Chapter – 1

INTRODUCTION AND RESEARCH METHODOLOGY
Integration of economies world over has brought in multiple growth in the volume of international trade and business. This in turn has led to increase in the demand for international money and need for innovative financial instruments both at national and global level. Changes in the interest rates, exchange rates and equity prices in different financial markets led to increase in the volatility and manifold increase in the financial risk to the individual as well as institutional investors. Adverse changes in these variables have even threatened the very survival of the business world. To manage these risks, new financial instruments have been developed in the financial market, which are popularly known as Financial Derivatives.

The basic purpose of Financial Derivatives is to provide commitments to prices for future dates for giving protection against adverse movements in the future prices of underlying assets thereby reduce/manage/control the extent of financial risk. Derivatives allow investors to establish, at low cost, return distributions that matchup with their levels of risk aversion. Derivative instruments are different from Insurance, in that they cover general risks whereas the latter covers specific risks. Financial Derivatives also provide an opportunity to earn profit for those persons who have higher risk appetite. These instruments indeed facilitate to transfer the risk from those who wish to avoid it to those who are willing to accept the same. In the stock market, derivative instruments have emerged as the most important speculative vehicles and as risk management tools. Financial derivatives have become increasingly popular and most commonly used in the world of finance. The rate of growth of derivatives is so phenomenal all over the world that now it is called as the derivatives revolution. According to an estimate recorded in the NSE Fact Book, the present annual
trading volume of derivative market has reached ₹ 3,13,49,731.74 Cr for the year 2011-12.

CONCEPT OF DERIVATIVES

Derivatives are financial instruments, which derive their value from the value of an underlying asset. This implies that Derivative instruments have no independent value. The underlying asset in the derivatives contract can be securities, commodities, bullion, currency, livestock or anything else.

As per the Securities Contracts (Regulation) Act 1956, “Derivative” includes

1. Security derived from a debt instrument, share, loan whether secured or unsecured, risk instrument or Contract for differences or any other form of security.

2. A contract, which derives its value from the prices, or index of prices of underlying securities.

CHARACTERISTICS OF DERIVATIVES

1. The derivatives instrument relates to the future contract between two parties. It means there must be a contract binding on the underlying parties and the same to be fulfilled in future. The future period may be short or long depending upon the nature of contract.

2. Normally, the derivative instruments have the value, which is derived from the values of underlying assets, such as agricultural commodities, metal, financial assets, intangible assets, etc. Value of derivatives changes according to the changes in the value of underlying instruments. Sometimes, it may be nil or zero, but never less than zero.
3. Generally, counter parties have specified obligation under derivative contract. Obviously, the nature of obligation would be different as per the type of instrument of a derivative. For example, the obligation of the counter parties, under forwards, futures contracts are different from the obligations in options contracts.

4. The derivatives contract can be undertaken directly between two parties or through a particular exchange like financial future contracts. The exchange-traded derivatives such as Futures and Options are quite liquid and have low transaction costs in comparison to the tailor made contracts like Forwards.

5. In general, the financial derivatives are carried off-balance sheet. The size of derivative contract depends upon its notional amount. The notional amount is the amount used to calculate payoff.

6. In derivatives trading, transactions are mostly settled by taking offsetting position in the derivatives themselves.

7. Derivatives are also known as deferred delivery and deferred payment instruments. It means that it is easier to take short or long position in derivatives in comparison to other assets or securities. Further, it is possible to combine them to match specific requirements, i.e., they are more easily amenable to financial engineering.

8. Derivatives are mostly secondary market instruments and have little usefulness in mobilizing fresh capital by the corporate world. However, warrants and convertibles are exception in this respect.

9. Although in the market, the standardized, general and exchange-traded derivatives are being increasingly evolved, still there are so many
privately negotiated, customized and Over The Counter (OTC) traded derivatives in existence. They expose the trading parties to operational risk, counter-party risk and legal risk. Further, there may also be uncertainty about the regularity status of such derivatives.

10. The derivative instruments, sometimes, because of their off-balance sheet nature, can be used to clear up the balance sheet. For example, a fund manager who is restricted from taking particular currency can buy a structured note whose coupon is tied to the performance of a particular currency pair.

ECONOMIC GROWTH AND VOLATILITY OF STOCK MARKET

Stock Market Index is considered as the barometer of a country’s economic progress. If the Index is rising and does not experience many ups and downs, it attracts huge investments from the domestic and foreign investors. On the other hand, high volatility in Stock Index acts as a barrier for economic progress because it discourages investment in stock market instruments. Derivatives are innovative financial instruments, which facilitates the investors to invest in stock market instruments, which have high return potential, and at the same time hedge against the volatility in the prices of such instruments. However, the primary objective of Derivative products is to manage/control/reduce volatility in the stock market and thereby improves the activity in the stock market transactions. In fact, ‘Derivatives’ are considered as the most important pillar for the economic growth, the other three pillars being stock market, banking and insurance sectors.
ORIGIN OF FINANCIAL DERIVATIVES IN INDIA

Derivatives markets in India have been in existence in one form or the other for a long time. In the area of commodities, the Bombay Cotton Trade Association started futures trading back in 1875. In 1952, the Government of India banned cash settlement and options trading. Derivatives trading shifted to informal forwards markets. In recent years, government policy has shifted in favour of an increased role of market-based pricing and less suspicious derivatives trading. The first step towards introduction of financial derivatives trading in India was the promulgation of the Securities Laws (Amendment) Ordinance, 1995. It provided for withdrawal of prohibition on options in securities. The last decade, beginning the year 2000, saw lifting of ban on futures trading in many commodities. Around the same period, National Electronic Commodity Exchanges were also set up. Financial Derivatives trading commenced in India in June 2000 after SEBI granted the final approval to this effect in May 2001 on the recommendation of L. C Gupta committee. Securities and Exchange Board of India (SEBI) permitted the derivative segments of two stock exchanges, NSE and BSE and their clearing house/corporation to commence trading and settlement in approved derivative contracts. Initially, SEBI approved trading in Index Futures contracts based on various stock market indices such as, S&P CNX, Nifty and Sensex. Subsequently, index-based trading was permitted in Options as well as individual securities. The trading in BSE Sensex Options commenced on June 4, 2001 and the trading in Options on individual securities commenced in July 2001. Futures contracts on individual stocks were launched in November 2001. The derivatives trading on NSE commenced with S&P CNX Nifty Index Futures on 12th June 2000. The trading
in Index Options commenced on 4th June 2001 and trading in Options on individual securities commenced on 2nd July 2001. Single Stock Futures were launched on 9th November 2001. The Index Futures and Options contract on NSE are based on S&P CNX. At the present Futures and options in Stocks are permitted in 143 stocks belonging to 13 industrial sectors as on June 2013.

**ECONOMIC FUNCTIONS OF THE DERIVATIVE MARKET**

The derivatives market performs a number of economic functions. Some of them are as follows:

1. Prices in an organized derivatives market reflect the perception of the market participants about the future and lead the prices of underlying to the perceived future level. The prices of derivatives converge with the prices of the underlying at the expiration of the derivative contract. Thus, derivatives help in discovery of future as well as current prices.

2. The derivatives market helps to transfer risks from those who have them but do not like them to those who have an appetite for them.

3. Derivatives, due to their inherent nature, are linked to the underlying cash markets. With the introduction of derivatives, the underlying market witnesses higher trading volumes. This is because of participation by more players who would not otherwise participate for lack of an arrangement to transfer risk.

4. Speculative trades shift to a more controlled environment in derivatives market. In the absence of an organized derivatives market, speculators trade in the underlying cash markets. Margining, monitoring and surveillance of the activities of various participants become extremely difficult in these kinds of mixed markets.
5. An important incidental benefit that flows from derivatives trading is that it acts as a catalyst for new entrepreneurial activity. The derivatives have a history of attracting many bright, creative, well-educated people with an entrepreneurial attitude. They often energize others to create new businesses, new products and new employment opportunities, the benefit of which are immense.

