Final Report

On

Risk-Return Dynamics of Derivative Based Investment Strategies

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to

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Abstract

Purpose- The purpose of the present research is to explore the use of index derivatives in the portfolio adopted by individual investors. The study involves the in-depth analysis on the relationship between risk and return involved with the use of index derivatives. The objective is also to examine the impact of the use of leveraging on the value of index based portfolio of derivatives. In addition, the study also attempted to compute the amount of margin limits for exposure by using the VaR measure.

Research Methodology- To address the objectives of the study the data set on daily prices of S&P CNX Nifty comprising of 2466 observations (January 1, 1998 to October 25, 2007) is sampled. The data is analysed using statistical and econometric techniques in the light of theoretical background of the problem and the researcher's insight regarding the working of Indian capital market.

Findings- The index derivatives provide individuals with the opportunity to invest in a well diversified portfolio to exploit the emerging potential of the market. Evidences suggests that if index futures (naked) and covered call are considered for long terms on rolling basis as an investment strategy by using value at risk (VaR) measure, it amounts in translating significantly higher rate of returns to its respectively increased risk. Only option backed strategies like straddle and strangle does not at all result in any incentive, if bench marked with cash portfolio.

Research Limitations- The present research has limitations on account of the prevailing rules with regards to the margin requirements for different category of investors in India. Moreover, the specific level of additional risk-adjusted returns available suffers from dynamism with ever changing tax rates and interest (margin loan) rates.

Practical Implications- This research demonstrates that the risk exposure necessary to obtain full capital gain potential can be used and maintained with an aggressive strategy as and when there is an opportunity.

Keywords- Derivative, Index, Volatility, Futures, Options, Straddle, Strangle, Value at Risk (VaR)

1. Introduction

Rational investors with limited capital, once constrained, can now achieve full diversification benefits through investing in index derivatives, for maximizing the returns on their funds for a given level of risk. All the investment decisions possess varying degree of risks. Returns come in the form of income such as interest or dividends or through growth in capital values (i.e. capital gains) short terms as well as long term.

With the emergence of financial derivatives, the fund managers have included them as a standard in modern portfolio management. Derivatives have widely been used as they facilitate hedging, that is, they enable fund mangers of an underlying asset portfolio to transfer some parts of the risk of price changes to others who are willing to bear such risk. Options are the specific derivative instruments that give their owner the right to buy (call option holder) or to sell (put option holder) a specific number of shares (assets) at a specified price (exercise price) of a given underlying asset at or before a specified date (expiration date). In lieu of this privilege, the holder of the option (long position) pays a market determined price (option premium) to the writer or seller (short position) of the option. Adam and Maurer (1999) suggest that the non-linear pay off characteristics of options requires the use of dynamic portfolio rebalancing. However, from practical point of view, dynamic portfolio rebalancing is often neither feasible nor desirable, instead, investors prefers to implement a buy-and- hold strategy over specific period of time. Therefore, the present study has used buy-and-hold strategies involving future & options and a combination their-off, like Naked Future, Covered Call, Straddle and Strangle.

In an attempt to make appropriate investment decisions in particular under risk the portfolio manager must be able to compare the hedging effectiveness of the strategies involving the use of options under covered call and the pure option strategies like straddle and strangle. The study also examines the risk and return associated to taking of future position as buy-and-hold strategy vis-à-vis cash position.

Derivatives Trading in India: The Indian equity market has widely been regarded as one of the best performing market amongst the emerging markets of the world like China, Indonesia, Brazil, Russia, Mexico, Korea etc.

The first step towards introduction of derivatives trading in India was the promulgation of the Securities Laws (Amendment) Ordinance, 1995. It withdrew the prohibition on options in securities. The market for derivatives however, did not take off, as there was no regulatory framework to govern trading of derivatives. SEBI set up a 24 -member

committee under the Chairmanship of Dr. L. C. Gupta on November 18, 1996 to develop regulatory framework for derivatives trading in India. In its report, the committee prescribed necessary pre-conditions for introduction of derivatives trading in India; it recommended that derivatives should be declared as 'securities' so that the regulatory framework applicable to trading of 'securities' could also govern trading of securities. SEBI also set up a group in June 1998 under the Chairmanship of Prof. J. R. Varma to recommend measures for risk containment in derivatives market. The Report worked out the operational details of margining system, methodology for charging initial margins, broker net worth, deposit requirement and real-time monitoring requirements.

The Securities Contract Regulation Act SC(R) A was amended in December 1999 to include derivatives within the ambit of 'securities'. Thereafter a regulatory framework was developed for governing the trading in derivatives. Derivatives were formally defined to include:

(a) a security derived from a debt instrument, share, loan whether secured or unsecured, risk instrument or contract for differences or any other form of security, and

(b) a contract which derives its value from the prices, or index of prices, or underlying securities. The Act also made it clear that derivatives are legal and valid, but only if such contracts are traded on a recognised stock exchange. The Government also rescinded in March 2000 the three-decade old notification, which prohibited forward trading in securities.

Derivatives trading commenced in India after SEBI granted the final approval to commence trading and settlement in approved derivative contracts on the NSE and BSE.

This has also been proved beyond doubt across the financial world that the regulatory norms in place governing the Indian Capital Market are one of the best in the world. Recently NSE has been awarded “Derivative Exchange of the year” by Asia Risk Magazine.

The derivatives trading on NSE commenced on June 12, 2000 with futures trading on S&P CNX Nifty Index, options trading on the S&P CNX Nifty Index commenced on June 4, 2001. Individual stock options were introduced on July 2, 2001 and Individual stock futures were introduced on November 9, 2001 by the National stock Exchange of India. Subsequently, the product base has been increased to include trading in futures and

options on S&P CNX Nifty Index, CNX IT Index, Bank Nifty Index and Single securities (188 stocks as stipulated by SEBI) and futures on interest rate. Futures and options contracts were introduced on CNX Nifty Junior and CNX 100 indices for trading in F&O segment on June 1, 2007.The turnover in the derivatives segment has witnessed considerable growth since inception. In the global market, NSE ranks first (1st) in the world in terms of number of contracts traded in the Single Stock Futures, second (2nd) in Asia in terms of number of contracts traded in equity derivatives instrument. Since inception, NSE established itself as the sole market leader in this segment in the country with more than 98 % market share.

Comparative Analysis – World Exchanges (October 2007)

Product	**Stock Futures**		**Index Futures**		**Stock Options**		**Index Options**	
NSE's Position	1st with 24,008,470 contracts		2nd with 17,842,671 contracts		15th with 1,126,544 contracts		6th with 6,407,789 contracts	
Rank	**Name of the Exchange**	**Number of Contracts**	**Name of the Exchange**	**Number of Contracts**	**Name of the Exchange**	**Number of Contracts**	**Name of the Exchange**	**Number of Contracts**
1	**NSE**	24,008,470	Eurex	28,201,475	International Securities Exchange	82,862,031	Korea Exchange	205,967,768
2	JSE	8,367,397	**NSE**	17,842,671	Chicago Board Options Exchange	51,777,531	Chicago Board Options Exchange	37,222,508
3	Eurex	2,195,807	Osaka SE	7,593,305	Philadelphia SE	42,216,206	Eurex	30,228,337

Data on CBOT and CME not available

Source: F&O Update October 2007, NSE India

Traded Value: The F&O segment reported a total trading value (notional) of Rs.7,356,271 crore (US $ 1,687,605 million) during 2006-07 as against Rs. 4,824,250 crore (US $ 1,687,605 million), a rise of more than 52.49 % over the past one year. The average daily trading volume during 2006-07 showed a growth of 53.71 % over the preceding year. In absolute terms the traded volumes grew from Rs. 19,220 crores (US $ 4,308.48 million) during 2005-06 to Rs. 29,543 crores (US $ 6,777.53 million) during 2006-07. Lately, during the month of October 2007, the average daily traded value reached as high as Rs. 83,348 crore (Source: NSE Fact Book-2007 & NSE Derivative Update October 2007)

Global Derivatives Markets: As per the FIA Annual Volume Survey the global overall futures and options contract volume was up nearly 11.67% in 2005. The

individual futures and options contract volume registered a growth of 13.44% and 10.53%, respectively, in the year 2005.
Looking at the individual sectors, growth has been fairly strong across the board with the main exception being precious and non-precious metals. The trading in foreign currency/index has grown by 57.06% in 2005, followed by Individual equities which registered growth of 18.04%.

On the basis of details for the top 20 contracts for the year 2005, Kospi 200 options of Kofex led the table with more than 2.5 billion contracts in 2005 followed by Euro-Dollar Futures of CME. TIIE 28 Futures MexDer has witnessed a huge decline of 51.55% which skipped down its position to number 13.

NSE, too, has been making huge strides by moving upwards in the global ranking. NSEIL ranked first (1st) in the single stock future category in the year 2005. NSE has been ranked 14th in the global futures and options volume in 2005 against its rank of 17th in the previous year. In the top 40 Futures Exchanges of the World, NSE stands at the 7th position in 2005 as against 10th in the year 2004.
(Source: ISMR-2006, NSE)

Following the implementation of reforms in the securities industry during the last decade, Indian stock markets have stood out in the world ranking as well as in the developed and emerging markets. India has a turnover ratio of 94.2%, which is quite comparable to the other developed market like the US and UK which has turnover ratios of 129.1% and 141.9% respectively. As per Standard and Poor's Fact book India ranked 17th in terms of market capitalization (18th in 2004) and 18th in terms of total value traded in stock exchanges and 20th in terms of turnover ratio as on December 2005.

