998) in his study regarding the impact of options on the return volatility seeks to determine whether the introduction of options affects the return variance of underlying stocks. A control group is constructed by matching each stock in the sample group one-for-one with another stock within the same trading location. The evidence that emerges out from the results indicates that the average impact of options introduction on variance is insignificant, since the control group exhibits change in variance that match the change in options stocks. Thus, this evidence supports the hypothesis that options listing have no significant effect on stock return variance.

Cao, H. Henry (1999) examines the effect of derivatives assets on information acquisition and price behavior in the rational expectation equilibrium. The results demonstrate that introduction of options contracts performs market completion function. However, additional options trading will have less effect on the price of underlying asset. It is also concluded that introduction of derivatives reduces price volatility as price becomes a less biased estimate of the asset payoff due to more information collection, regarding liquidity. He cautions that the effect on trading volume (liquidity) of underlying asset would depend upon the kind of derivatives asset introduced in the market. He expects the liquidity of the underlying asset to increase after the commencement of options trading.

Kumar Raman, Atulya Sarin and Kuldeep Shastri (1998) undertake the study to find the impact of options trading on the market quality of the underlying security. After a comprehensive analysis in terms of liquidity, information asymmetry and price efficiency. The findings that they put forth are Consistent with the findings of earlier studies. They come to the conclusion that options listing do have a beneficial impact on the market quality of the underlying

share, more specifically, they observe a decrease in the spread and an increase in quoted depth, trading volume, trading frequency and transaction size after options listing which simply indicates higher liquidity, lower information asymmetry and greater price efficiency.

Damodaran, Aswath and Joseph Lim (1991) in their study wherein, an attempt is made to investigate the effects of options listing on the underlying stocks return process. The potential explanation put forward for the observed variance decline after the listing of options contracts is that the option listing does not lead to shift in intrinsic variance rather it expedites the price adjustment process.

Skinner, Douglas J. (1989) undertakes the study to examine the relationship between options markets and stock return volatility. After the analysis of the data, he concludes that options listing is associated with a decline in stock return variances and an increase in trading activity in the underlying stock. But, he does not find any impact on non-diversifiable risk of the stock. However, he is unable to find the evidence whether the decline in the variance of observed returns is attributable to the changes in trading noise.

Hayes, Samuel L. and Michael, E. Tannenbaum (1979) investigate the impact of option listing on the volume of underlying shares traded in the cash market. They conclude that the listing does not result in increase in the volume of trading in the underlying shares. According to them, this effect is caused by the variety in option trading strategies and linking between cash market and option market as it results in continued feedback to each of these markets.

Whiteside, Mary M; William, P. Dukes and Patrick, M. Donne (1983) undertake the study to examine the short-term impact of option trading on underlying securities. The study do not find any clear evidence regarding the impact of options trading on the volatility of underlying security or average daily volumes. However, when results are evaluated by the year of trading, post-derivatives period witnesses a trend towards decreased variability in the number of shares traded daily

The present study has been undertaken with the following objectives:

1. To study the behaviour of volatility during pre and post derivatives period.
2. To assess the impact of Index Options on the volatility of spot Index.
3. To draw conclusion regarding the impact of Index Options trading on the volatility of the underlying Index.

#### **Hypothesis:**

H0: The onset of index Options trading does not cause any change in the volatility of the underlying index.

H1: The onset of index options trading causes a change in the volatility of the underlying index.

#### **Data Analysis:**

So as to accomplish the objectives of the study, the researcher has collected the relevant intraday data from the National Stock Exchange. For the purpose of determining the examining impact of Index options on the underlying Spot Index (S&P CNX NIFTY 50) volatility. The data of S&P CNX NIFTY (50) underlying spot index is collected and then divided into two periods, namely, pre-derivatives period and post derivatives period. The daily observations are recorded and then the mean of every day's observation is calculated by taking into consideration the previous close price, open price, high price, low price, last price and close price. The mean of every trading day stands as the representative of that day.

In the present study two reference periods are taken into consideration so as to achieve the set objectives of the study and are divided into two sub-groups. The first sub-group that stands as the pre-derivatives period has been taken from (1<sup>st</sup> January 1995 – 30<sup>th</sup> September 2000). It is the period during which index options were yet to be introduced by the National Stock Exchange on underlying spot index. The researcher has left out the fourth quarter of 2001 (1<sup>st</sup> oct.-31<sup>st</sup> Dec.) so as to exclude the reaction period of the spot market towards the introduction of index options. The second sub-group that stands as the post-derivatives period has been taken from (1<sup>st</sup> January 2001 to 31<sup>st</sup> December 2006). It is the period during which index options were available on the sample underlying index at the National Stock Exchange of India.

#### **Analysis and Interpretation**

Analysis of Volatility of S&P CNX NIFTY (50) of Pre-Derivatives and Post-Derivatives Period.