**TYPES OF DERIVATIVES**

Broadly, Derivatives can be classified in to two categories Commodity Derivatives and Financial Derivatives. In case of commodity derivatives, underlying asset can be a commodity like wheat, gold, silver, crude oil, gas etc., whereas in case of financial derivatives underlying assets are stocks, currencies, bonds and other interest rate bearing securities etc. Another way of classifying the financial derivatives is into basic and complex derivatives. In this, Forward contracts, Future contracts and Option contracts have been included in the basic derivatives whereas Swaps and other Derivatives are categorised as complex because they are built up from either Forward/Futures or Options contracts or both. In fact, such derivatives are effectively derivatives on derivatives. (Hybrid derivatives). The features of those Derivatives instruments are briefly presented here.

**FORWARD**: A forward contract is an agreement between two parties to buy or sell an asset at a specified point of time in the future. In case of a forward contract the price which is paid/ received by the parties is decided at the time of entering into contract. It is the simplest form of derivative contract mostly entered by individuals in day-to-day life. Forward contract is a cash market transaction in which delivery of the instrument is deferred until the contract has been made.
Although the delivery is made in the future, the price is determined on the initial trade date. One of the parties to a forward contract assumes a long position (buyer) and agrees to buy the underlying asset at a certain future date for a certain price. The other party to the contract known as seller assumes a short position and agrees to sell the asset on the same date for the same price. The specified price is referred to as the delivery price. The contract terms like delivery price and quantity are mutually agreed upon by the parties to the contract.

**FUTURES:** Futures is a standardized Forward contact to buy (long) or sell (short) the underlying asset at a specified price at a specified future date through a specified exchange. In the Futures, contracts the exchanges will act as a buyer as well as seller. Exchange sets the standards for quality, quantity, price quotation, date and delivery place (in case of commodity). Futures contracts being traded on organized exchanges impart high liquidity to the transaction. The clearing house, being the counter party to both sides of a transaction, provides a mechanism that guarantees the honouring of the contract and ensuring very low level of default.

**OPTIONS:** In case of Futures contact, both parties are under obligation to perform their respective obligations out of a contract. But in an options contract, as the name suggests, is in some sense, an optional contract. An option is the right, but not the obligation, to buy or sell something at a stated date at a stated price. A “call option” gives the holder the right to buy; a “put option” gives the holder the right to sell. Options are the standardized financial contract that allows the buyer (holder) of the option, i.e. the right at the cost of option premium, not the obligation, to buy (call options) or sell (put options) a specified asset at a set price on or before a specified date through exchanges. Options contracts are of
two types: *call* options and *put* options. Apart from this, options can also be classified as OTC (Over the Counter) options and exchange traded options. In case of exchange traded options contract, contracts are standardized and traded on recognized exchanges, whereas OTC options are customized contracts traded privately between the parties. A call option gives the holder (buyer/one who is long call), the right to buy specified quantity of the underlying asset at the strike price on or before expiration date. The seller (one who is short call) however, has the obligation to sell the underlying asset if the buyer of the call option decides to exercise his option to buy.

**SWAPS:** A Swap can be defined as a barter or exchange. It is a contract whereby parties agree to exchange obligations that each of them have under their respective underlying contracts or we can say, a swap is an agreement between two or more parties to exchange stream of cash flows over a period of time in the future. The parties that agree to the swap are known as counter parties. The two commonly used swaps are: i) *Interest rate swaps* which entail swapping only the interest related cash flows between the parties in the same currency, and ii) *Currency swaps:* These entail swapping both principal and interest between the parties, with the cash flows in one direction being in a different currency than the cash flows in the opposite direction.

**WARRANTS:** Warrants and Convertibles are other important categories of financial derivatives, which are frequently traded in the market. Warrants is just like an option contract where the holder has the right to buy the shares of a specified company at a certain price during the given time period. In other words, the holder of a warrant instrument has the right to purchase a specific number of shares at a fixed price in a fixed period from an issuing company. If the holder
exercised the right, it increases the number of shares of the issuing company, and thus, dilutes the equities of its shareholder. Warrants are usually issued as sweeteners attached to senior securities like bonds and debentures so that they are successful in their equity issues in terms of volume and price. Warrants can be detached and traded separately. Warrants are highly speculative and leverage instruments, so trading in them must be done cautiously.

CONVERTIBLES: Convertibles are hybrid securities, which combine the basic attributes of fixed interest, and variable return securities. Most popular among these convertible bonds, convertible debentures and convertible preference shares. These are also called equity derivatives securities. They can be fully or partially converted into the equity shares of the issuing company at the predetermined specified terms with regards to the conversion period, conversion ratio and conversion price.

PARTICIPANTS IN A DERIVATIVE MARKET

The derivatives market is similar to any other financial market and has following three broad categories of participants:

**Hedgers:** These are investors with a present or anticipated exposure to the underlying asset which is subject to price risks. Hedgers use the derivatives markets primarily for price risk management of assets and portfolios.

**Speculators:** These are individuals who take a view on the future direction of the markets. They take a view whether prices would rise or fall in future and accordingly buy or sell futures and options to try and make a profit from the future price movements of the underlying asset.
**Arbitrageurs:** They take positions in financial markets to earn riskless profits. The arbitrageurs take short and long positions in the same or different contracts at the same time to create a position, which can generate a riskless profit.

**PRESENT STUDY:**

The present study is undertaken to assess the impact of financial derivatives on stock market volatility with special reference to the Financial Derivatives in National Stock Exchange. A brief review of past research studies in this area is presented below before stating the need, objectives and methodology of the present study.

**REVIEW OF LITERATURE**

Black\(^1\) (1975) in his paper discussed the possible need for different volatilities for options with different remaining time to expiration. If the volatility has been unusually high lately, a gradual decline back to more normal levels may be expected. The reverse may be expected in periods of unusually low volatility. This mean reversion in volatility levels might therefore explain some of the term structure patterns in implied volatility detected in other studies.

Cox\(^2\) (1976) asserts that the introduction of derivatives market causes a stabilising influence on the underlying market because of the speed at which information is incorporated into the prices as well as the amount of information reflected in expected prices. This event would be mainly because derivative markets attract an additional set of traders to the market and because these markets, which have lower transaction costs, transmit the new information to the spot market more quickly. It provides circumstances, which are more favourable to entering the financial markets, and therefore the dispersal of the risk is improved.
Macbeth and Mervilli\textsuperscript{3} (1979) have analyzed that the market prices of equity call options written on six different stocks and compared these to the prices predicted by using the Black-Scholes model. The implied volatility was found to be different across moneyness and time to expiration. For all options, there was a tendency for the implied volatility to decrease as the option became less in-the-money. The time to expiration relationship, however, depends on the moneyness of the calls. For example, in-the-money options with a short remaining time to expiration tend to have higher implied volatilities than corresponding options with a longer time to expiration. For out-of-the-money options, the relationship is reversed.

Whiteside, Dukes and Dunne\textsuperscript{4} (1983) have examined the short-term impact of option trading on underlying securities before and after the 3-year moratorium lasted from mid-1977 until early 1980 that was called by Securities Exchange Commission (SEC) to investigate the market implications of option trading. They did not find any clear evidence of impact of option trading on the volatility of underlying security or average daily trading volumes. However, when the results are evaluated by the year of trading, post-moratorium period witnessed a trend towards decreased variability in the number of shares traded daily.

Rubinstein\textsuperscript{5} (1985) has examined in his paper any systematic deviations in the volatility smile. Using all reported trades and bid-ask quotes on the 30 most liquid CBOE option classes from August 1976 to August 1978, he conducted a non-parametric test for the null hypothesis that implied volatilities computed from the Black-Scholes formulae exhibit no systematic differences across strike prices or across time to maturity for otherwise identical options. The result of his
The study was that for out-of-the-money call options implied volatility was systematically higher for options with shorter time to maturity. His other results were statistically significant but changed across sub-periods. Samples were divided into two sub-periods: Period I from August 23, 1976 to October 21, 1977, and Period II from October 24, 1977 to August 31, 1978. For at-the-money calls, he found that period I implied volatilities for options with short time to maturity are higher than for those with longer time to maturity, while the opposite result is true in Period II. Furthermore, Period I implied volatilities are higher for options with lower striking prices, but again, the result is reversed in Period II. Thus, study concludes that systematic deviation from the Black-Scholes model appears to exist, but the pattern of deviations varies over time.