A comparative study of concentration of market indices and indices stocks in different world markets. It is seen that the index stocks' share of total market capitalization in India is 77.9% whereas US index accounted for 92.7%. The ten largest index stocks share of total market capitalization is 33.9% in India and 13.9% in case of US.
The stock markets worldwide have grown in size as well as depth over last one decade.
It is observed that the turnover on all markets taken together though have grown from US $ 29.70 trillion in 2003 to $47.32 trillion in 2005. It is significant to note that US alone accounted for about 45.46% of worldwide turnover in 2005. Despite having a large number of companies listed on its exchanges, India accounted for a meagre 0.94% in total world turnover in 2005. The market capitalization of all listed companies taken

together on all markets stood at US$ 43.64 trillion in 2005 ($38.90 trillion in 2004). The share of US in worldwide market capitalization decreased from 41.96% as at end-2004 to 38.95% in end-2005, while Indian listed companies accounted for 1.27% of total market capitalization in 2005 and has grown to 2.70% at the end of 2007.

There has also been an increase in market capitalization as per cent of GDP in some of the major country groups. The increase, however, has not been uniform across countries. The market capitalization as a percent of GDP was the highest at 108.9% for the high income countries as at end-2004 and lowest for middle income countries at 43.7%. Market capitalisation as percent for GDP in India stood at 56.1% as at end-2004. The turnover ratio, which is a measure of liquidity, however was approximately same for both the high-income countries and low-income countries 114% and 107.6%, respectively. The total number of listed companies stood at 28,001 for high-income countries, 14,117 for middle income countries and 6,756 for low-income countries as at end-2005.

2. Literature Review

Friend, Brown, Herman, and Vickers (1962) offered the first empirical analysis of mutual funds performance. Treynor (1965), Sharpe (1966), and Jensen (1968) developed the standard indices to measure risk adjusted mutual fund returns. Grinblatt and Titman (1989b) constructed a positive period weighting measure of fund performance. Numerous studies have tested the mutual fund manager's market-timing ability [Treynor and Mazuy (1966), Henriksson and Merton (1981), Chang and Lewellen (1984)] and the diversification benefits and risk-adjusted performance of funds [Grinblatt and Titman (1989a), Ippolito (1989), Lehman and Modest (1987), and Logue and Rogalski (1989)].

Chang and Lewellen (1985), using a test procedure derived from arbitrage pricing theory, found that mutual fund portfolios did not outperform a passive buy-and-hold portfolio strategy. Ippolito (1989) examined the relation between mutual fund investment performance and other variables such as asset size, expenses, turnover, and load status. Domestic mutual fund risk-adjusted returns, net of fees and expenses, were comparable to returns of index funds. However, portfolio turnover was unrelated to fund performance.

In 1990, the literature was extended by Cumby and Glen to include international mutual funds. The performance of 15 U. S.-based internationally diversified funds was compared to the Morgan Stanley Index for the U. S., the Morgan Stanley World Index,

and to a benchmark combining the world index and Eurocurrency deposits. The time period analyzed was 1982-1988. Both the Jensen index and the methodology developed by Grinblatt and Titman (1989b) were employed to measure portfolio performance. Cumby and Glen concluded the funds did not outperform the international equity index; however, there was some evidence of the funds outperforming the U.S. index.

Eun, Kolodny, and Resnick (1991) reported similar findings. The benchmarks used in their study were the Standard and Poor's 500 Index, the Morgan Stanley Capital International World Index, and a self-constructed index of U.S. multinational firms. For the period 1977-1986, the majority of international funds outperformed the U. S. market. However, most of the funds failed to outperform the world index. The sample consisted of 19 U. S.-based international funds, and the Sharpe measure was used to assess excess returns.

Edwards (1988) tried to examine the fact that that stock index futures trading has destabilized the spot market in the long run. Using variance ratio F tests from June 1973 to May 1987, Edwards concluded that the introduction of futures trading has not induced a change in the volatility in the long run. He observes that there is some evidence of futures induced short run volatility, particularly on futures contract expiration days, but this volatility does not appear to carry over to longer periods of time.

Harris (1989) examined volatility after introduction of index futures by comparing daily return volatilities during the pre futures (1975-82) and post futures (1982-87) period between S&P 500 and a non S&P 500 group of stock controlling for differences in firm attributes. He found that increased volatility was a common phenomenon in different markets and index futures by themselves might not be a cause.

Chan and Karolyi (1991) estimated the intraday relationship between returns and returns' volatility in the stock index and stock index futures. Their study covered both S&P500 and Major Market Index (MMI) futures. Bivariate GARCH models were used to estimate volatility. Their results indicated a strong inter market dependence in volatility of spot and futures returns.

Lee and Ohk (1992) studied five of the most international index futures market: Sydney, Hong Kong, Tokyo, London and New York. Lee and Ohk identified an increase in spot market volatility increases following the introduction of NIKKEI, FT-SE100 and VLCI indexes. As for the AOI and Hang Sang, no empirical evidence of index futures induced

volatility was found. The use of a GARCH model made possible the identification of important efficiency benefits on the markets where the increase of volatility were found. After the start of these index futures markets, the persistence of volatility shocks in the spot market decreased.

Hendrik Bessembinder and Paul J Seguin (1992) examined whether greater futures trading activity, volume and open interest are associated with greater equity volatility. They also documented the heterogeneous effects on volatility of the expected and unexpected components of each trading series. They used the S&P 500 index prices from January 1978 to September 1989 breaking them into expected and unexpected components using an ARIMA (0, 1, and 1) model. They found evidence that active futures markets are associated with decreased rather than increased volatility and a positive relationship between equity volatility, contemporaneous trading volumes in the spot equity and equity futures market. They documented a positive relationship on spot volatility with unexpected futures trading volumes with a negative relationship with open interest.

The study of Kamara, Miller & Siegel (1992) examined the influence of innovations in the rate of productive activity, unanticipated changes in the discount rate, unanticipated changes in the default risk premium, unanticipated price level changes and changes in expected inflation on the volatility for the pre-futures and post-futures period in S&P500 Index. Using data for the period 1976 to 1987, the changes in volatility are examined using parametric and non- parametric tests. The results indicate that the increase in volatility in the post futures period cannot be completely attributed to the introduction of futures trading.

Gary Robinson (1993) analyzed the daily stock price volatility on the London Stock Exchange for the period 1980-93 to measure the effect of futures on cash market volatility and concluded that index futures contracts were found to have reduced volatility significantly by around 17%.

Antoniou and Holmes (1995) examined the relationship between the information and volatility in FTSE 100 Index in the UK using GARCH technique. The study indicate that introduction of FTSE 100 Index futures has changed the volatility in the spot market and attribute this to better and faster dissemination of information flow due to trading in stock index future.

Kumar R., Sarin A. and Shastri K. (1995) found that in Japan, the volatility of indexed stocks decreased relative to non-indexed stocks with the listing of index futures.

Maurice Peat and Micahael McCorry (1997) examined the impact of the introduction of Individual share futures (ISFs) contracts on the trading behavior of the underlying equity market on Sydney Futures Exchange and concluded that the introduction of futures contract resulted in a significant increase in both the underlying market trading volume and volatility with no discernible returns effect.

This study of Martin Bruand and Rajna Gibson-Asner (1998) examined the informational feedback effects associated to the listing and trading of futures in Switzerland. The listing of index futures generated positive abnormal returns for large stocks and for the index. While reducing the variance of blue chips and of the index, their variance's stochasticity decreased with futures listings.

Even, some of the researchers have tried to find out the impact of derivatives on underlying bonds also. Among them, Benjamin H. Cohen (1999) compared the variances of price changes over different time horizons before and after the start of organized futures trading to measure the impact of futures on underlying asset prices. The study found that ratios of the variances of multi-day and daily price movements declined for bond prices in the United States and Germany. Though no such effect was found for Japanese bonds, other indicators confirmed that serial correlation had tended to decline since the introduction of derivatives.

Soosung Hwang and Stephen E. Satchell (2000) tried to investigate the possible changes in the unobserved fundamental volatility and transitory noise resulting from the introduction of futures on FTSE100 stock index. Using factor GARCH model, the study concluded that there is no change in fundamental volatility after the introduction of index futures.

Chang, Cheng and Pinegar (1999) analyzed the effect of index futures listing on the underlying stocks by decomposing portfolio volatility into the average volatility of component stocks and the cross sectional dispersion of returns. They found that when Nikkei 225 futures were listed in Japan, the cross-sectional dispersion of returns across stocks in the index decreased, and index volatility increased proportionally more than the average volatility of the individual stocks. No such result was found for stocks outside

the index, nor was any effect found at the time of offshore listing of Nikkei 225 futures in Singapore.

Michael D Mckenzie, Timothy J Brailsford and Arobert W. Faff (2000) examined the impact of trading in individual Share futures contracts on the systematic risk and volatility of the underlying shares. The study evidenced a general reduction in systematic risk on individual stocks and decline in unconditional volatility while the evidence concerning the impact on conditional volatility was mixed.

Stewart Mayhew (2000) examined stock market volatility before and after the introduction of index futures in 25 countries. They then tested whether spot volatility after the introduction is related to futures market volumes and open interest. The study was conducted over a general time period between 1973 and 1997 using the excess returns over the world market index. They used a variety of model like GJR-GARCH, non-linear GARCH (NGARCH) and exponential GARCH (EGARCH). To estimate the impact of futures introduction they incorporated a multiplicative dummy in the variance equation. To study the effect of trading activity, they broke the data series of open interest and volume into expected and unexpected components using an ARIMA model, restricting to five or less AR and MA terms. They found that futures trading are related to an increase in conditional volatility in US and Japan, but in the rest of the countries' studies they found no significant effect.

