CHAPTER 2

RESEARCH METHODOLOGY

This chapter describes the methodology adopted in conducting the study. The chapter also lists out the literature reviewed during the research process and presents a summary of the literature reviewed. The need and relevance of the study is elaborated, the objectives of the study are established, hypotheses are drawn and the methodology adopted to test the hypotheses is explained along with the scope and limitations of the study.
2 RESEARCH METHODOLOGY

2.1 LITERATURE REVIEW

Sharon Jose (2005): This article explains in detail, the complete theoretical framework of index futures. It also discusses the growth and trends in the index futures market. The complexities involved in the trading mechanism of such products are also discussed at length. In essence, the article captures the pros and cons involved in index futures and their application.

G. P. Samanta and Kaushik Bhattacharya suggest that, Empirical evidence for the developed economies suggests that the information on the spread between E/P ratio at the stock market and a measure of interest rate is sometimes useful in predicting stock market movements. In case of emerging markets like India, the issue has, however, not received adequate attention. Their paper employs several statistical and econometric tools (viz., correlation analysis, regression analysis, Granger’s causality test and measures of out-of-sample forecast performance) for rigorously assessing the usefulness of spread in explaining stock market return in India. They also attempt to examine the possibility of formulating profitable business/trading strategy using spread for varying degrees of transaction cost. Empirical results reveal that though spread seems to have reasonably strong causal influence on return and the causal model helps achieving forecasts slightly better than the random walk model, the usefulness of spread in formulating a profitable business strategy is not clear. The paper finds that the performances of different strategies vis-à-vis a simple buy-
and-hold strategy would crucially depend on several factors like the choice of interest rate, choice of trading period and choice of threshold for determining extreme values of spread. The paper also reveals that the profitability of a spread based trading strategy would crucially depend on the extent of transaction cost. In this context, however, it is interesting to note that a spread based strategy in many occasions yielded higher returns than that of the buy-and-hold strategy, especially when transaction cost was low.

**Richard Heaney (1995):** here the author tries to explain the volatility in the all ordinaries index of the Australian index with the help of the cost of carry model. He uses the 90-day bank accepted bills as the benchmark interest rate. The conclusion is that there are other factors like dividends, taxes and the cost of carry itself that have an effect on the volatility of the all ordinaries share index.

**Don M Chance (2003):** this article explains in detail the relationship between forward and futures prices. Empirical data are examined and demonstrate the difficulty in accurately measuring the price differential of spot and futures markets. The authors conduct a test using the Heath-Jarrow-Morton Model to yield arbitrage-free futures prices. They use a data set consisting of daily LIBOR spot rates of from one to twelve months for about 3500 days over the period of 1987-2000, the difference between Eurodollar forward and futures prices is found to be much smaller than had been previously thought. The difference is negative as it should be but very close to zero. Further tests reveal that more accurate estimates of
volatility give even smaller differences but that it is not difficult to obtain satisfactory estimates of volatility for purposes of examining this issue.

K Chan, KC Chan GA Karolyi: They examine the intraday relationship between returns and returns volatility in the stock index and stock index futures markets. Their results indicate a strong inter-market dependence in the volatility of the cash and futures returns. The authors opine that, price innovations that originate in either the stock or futures markets can predict the future volatility in the other market. They show that this relationship persists even during periods in which the dependence in the returns themselves appears to weaken. The findings are robust to controlling for potential market frictions such as asynchronous trading in the stock index. The results have implications for understanding the pattern of information flows between the two markets.

Antonios Antoniou, Gioia Pescetto, Antonis Violaris(2003): This paper addresses the important relationship between stock index and stock index futures markets in an international context. The authors argue that, by simply examining the spot-futures relationship within a single country as most of the extant literature does and thus ignoring possible market interdependencies between countries, the dynamics of price adjustments may be mis-specified and thus findings misleading. The main contribution of the paper is to improve the understanding of pricing relationship between spot and futures markets in the light of international market interdependencies. Using a multivariate VAR-EGARCH methodology, the paper investigates stock index and stock index futures market
interdependence that is, lead-lag relationships and volatility interactions between the stock and futures markets of three main European countries, namely France, Germany and the UK. In addition, the paper explicitly accounts for potential asymmetries that may exist in the volatility transmission mechanism between these markets. The main conclusions of the paper imply that investors need to account for market interactions across countries to fully and correctly exploit the potential for hedging and diversification.