Edwards (1988) has studied that whether Stock Index Futures trading destabilised the spot market in the long run. Using variance ratio F tests for the period June 1973 to May 1987, he concluded that the introduction of futures trading did not induce a change in spot volatility in the long run.

Anthony (1988) empirically investigates the relation between common stock and call option trading volumes using Granger-Newbold Causality test and Multivariate Causality tests. The study concludes that option-trading volume “leads” stock volume with a one-day lag. However, the results support the dependence between the two series though the leading role for option volume was less strongly supported, i.e. 48 per cent of cases based on both the tests.

Vijh (1988) has examined the potential biases from trade prices and concludes that more trades in the option market occur at ask than at bid. He observes that it may lead to option trade prices to be upward biased estimates of the corresponding true prices. He, further, adds that this bias and non-
synchronous trading may create an impression that option prices contain information not reflected in the contemporaneous stock prices even during times when the two prices are in equilibrium.

Detemple and Jorion\(^9\) (1990) have observed that an option written on a stock cannot be replicated by a trading strategy in the stock and bonds as it expands the opportunity set of investors by enabling them to achieve payoff patterns that could not be achieved in its absence. They note that the introduction of option market increases the speed at which information is released to the market because investors with private information prefer to take position in option market as against the stock market. Therefore, the introduction of options has price effects, volatility effects, cross effects, announcement effects and persistence effects on the market for underlying shares. For the first time, they investigated the impact of delisting of options and found it to be just reverse of the listing effect.

Sheik\(^10\) (1991) has found that the characteristics of the observed biases are apparently different from the biases reported upon option prices on an individual stock. They suggest that the observed biases correspond to biases that arise if option market prices incorporate a stochastically changing volatility of the underlying index. Furthermore, in two of the three sub-periods in his sample, the implied volatilities with different strike prices but same time to maturity exhibit a U-Shaped pattern, which is often characterized as a ‘smile pattern’.

Damodaran and Lim\(^11\) (1991) in their paper have investigated the potential explanation for the observed variance decline after listing of option contracts. They conclude that option listing does not lead to shift in intrinsic variance rather it expedites the price adjustment process. It also leads to decline
in the noise term that can be attributed to decline in either bid-ask spread (as market makers face more competition) or in noise in the information process as institutional activity increases in optioned stocks. However, they were unable to find the relation of trading volume with the event of option listing.

Heynen\textsuperscript{12} (1993) have examined the implied volatility patterns for European Options Exchange (EOE) stock index call options, which were European style options on an index of 25 active stocks on the Amsterdam Stock Exchange. Using Rubinstein’s (1985) non-parametric approach and transactions data from January 23 to October 31, 1989, it result was shown that implied volatility patterns are significantly U-shaped. He reviewed the predictions of various stochastic volatility models and found the observed smile pattern to be inconsistent with them, and suggests an alternative explanation for the volatility smile, based on market imperfections.

Douglas Foster and Viswanathan\textsuperscript{13} (1993) have examined in their paper that the empirical behaviour of stock market trading volume, trading costs, and price change for New York Stock Exchange data from 1988, with the help of Ordinary Least Square Method. The Intraday test results indicate that, for actively traded firms trading volume, adverse selection costs, and return volatility are higher in the first half-hour of the day. This evidence is inconsistent with the Admati and Pfleiderer (1988) model, which predicts that trading costs are low when volume and return volatility are high. Intraday test results showed that, for actively traded firms, trading volume is low and adverse selection costs are high on Monday, which is consistent with the predictions of the Foster and Viswanathan (1990) model. The result indicates that existing theoretical models based on the adverse selection faced by the market maker are broadly consistent
with observed patterns in the volume-volatility relation. That is, intraday trading volume is high when returns are most volatile.

Duque and Paxson\textsuperscript{14} (1994) examined the smile using the most actively traded equity call options on LIFFE in London. A European model is used to find the implied volatility after excluding options with possible early exercise. They indirectly analysed whether simple and complex hedging could successfully arbitrage the smile and the apparent pattern of Black-Scholes implied volatilities arise, in part, since the conventional model ignores stochastic volatility. The study evidences smile pattern and relatively high implied volatility for in-the-money options, but there is also a “wry grin” (the implied volatilities for in-the-money options are smaller than for out-of-the-money options) or “reverse grin” (in-the-money volatilities are higher than for out-of-the-money options). Different trading strategies based on the relative implied volatilities are then tested as pseudo arbitrage of the smile. However, after transaction costs, most abnormal returns are eliminated.

Hong Choi and Subrahmanyam\textsuperscript{15} (1994) using the intra-day data of US Major Market Index futures for a year period before and after introduction of index futures and investigated both volatility and liquidity of the underlying cash market. They indicate that post index futures have an increase in the average intraday bid-ask spread but no significant change in the volatility. Finding on asymmetric information in the market resulted in an increase after the futures introduction. Whereas volume undoubtedly increased and has shown a rise in the trading activity of the markets after the introduction of index futures.

Antonio and Holms\textsuperscript{16}(1995) conducted study to ascertain that the introduction of derivatives reduces volatility in cash market since speculations
are expected to migrate to derivative market and find that the introduction of the
index futures resulted in increased level of volatility in the short run, but no
significant impact is found in the long run. For this they investigated the impact
of trading in the FISE-100 index futures contract suggest there has been an
impact on spot price volatility. In particular, the variance of price changes pre-
futures was integrated, suggesting shocks (i.e. items of news) have a permanent
effect on price changes, whereas the post-futures sample is stationary. The results
suggest that futures trading improves the quality and speed of information
flowing to spot markets.

Tina. M. Galloay and James M. Miller17 (1997) investigated the index
futures trading and stock return volatility of Midcap 400 index futures. This study
presented new evidence on the relation between index futures trading and
volatility in the equity market using the S&P Midcap 400 stock index and Midcap
400 index futures. Daily data and trading volume data were obtained from
separate period such as pre index period that is before June 1991, interim period
which includes 175 trading after June 5th 1991 but before February 13th 1992
and post futures which includes after February 13th 1992. To determine changes
in return volatility, Skinners methodology was employed. The analysis indicated
that the documented decrease in return volatility for the Midcap 400 stocks is
simply a reflection of a decrease in return volatility that affected all medium
capitalization stocks.

G. Geoffrey Booth, John Paul Broussard, Teppo Martikainen and
Vesa Puttonen18 (1997) made a study on prudent margin levels in the Finnish
stock index futures market. The purpose of this study was to examine the
behaviour of Finland’s stock index futures intraday and daily price movement
and to incorporate the observed external price behaviour in an assessment of the Finnish futures markets current initial and variation margin setting practices. Sample period of the study began on 2\textsuperscript{nd} May 1988 and ended on December 5\textsuperscript{th} 1994. Two different types of intraday futures return such as minimal returns and the minimal and maximal returns within a day irrespective of the closing price were constructed. Empirical result of estimating equations and minimal and maximal return indicated a close coherence between actual and fitted observations.

**Roger Craine\textsuperscript{19} (1997)** valued the futures market performance Guarantees. This study derived the market value of the futures market performance guarantee and presented estimates of the value of the exchanges exposure on the nearby S&P 500 contract during October 1987 market crash. This paper employed the econometrics model to assess whether the probability is economically important or not. It was illustrated the valuation technique by estimating the value of the exchanges performance guarantee on the nearby contracts on December S&P 500 futures contracts in October 1987. Black’s option pricing formula was applied for call option valuation. The result showed that the implied variances from the November option, although high by historical standards are an order of magnitude smaller than the G-K estimates.