Hyun-Jung Ryoo, Graham Smith (2000) investigated the impact on the spot market of trading in KOSPI 200 futures. Empirical results showed that futures trading increased the speed at which information was impounded into spot market prices and did not result in greater jump into volatility. There was stronger evidence that the stock index futures market leads the spot market.

Shafiqur Rahman (2001) examined the impact of trading in the Dow Jones Industrial Average (DJIA) index futures on the conditional volatility of component stocks. He investigated the contention that the introduction of futures on the DJIA could increase volatility in the 30 stocks comprising the DJIA. Using data from April through June 1997 (pre-futures period) and April through June 1998 (for post-futures period), the conditional volatility of intraday returns for each stock was estimated with the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model and then compared to determine if the estimated parameters have changed significantly after the introduction of the various derivatives. The results suggested that the introduction of index futures on

the DJIA has produced no structural changes in the conditional volatility of component stocks.

The study of Benilde Maria Do Nascimento Oliveria and Manuel Jose Da Rocha Armada (2001) indicate some contradictory results. While studying on the Portuguese Stock Market and taking PSI-20 as a proxy to estimate the volatility, the study concluded that the introduction of the PSI-20 index futures contributed to an increase of the Portuguese Stock Market volatility.

Thenmozhi M (2002) studied the impact of the introduction of index futures on underlying index volatility in the Indian markets. Applying Variance Ratio Test, Ordinary Least Square Multiple Regression Technique, he concluded that futures trading have reduced the volatility in the spot markets. Further in a lead lag analysis. Thenmozhi found that the futures market leads the spot index returns by one day. But this study neglected inherent time varying characteristics and clustering of volatility and possible autocorrelation. Therefore, the inferences drawn are unreliable.

Thiripalraju. M & Prabhakar R. Patil (2002) investigated non-linear volatility with the help of ARCH model to find out volatility changes due to introduction of index futures in S&P CNX Nifty and its underlying stocks. Using data from June 22, 1999 to May 31, 2001, he concluded that the volatility is non-linear and there is a reduction in volatility both in the cash index and in its underlying stocks after the introduction of trading on index futures in the Indian stock market.

Pierluigi Bologna and Laura Cavallo (2002) conducted a study to analyse the effect of the introduction of stock index futures on the volatility of the Italian Stock Exchange. The results showed that the introduction of stock index futures had led to diminished stock market volatility and no other contingent cause seemed to have systematically reduced it. Further, they suggested that the impact of futures onset on the underlying market volatility was likely to be immediate and active and developed futures markets enhanced the efficiency of the corresponding spot markets.

While analyzing the data relating to Indian stock market from June 2000 till October 2002, M. T. Raju and Kiran Karande (2003) concluded that introduction of futures has helped in reducing volatility in the cash market.

Premalatha Shenbagaraman (2003) examined the impact of introduction of NSE Nifty index futures on Nifty index. Using an event study over the period from October 1995 to December 2002, she tested for changes in the volatility before and after the introduction. Using GARCH techniques to model the time series, she concluded that futures trading have not led to a change in the volatility of the underlying stock index but the structure of volatility seemed to have changed in post-futures period.

Robert W. Faff and Michael D. Mckenzie icle (2003) investigated the impact of the introduction of stock index futures trading on the daily returns seasonality of the underlying index for seven national markets and indicated reduced seasonality of mean returns leading to more efficiency in the markets.

M.W. Hung, C F Lee, L C So (2003) tried to investigate whether foreign-listed single stock futures (SSFs) have any impact on their domestic underlying stock markets. They used GARCH (1, 1) and GJR-GARCH (1, 1) to analyse the data from the London International Financial Futures and Options Exchange (LIFFE). The Results showed that the introduction of the foreign listed SSF contracts seemed to have more explanatory power with respect to the higher volatility of their domestic spot markets than the announcement of the SSF contracts. Also, for two of the nine securities, the daily activity shocks of the foreign-listed SSFs were responsible for the higher conditional volatility of their home underlying stocks.

Nagaraj KS and Kotha Kiran Kumar (2004) studied the impact of Index futures trading on spot market volatility using the data from June 12, 2000 to Feb. 27, 2003 of S&P CNX Nifty. Using ARMA-GARCH Model, the study also examined the effect of the Sept. 11 terrorist attack on the nifty spot-futures relation. The study found that the post Sept. 11 attack, the relation between futures trading activity and spot volatility has strengthened, implying that the market has become more efficient in assimilating the information into its prices.

Nupur Helamsaria and Saikat Sovan Deb (2004) analyzed the impact of index futures on Indian stock market volatility using the data for the period June 9, 1999 to August 1, 2003 of NSE 500 and S&P CNX Nifty index. The results obtained using GARCH model show that the introduction of futures results in a reduction in spot market volatility. It also showed that domestic market factors represented by NSE 500 had a significant effect in determining the volatility of the Nifty index but the other international factors are found to have insignificant effect.

Golaka C. Nath (2004) studied the behavior of stock market volatility after the introduction of futures using the data from January 1999 to October 2003 of S&P CNX Nifty and 20 individual stocks. Using the IGARCH Model, he concluded that the volatility of the market as measured by Nifty index had fallen in the post futures period. In case of individual stocks, the result was mixed.

M Thenmozhi and M Sony Thomas (2004) analyzed the relationship between stock index futures and corresponding stock market volatility of the NSE- Nifty using the GARCH technique. Using the data from 1995 to 2003, the study concluded the reduction of volatility in the underlying stock market and increased market efficiency.

Gauri Mohan, Saurabh Kumar, and Sriharsha Pappu (2004) analyzed the data of NSE NIFTY from 13th July 1998 to11th July 2002 to measure the impact of futures trading on National Stock Exchange (NSE) of India and concluded that introduction of future had increased the efficiency of market by quicker dissemination of information. But change in volatility of the underlying stock market could not be completely attributed to the introduction of futures trading.

Joshi Manisha & Chiranjit Mukhopadhyay (2004) tried to address whether, and to what extent, the introduction of Index Futures trading had changed the volatility structure of the underlying NSE Nifty Index. Using a CUSUM plot, Bayesian analysis, the classical F-Test (Variance-Ratio test) and GARCH family of techniques, the results indicated that while the introduction of futures trading had no effect on the underlying mean level of the returns and marginal volatility, it had significantly altered the structure of spot market volatility. Moreover, it was found that new information was assimilated into prices more rapidly than before, and there was a decline in the persistence of volatility since the onset of futures trading. These results for NSE Nifty were obtained after using a control index, namely, NIFTY Junior, which does not yet have a derivative segment.

Gupta (2003) tried to examine the impact of introduction of index futures on the underlying stock market volatility in India and then compared the futures market volatility with the spot market volatility. Analyzing the daily price data for BSE Sensex and S&P CNX Nifty Index from June 1998 to June 2002, the empirical results reported that the over-all volatility of the stock market has declined after the introduction of the index futures for both of the indices. However, there was no conclusive evidence, which

suggested that, the futures volatility was higher (lower) in comparison to the underlying stock market in terms of both the indices.

In their study, Ash Narayan Sah and G. Omkarnath (2005) tried to examine the impact of futures trading on the volatility of S&P Nifty and BSE Sensex using ARCH\GARCH technique. Further, surrogate indices like BSE100 and Nifty Junior were used to assess whether the introduction of derivatives per se has been instrumental or the volatility has plummeted in line with general fall in market wide volatility. Using the data from 1st April 1998 through 31st March 2005 the results established that introduction of futures had negligible or no effect on the volatility. When surrogate index had been taken into consideration S&P Nifty showed decline in volatility while BSE Sensex exhibited rise in volatility.

Joao Paulo Tome Calado, Maria Teresa Medeiros Garcia and Sergio Emanuel Tome Mendes Pereira (2005) analyzed the data of 8 individual stocks listed on Portuguese stock market. Using the data from June 20, 1997 through January 12, 2001, the study concluded there was no significant difference in the variance (unadjusted and adjusted) for the underlying stocks after futures listings.

Vipul (2006) investigated the changes in volatility in the Indian stock market and found a strong evidence of a reduction in the volatility of the underlying shares after the introduction of derivatives. However, the inter-day unconditional volatility of the equity index increased after the introduction of derivatives. The study explained this contradiction by an increased correlation between the prices of its constituent shares caused by arbitrage transactions in the cash market.

While analysing the data for S&P CNX Nifty for the period ranging form June 1999 to December 2005, S V Ramana Rao (2007) concluded that the volatility has increased after the introduction of index futures.

Malik (2007) on investigating the performance of country funds belonging to emerging and developed markets of the world found that there are compelling evidences to support that higher volatility measured by standard deviation has direct influence on the earning of the portfolio of managed fund represented by country funds.

A few studies have been carried out to measure the relationship between trading activities of derivatives contract and volatility of underlying stock market. For example,

Minho Kim, Gyeong Rok Kim & Mincheol Kim (2004) tried to measure the relationship between the trading activities of the Korea Stock Price Index 200 derivatives contracts and their underlying stock market volatility and found a positive contemporaneous relationship between the stock market volatility and the derivatives volume but the relationship was negative between the volatility and open interest.

3. Research Methodology

In the present study, I have taken S&P CNX Nifty as representative index of stock market for the purpose of risk return dynamics of derivative based investment strategies in India. S&P CNX Nifty comprises of well diversified 50 stocks accounting for 21 sectors of the Indian economy that has been widely recognised as the second best emerging economy only next to China. It is also used for variety of purposes such as benchmarking fund portfolio; Index based derivatives & Index funds. In recent time, NSE has promoted it as the "Stock of the Nation".