**John Paul Broussard, G Geoffrey Booth, Otto Loistl (1998):** Compares the trading efficiency of electronic and open outcry futures markets. The authors argue that the difference between the German DAX (floor) and FDAX (electronic) markets is due to asset type, not due to information processing speed. The article describes the German trading environment, comparing trading data from 1992 to 1994. It shows that the returns for DAX are positively skewed and for FDAX negatively skewed and more volatile. From regression and Granger causality tests, the authors establish a feedback relationship between the two markets, in which the spot market is slower to digest information than the futures market. They point out that the dominant DAX stocks are also traded electronically, so the means of trade is not the cause of the difference.

**Donald Lien; Li Yang (2004):** In this study, the authors investigate the daily relationships between returns on individual stocks and their corresponding futures contracts in Australian, Hong Kong, and United Kingdom markets. They find that, at the beginning of the life of a futures
market, autocorrelation of futures returns is similar to that of individual stock returns. As the market becomes mature, the autocorrelation of futures returns behaves differently from the autocorrelation of stock returns. Through the linkage between return autocorrelations and trading volume, they find that a larger trading volume depresses the return autocorrelation and shrinks the differences of return autocorrelation between stock and its futures. In addition, futures trading volume has more significant impact on the patterns of return autocorrelations than the stock trading volume. The effect is non-linear in the sense that it is much more prominent during high futures trading periods. Summary of these findings suggests that the difference of return autocorrelations between an individual stock and its futures contract is due to low trading activities of futures.

Nupur Hetamsaria; Saikat Sovan Deb (2004): The exchange traded index futures were launched in India in June 2000. Subsequently, other derivative products like the index options, stock options, stock futures, were launched. Derivative products are turning more and more popular day by day. NIFTY futures are scaling new heights and breaking records daily, in terms of volumes. The impact that the derivatives market has on the underlying spot market remains an issue debated again and again, with arguments both in favour and against them. This study aims to study the impact of the introduction of stock index futures on the volatility of the Indian spot markets. The issues addressed in this paper are: Firstly, does the introduction of stock index futures reduce stock market volatility?
Secondly, if there is a reduction in the volatility of the stock market post futures, are there no other reasons that could have caused such a reduction? And thirdly, if the futures effect is confirmed, is the effect immediate or delayed? The amended GARCH model is used to study the above objectives. The results obtained show that the results remain consistent with the studies for other emerging markets, like Malaysia and Italy. That is, the introduction of futures results in a reduction in stock market volatility. Also, apart from the introduction of stock index options in June 2001, there are no other factors that had caused this reduction. However, the authors found that the futures effect is delayed on NSE.

Robert F. Engle, Kevin Sheppard (2001): The authors have developed the theoretical and empirical properties of a new class of multivariate GARCH models capable of estimating large time-varying covariance matrices, Dynamic Conditional Correlation Multivariate GARCH. They show that the problem of multivariate conditional variance estimation can be simplified by estimating uni-variate GARCH models for each asset, and then, using transformed residuals resulting from the first stage, estimating a conditional correlation estimator. The standard errors for the first stage parameters remain consistent, and only the standard errors for the correlation parameters need be modified. They use the model to estimate the conditional covariance of up to 100 assets using S&P 500 Sector Indices and Dow Jones Industrial Average stocks, and conduct specification tests of the estimator using an industry standard benchmark for volatility models. The authors claim that, this new estimator
demonstrates very strong performance especially considering ease of implementation of the estimator.

**Robert F. Engle and Joe Lange (1997):** The paper proposes a new measure of market liquidity, VNET, which directly measures the depth of the market. VNET is constructed from the excess volume of buys or sells during a market event defined by a price movement. As this measure varies over time, it can be forecast and explained. Using NYSE TORQ data, it is found that market depth varies positively but less than proportionally with past volume and negatively with the number of transactions. Both findings suggest that over the day high volumes are associated with an influx of informed traders and reduce market liquidity. The timing of events plays an intimate role in the analysis. High expected volatility as measured by the ACD model of Engle and Russell (1997) reduces expected liquidity. Finally, market depth is smaller when the one-sided trading volume is transacted in a shorter than expected time, providing an estimate of the value of patience.