**Galloway and Miller\textsuperscript{20} (1997)** explored the relation between index futures trading and volatility in equity market using the S&P MidCap 400 stock index and Mid Cap 400 index futures. Daily return and trading volume data were obtained for 398 stocks from the CRSP database for three separate periods. The first i.e. pre-index period includes 250 trading days before June 5, 1991. This period precedes both the existence of Mid Cap index and the trading of Mid Cap
futures. The second, or interim, period includes 175 trading days after June 5, 1991 till February 13, 1992. The study documents a significant decrease in return volatility and systematic risk, and a significant increase in trading volume for the Mid Cap 400 stocks after the introduction of Mid Cap Index. A control sample of medium-capitalization stocks, however, exhibits similar contemporaneous changes in these measures. The Mid Cap stocks and control stocks also experienced a significant decrease in volatility and an increase in volume after the introduction of Mid Cap 400 index futures. Consequently, the study confirms that there is no significant relationship between futures trading and volatility in the stock market. Finally, a new puzzle emerged concerning why there are market-wide changes in risk and liquidity. Prior studies document that aggregate stock market volatility varies over time and the variation is related to a variety of economic variables.

**Maurice and Michael**\(^{21}\) (1997) investigated the introduction of single-stock futures on return, volatility and the microstructure of the underlying securities. And to examine this derivative type they took two theoretical standpoints one towards completion and stabilisation and other destabilisation of the market. Their study considers all the listed single stock futures in Sydney Futures exchange for the period before and after listing. The enquiry into the behaviour of volume after introduction resulted in increase of mean trading volume in the underlying market signifying stabilisation. However, their enquiry into the underlying volatility does not supported completion of market, as they find no significant change in the level of returns and an increase in underlying volatility. Hence, they concluded a week destabilisation effect of introduction.
Kee-Kong Bae, Kalok Chan and Yan-Leung Cheung (1998) investigated the profitability and arbitrage by dividing the analysis into three parts in which first part revealed arbitrage profitability, the second part was examined arbitrage profitability based on quotations information and in third part transaction prices were used. This study obtained data from Hong Kong Futures Exchange for Hang Sang futures index and option contracts for the sample period from 1st October 1993 to 30th June 1994. The authors compared the results to examine the effectiveness of the approach that evaluated arbitrage opportunity based on transaction price and it takes into account the impact of bid-ask cost through estimated spread. Results showed that the frequency of mispricing opportunities varies across different approaches in a pattern similar to before the percentage violation are the highest for transaction prices, lower for feasible transaction prices and the lowest for bid-ask quotations.

Abhay and Abhyankar (1998) made an investigation on linear and non-linear Granger Causality. The main purpose of this study was to tie together of Dwyer, Locke and Yu (1996) and explore further the nature of the non-linear causal relationship between the index futures and the cash market in U.K. Back and Brock test, Granger Causality test and ARMA model were used in its empirical analysis as tools to reveal the objectives. The data set consisted of intraday price histories for four FTSE 100 index futures contracts maturing in March 92, June 92, Sept 92 and the FTSE 100 index recorded minutes by minutes during 1992. The FTSE cash index series exhibited high positive autocorrelation at the first lag in each period with statistically significant positive autocorrelation up to lag 6 during some futures contracts periods. The results of the linear Granger Causality test based on the multivariate regression index using both raw
and AR filtered cash index return indicated that a high degree of contemporaneous correlation between the cash and futures contracts.

Jacobs and Onochie\textsuperscript{24} (1998) revealed that there is a positive relationship between trading volume and price volatility, by measuring the price changes in conditional heteroskedasticity in international financial futures markets by applying bivariate GARCH(1,1). The underlying products are interest rate assets representing investments in various international money and bond markets of Sterling, Eurodollar, U.S. Treasury bond, German Government bond (Bund), 3-month European Currency Unit (ECU), and the Euro mark. The result suggests that there is a strong evidence of second-order dependence in the joint return and trading volume process for various international financial futures markets and the level of trading volume positively influences the conditional variance of futures price change. It also inferred that the issue of time varying volatility is of importance to option pricing. The implication of these findings that futures price changes and volume are not only jointly distributed, but also influences price volatility, can guide theorists and practitioners alike in re-thinking the pricing relationships for financial futures.

Joshua Turkinton and David Walsh\textsuperscript{25} (1999) made an investigation on price discovery and causality in the Australian share price index futures markets. This study aimed to address the extend and timing of lead lag relationship between share price index futures and the underlying spot index. The sample period of the study ran from 3rd January 1995 to 21st December 1995 where the sample was drawn every 5 minutes. Simple Cost and Carry method, Co-integration test, ARMA model and simple Granger Causality test were employed for the analysis of the study. The causality tests results indicated that bi-
directional causality among the variables and authors found that an index shop appears to induce a very large response in the futures.

Cao\textsuperscript{26} (1999) studies the effect of derivative assets on information acquisition and price behaviour in a rational expectation equilibrium. Firstly, his results show that introduction of options performs market completion function, however, additional new option trading will have less effect on the price of underlying asset. Secondly, he concludes that introduction of derivatives reduces price volatility as price becomes a less biased estimate of the asset payoff due to more information collection. Thirdly, the informational content of future earnings announcements decreases after the introduction of option trading as information collection is more intensive before public announcement. This can be proved from the fact that there is an increase in the number of analysts covering the stock and rise in institutional holding after the listing of options. Finally, as regards the volume effect of options, he cautioned that the effect on trading volume in underlying asset market would depend upon the kind of derivative asset introduced in the market. He expects the liquidity of underlying asset to increase after the commencement of option trading.

Gulen and Mayhew\textsuperscript{27} (2000) examine stock market volatility before and after the introduction of index futures trading in twenty-five countries, using various GARCH models augmented with either additive or multiplicative dummy. Their statistical model takes care of asynchronous data, conditional heteroskedasticity, asymmetric volatility responses, and the joint dynamics of each country’s index with the world market portfolio. They found that futures trading is related to an increase in conditional volatility in the U.S. and Japan, but in nearly every other country, no significant effect could be found.
Joel Hasbrouck\textsuperscript{28} (2001) studied on intraday price formation in US equity index markets. This study empirically investigated in the price discovery of US equity index market in the new environment where the mirror of index with exchange traded funds, electronically traded markets, small denomination futures contracts and a family of sector ETF that break the index into nine components. This paper assessed the importance of the step by step development of US equity markets by considering the NASDAQ 100 index, EFT futures contracts and S&P 500 index as the sample for the analysis. Co-integration, Vector Error Correction Model and VAR Models result suggested that for the S&P 500 and NASDAQ 100 index, price discovery was dominated by futures trading. The S&P 500 sector funds were EFTs that were constructed on industry lines and could be used to replicate the overall index.

Isakov and Morard\textsuperscript{29} (2001) in their paper have investigated the performance of option strategies especially covered call strategy on Swiss exchange during 1989-1996. The authors have used stochastic dominance and modified beta approaches rather than mean-variance model to compare the performance of portfolio because in their opinion mean-variance framework is not appropriate to assess the relative performance of portfolios, as return distribution of portfolios including options are not normal. They concluded that the use of option strategies consistently increase the performance of stock portfolios even in the presence of transaction cost.

Gong-meng Chen, Michael Firth and Oliver Rui\textsuperscript{30} (2001) have examined the dynamic relationship between returns, volume, and volatility for major nine national stock indexes for the period from 1973 to 2000. They evaluated with the help of quadratic time trend method, Augmented Dickey
Fuller test, Regression the daily trading volume on stock returns and absolute returns, Vector Auto regression (VAR) and EGARCH techniques were used to examine the returns, trading volume, conditional volatility relation. The results show a positive correlation between trading volume and absolute value of stock price change. Granger Causality tests demonstrated that for some countries, returns cause volume and volume causes returns. The findings indicate that trading volume contributes some information to the returns process and more can be learned about the stock market through studying the joint dynamics of stock prices and trading volume than by focusing only on the univariate dynamics of stock prices. The results of the study were found robust across all nine major stock markets, implying that there are similar returns, trading volume, and volatility patterns across all markets under study.

Toshiaki Watanabe\textsuperscript{31} (2001) examined the relation between price volatility, trading volume and open interest for Nikkei 225 stock index futures traded on the Osaka Securities Exchange (OSE) by employing the method developed by Bessembinder and Seguin (1993) for the sample period extended from 24\textsuperscript{th} August 1990 to 30th December 1997. The reason for investigating the Nikkei 225 futures traded on the OSE was that the OSE changed regulation such as margin requirements, price range and time interval in updating quotation several times. The authors felt interesting to examine whether changes in regulation may influence the effects of volume on volatility. Therefore, the samples prior to and beginning 14 February 1994 were analyzed separately. However, no relation between price volatility, volume and open interest was found for the period prior to 14 February 1994, when the regulation increased
gradually. This result provides evidence that the relation between price volatility, volume and open interest may vary with the regulation.