S&P CNX Nifty stock has constantly represented more than 55% of the total market capitalization since March 2002 and it attained 56.78 % on 29th September 2007 (NSE Fact-Book, 2007). During the last six months all the Nifty stocks had shared approximately 41.16% of the traded value of all stocks on the NSE.

S&P CNX Nifty F & O has 58.27 percent share in the total traded volume in derivatives in the month of March 2007 (NSE Fact-Book, 2007). As per NSE's F&O update for the month of October 2007, the traded value in Nifty future was 29.84 percent of the total traded value of futures, where as it was 76.21 percent in case of options on the Nifty of the total traded value in options. However, in aggregate, the share of index future and options was 35.92 percent of total traded value of future and option for the month of October 2007. The traded value of F & O during this period was 80.10 percent of total traded value on the National Stock Exchange of India.

Therefore, the S&P CNX Nifty has been sampled as a portfolio that is the true representative of the Indian Capital market to meet the objectives of the study.

Objectives of the Study:

The study is aimed to achieve the following objectives:

a) To examine the performance of various derivatives based investment strategies.
b) To examine the risk associated with different investment strategies.

c) To assess the level of margin required to reduce the risk of stop losses being triggered;
d) To examine the extent to which derivatives have been able to hedge the risk; and
e) To examine whether derivatives can be used as an alternative to delivery based investing.

The present study is focused to assess the risk – return analysis of the derivative based investment strategies on S&P CNX Nifty (hereafter called Nifty)

In all, following six strategies have been developed involving the Nifty futures and options for empirical testing, namely;

1) Long Future (Naked);
2) Covered Call (Long Future with Short Call);
3) Long Straddle;
4) Short Straddle;
5) Long Strangle; and
6) Short Strangle

Future Contract:

A futures contract is a forward contract, which trades on an exchange. S&P CNX Nifty futures are traded on National Stock Exchange. When only a long position is taken, it is called naked long future.

Covered Call:

Under this strategy the long position on the Nifty is to be covered with short call on the Nifty. In choosing the strike price of the call a distance from spot price of two percent or more has been kept to factor in the historical growth rate of the Indian capital market.

Straddle:

It involves taking instantaneous position (long or short) in call and as well as put with the same strike price and expiration date. In case the position is long it is called long straddle, in opposite case it is called short straddle.

Strangle:

It involves taking instantaneous position (long or short) in call and as well as put with the same expiration date but different strike price of the call and option. In case the position is long it is called long strangle, in opposite direction, it is called short strangle.

Data: The data has been taken in different sets to meet the objectives of the study. Initially, the first set of data comprises of daily closing price of the Nifty (January 1, 1998

to October 25, 2007) comprising 2466 observations for assessing the daily volatility. For predicting the volatility for the forth coming future contract, starting with effect from the contract of January 2001, the average daily volatility of the immediate preceding 36 months has been used.

Second set of data comprises of 1714 observations of daily future prices on Nifty between 28th December 2000 and 25th October 2007 (82 months). This data has been used in monitoring the value at risk involved due to changes in the value of portfolio taking place because of frequent changes in price (volatility in prices).

Third set of data comprises of 1589 observations of daily prices of call and put for straddle. Fourth set of data comprises of 1589 observations of each on call and put for strangle. In case of strategies involving options, the data covered the period of 76 near month contracts beginning 28th June 2001 to 25th October 2007.

Return: Although there are numerous approaches to assess the out come of any investment decision but it is the rate of return that matters at the end of the day. In the present study too, for the estimation of return on assets, the method of continuous compounding has been used. The continuous compounding returns are also known as log returns of an asset for time period 't' is defined to be the natural logarithms of its gross return $(1 + R_t)$:

$$r_t \equiv \log(1 + R_t) = \log \frac{P_t}{P_{t-1}}$$

$$where \quad R_t = \frac{P_t}{P_{t-1}} - 1$$

Risk:

I assumed that the time series of interest, r_t, is decomposed into two parts, the predictable and unpredictable component, r_t, = $E(r_t|I_{t-1}) + e_t$, where I_{t-1} is the information set at time t - 1, E is the conditional mean operator and e_t is the unpredictable part, or innovation process. The conditional mean return is considered as a k-th order autoregressive process, AR(k):

$$E(r_t / I_{t-1}) \equiv c_0 + \sum_{t=1}^{k} c_t r_{t-1}$$

The autoregressive process allows for the autocorrelation induced by discontinuous (or

Non-synchronous) trading in the stocks making up an index. The unpredictable component, e_t can be expressed as an ARCH process in the following form:

$$e_t = z_t \sigma_t$$

Where z_t is a sequence of independently and identically distributed random variables with zero mean and unit variance. The conditional variance of e_t is σ_t^2 a time-varying, positive and measurable function of the information set at time t - 1. Note that, even though the innovation process for the conditional mean is serially uncorrelated, it is not time independent.

Engle (1982) introduced the ARCH (q) model and expressed the conditional variance as a linear function of the past q squared innovations

$$\sigma_t^2 = a_o + \sum_{t=1}^{q} a_t e_{t-1}^2$$

.

For the conditional variance to be positive, the parameters must satisfy $a_0 > 0$ and $a_i >= 0$, for all i = 1, . . . , q.

Bollerslev (1986) proposed a generalization of the ARCH model and the GARCH (p, q) model:

$$\sigma_t^2 = a_o + \sum_{t=1}^{q} a_t e_{t-1}^2 + \sum_{j=1}^{p} b_j \sigma_{t-j}^2$$

Where a0 > *0* and $a_i >= 0$, for all *i = 1, . . . , q,* and $a_0 > 0$ and $b_j >= 0$, for all *j = 1, . . . , p.*

If $\sum_{i=1}^{q} a_i + \sum_{j=1}^{p} b_j < 1$, then the process e_t is covariance stationary and its unconditional variance is equal to

$$\sigma^2 = a_o / (1 - \sum_{i=1}^{q} a_i - \sum_{j=1}^{p} b_j)$$

In the present study, the actual daily log returns have been used to predict the daily variance using the E-view software. The daily standard deviation is based on the average of the daily SD of the 36 months immediately preceding the start of the monthly S&P CNX Nifty Index future contract. Then this daily standard deviation has been converted into monthly standard deviation by multiplying the square root of the actual

number of trading days during the forthcoming monthly future contract (Fama 1965; French 1980; French and Roll 1986). The SD so calculated have been used to calculate the margins required for the derivative portfolio during the forthcoming/following monthly future/option contract. The results of the study conducted by Fama (1965) and French (1980) suggests that volatility is far larger when exchange is open than when it is closed. In another study French and Roll (1986) reasonably concluded that volatility is largely caused by trading itself. Hence, in the present study, the daily data for actual trading days have been used to measure volatility and days when the exchange is closed have been ignored. However, the standard deviation for the various portfolios used in the present study is based on the monthly log returns of the portfolio in question. The yearly standard deviation of the portfolio has been reached by multiplying the square root of 12 (or actual number of months during the year) to the monthly standard deviation. In case of 2007, there were only 10 months till the expiry of the derivative contracts for the month of October and similarly in case of options, the number of months during 2001 was only 6, beginning with the contract for the month of July 2001.

In the absence of actual trading days, the most widely used approach is the one generally used by practitioners has been that the daily volatility is being converted into monthly volatility by multiplying $\sqrt{21}$. The normal premise in the equity markets is that on an average there are 252 trading days in a year.

In the present study the Value at Risk (VaR) approach have been used with regard to various derivative based investment strategies. VaR is an attempt to provide a single number that summarizes the total risk in a portfolio of financial assets. The VaR calculation is aimed at making a statement of the form “We are X percent certain that we will not lose more than V dollars (rupees) in the next N days.” The variable V is the VaR, X is the confidence level, and N is the time horizon. VaR is an attractive measure because it addresses the issue of: “How bad can things get?” This is the question all the investors as well as portfolio managers want answered. For computing the VaR, it is assumed that the returns are behaving like normal probability rule.

Artzner, Delaen, Eber and Heath (1999) proposed a number of properties that a risk measure should have. A risk measure used for specifying capital requirements can be thought of as the amount of cash (or capital) that must be added to a position to make its risk acceptable. Therefore, VaR measure is an approach that would address the issue of margin an investor should keep against the exposure in derivatives.

Hence, the present study has used VaR with an attempt to limit the risks taken by the investors and traders at the confidence level of 99 percent. This approach would assure the investors and traders to the extent of 99 percent that during the forthcoming monthly future contract period the loss in value of their portfolio would not exceed the margin so calculated as 2.33 daily standard deviations multiplied by square root of the actual number of trading days falling under each month's future contract. This would statistically leave only one percent chances that the loss would exceed the margin so calculated at 99% confidence level.

Mechanism of Maintaining Derivative based Investment Strategies:

The future contract on the S&P CNX Nifty has been taken as one of the derivative portfolio named Long Future (Naked) besides other five derivative based portfolios namely Covered Call, Long Straddle, Short Straddle, Long Strangle and Short Strangle. All the portfolios involving derivatives would thereafter be referred as Derivative Portfolio.

For comparison purpose, a cash portfolio on the S&P CNX Nifty over the corresponding period of time to that of derivative portfolios has also been considered. In case of cash portfolio, all the constituent scripts of this index have been acquired in the proportion they constitutes the S&P CNX Nifty Index (thereafter referred as Cash Portfolio).