**Robert F. Engle and Andrew J. Patton (2001):** Here the authors suggest that, a volatility model must be able to forecast volatility; this is the central requirement in almost all financial applications. In this paper they outline some stylized facts about volatility that should be incorporated in a model; pronounced persistence and mean reversion, asymmetry such that the sign of an innovation also affects volatility and the possibility of exogenous or predetermined variables influencing volatility. They use data on the Dow Jones Industrial index to illustrate these stylized facts, and the ability of GARCH-
type models to capture these features. They conclude with some challenges for future research in this area.

**Robert Engle (2000):** Time varying correlations are often estimated with Multivariate GARCH models that are linear in squares and cross products of returns. A new class of multivariate models called dynamic conditional correlation (DCC) models is proposed in this paper. These have the flexibility of uni-variate GARCH models coupled with parsimonious parametric models for the correlations. They are not linear but can often be estimated very simply with uni-variate or two step methods based on the likelihood function. It is shown that they perform well in a variety of situations and give sensible empirical results.

**Robert Engle (2001):** In this article the author explains clearly the use of ARCH and GARCH models and their practical applications in applied econometrics. He takes an example from the Dow Jones and a few portfolio examples with empirical data to drive home the point of applicability of ARCH and GARCH models. The article is concludes That analysis of ARCH and GARCH models and their many extensions provides a statistical stage on which many theories of asset pricing and portfolio analysis can be exhibited and tested.

**Dr. Premalata Shenbagaraman:** The objective of this study was to assess the impact of introducing index futures and options contracts on the volatility of the underlying stock index in India. This paper explores the impact of the introduction of derivative trading on cash market volatility using data on stock index futures and options contracts traded on the S & P
CNX NIFTY (India). The results suggest that futures and options trading have not led to a change in the volatility of the underlying stock index, but the nature of volatility seems to have changed post-futures. The author also examines whether greater futures trading activity (volume and open interest) is associated with greater spot market volatility. No evidence is found of any link between trading activity variables in the futures market and spot market volatility. The results of this study are especially important to stock exchange officials and regulators in designing trading mechanisms and contract specifications for derivative contracts, thereby enhancing their value as risk management tools.

**Annastiina Silvennoinen, Timo Terasvirta (2007):** This article contains a review of multivariate GARCH models. Most common GARCH models are presented and their properties considered. This also includes nonparametric and semi-parametric models. Existing specification and misspecification tests are discussed. Finally, there is an empirical example in which several multivariate GARCH models are fitted to the same data set and the results compared.

**Christos Floros Dimitrios V. Vougas (2007):** This paper examines the lead-lag relationship between futures and spot markets in Greece. For both available stock index futures contracts (FTSE/ASE-20 and FTSE/ASE Mid 40) of the Athens Derivatives Exchange (ADEX), they employ a Bivariate GARCH model to explain price discovery of futures market over the crisis period 1999 to 2001. Empirical results confirm that futures market plays a price discovery role, implying that futures prices contain useful
information about spot prices (in line with similar findings in the literature). These findings are helpful to financial managers and traders dealing with Greek stock index futures.

Ken Johnston and Elton Scott (2000): This study investigates the extent of the contribution of the original GARCH model to our understanding of the stochastic process underlying exchange rate price changes, and examines if the movement of current research to GARCH type models exclusively is warranted. GARCH(1,1) parameters are calculated on a yearly basis and used to standardize the exchange rate price change data. Frequency distributions and statistical tests indicate that independence still exists after standardization. This indicates that GARCH type models alone are inadequate since all are similar in form, and would have difficulty in accounting for such independence. It could be argued that the poor performance of the GARCH model is due to the models incorrect assumption of a normal distribution. This argument is tested by comparing the GARCH standardized data with mean -variance standardized data, which makes no assumptions about the distributional form. Results of likelihood ratio tests, question the significance of conditional volatility, in explaining exchange rate price changes. Curiously there are cases where GARCH e2(t-1) parameters are significant when tests for first-order heteroskedasticity are not significant; this suggests that the model may be misspecified. Overall, results indicate that although previous research finds that volatility clustering plays a role in determining the stochastic process,
it is not the dominate factor. This study questions the contribution of the GARCH type models.