**Bhanupant** (2001) investigated the dynamic relationship between stock index returns and trading volume using the Augmented Dickey-Fuller (ADF), Linear and Non-Linear Granger Causality hypothesis test on the National Stock Exchange (NSE) data 1 January 1996 to 6 August 2002 with a total of 1649 data points. Linear Granger Causality test was used to investigate the linear relationship while the Non-Linear Granger causality was investigated using modified Baek and Brock test proposed by Hiemstra and Jones (1994) for the daily returns on S&P CNX Nifty and the total trading volume at NSE. Bidirectional linear Granger causality between index returns and volume change was observed for the period when rolling settlement was either not introduced or partially introduced. The period, when rolling settlement was introduced, there found no evidence of linear causality in either direction. The shift in linear causal relationship indicates that efficiency at NSE has improved with introduction of rolling settlement mechanism. Nonlinear Granger causality between the returns and volume change was not evident in either direction.

**McKenzie, Brailsford and Faff** (2001) have studied impact of single stock futures for existing stock futures of Sydney Futures Exchange for a period of Jan 1990 to June 1998. In order to verify conditional and unconditional volatility of deriving stocks they employed T-GARCH method of estimation for a mean market model. Their study found evidence of a reduction in the underlying stocks’ unconditional volatility and some evidence, which is no consistent across all stocks for asymmetric response.
Pilar and Rafael\textsuperscript{34} (2002), examined the effect of introduction of derivatives on the volatility and trading volume of underlying Ibex-35 index by using GJR model and result that trading volume increased significantly but conditional volatility decreased after introduction of derivatives.

Najand Mohammad\textsuperscript{35} (2002) examined the relative ability of various models to forecast daily stock index futures volatility for S&P 500 futures index between January 1983 and December 1996 with a continuous sequence of 3561 observations are gathered over fourteen year period. He estimated the models using 3500 and 3380 observations and saving the last 60 and 180 observations for out-of-sample forecasting comparisons between models. The linear and non linear models employed for the study are Random Walk, AR model, MA model, Single Exponential Smoothing models, Double (Holt) Exponential Smoothing models, GARCH - M, EGARCH and ESTAR models. Their findings suggest autoregressive (AR) model is a more appropriate model under RMSE and MAPE criteria. In non-linear model, GARCH and ESTAR model fitting were more appropriate than linear models by using RMSE and MAPE error statistics. Finally, EGARCH appeared to be the best model for forecasting stock index futures price volatility.

Pandey Ajay\textsuperscript{36} (2002) reported the empirical performance of various unconditional volatility estimators and conditional volatility models by using S&P CNX Nifty, India. The data set on S&P CNX Nifty for the period 1\textsuperscript{st} January 1996 to 31\textsuperscript{st} December 2001 were considered by using different class of models. In order to test the ability of models estimated to forecast volatility, he compared the unconditional estimators with the realized volatility measure. For conditional volatility models, the forecasts for the same periods are obtained by
estimating models from the time-series prior to the forecast period. The results indicate, that the conditional volatility models provide less biased estimates, extreme-value estimators are more efficient estimators of realized volatility. As far as forecasting ability of models is concerned, conditional volatility models fare extremely poorly in forecasting five-day (weekly) or monthly realized volatility. In contrast, extreme value estimators, other than the Parkinson estimator, perform relatively well in forecasting volatility over these horizons.

Varma\textsuperscript{37} (2002) examined the mispricing of volatility in the Indian index options market using closing Nifty futures and options prices from June 2001 to February 2002. First, the study examined whether the market prices can be explained by the sophisticated benchmark - the smile adjusted GARCH volatility Black model. This study fits a smile and examines whether the observed smile is reasonable, rather than imposing a priori notion of what the smile should be. Specifically, he employs the Black formula to calculate the implied volatility for each option each day, and then fits a volatility smile to these implied volatilities. Next, he uses the Breeden-Litzenberger formula to compute the implied probability distribution for the terminal stock index price from the fitted smile. The implied probability distribution is then compared to theoretical models and to the historical distribution to determine whether the observed smile is a reasonable one. He proceeds to investigate how well the naïve model and its more realistic variants perform in explaining the observed market prices. The result suggests that the Indian market stands almost exactly half way between a naive market where the pricing completely ignores the downside protection provided by options and a mature market where the pricing reflects a reasonable theoretical model of the value of the downside protection.
Nath Golaka C\textsuperscript{38} (2003), his paper on “Behaviour of Stock Market Volatility after Derivatives”, examined the behaviour of volatility in equity market in pre and post derivatives period in India using static and conditional variance. he reproduced conditional volatility using 4 different method: GARCH(1,1), IGARCH with $l = 0.94$, one year rolling window of standard deviation and a 6 month rolling standard deviation. He has considered 20 stocks randomly from the NIFTY and Junior NIFTY basket as well as benchmark indices itself. He also used static point volatility analysis dividing the period under study among various time buckets and justified the creation of such time buckets. It observed that for most of the stocks, the volatility had come down in the post derivative period while for only few stocks in the sample, the volatility in the post derivatives has either stayed more or less same or has increased marginally. All these methods advised that the volatility of the market as measured by benchmark indices like S&P CNX NIFTY and S&P CNX NIFTY JUNIOR have fallen after in the post derivatives period.

Syed Abuzar Moonis and Ajay Shah\textsuperscript{39} (2003) tested time-variation in Beta in India. There are two approaches on time variation beta such as kalman filter model and bivariate GARCH model in this study. The data sets of the study contained daily return on the BSE for 50 highly liquid stocks and the NSE50 index for the period from 1st May 1996 to 30th March 2000. To measure the improvement on fit over the conventional OLS beta market model, they used two measures, the coefficients of determination and the variances of the errors. The empirical results showed a tendency for beta to be mean reverting and showed little evidence of beta as a random walk process.
Snehal and Saurabh (2003) examined the volatility effects on Indian spot market in line with Bologna and Cavallo (2002) GARCH Methodology using daily data of both BSE Sensex and S&P CNX Nifty having BSE-200 and Nifty Junior as proxy to capture market wide changes. The study predicts that there is change in the underlying market since year 2000 reflected by the reduction in volatility in all the examined indices. However, they concluded that as BSE have rare volumes in the derivative segment, the reduction of volatility can be attributed only to S&P CNX Nifty futures and same as vague for BSE.

Rahman (2004), explored the impact of trading in DJIA Index future & future option on the conditional volatility of component stock by using GARCH model to make comparison of conditional volatility of intra-day return before and after introduction of derivatives. The result showed that introduction of index future & future option on DJIA has no impact on conditional volatility of component stock.

Premalatha Shenbagaraman (2004) made research on the topic do futures and option trading increase stock market volatility with the objective to assess the impact of introducing index futures and option contracts on the volatility of the underlying stock index in India. Daily closing prices for the period October 1995 to December 2002 for the CNX Nifty, Nifty Junior, Nifty futures contract volume and open interest were taken from NSE website. The authors used GARCH model, EGARCH model of Nelson (1991), the GARCH mode with t. distribution and GJR-GARCH Model of Glosten. The empirical results of the study revealed that derivatives introduction had no significant impact on spot market volatility.
Robbani and Bhuyan\textsuperscript{43} (2005), used the GARCH model to examine the effect of introduction of future & option on the DJIA on the volatility & trading volume of its underlying stocks and found that level of volatility and trading volume increased after introduction of future & option on the index.