The philosophy of buy- and- hold has been used for all the portfolios (derivative as well as cash) with an initial investment of Rs 2,50,000 (Rs. two lacs fifty thousand only) for each portfolio. The amount has been used as margin money for taking exposure in future and options (short) and paying of option premium for taking long position in the options. It has been presumed that ten percent of the notional value of exposure at every point in time would be the minimum required margin. Hence the total amount of margin provided was further enhanced by a margin (called additional margin) calculated as 2.33 daily standard deviations multiplied by square root of the actual number of trading days falling under each month's future contract. This would statistically leave only one percent chances that the loss would exceed the margin so calculated at 99% confidence level.

The amount provided as margin money and/or lying in the bank account attached to the trading account for the aforesaid portfolio carries a normal rate of interest @ 4 percent per annum as paid under saving bank account scheme. This assumption has been based on the services provided by the ICICIDirect.com (subsidiary of ICICI Bank Limited) as one of leading brokerage house in India with close to two-third market

share). Where as, in case of any short fall on money required in case of only option based strategies namely Straddle and Strangle interest @ 12 percent per annum has been charged (12% is the widely prevailing rate of interest in case of loan against shares/securities).
The transaction cost of rolling over in case of derivative portfolio and cash portfolio alignment have been ignored. Although, in practice the cost of trading in cash has always been higher to that of trading in derivatives, but the higher cost have partially been compensated by the dividend yield of the index (Nifty), that has been 1.67 percent per annum during 2001 to 2007 (Source: NSE).

The modus operandi used for derivative portfolio has also been of buy-and-hold, where Nifty Future contracts have been rolled over from one month to another month on last day of the expiry of the future contract during the entire period under study.

In case of Nifty Cash Portfolio, the portfolio has been aligned (to match the proportion of each script as an index constituent) on the last day of expiry of the future contract i.e. the day when Nifty Future Portfolio has been rolled over for the next month.

In case of maintaining the long position (Long Naked Future) in the index futures, the rolling approach has been used. The rolling approach refers that at the expiry of every month's future contract, the next month contract would be purchased at the closing price on the last day of the expiry of the preceding month and the future contract of the current month would be squared-off or allowed to expiry at the closing price on the expiry of the contract, and so on the position in the index future contracts are rolled over the entire period of 82 months beginning 28th December 2000 to 25th October 2007. In the case of Covered Call, the long position in the index futures have been covered by taking the short position of the out-of-money calls with strike price higher by 2-3 percent of the spot price

However in the case of investment strategies involving options, the Straddle (long as well as short) and Straddle (long as well as short), the following approach have been used while deciding on the strike price.

While selecting the strike price of call option and put option, the normal historical growth rate of the Indian capital market has been taken into account. The BSE Sensex, since its inception in 1978-79 that has grown at a CAGR of 21 percent (including two percent for dividend) where as in case of S&P CNX Nifty the annual growth has been about 21.6

percent (including two percent for dividend) during the last seven years ending 31st December 2007.

The standard deviation of the Indian capital based on monthly returns for last nine calendar years ending 31st December 2006 has been 7.36 percent. Taking into account the normal rate of return and the volatility in the India capital market, in the present study the researcher has opted, but not restricted, to choose out-of - money calls with strike price higher by 1-2 percent and in- the- money put with strike price higher by 1-2 percent of the spot price on the day of entering into the contracts amounting in the formation of straddle for the purpose of empirically examining the performance of straddle. In case of assessing the performance of strangle the out-of-money calls with strike price higher by 2-3 percent of the spot price and out-of-the money put with strike price lesser up-to 1 percent of the spot price on the day on entering into contract for the month under consideration has been taken into account for examining the risk return dynamic of the said strategy.

Risk Adjusted Portfolio Performance:

William Sharpe (1966) suggested an alternative technique for performance evaluation. Hence, Sharpe's ratio to measure excess return per unit of risk undertaken has been used to measure the performance of derivative based portfolio on S&P CNX Nifty. The measure is the ratio of the risk premium of the portfolio, divided by the standard deviation of the portfolio's return:

Sharpe Ratio **=** $\frac{\overline{R} - R_f}{\sigma}$

Where, $\overline{R}$ **=** rate of return of the portfolio,

R_f **=** risk free rate of return over the same interval.

(The risk free return has been the corresponding to the rate of return offered by National Saving Certificates (NSCs) by Indian Post Office at the beginning of the calendar year under study. Hence, the risk free rate of return taken for the calendar year 2001 was 11%, for the year 2002 was 9.5%, for the year 2003 was 9% and 8% for the calendar years 2004 to 2007).

σ **=** standard deviation of the return of the portfolio.

Sources of Data:

The data have been sourced from the website of National Stock Exchange of India (NSE). Needless to mention that to enrich the quality of the present study, other sources of literature and relevant information have also been explored from various books, journals, magazines, business news papers and various websites on financial planning and investment management.

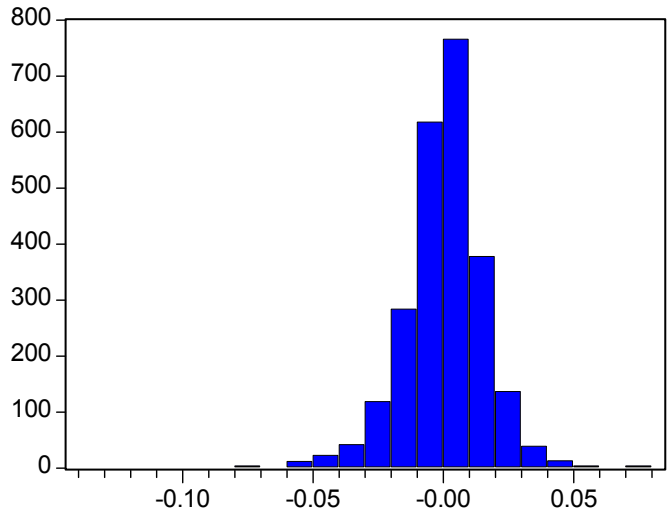
4. Empirical Results

The empirical results have been presented in two parts, the first part as presented at 4.1, refers to the estimation of the behaviour of stock returns on the basis of GARCH Model. The second part as presented at 4.2, relates to the empirical results delivered by various derivative based investment strategies undertaken during the course of the present study.

4.1 Behaviour of Stock Returns: GARCH Approach

It can be concluded from the descriptive statistics for the daily returns as presented in Table- 4.1, that the data is not normally distributed, which seems to be a general phenomenon world wide for stock returns. The coefficient of kurtosis is greater than three which characterize that the returns are distributed in the form of leptokurtosis exhibiting fat tails and excess peakedness at the mean. From these characteristics thus it may concluded that it is eligible for fitted in the form of GARCH model.

Table- 4.1: Descriptive of Daily Log return



Series: Daily Log Return	
Sample 1 2448	
Observations 2448	
Mean	0.000628
Median	0.001440
Maximum	0.079691
Minimum	-0.130539
Std. Dev.	0.015853
Skewness	-0.504505
Kurtosis	7.388225
Jarque-Bera	2068.011
Probability	0.000000

It is found that an AR (2)-GARCH (1,1) model could fit the data best for the given return series. This model is given by following equations:

$$y_t = c_o + c_1 y_{t-1} + \varepsilon_t \qquad ----(i)$$

$$\sigma_t^2 = a_o + a_1 \varepsilon_{t-1}^2 + a_2 \sigma_{t-1}^2 \qquad ----(ii)$$

Equation (1), the mean equation, has the stock return as dependent variable and a constant, lagged value of the dependent variable, the AR (1) term, and a disturbance term as right hand side variables. The disturbance term in equation (1) is allowed to have a variable variance and it is modeled by equation (2). The variance is a function of the lagged value of itself and the lagged squared value of the disturbance term of equation (1). Since *s2t* is the one day ahead forecast variance based on past information, it is called the conditional variance.

The models are estimated using the entire dataset available and the results are presented in Table- 4.2 and Table-4.3. First, I model the conditional mean as a first order autoregressive process and then the conditional variance as a GARCH (1, 1) process. The results of conditional mean model and thereafter testing its residuals for ARCH effects are presented in following Table-4.2.

Table-4.2: Conditional Mean Model for Daily Return

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Probability**
C	0.000626	0.000318	1.964415	0.0496
AR(1)	0.065598	0.020184	3.249989	0.0012
AR(2)	-0.06859	0.020186	-3.3979	0.0007
R-squared	0.008455	Mean dependent variable	0.000626	
Adjusted R-squared	0.007643	S.D. dependent variable	0.015859	
S.E. of regression	0.015798	Akaike info criterion	-5.45659	
Sum squared resid	0.609748	Schwarz criterion	-5.44947	
Log likelihood	6676.407	F-statistic	10.41588	
Durbin-Watson stat	1.996476	Probability (F-statistic)	0.000031	
Test for Normality				
Jarque-Bera Statistics=1938.93(0.000)				
ARCH Test				
F-statistic	85.98201	Probability	0.000	
Obs*R-squared	366.2979	Probability	0.000	

The results indicate that the coefficients of AR (1) and AR (2) are statistically significant imply there is short term dependence in the stock returns but these are too small to predict the returns to make abnormal profit. So this coefficient is consistent with weak

form of market hypothesis. The Jarque-Bera χ_2 statistics in the table indicates that the null of normally distributed residuals is rejected for stock returns. The F-statistic shows that there is presence of ARCH effect in return series. Thus the results presented in the above imply that return series can be modelled for conditional variance through GARCH process. The conditional variance is modelled in the form of GARCH(1,1) is considered as most appropriate after taking into account the model fitting criteria of Akaike information criterion(AIC) and Schwarz information criterion(SIC). The results of AR (2)-GARCH (1,1) are presented in the Table-4.3.