Year	PRE-DERIVATIVES	Year	POST-DERIVATIVES
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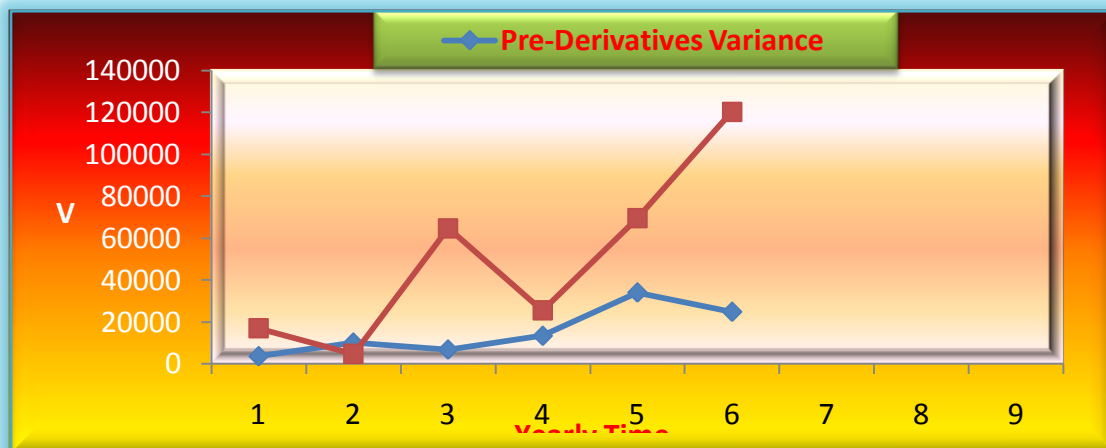
	N	MEAN	STD. DEV	VAR		N	MEAN	STD. DEV	VAR
1995	246	989.15	60.12	3615.46	2001	188	1121.55	129.26	16709.30
1996	250	990.16	100.44	10090.06	2002	251	1056.02	67.78	4594.82
1997	244	1080.87	82.45	6798.51	2003	254	1233.70	254.27	64658.25
1998	250	966.71	115.40	13318.18	2004	254	1755.86	158.99	25280.26
1999	254	1211.34	184.05	33876.33	2005	251	2268.91	263.52	69443.36
2000	250	1417.61	157.26	24733.61	2006	250	3357.09	346.87	120320.96

**Source:-** Compiled from the data taken from NSE India.

As reflected above in the table, it is quite evident that the pre-derivatives period has recorded volatility at lower levels compared to the post derivatives period as the first year of the pre-derivatives period records the level of volatility at 60.12 mark in terms of standard deviation that also stands as the lowest level of volatility throughout the pre-derivatives period, followed by a significant increase of 67.06% in the second year, touching the volatility level of 100.44 mark. However, the third year witnesses a decline in the level of volatility by 17.91% that pushes down the volatility to 82.45 mark. The fourth year again registers an increase in the level of volatility by 39.96% that pushes up the level of volatility to move from 82.45 mark to 115.40 mark. This upward trajectory in the level of volatility continues in the fifth year as well that takes the level of volatility to 184.05 mark, increasing by 59.48% that also stands as the highest level of volatility in terms of standard deviation throughout the Pre-derivatives period. The last year of the pre-derivatives period registers a decline in the level of volatility by 14.55% that takes the volatility level to 157.26 mark. The spread of volatility during the pre-derivatives period stands at (60.12-184.05) levels which is quite reasonable. These figures depict how consistent the spot index is, in terms of volatility, during the pre-derivatives period. The average volatility throughout the pre-derivatives period stands at 116.62 mark in terms of standard deviation.

The post-derivatives performance of spot index depicts a different picture in comparison to the pre-derivatives period results as the first year records the level of volatility at 129.26 mark in terms of standard deviation which is followed by a decline in the subsequent year by 47.56%, touching 67.78 mark that also stands as the lowest level of volatility in terms of standard deviation throughout the post-derivatives period. The third year of the post-derivatives period records a substantial increase as the level of volatility touches 254.27 mark, increasing by 275.14%. But, the fourth year again witnesses a decline by 37.47% that pushed down the level of volatility to 158.99 mark. However, the fifth year registers a significant increase in the level of volatility by 65.74%, touching 263.52 mark. This upward trajectory in the level of volatility continues in the last year as well, as the level of volatility touches 346.87 mark, increasing by 31.62% that also stands as the highest level of volatility in terms of standard deviation throughout the post-derivatives period. The spread of volatility throughout the post-derivatives period stands at (67.78-346.87) levels. These figures stand as an evidence that confirm that the level of volatility throughout the post-derivatives period has remained at higher levels as compared to pre-derivatives period. The average level of volatility throughout the post-derivatives period stands at 203.34 mark in terms of standard deviation.

Graphical Presentation of Variance of S&P CNX NIFTY (50).



In the above given graph one can see the movements of variance of both pre-derivatives period and post-derivatives period. The graph of both the periods clearly demonstrates that the spread of pre-derivatives periods stands at (3615.46-33876.33) levels, besides the average level of variance during the pre-derivatives period stands at 15405.25 mark while as the spread of variance during the post-derivatives period stands at (4594.82-120320.96) levels, besides, the average level of variance stands at 50167.33 level which is far higher than the pre-derivatives period. Therefore, the graph suggests that the level of variance has gone up considerably during the post-derivatives period.

### **Conclusion:-**

In order to determine the volatility effects of index options on the underlying spot index the researchers have taken S&P CNX NIFTY-50 as the sample index because this is the only index on which the index options were available throughout the reference period of the study. The statistical analysis of the data of NIFTY-50 indicates that the level of volatility has witnessed, statistically, significant increase throughout the post-derivatives period. These results suggest that the inception of index options has brought about higher levels of volatility in the underlying spot index. Thus, the above mentioned statistical results strengthen the conjecture that the listing of index options brought about higher levels of volatility in the underlying spot market.

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