Karmakar\textsuperscript{44} (2005) estimated the conditional volatility models in an effort to capture the stock market volatility in India by employing GARCH (1,1) models by suing three sets of data. The first 2 sets comprised of S & P CNX Nifty and BSE Sensex for the period from 2nd January, 1991 to 10th June 2003. The third set comprised of daily closing prices of 50 underlying individual companies from June 1994 to October 2002. To evaluate the models in terms of out-of-sample forecast accuracy by Mean Error, Mean Absolute Error, Mean Absolute Percentage Error and Root Mean Square error are investigated whether there is any leverage effect in Indian companies. It is observed that the GARCH (1,1) model provides reasonably good forecasts of market volatility. The findings suggest, the movement in stock market return volatility is not explained by the fundamental economic factors, but also the presence of ‘fade’ due to the actions of noise traders in the market might be associated with these immeasurable elements of stock price volatility. However, the initial boost up of share prices and the resultant fluctuation were believed to be due to fundamental economic factors of the period which were supplemented by a number of liberalization policies and procedures of the government. Finally, the real cause of excessive movement was attributed to the irrational behaviour of the market speculators and frenzy investors who drove the price away from fundamental level resulting in fads or bubble as the natural outcome of the price formation process.
Ash Narayan Sah and G. Omkarnath\textsuperscript{45} (2005) made a study on derivatives trading and volatility of Indian stock market. This study tried to understand whether the Indian stock markets show some significant changes in the volatility after the introduction of derivatives trading and also examined whether decline or rise in volatility can be attributed to introduction of derivatives alone or due to some macro economic reasons. The study used daily data like S&P Nifty, Junior Nifty, NSE 200 and S&PCNX 500, BSE Sensex-BSE 100, BSE 200 from the period April 1998 to March 2005. Auto-Regressive Conditional Heteroskedastic (ARCH) model was applied to achieve the stated objective. The study concluded that the impact of the introduction of the futures and options of the volatility of the underlying markets was negligible as evident from the magnitude of the coefficient of the futures and options dummies.

Oliver Fratzscher\textsuperscript{46} (2006) in his observation, derivatives constitute an important in the efficient operations of capital markets across Asia. According to Oliver Fratzscher, developmental benefits of real economic growth can be significant only when uncertainty is reduced and risk is managed more efficiently. In this regard, he said that the derivatives have emerged as most significant hedging instruments. In his opinion, the success of derivative markets depends on clearing and settlement through central counter party, good governance, best practice of accounting standards, full disclosure etc., According to him derivative products made Asian capital markets more competitive and have given significant developmental benefits as hedging tools for commodity producers and cheaper financial tools for corporations. In his opinion, derivatives are inherently risky products and have to be cautiously employed balance by between danger and opportunity.
Mukherjee and Mishra’s 47 (2006) study empirically investigated the usefulness and impact of two non-price variables-open interest and trading volume from option market preceding the Nifty index in underlying cash market in India. The study applied open interest and volume based predictors for both call and put option. Daily data for both price as well as non-price variables, for two different sub periods, have been employed in order to explore whether there is any significant change in the relationship between open interest, trading volume and index in two different sub periods. The empirical findings confirm that the open interest based predictors are significant in predicting the spot price index in underlying cash market in both the periods, just after the initiation of the index option in the market and in the later sub period. As far as the volume-based predictors are concerned, the study shows that its impact is insignificant just after the initiation but has shown significant explanatory power in the later sub period. Out of the variables, the trading volume shows more impact as compared to open interest in the matter of price prediction in cash market. The impact of both are significant at 1% level of significance, the value of adjusted R-square and F-statistics in two sub periods also exhibits that these variables in the option market have significant power in discovering the price index in underlying cash market.

Banerjee & Sarkar 48 (2006), in his paper has attempted to examine the daily volatility using high frequency intraday data in the stock index return of a very popular stock market in India. Using high frequency intra-day data covering a period from June 01, 2000 through December 16, 2003, is used to model volatility using various established volatility models like Random walk, Historical Average, EWMA, GARCH, EGARCH, TGARCH and PGARCH models. The remaining data set, from December 17, 2003 through 30 January,
2004, was used to test the efficacy of various models using RMSE, MAE and Theil-U statistic. Their findings suggest that the Indian stock market experiences with volatility clustering and found GARCH-type models could predict the market volatility better than simple volatility models, like historical average, moving average etc. It was also observed that the asymmetric GARCH models provide better fit than the symmetric GARCH model, confirming the presence of leverage effect. Finally, their results showed that the change in trading volume in the market directly affects the volatility of asset returns and volatility clusters are not very persistent in India, but it is contrary to experienced countries. Further, the presence of FII in the Indian stock market does not appear to increase the overall market volatility. These findings have profound implications for the market regulator.

Pati & Kumar\(^{49}\) (2006) attempted to examine the maturity and volume effects on the volatility dynamics for futures price in Indian Futures Market for the period from January 1, 2002 to December 29, 2005 for near month contract with 1009 sample data points. For empirical analysis, they used ARMA-GARCH, ARMA-EGARCH models. The empirical evidence suggests that there is time varying volatility, volatility clustering and leverage effect in Indian futures market. With respect to volume-volatility relationship, the results suppressed the Mixtures of Distribution Hypothesis. This study concluded that time-to-maturity is not a strong determinant of futures price volatility, but rate of information arrival proxied by volume and open interest are the important sources of volatility. This relationship has important implications for the new futures contracts. This study does not provide support for the Samuelson Hypothesis in Indian futures market, which is found to be informational efficient. The finding
of this study had a message for investors, market regulator-market surveillance that risk management practices should be further strengthened to take care of greater market volatility associated with an increased volume of trading. Finally, the result suggests maturity effect does not hold in Indian futures markets, the investors should not base their investment decision on time-to-maturity.

Mahmood & Salleh\cite{50} (2006) examined the relationship between return, trading volume and market depth for two futures contracts, namely Stock Index Futures and Crude Oil Futures traded at the Kuala Lumpur Option and Financial Futures and Commodity and Monetary Exchange for the period from 15th December 1995 to 19th January 2001. They tested with the two famous hypothesis one, whether the sequential arrival of new information to the market move both the trading volume as well as price. The second one is about the mixture of distribution hypothesis where information may be considered as mixing variable. They used the diagnostic tests like Unit root Test, Ljung-Box Test and ARIMA (10,1,0) and evaluated with the help of GARCH (1,1). The effects of volume as well as open interest, proxy of market depth, on volatility and vice versa were also studied. Since both volume and open interest were found highly serially correlated, these variables were divided into expected and unexpected components. Finally, the results showed a positive expected and unexpected volume and market depth effect on volatility.

Misra, Kannan and Sangeeta\cite{51} (2006) have investigated the existence of volatility surfaces in S&P CNX Nifty index option for the period January 2004 to December 2004. The result of the study shows that deep in-the-money and deep out-of-the-money options are having higher volatility than at-the-money options. The implied volatility of out-of-the-money call options is more than in-the-
money call options. The implied volatility is higher for far the month contracts than for near the month contracts. Deep in-the-money and out-of-the-money options with shorter maturity have higher volatility than those of with longer maturity. Put options have higher volatility than call options. The results show that the shape of the volatility smile in India is similar to that which was prevailing in US before the stock market crash of 1987.

Maheshwaran and Ranjan\textsuperscript{52} (2006) examined the ability of implied volatility to predict the realized volatility. They estimated the implied volatility for the Nifty ‘call’ option series and Nifty ‘put’ option series and analyzed their capability to predict the realized volatility separately. They also compared the information content of the implied volatility of Nifty options with the three other Asian indices i.e. Hang Seng (Hong Kong), KOSPI (South Korea) and TWSEW (Taiwan). The R-square for the regression equation for India is 3%, 7% for Korea, 38% for Hong Kong and 39% for Taiwan. The co-efficient of implied volatility is not significant for India, but significant for other countries. They concluded that the implied volatility is a poor and biased estimator of realized volatility in case of Indian and South Korean market but useful in the other two markets namely Hong Kong and Taiwan.

Alexakis Panayiotis\textsuperscript{53} (2007) investigated the effect of the introduction of Stock Index Futures on the volatility of the Spot equity market and contributes in this way to the contrasting arguments with respect to the stability and destabilising effects of such products. The statistical results indicated that the index of Futures trading is fully consistent with efficient market operation as it exerts a stabilising effect in the spot market, reducing volatility asymmetries and improves the quality and speed of the flow of information.
Samanta and Samanta\textsuperscript{54} (2007), analyzed the impact of introducing index futures and stock future on the volatility of underlying spot market in India by taking S&P CNX Nifty, Nifty Junior and S&P 500 and used GARCH model for the study. He found that there is no significant change in the volatility of spot market, but the structural changes in the volatility to some extent. He also found mixed result in spot market volatility in case of 10 individual stocks.