The results indicate that both the coefficients of GARCH model are statistically significant at 1% level. The residuals of the model have no ARCH effect. It means fitted model is appropriate for forecasting the conditional variance of the returns.

Table-4.3: Conditional Variance for Daily Return

Variable	Coefficient	Std. Error	z-Statistic	Probability
Conditional Mean Equation				
C	0.001409	0.000276	5.113321	0.000
AR(1)	0.095544	0.022894	4.173254	0.000
AR(2)	-0.03932	0.020712	-1.89856	0.0576
Conditional Variance Equation				
C	1.23E-05	1.58E-06	7.781668	0.000
RESID(-1)^2	0.155879	0.012885	12.09762	0.000
GARCH(-1)	0.79944	0.014354	55.69438	0.000
R-squared	0.004419	Mean dependent variable	0.000626	
Adjusted R-squared	0.002379	S.D. dependent variable	0.015859	
S.E. of regression	0.01584	Akaike info criterion	-5.65953	
Sum squared resid	0.612231	Schwarz criterion	-5.6453	
Log likelihood	6927.602	F-statistic	2.165902	
Durbin-Watson stat	2.05141	Probability (F-statistic)	0.055234	
ARCH Test				
F-statistic	1.343253	Probability	0.243024	
Obs*R-squared	6.714295	Probability	0.24277	

4.2 Results of Derivative based Investment Strategies:

Long Future (Naked):

The results of the derivative based portfolio on S&P CNX Nifty Index future and the cash portfolio of the corresponding index have been presented in the Table- 4.4 and shown in Figure- 4.4.

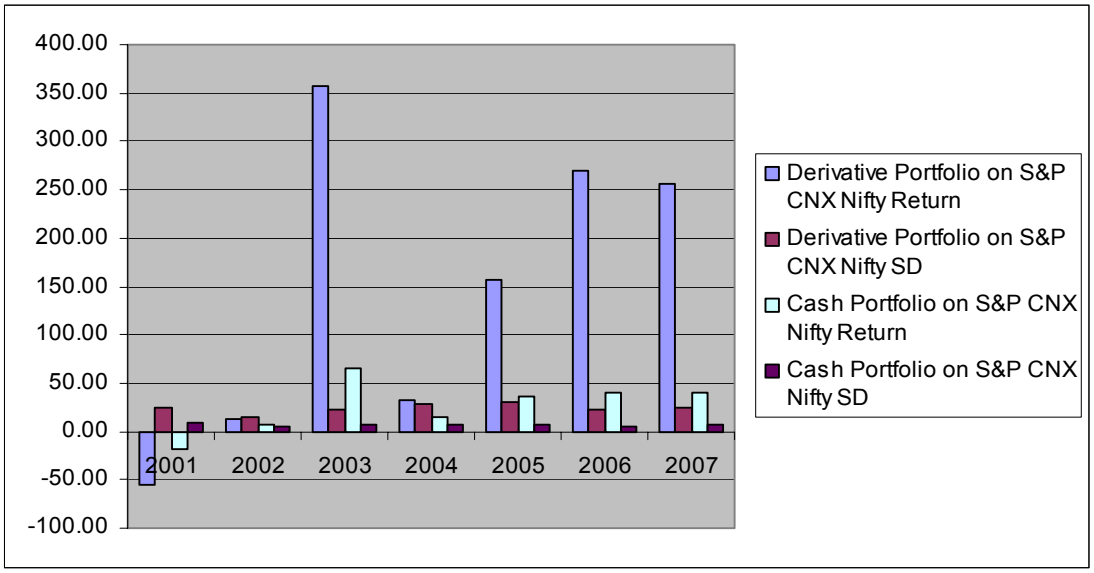
The through analysis of the table, suggests that during the entire 82 months beginning 28th December 2000 under study, the derivative portfolio based of S&P CNX Nifty Index future does not at all amount in higher degree of risk when compared with the cash portfolio being held in proportion to the index composition, rather compensates very smartly for higher degree of risk under taken by the investors, as suggested by the Sharpe's ratio (William Sharpe,1966) that is the measure of total risk premium of the portfolio divided by standard deviation of the portfolio's return). The Sharpe's ratio was in favour of derivative portfolio (45.5994 Vs 4.6388) to cash portfolio. The examination of the table also suggest that, it is only during the calendar year 2004, when Sharpe's ratio was slightly in favour of cash portfolio vis-à-vis derivative portfolio, where as during all remaining calendar years under study the Sharpe's ratio has been in favour of the derivative portfolio by huge margins of more than 100 percent during 2002, 2003, 2006 and 2007. During the entire period under study, the compounded annual growth rate (CAGR) of returns of the derivative portfolio was 97.12 percent against the 24.45 percent of the cash portfolio. On account of value at risk (VaR), during the entire period under the study of 82 months, the margin maintained at 99 percent significance level were statistically found to be significant (sufficient) in avoiding the stop losses being trigger for want of margins so maintained, as there was not a single default despite the probability of 0.82 times (one percent of 82).

In the present study where index has been taken as an portfolio, there is no conclusive evidence, except during two (2001 & 2004) out of seven calendar years, to support that the higher volatility may be associated with lower stock returns, the notion put forth by Black (1976).

Table- 4.4: Long Future (Naked)

	Derivative Portfolio on S&P CNX Nifty			Cash Portfolio on S&P CNX Nifty		
	Return	SD	Sharpe Ratio	Return	SD	Sharpe Ratio
2001	-55.10	84.59	-0.7814	-18.33	29.51	-0.9938
2002	12.93	48.79	0.0703	7.33	16.59	-0.1306
2003	357.81	78.82	4.4256	65.21	24.97	2.2507
2004	31.69	101.74	0.2328	13.88	24.42	0.2409
2005	157.66	105.63	1.4169	37.00	23.21	1.2494
2006	268.69	77.59	3.3601	40.70	19.98	1.6366
2007	255.65	79.90	3.1161	40.26	21.07	1.5940
Aggregate	10228.46	222.96	45.5994	345.89	61.31	4.6388
CAGR	**97.12**			**24.45**		

Figure- 4.4: Long Future (Naked)



Covered Call:

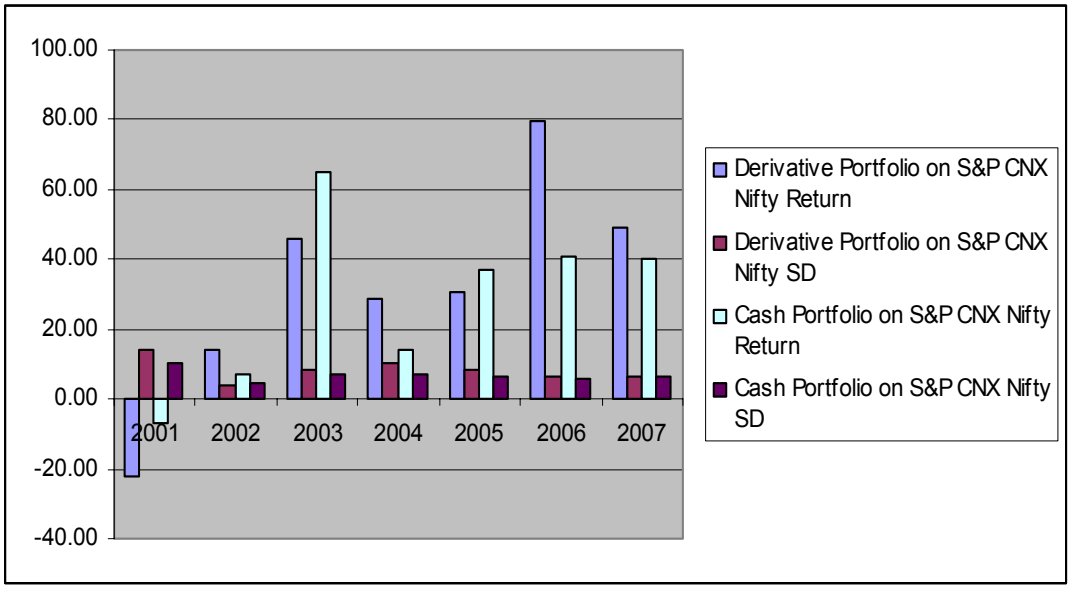
The results of the derivative portfolio (covered call on S&P CNX Nifty Index) and the cash portfolio of the corresponding index have been presented in the Table- 4.5 and shown in the Figure- 4.5. The period of study covered was 76 months ending on 25th October 2007, where options have been involved?

The results indicate that in terms of CAGR the derivative portfolio has an edge over the cash portfolio (32.17% Vs. 29.30%) during the entire period of study, but in terms of risk compensation as point out by Sharpe's ratio, it is the cash portfolio that has an edge over derivative portfolio (6.0644 Vs. 5.9040).

Table- 4.5: Covered Call (S&P CNX Nifty)

	Derivative Portfolio on S&P CNX Nifty			Cash Portfolio on S&P CNX Nifty		
	Return	SD	Sharpe Ratio	Return	SD	Sharpe Ratio
2001	-22.03	34.74	-0.7925	-6.76	24.82	-0.4942
2002	14.22	13.85	0.3408	7.33	16.59	-0.1306
2003	45.96	29.93	1.2348	65.21	24.97	2.2507
2004	28.56	35.16	0.5847	13.88	24.42	0.2409
2005	30.42	29.62	0.7572	37.00	23.21	1.2494
2006	79.75	23.03	3.1160	40.70	19.98	1.6366
2007	49.32	20.38	2.0923	40.26	21.07	1.5940
Aggregate	484.95	72.48	5.9040	409.04	58.05	6.0644
CAGR	**32.17**			**29.30**		

Figure- 4.5: Covered Call (S&P CNX Nifty)



Straddle:

The results of the option based strategy called Straddle on S&P CNX Nifty Index and the cash portfolio of the corresponding index have been presented in the Table- 4.6 and 4.7 for long straddle and short straddles respectively.