Shalini Bhatia: In this article the author applies the Co-Integration approach to study the long run relationship between S&P CNX NIFTY futures and spot index and the Error Correction Model to examine the short-term adjustment process, using high frequency data, the study finds that, price discovery happens in both, the futures and the spot market. However the S&P CNX NIFTY Futures Index is more efficient than the S&P CNX NIFTY Index and leads the spot index by 10 to 25 minutes. Such a finding is consistent with similar studies in U.S and U.K markets.

Kedar nath Mukherjee and R. K. Mishra: By using intraday data from April to September 2004, The authors attempt to investigate the possible lead-lag relationship, both in terms of return and volatility, among the NIFTY spot index and index futures market in India and also to explore the possible changes (if any) in such relationship around the release of different types of information. The results suggests that though there is a strong contemporaneous and bi-directional relationship among the returns in the spot and futures market, the spot market has been found to play comparatively stronger leading role in disseminating information available to the market, and therefore said to be more efficient. Apart from this, there is also interdependence (in both direction) and therefore more or less symmetric spillovers among the stock return volatility in the spot and futures market. The results relating to the informational effect on the lead-lag relationship exhibit that though the leading role of the futures market
wouldn't strengthen even for major market-wide information releases, the role of the futures market in the matter of price discovery tends to weakens and sometime disappear after the release of major firm-specific announcements.

**Ajay Pande:** In this study, the author uses three-years' high-frequency data set of five-minutes returns to construct measures of realized volatility with which some of the extreme-value estimators proposed in the literature and the traditional estimators are compared. Based on five criteria used to evaluate the bias, efficiency and predictive power, the author finds that almost all the extreme-value estimators are free of bias and perform well compared to their traditional counterparts for the S&P CNX NIFTY stock-index and the 10 constituent stocks studied. He also finds that the extreme-value estimators are 2-5 times more efficient and have better predictive power. With the exception of the Parkinson estimator for the index, all are unbiased. Even though specific estimators perform well for a particular asset, all the estimators perform well enough to justify their use when compared with the traditional estimators. The efficiency gains are however, marginal in case of relatively illiquid stocks.

**Dr.(Ms.) M. Thenmozhi:** The purpose of the study is to examine if there is any change in the volatility of NIFTY index due to the introduction of NIFTY futures and whether movements in the futures price provide predictive information regarding subsequent movements in the index prices. The study shows that inception of futures trading has reduced the volatility of spot index returns. The information flow is higher in the post
futures period resulting in decline in spot index volatility in the post futures period. The lead lag analysis shows that futures have little or no memory effect and infrequent trading is virtually absent in futures market. The study also shows that futures market transmits information to cash market and futures market is faster than spot market in processing information. The futures returns lead the spot index returns by one day and this relationship is robust. It is also shown that the cash index returns do not lead the futures returns. The advent of stock index futures and options has profoundly changed the nature of trading on stock exchanges. The concern over how trading in futures contracts affects the spot market for underlying assets has been an interesting subject for investors, market makers, academicians, exchanges and regulators alike. These markets offer investors flexibility in altering the composition of their portfolios and in timing their transactions. Futures markets also provide opportunities to hedge the risks involved with holding diversified equity portfolios. As a consequence, significant portion of cash market equity transactions are tied to futures and options market activity. In the Indian context, derivatives were mainly introduced with a view to curb the increasing volatility of the asset prices in financial markets; bring about sophisticated risk management tools leading to higher returns by reducing risk and transaction costs as compared to individual financial assets. However, it is yet to be known if the introduction of stock index futures has served the purpose claimed by the regulators. The launch of derivative products has significantly altered the movement of the share prices in the spot market.
The spot and futures market prices are linked by arbitrage, i.e., participants liquidating positions in one market and taking comparable positions at better prices in another market, or choosing to acquire positions in the market with the most favourable prices. If, for example, the observed futures price is above (below) the theoretical futures price, arbitrageurs sell (buy) futures and buy (sell) the underlying security, driving down (up) the price of the futures and driving up (down) the prices of security. This raises important questions about the effect that index derivatives have on volatility of the spot market. While there is still disagreement as to whether futures trading increases or decreases the volatility of spot prices, the question is still an empirical one. However, if one market reacts faster to information, and the other market is slow to react, a lead-lag relation is observed. The lead-lag relation between price movements of stock index futures and the underlying cash market illustrates how fast one market reflects new information relative to the other, and how well the two markets are linked. Hence, this study attempts to examine the lead – lag relationship between the futures and the underlying spot market.