Drimbetas\textsuperscript{55} (2007) studied the effect of introduction of future & options into the FTSE/ASE 20 Index on the volatility of underlying index by using EGARCH model. He reported reduction in the conditional volatility of index and consequently increases its efficiency.

Suchismita Bose\textsuperscript{56} (2007) attempted to understand the volatility characteristics and transmission effects in the Indian stock index and index futures markets by using daily data for the market index of NSE-S&P CNX Nifty for the period from June 2000 to March 2007. U.S Dow Jones Industrial average returns was also included in the analysis. The empirical results indicated that NSE index and its futures return volatility had no tendency to drift upward indefinitely with time, but in fact had a normal or mean level to which they ultimately revert. In the case of volatility transmission, it was found strong bidirectional volatility spillovers between the markets implying that the price and returns dynamics in one market are capable of explaining much of the movement in the other.

Sabri\textsuperscript{57} (2008) explored the impact of change in trade volume on volatility of stock prices as expressed by unified Arab Monetary fund stock price index. He reported increase in both trading volume & stock price volatility. He
also found the correlation between volume and price movement was higher in the stock markets of the oil Arab states compared to the nonoil Arab states.

Mallikarjunappa and Afsal\textsuperscript{58} (2008), in their study have examined the implication of the introduction of derivative trading on spot market volatility for S&P CNX Nifty by using GARCH model and concluded that price sensitivity to old news is higher during pre future period than post future period and with introduction of future, market volatility is determined by recent innovation. They also explored effect of future trading on spot market volatility by using GARCH model on CNX Bank Nifty and found that there is no impact of future trading on spot market volatility. However, impact of new news increased and persistence effect of old news decreased in post future period.

Malabika & Srinivasan\textsuperscript{59} (2008) have analyzed the empirical relationship between stock return, trading volume and volatility for select Asia-Pacific Stock Market by applying preliminary test, Granger Causality test and EGARCH (1,1) model. The data set comprises of seven national stock markets for the period spanning from 1st January 2004 to 31st March 2008. The results evidenced a significant relationship between trading volume and the absolute value of price changes. Granger Causality test was used to explore, whether return causes volume or volume causes return. The results suggested that the returns were influenced by volume and volume also was influenced by returns for most of the markets.

Mahajan and Singh\textsuperscript{60} (2008) have investigated the pattern of information flow between trading volume and return volatility using daily data for Nifty index during the period from July 2001 to March 2006. The methods used included Correlation analysis, Unit root tests, VAR modelling, Granger causality test,
GARCH (1,1) and EGARCH model. The study provided evidence of low but significant positive contemporaneous relationship between volume and return volatility that was indicative of both mixture of distribution and sequential arrival hypothesis. The differential cost of taking long and short positions were examined by applying asymmetric EGARCH (1,1) model to check the relationship between the variables. The study further confirmed a weak unidirectional causality from volume to return volatility, which also indicates the mild support for sequential information flow directed from volume to price change. The study contributes to the enhance understanding of researchers, regulators, speculators, and other participants in market on market efficiency and information processing.

Rashid and Ahmad (2008) evaluated the relative performance of linear versus nonlinear models to forecast stock index volatility by using daily data for the period January 2001 to November 2007 for Karachi Stock Exchange. The purpose of this study was to predict the daily stock price index by employing linear and non-linear models like: random walk, autoregressive model, moving average, exponential smoothing, Holt exponential smoothing models, GARCH, EGARCH and PARCHES models, to assess the forecasting performance of the models by considering Root Mean Square Error (RMSE). It was found that, among linear models of stock price index volatility, the exponential smoothing models ranked first using the RMSE criterion. They also found that within the nonlinear models, the GARCH model was superior as compared to the EGARCH and the PGARCH models. Finally, the study concluded based on the RMSE that the nonlinear ARCH-class models clearly dominate the linear models in out-of-sample forecasting exercise for stock price index volatility.
Satya Swaroop Debasish (2009) in his paper investigated the effect of Nifty Futures trading on the volatility and operating efficiency of Indian Stock Market in general and the underlying stock in particular. The study covers a period of fourteen years i.e. from 1995 to 2009. The author has applied event study approach to test the change in volatility and efficiency of stock returns by making a comparison between pre and post introduction of Nifty Index Futures. The study revealed mixed results i.e. reduced spot volatility and reduced trading efficiency and in the short run, there is a trade-off gains and costs associated with the introduction of derivatives. The study concluded that the derivatives have led to market stabilization cut the market has to pay a price for it in the future of loss in the market efficiency.

Maniar Hiren M (2009), in this paper, he analyzed the effect of the introduction of derivatives (futures and options) in the Indian market on the volatility and on the trading volume of the underlying index. The period examined covers from April 2001 to March 2006. To learn this effect, he used three models of conditional volatility GARCH, EGARCH and GJR. He found significant impact on variance: the proof pointed out that the conditional volatility of the underlying index declines after derivative markets are introduced. The trading volume of NSE (National Stock Exchange of India) Nifty -50 increases significantly. In addition, the introduction of the derivative contracts in India verified a decrease in uncertainty in the underlying market and an increase in liquidity, which possibly enhance their efficiency.

Ulkem Basdas (2009) investigated the lead lag relationship between the spot index and futures price for the Turkish derivatives exchange by using ISE30 and compare the forecasting abilities of ECM, ECM with COC, ARIMA, and
VAR model considering the data from February 4th 2005 to May 9th 2008. The series of futures prices on ISE 30 index was gathered from the Turk DEX Website and the spot value also collected from the same source and for the same period. The Ganger causality test results indicated that the log of spot price significantly Granger cause log of futures but not vice versa.

Vasilieios Kallinterakis and Shikha Khurana\(^\text{65} (2009)\) have investigated volatility persistence and the feedback trading hypothesis from Indian evidence to produce an original contribution to the finance literature by examining the relationship between feedback trading and volatility from a markets evolutionary perspective, and to test internationally established facts regarding feedback trading in an Indian markets contexts. In order to test the feedback trading with the Senatana and Wadhwani Model, the authors applied conditional variance. The daily closing prices from the BSE 30, BSE 100 and BSE 200, and S&PCNX Nifty 50 from 1992 to 2008 were taken in to consideration. The empirical result indicated that positive feedback trading is evident throughout the period from 1999. Volatility was found to maintain significant asymmetries in most of the period under examination.

Gahlot Ruchika, Datta Saroj and K. Kapil Sheeba\(^\text{66} (2010)\), have examined the impact of derivative trading on stock market volatility by taking closing prices of S&P CNX Nifty as well as closing prices of five derivative stocks and five non derivative stocks from April 1, 2002 to March 31, 2005. The study used GARCH model to capture nature of volatility over time and volatility clustering phenomenon of data. Results showed mixed effect in case of 10 individual stocks. These results can help investors in making investment decision. It also helps to identify need for regulation.
Apart from the above review of literature, chapter-wise specific review of literatures is presented in respective chapters.

**NEED FOR THE STUDY**

From the review of literature, it can be observed that academicians, researchers, and financial organizations both in India and abroad have carried out research studies covering various aspects of Financial Derivatives. However, the present study is different from the above research studies in terms of both period and the sample chosen. This is made clear in the methodology of the study.