The through perusal of the tables show that the Sharpe's ratio favours the long straddle only during the calendar years 2001 and 2003 and short straddle only once (during 2004) in the entire period of 82 months under study. Hence, results advocate that there is no use of going in for the options based strategy called straddle (long or short). In

case of long straddle the results are in line with notion of higher volatility results in lower stock returns put forth by Black (1976).

In terms of aggregate CAGR the derivative portfolio strategises of Long Straddle as well as Short Straddle have not only resulted in negative returns but have almost eaten away the entire (95.23% of initial investment) investment in case of Long Straddle. Hence, in the present study, the proposed methodology of selecting the strike price of the straddle only on the basis of long term historical growth rate needs to be revisited, as it does not provide any evidence to support such strategy for rational investors either in terms of risk, return or combination thereof.

Table- 4.6: Straddle (Long)

	Derivative Portfolio on S&P CNX Nifty			**Cash Portfolio on S&P CNX Nifty**		
	Return	SD	Sharpe Ratio	Return	SD	Sharpe Ratio
2001	-2.25	273.34	-0.0284	-6.76	24.82	-0.4942
2002	-80.83	260.14	-0.3472	7.33	16.59	-0.1306
2003	2722.74	272.70	9.9515	65.21	24.97	2.2507
2004	-73.54	267.44	-0.3049	13.88	24.42	0.2409
2005	-62.99	375.83	-0.1889	37.00	23.21	1.2494
2006	-94.84	186.35	-0.5518	40.70	19.98	1.6366
2007	78.45	679.19	0.1057	40.26	21.07	1.5940
Aggregate	-95.23	939.76	-0.1620	409.04	58.05	6.0644
CAGR	**-38.15**			**29.30**		

Figure- 4.6: Straddle (Long)

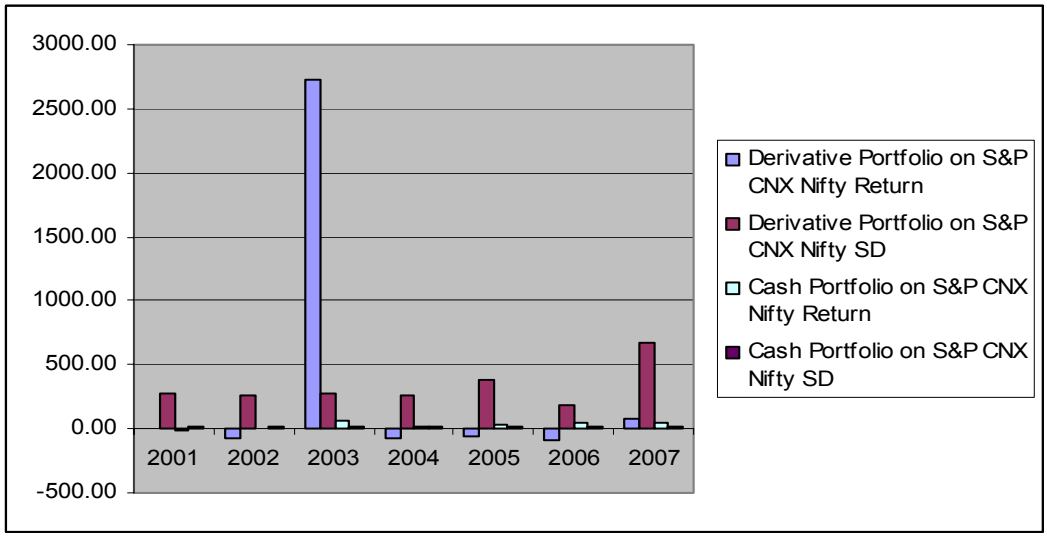
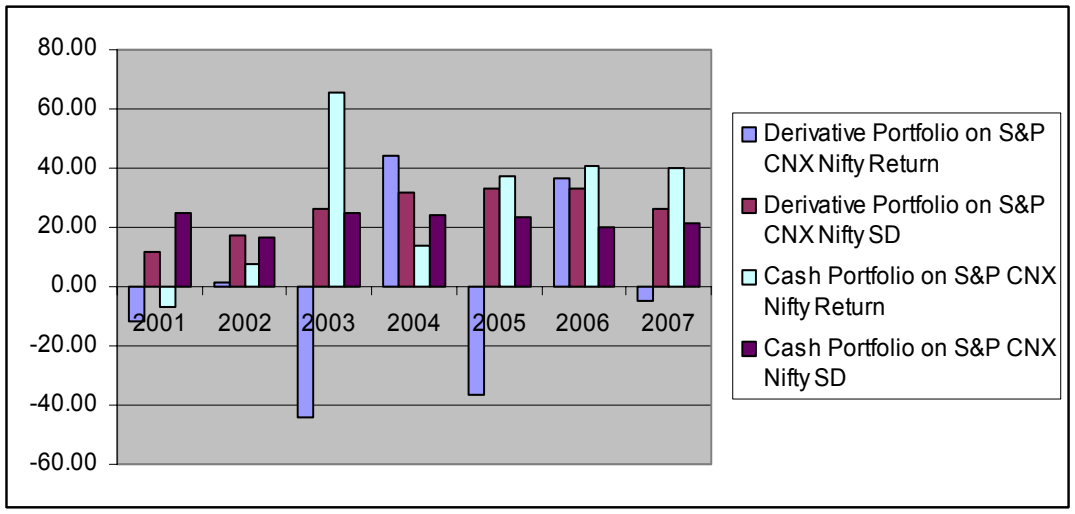


Table- 4.7: Straddle (Short)

	Derivative Portfolio on S&P CNX Nifty			Cash Portfolio on S&P CNX Nifty		
	Return	SD	Sharpe Ratio	Return	SD	Sharpe Ratio
2001	-11.76	11.85	-1.4569	-6.76	24.82	-0.4942
2002	1.29	17.38	-0.4726	7.33	16.59	-0.1306
2003	-44.27	26.11	-2.0403	65.21	24.97	2.2507
2004	44.39	31.38	1.1595	13.88	24.42	0.2409
2005	-36.63	33.33	-1.3391	37.00	23.21	1.2494
2006	36.41	33.07	0.8591	40.70	19.98	1.6366
2007	-4.77	26.25	-0.4357	40.26	21.07	1.5940
Aggregate	-40.79	72.44	-1.3499	409.04	58.05	6.0644
CAGR	**-7.94**			**29.30**		

Figure- 4.7: Straddle (Short)



Strangle:

The results of the yet another option based strategy called Strangle on S&P CNX Nifty Index and the cash portfolio of the corresponding index have been presented in the Table- 4.8 for long strangle and in the Table- 4.9 for short strangle.

It has been found that in the case of option based strategy called Strangle (both long and/or short), its performance has further deteriorated as compared to straddle in terms of both (risk as well as return).

In case of long strangle, the entire initial capital has been lost, where as in case of short strangle little over half (50.43%) of the initial capital has been lost. The Sharpe ratio has been lower during the entire period under study in case of short as well as long strangle, exception during the initial period of one and half years (July 2001 to December 2002) in case of long strangle only.

Table- 4.8: Strangle (Long)

	Derivative Portfolio on S&P CNX Nifty			Cash Portfolio on S&P CNX Nifty		
	Return	SD	Sharpe Ratio	Return	SD	Sharpe Ratio
2001	-87.88	544.12	-0.1716	-6.76	24.82	-0.4942
2002	-78.91	730.16	-0.1211	7.33	16.59	-0.1306
2003	442.16	723.28	0.5989	65.21	24.97	2.2507
2004	-19.80	341.99	-0.0813	13.88	24.42	0.2409
2005	269.87	357.69	0.7321	37.00	23.21	1.2494
2006	-113.91	636.64	-0.1915	40.70	19.98	1.6366
2007	-46.69	123.85	-0.4308	40.26	21.07	1.5940
Aggregate	-103.05	1373.79	-0.1165	409.04	58.05	6.0644
CAGR	**-42.37**			**29.30**		

Figure- 4.8: Strangle (Long)