**Edwards (1988):** tries to gather evidence to verify the fact that stock index futures trading has de-stabilised the spot market in the long run. Using variance ratio F tests from June 1973 to May 1987, Edwards concludes 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):** observes increased volatility after the introduction of index futures by comparing daily return volatilities during the pre-futures (1975-1982) and post-futures (1982-1987) between S&P 500 and a non S&P 500 group of stocks controlling for differences in firm attributes (beta, price-level, size and trading frequency). He notes that increase in volatility is a common phenomenon in different markets and index futures by themselves may not bear the sole responsibility. He points out other index-related instruments and developments such as growth in index funds and increase in foreign ownership of equity as possible explanations of higher volatility in stock markets.

**Ross (1989):** demonstrates that, under conditions of no arbitrage, variance of price change must be equal to the variance of information flow. This implies that the volatility of the asset price will increase as the rate of information flow increases. If this is not the case, arbitrage opportunities will be available. It follows, therefore, that if futures increase the flow of information, then in absence of arbitrage opportunities the volatility of the spot price must change.

**Herbst et. al., (1990):** document expiration day volatility of the stock index futures and the "special" Friday opening. Volatility is measured by the standard deviation of returns. It is seen that there is a fall in the triple witching hour due to change in settlement procedure from the third Friday to preceding Thursday.
Hodgson et al., (1991): study the impact of All Ordinaries Share Index (AOI) futures on the Associated Australian Stock Exchanges over the All Ordinaries Share Index. The study spans for a period of six years from 1981 to 1987. Standard deviation of daily and weekly returns is estimated to measure the change in volatilities of the underlying index. The results indicate that the introduction of futures and options trading has not affected the long-term volatility, which reinforces the findings of the previous U.S. studies. However, there was a problem of confounding variables such as floating of Australian dollar in late 1983, deregulation of stock exchanges, foreign bank ownership and mutual fund investment rules during 1984.

Kalok Chan et al., (1991): estimate the intraday relationship between returns and returns volatility in the stock index and stock index futures. The study covers both S&P500 and Major Market Index futures. The intraday patterns of volatility are estimated using autocorrelation and cross correlation patterns of the intraday returns. Bivariate GARCH model is used to estimate the volatility. Results indicate a strong inter-market dependence in the volatility of the cash and futures returns. It is also shown that the intraday volatility patterns that originate either in stock or futures market demonstrate predictability in the other market.

Bessembinder and Seguin (1992): examine whether greater futures trading activity (volume and open interest) is associated with greater equity volatility. Their findings are consistent with the theories predicting that active futures markets enhance the liquidity and depth of the equity
markets. They provide additional evidence suggesting that active futures markets are associated with decreased rather than increased volatility.

Herbst et.al., (1992): examine the informational role of the end-of-day returns in the stock index futures for the period 1982 to 1988. Volatility is estimated from the standard deviation of the returns. It is shown that the end of day return volatility is positively correlated to the next day's spot returns.

Kamara et.al., (1992): observe the stability of S&P 500 index returns with the introduction of S&P 500 index futures. They also assess the change in the volatility of S&P 500 index due to the introduction of futures trading for the period 1976 to 1987. The changes in the volatilities are examined using parametric and nonparametric tests. The variance ratio F-tests used by Edwards (1988 a,b) are sensitive to the underlying assumption of normally distributed stock returns. Apart from F-tests, Kolmogorov-Smirnov two-sample test and Wilcoxon Rank sum test are used to find out if the dispersion is significantly high in the post-futures period. The results show that the daily returns volatility is higher in the post futures period while the monthly returns remain unchanged. He concludes that increase in volatility of daily return in the post-futures period is necessarily not related to the inception of futures trading.

James. T.W., (1993): study the impact of price discovery by futures market on the cash market volatility. The study is conducted using Garbade and Silber model to estimate the price discovery function of the futures market. The results affirm that futures market is beneficial with
respect to cash market as it offers better efficiency, liquidity and also lowers the long-term volatility of the spot market.