**Objectives:** The objectives of the present study are

1. To analyse the nature and growth of Financial Derivatives in India
2. To analyse the impact of Index Futures and Stock Futures on the Stock Market Volatility
3. To analyse the impact of Index Options and Stock Options on the Stock Market Volatility
4. To analyse the impact of non price variables on the underlying Cash Market

**The following are the Hypotheses of the Study:**

- $H_{01}$: Index Futures and Stock Futures have no impact on stock market volatility
- $H_{02}$: Index Options and Stock Options have no impact on stock market volatility
- $H_{03}$: Non-price variables like Open Interest and Trading Volume have no impact on underlying Cash Market
METHODOLOGY

Study Period: The present study covers a period of Nineteen years i.e. from 1995 to 2013. For the purpose of detailed analysis, the study period is divided into three sub periods 1. Pre introduction of derivatives period (1995 to 2000) 2. Post introduction period-I (2000 to 2006) 3. Post introduction period-II (2006-2013). Each sub period covers five years and the analysis is made by taking both short-term intervals as well as long-term intervals within these periods. Short intervals range from one month to one year. Long intervals range from two years to five years. For instance, to assess the impact of derivatives on volatility during short intervals, comparison is made between one month, two months, three months, six months, nine months and one year of pre periods with the corresponding post periods in the short intervals. Similarly, in the long intervals the comparison is made between two years, three years, and four years of pre periods with the corresponding interval periods in the post introduction. Further, during the long intervals, the comparison is also made between the volatility during the five years before introduction with the two post sub periods of five years. To study the impact of non-price variables in index options contracts three sub periods have been considered. 1. First sub period from July 2001 to December 2001, 2. Second sub period from January 2006 to June 2006 and 3. Third sub period from July 2011 to December 2011, comprising a total of Eighteen months (excluding the expiration day).

To assess the impact of Stock Futures and Stock Options on stock market volatility, 10 industrial groups out of 13 industrial groups in which derivatives trading is permitted have been chosen. These industrial sectors are Banking, FMCG, Infrastructure, Pharmaceuticals, Telecommunication, Finance,
Information Technology, Petrochemicals, Manufacturing and Engineering. For the purpose of detailed analysis, two companies from each of these industrial groups have been selected. The companies selected for detailed analysis for futures and options are different. The purpose behind in selecting two separate set of companies to study the impact of futures and options is the basic difference between the nature of these instruments. While the Future contracts are binding contracts the execution of which is obligatory, the execution of option contracts is not obligatory. But, care has been taken to see that the two sets of companies are representative of the respective industrial sectors. The market capitalisation weightage of the selected companies for impact study of futures is about 40% and the market capitalisation weightage of the selected companies for studying the impact of options is about 21per cent in total market capitalisation of NIFTY INDEX as on 29\textsuperscript{th} June 2012. Hence, the weightage of selected companies for the study on futures and options put together is about 61%. While selecting these companies care has been taken to see that permission for derivatives trading in these companies is almost from the date of launching/nearer to the date of launching of derivatives in India. Care also has been taken to see that the selected companies are among the top five in terms of turnover in the Derivative trading in the respective industrial sectors. The selected companies are shown below sector wise:
**Table 1.1: selected companies for analysis of Futures and Options analysis**

<table>
<thead>
<tr>
<th>Sector Name</th>
<th>Company Name (Futures)</th>
<th>Company Name (Options)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BANKS</td>
<td>State Bank of India</td>
<td>ICICI Bank Ltd</td>
</tr>
<tr>
<td>FMCG</td>
<td>ITC Ltd.</td>
<td>Hindustan Unilever Ltd.</td>
</tr>
<tr>
<td>INFRASTRUCTURE</td>
<td>Reliance Infrastructure Ltd</td>
<td>Jaiprakash Associates Ltd.</td>
</tr>
<tr>
<td>PHARMACEUTICALS</td>
<td>Ranbaxy Laboratories Ltd</td>
<td>Cipla Ltd.</td>
</tr>
<tr>
<td>TELECOMMUNICATION</td>
<td>Mahanagar Telephone Nigam Ltd</td>
<td>Bharti Airtel Ltd.</td>
</tr>
<tr>
<td>FINANCE</td>
<td>Housing Development Finance Corporation Ltd.</td>
<td>Reliance Capital Ltd.</td>
</tr>
<tr>
<td>INFORMATION TECHNOLOGY</td>
<td>Infosys Technologies Ltd.</td>
<td>Wipro Ltd</td>
</tr>
<tr>
<td>PETROCHEMICALS</td>
<td>Reliance Petroleum Ltd</td>
<td>Oil &amp; Natural Gas Corporation Ltd</td>
</tr>
<tr>
<td>MANUFACTURING</td>
<td>Tata Steel Limited</td>
<td>Tata Motors Ltd</td>
</tr>
<tr>
<td>ENGINEERING</td>
<td>Larsen &amp; Toubro Ltd.</td>
<td>Praj Industries Ltd</td>
</tr>
</tbody>
</table>

**Sample:** To assess the impact of Index Futures and Index Options on Stock Market volatility, S&P CNX Nifty of NSE is selected as it constitute more than three-fourth of the total turnover of Derivatives trading in India. To assess the impact of Stock Futures and Stock Options, the daily opening, high, low and closing prices of respective stocks have been taken for the study.

**Data collection:** The study is based mainly on secondary data, which have been collected from various websites of NSE, BSE, SEBI and selected companies. The opening, high, low and closing prices of S&P CNX Nifty index and opening, high, low and closing prices of selected individual Stock were collected from the official website of NSE. Data on turnover in derivative instruments at NSE were collected from various monthly and yearly bulletins of SEBI. The data regarding the non-price variables has been taken from the daily bhavcopy posted on the NSE website which provides all the market information on call and put options.
traded on different stocks during the day that include option premium (open, high, low and close), trading volume and open interest at each strike price.

**Statistical tools of analysis:** The collected data have been scrutinized to measure the volatility in CNX NIFTY and selected stock prices. Four types of volatility in stock prices – open-to-open, close-to-close, high-low and open to close have been calculated for both short and long intervals before and after the introduction of derivatives. For measuring the inter-day volatility, variations between open-to-open prices and Close to close prices have been calculated by using the statistical measure of standard deviation. For measuring intra-day volatility, variations between high-low prices and the open to close prices have been calculated by applying the Parkinson’s Model and Garman and Klass Model respectively. The data have been tested by using the statistical tool F-test to observe the significant levels of impact.

The inter relationship between the net open interest and trading volume in Option market and the prices in underlying cash market have been measured using the technique of Granger’s Causality test by many researchers in the past. But, in the present study, a simple and widely accepted methodology used by Bhuyan and Choudhury (2001), Bhuyan and Yan (2002) and recently by Srivastava (2003) have been taken into consideration. The terms and notations applied in the methodology of the present study are quite same as used in these studies.

The notations which have been applied for two predictors-volume based predictor and open interest based predictor respectively are \( V^C_{it} \) for call option trading volume and \( V^P_{jt} \) for put option trading volume. Simultaneously the notations \( O^C_{it} \) and \( O^P_{jt} \) respectively have been applied for call net open interest and put net open interest at time ‘t’ with the strike price \( X^C_i \) and \( X^P_j \) respectively. The natural logarithms of all the variable have been used to account for the heteroscedasticity, i.e. unequal variance among
the variables. Now, in order to find out the relative significance of volume-based predictors and open interest based predictors separately in the matter of price prediction in underlying cash market, the following regression equations have been used:

\[
\ln I_T = \alpha_0 + \alpha_1 \ln I_t + \alpha_2 \ln O^C_t + \alpha_3 \ln O^P_t + \varepsilon_t
\]

\[
\ln I_T = \alpha_0 + \alpha_1 \ln I_t + \alpha_2 \ln V^C_t + \alpha_3 \ln V^P_t + \varepsilon_t
\]

The methodology adopted for analysing the impact of Futures & Options on stock market volatility in Third and Fourth Chapters is presented in detail in respective chapters.

**CHAPTER WISE STUDY**

The study is divided into six chapters including the introductory chapter.

**Chapter One**

This chapter provides theoretical base of Financial Derivatives, need and significance of the study and research design, methodology adopted.

**Chapter Two**

Provides an overview of the growth of Financial Derivatives trading.

**Chapter Three**

Gauges the impact of Index Futures and Stock Futures on Stock Market volatility

**Chapter Four**

Analyses the impact of Index Options and Stock Options on the Stock Market volatility

**Chapter Five**

Analyses the impact of non-price variables on underlying cash market

**Chapter Six**

Presents the summary of findings and suggestions.
References:


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64. Ulkem Basdas (2009), Lead lag relationship between the spot index and futures price for the Turkish Derivative Exchange, ssrn.com, pp.1-18.