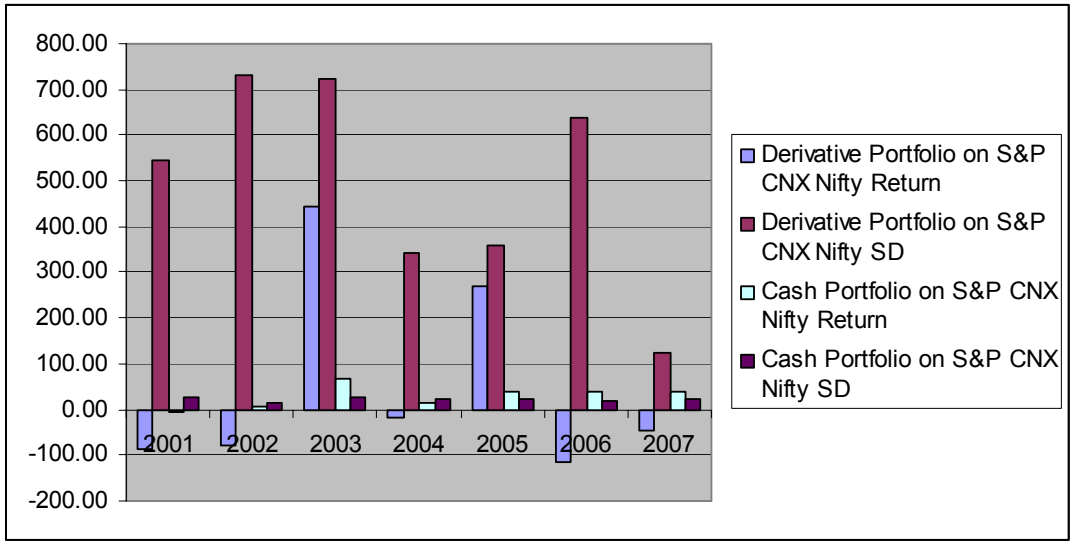
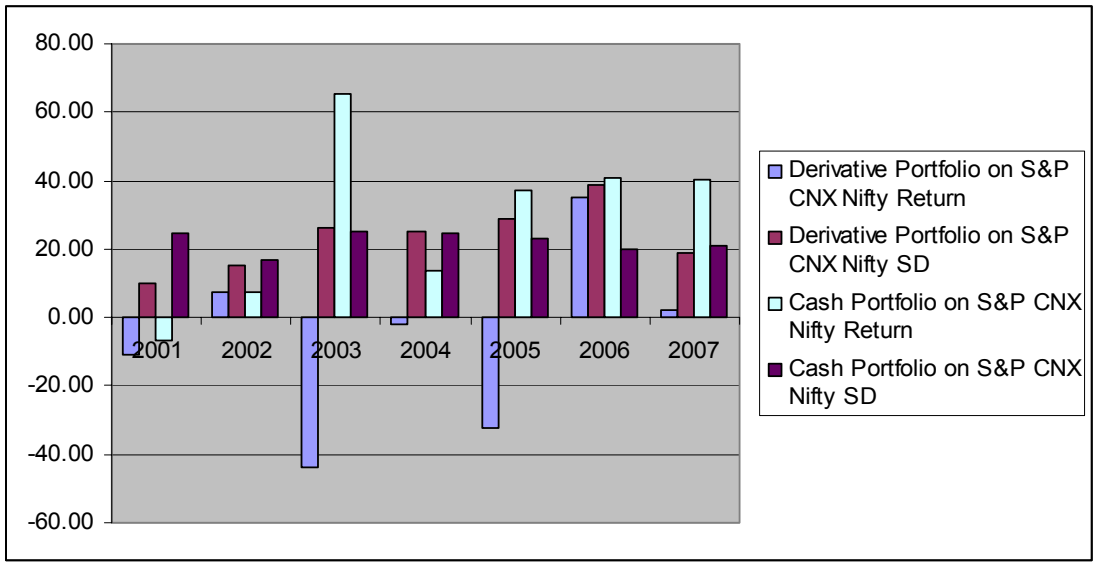


Table- 4.9: Strangle (Short)

	Derivative Portfolio on S&P CNX Nifty			Cash Portfolio on S&P CNX Nifty		
	Return	SD	Sharpe Ratio	Return	SD	Sharpe Ratio
2001	-10.88	10.03	-1.6338	-6.76	24.82	-0.4942
2002	7.45	15.27	-0.1345	7.33	16.59	-0.1306
2003	-43.73	26.12	-2.0190	65.21	24.97	2.2507
2004	-1.84	25.24	-0.3898	13.88	24.42	0.2409
2005	-32.35	28.88	-1.3971	37.00	23.21	1.2494
2006	35.32	38.67	0.7067	40.70	19.98	1.6366
2007	2.39	18.94	-0.2259	40.26	21.07	1.5940
Aggregate	-50.43	66.82	-1.6076	409.04	58.05	6.0644
CAGR	**-10.49**			**29.30**		

Figure- 4.9: Strangle (Short)



The summarized results of all the strategies during the entire period of the study have been placed under Table No. 4.10. On the through review of the table, it is found that in case of naked exposure in index futures the returns have been duly compensating the additional amount of risk undertaken. The aggregate Sharpe ratio, a measure of the total excess risk undertaken being in favour (45.5994 vis-à-vis 4.6388) of the derivative based investment strategy.

In case of covered call the risk has been hedged to some extent, but occasionally, it has been observed that the additional risk fails to compensate, as suggested by the Sharpe ratio.

Both the option based strategies involving straddles and strangles (long and/or short), have completely failed to compensate the investors/traders being extremely found to be volatile on month on month basis. Hence for the option based strategies, it may be inferred that options can not be used as buy and hold rather can only be used for a very short period of time during the monthly contracts to take advantage of the market swings/movements over a short period of time like a day or two or at the most for a week.

Table: 4.10: Summarized Results of all the Strategies

Years			2001	2002	2003	2004	2005	2006	2007	Aggregate
Months (82)			**12**	**12**	**12**	**12**	**12**	**12**	**10**	**82**
Cash Portfolio		Return	-18.33	7.33	65.21	13.88	37.00	40.70	40.26	345.89
		SD	29.51	16.59	24.97	24.42	23.21	19.98	21.07	61.31
		Sharpe Ratio	-0.9938	-0.1306	2.2507	0.2409	1.2494	1.6366	1.5940	4.6388
Derivative Portfolio	Future (Naked)	Return	-55.10	12.93	357.81	31.69	157.66	268.69	255.65	10228.46
		SD	84.59	48.79	78.82	101.74	105.63	77.59	79.90	222.96
		Sharpe Ratio	-0.7814	0.0703	4.4256	0.2328	1.4169	3.3601	3.1161	45.5994
Months (76)			**6**	**12**	**12**	**12**	**12**	**12**	**10**	**76**
Cash Portfolio		Return	-6.76	7.33	65.21	13.88	37.00	40.70	40.26	409.04
		SD	24.82	16.59	24.97	24.42	23.21	19.98	21.07	58.05
		Sharpe Ratio	-0.4942	-0.1306	2.2507	0.2409	1.2494	1.6366	1.5940	6.0644
Derivative Portfolio	Covered Call	Return	-22.03	14.22	45.96	28.56	30.42	79.75	49.32	484.95
		SD	34.74	13.85	29.93	35.16	29.62	23.03	20.38	72.48
		Sharpe Ratio	-0.7925	0.3408	1.2348	0.5847	0.7572	3.1160	2.0923	5.9040
	Straddle (Long)	Return	-2.25	-80.83	2722.74	-73.54	-62.99	-94.84	78.45	-95.23
		SD	273.34	260.14	272.70	267.44	375.83	186.35	679.19	939.76
		Sharpe Ratio	-0.0284	-0.3472	9.9515	-0.3049	-0.1889	-0.5518	0.1057	-0.1620
	Straddle (Short)	Return	-11.76	1.29	-44.27	44.39	-36.63	36.41	-4.77	-40.79
		SD	11.85	17.38	26.11	31.38	33.33	33.07	26.25	72.44
		Sharpe Ratio	-1.4569	-0.4726	-2.0403	1.1595	-1.3391	0.8591	-0.4357	-1.3499
	Strangle (Long)	Return	-87.88	-78.91	442.16	-19.80	269.87	-113.91	-46.69	-103.15
		SD	544.12	730.16	723.28	341.99	357.69	636.64	123.85	1373.79
		Sharpe Ratio	-0.1716	-0.1211	0.5989	-0.0813	0.7321	-0.1915	-0.4308	-0.1165
	Strangle (Short)	Return	-10.88	7.45	-43.73	-1.84	-32.35	35.32	2.39	-50.43
		SD	10.03	15.27	26.12	25.24	28.88	38.67	18.94	66.82
		Sharpe Ratio	-1.6338	-0.1345	-2.0190	-0.3898	-1.3971	0.7067	-0.2259	-1.6076

5. Summary

The performance of derivative portfolio on S&P CNX Nifty Naked Future has be found to be exceptionally remunerative (CAGR: 97.12% Vs 24.45%) to the leveraged investors if margins are maintained as suggested by the 99% VaR (i.e. 2.33 standard deviation of the returns over the period of actual numbers of trading days duration the monthly future contract). Of all 1714 trading days falling under the present study, there has not been a single default for want of margins to be maintained for derivative exposure.

In case of Covered Call, the second strategy involving derivatives in the present study, has also been able to deliver better results (CAGR: 32.17% Vs. 29.30%) on all most both the parameters (risk as well as return) as evidenced by the Sharpe's measure (1966). Hence it may be concluded that both the derivative based strategies involving Naked Future and the Covered Call on the leading index S&P CNX Nifty of the Indian Capital Market have proved to be better than a cash portfolio held on same Index.

However, in case of pure option based investment strategies on the leading Indian Indices (S&P CNX Nifty) involving the Straddle (both long as well as short) and the Strangle (both long as well as short) have lagged far behind in terms of both risk and return to the cash portfolio held on the same index. Hence, option based strategies may be used, having understood the dynamics of volatilities (risk), only over a short period of

time to take advantage of price swings/movements and can not be used as a long term strategy.

Evidences suggests that if index futures (naked) and covered call are considered for long terms on rolling basis as an investment strategy by using value at risk (VaR) measure, it amounts in translating significantly higher rate of returns to its respectively increased risk.

Disclaimer:

It is worth to note that the results of the present study are based on the prediction of volatility as per GARCH Model. In reality, the volatility may vary depending upon the flow of diversified information's. Therefore, all the readers are hereby cautioned that there is always varying degree of risk in trading with derivatives based on the current market environment and sentiments. Hence, the author does not assume any responsibility in case market behaves otherwise.

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