**Jegadeesh and Subrahmanyam (1993):** compare the spread in NYSE before and after the introduction of futures on S&P 500 index as volatility can also be measured in terms of individual stock bid-ask spread. They find that average spread has increased subsequent to the introduction of futures trading. When they repeat their test by controlling for factors like price, return variance, and volume of trade, they still find higher spreads during the post-futures period. Overall results of Jegadeesh and Subrahmanyam (1993) suggest that introduction of index futures did not reduce spreads in the spot market, and there is weak evidence that spreads might have increased in the post futures period.

**Hong Choi et.al., (1994):** examine the impact of futures trading on the volatility and liquidity (as measured by bid-ask spread) of the spot market. Intraday data of S&P 500 and Major Market Index is used for a period of one year. The results indicate that the average intraday day bid-ask spread in post Major Market Index futures has increased while there is no significant change in the volatility. The trading volume has registered a rise in both S&P 500 and Major Market Index. Information asymmetry also has posted an increase due the introduction of futures trading.

**Hung-Gay Fung et.al., (1994):** examine the dependency in intra-day (minute-to-minute) stock index futures for the period 1987 - 1988. The dependency of intraday futures price is estimated using various models such Auto Regressive Fractionally Integrated Moving Average, Re-scaled
range test, Variance ratio test and Autocorrelation functions. It is shown that futures price do not appear to have long-term memory and that the price changes in futures market are not a random walk.

**Darrat et al., (1995):** examine if futures trading activity has caused stock price volatility. The study is conducted on S&P 500 index futures for a period of 1982 - 1991. The study also examines the influence of macro-economic variables such as inflation, term structure rates on the volatility of the S&P 500 stock returns. Granger causality tests are applied to assess the impact on stock price volatility due to futures trading and other relevant macro-economic variables. The results indicate that the futures trading have not caused any jump volatility (occasional and sudden extreme changes in stock prices). Term structure rates and OTC index have caused the stock price volatility while, inflation and risk premium have not influenced the volatility of stock prices.

**Antoniou and Holmes (1995):** examined the relationship between information and volatility in FTSE-100 index in the U.K. using GARCH technique. Although they find that introduction of FTSE-100 index futures has changed volatility in the spot market, they attribute this to better and faster dissemination of information flow due to trading in stock index futures.

**Gregory et. al., examine (1996):** how volatility of S&P 500 index futures affects the S&P 500 index volatility. The study also examines the effect of good and bad news on the spot market volatility. The change in the correlation between the index and futures before and after October 1987
crash is also examined. Volatility is estimated by EGARCH model. It is shown that the bad news increases the volatility than the good news and the degree of asymmetry is much higher for the futures market. The correlation between the S&P 500 index futures and S&P500 index declined during the October 1987 crash. Butterworth investigates the effect of futures trading in the FTSE Mid 250 index on the underlying spot market using symmetric and asymmetric GARCH methods. The results reported for the Mid 250 index indicate that while the existence of futures trading had made little impact on the underlying level of volatility, as measured by the standard deviation, it has altered significantly the structure of the spot market volatility. The two most likely explanations for changes in volatility of stock returns are microeconomic and macroeconomic factors. Harris (1989) investigates the former and Kamara (1992) investigates the latter. Harris notes that increase in volatility is a common phenomenon in different markets and index futures by themselves may not bear the sole responsibility. He points out other index related instruments and developments such as growth in index funds and increase in foreign ownership of equity as possible explanations of higher volatility in stock markets. Kamara (1992) examines the influence of innovations in the rate of productive activity, unanticipated changes in the default risk premium, unanticipated changes in discount rate, unanticipated price level changes and changes in expected inflation on the volatility for the pre-future and post-future period. The results indicate that the increase in volatility in the post futures period cannot be completely attributed to
the introduction of futures trading. It is seen that the results on the effect of index futures on the underlying spot market volatility are mixed. One view is that derivative securities increase volatility in the spot market caused by more highly-levered and speculative participants in the futures market. The introduction of stock index futures cause an increase in volatility in the short run, while there is no significant change in volatility in the long-run (Edwards 1988). This is because futures markets result in uninformed (irrational) speculators trading in both futures and cash markets, shocking prices in search of short-term gains. Hodgson and Nicholls (1991) quote that increased market volatility may increase real interest rates and the cost of capital, leading to a reduction in the value of investments and loss of confidence in the market. In turn, this can lead to a flow of capital away from equity markets. Secondly, with increased volatility, regulatory bodies may interfere in markets to enact further regulations. While these regulations are certainly costly and may or may not reduce stock price volatility; However, another view is that derivative markets reduce spot volatility; by providing low cost-contingent strategies, enabling investors to minimize portfolio risk by transferring speculators from spot markets to futures markets. The low margins, low transaction costs and the standardized contracts and trading conditions attract risk-taking speculators to futures. Hence, futures have a stabilizing influence as it adds more informed traders to the cash market, making it more liquid and, therefore, less volatile. It is seen that increased spot volatility from futures markets may not be undesirable if induced by objective new information.
In general, the quicker and more accurate prices reflect new information, the more efficient should be the allocation of resources.

**Kapil Gupta and Balwinder Singh:** Their study investigates the price discovery and hedging efficiency of NIFTY and all those stock futures whose trading started on 9th November 2001 and are continuously traded till 30th June 2006. The study observes information asymmetry in both futures and cash market and significant Jarque-Bera test rejects the hypothesis that returns in both markets follow normal distribution. Both futures and cash market returns are found to be integrated of order 1, which implies that strong long-run relationship exists between two markets and these results are strongly supported by predictable and stationary basis. Presence of information asymmetry and co-integration implies that both markets are inefficient in weak form. Moreover, Granger causality and Vector Autoregression (VAR) results provides significant evidence that futures market leads cash market, which implies that futures market is an efficient price discovery vehicle. On the basis of price discovery efficiency of the futures market, hedge ratio through EGARCH (1,1) and VAR (based on Error correction Methodology) have been estimated, which suggests that efficient price discovery of futures market provides good opportunities for the traders to hedge their market risk because hedging through futures (except for RELIANCE) help the traders to reduce portfolio variance by approximately 90% and even more in some cases.

It is seen from the literature that the volatility of the spot market is compared before and after introduction of futures and also tested for
variations in volatility due to flow of market information. The impact of information content on the underlying markets is tested and is found to have strong correlation with the volatility of the underlying markets. Besides, standard deviations of daily returns, bid-ask spreads for all stocks, GARCH models have been used as a measure for volatility. GARCH models have been used when the data spans over a long time period to accommodate heteroskedasticity in the returns. In the event of short run analysis of time series of data, standard deviation of daily returns have been used as a measure of volatility.

The literature surveyed weighs highly on the analysis and behavior of futures prices with respect to the spot prices and also uses advanced techniques like GARCH, ARCH ARIMA, Co-integration, etc. to empirically prove or disprove their hypothesis. In case of lead lag relationships between spot and futures prices there are enough research articles which prove that futures prices lead the spot prices in the international context. In the Indian context research is contradictory. When one article claims that futures prices lead the spot prices other articles prove it otherwise.
2.2 NEED AND RELEVANCE OF THE STUDY

After going through the prima facie literature available a need was felt to find out the main concerns in valuations of futures markets in India. It was also felt that not enough literature is available in the realm of futures markets and valuations of single stock futures as well as index futures in the Indian context. This study would help in enhancing the knowledge base of the academic community regarding valuations of single stock futures and Index futures. It would also help investors, arbitrageurs and speculators to form their strategies of participating in the derivatives market and devise better hedging strategies.

There is a popular belief that the prices in the spot market are influenced by the futures market as players in the futures market are more suave and smart. Another belief in the market is that the cost of carry is nothing but the risk free rate of return. The market participants also popularly believe that change in open interest has a bearing on the direction of the price in the contracts. This study envisages testing these assumptions. The results would either confirm and reinforce the belief system in the market or raise doubts on the effect of these parameters with the direction of the market.

The researcher here thinks that since futures contracts were introduced recently and the market for futures and options is not yet well developed in terms of depth of the market, with nearly half of the volumes in the Futures and options markets coming from NIFTY itself and a lot of single stock futures not having continuous trading and having high impact cost it was thought that the course of research should point towards a more
fundamental aspect of the cost of carry relationship and not pursue the lead
lag relationships between spot and futures markets.

2.3 OBJECTIVES

2.3.1 To examine the relations between the overnight MIBOR (the risk free rate)
and the cost of carry in the futures market on single stock and the index
futures.

2.3.2 To understand the behaviour of the futures prices of single stock futures
and index futures vis-à-vis the cost of carry.

2.3.3 To understand the behaviour of the futures prices of single stock futures
and index futures vis-à-vis open interest.

2.4 HYPOTHESES

The above objectives lead us to the following hypotheses

2.4.1 There is strong and positive correlation between the risk free rate of return
(represented by MIBOR) and the cost of carry for single stock futures.

2.4.2 There is a strong and positive correlation between the risk free rate of
return (represented by MIBOR) and the cost of carry for NIFTY futures

2.4.3 There is a strong and positive correlation between the change in risk free
rate of return (represented by MIBOR) and the change in the cost of carry
for single stock futures.

2.4.4 There is a strong and positive correlation between the change in risk free
rate of return (represented by MIBOR) and the change in cost of carry for
NIFTY futures.

2.4.5 There is a strong and positive correlation between the change in futures
price and the change in cost of carry in single stock futures
2.4.6 There is a strong and positive correlation between the change in NIFTY futures and the change in cost of carry in NIFTY futures.

2.4.7 There is a strong and positive correlation between the change in open interest and change in futures price in single stock futures.

2.4.8 There is a strong and positive correlation between the change in open interest and NIFTY futures.

2.5 METHODOLOGY

2.5.1 Period of Study: The period of study is defined as July 2002 to June 2006, which covers the early years in the introduction of futures in the Indian markets and then the developmental phase in the futures market in India. It is also large enough to enable reaching to meaningful conclusions.

2.5.1.1 Sample size: Seventeen liquid stocks were selected on a random basis from the universe of the S&P CNX NIFTY along with the NIFTY itself. The futures prices for the months of the contract expiring in July 2002 to June 2006 were considered for computing the cost of carry in the stock on a daily basis.

The data collected for the seventeen stocks and NIFTY consisted of 48 files each for each stock. Each file contained the OPEN, HIGH, LOW, CLOSE, Last Traded Price, Settlement Price, Number of Contracts Traded, open interest and Change in Open Interest for the specified Contract. The data was available on an average for about 90 days per contract, from the day of introduction of the contract to the expiry of the contract. It was observed that these contracts were traded thinly until they became near-month contracts. Therefore only the data pertaining to the
near month contracts was selected and a single data set of near month contract prices was prepared for each of these stocks. The data for the day of expiry was omitted and data for the next contract was included for the day of contract expiry as the cost of carry is expected to be zero on the contract expiry date for a specific contract.

The stocks selected were:

Table 2.1
List of the companies selected for analysis

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Industry</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Associated Cement Companies Ltd.</td>
<td>Cement and cement products</td>
<td>ACC</td>
</tr>
<tr>
<td>Bajaj Auto Ltd.</td>
<td>Automobiles - 2 and 3 wheelers</td>
<td>BAJAJAUTO</td>
</tr>
<tr>
<td>Bharti Airtel Ltd.</td>
<td>Telecommunication services</td>
<td>BHARTIAIRTEL</td>
</tr>
<tr>
<td>Bharat Heavy Electricals Ltd.</td>
<td>Electrical equipment</td>
<td>BHEL</td>
</tr>
<tr>
<td>Cipla Ltd.</td>
<td>Pharmaceuticals</td>
<td>CIPLA</td>
</tr>
<tr>
<td>GAIL (India) Ltd.</td>
<td>Gas</td>
<td>GAIL</td>
</tr>
<tr>
<td>Housing Development Finance Corporation Ltd.</td>
<td>Finance – housing</td>
<td>HDFC</td>
</tr>
<tr>
<td>Hero Honda Motors Ltd.</td>
<td>Automobiles - 2 and 3 wheelers</td>
<td>HEROHONDA</td>
</tr>
<tr>
<td>Infosys Technologies Ltd.</td>
<td>Computers – software</td>
<td>INFOSYSTCH</td>
</tr>
<tr>
<td>ITC Ltd.</td>
<td>Cigarettes</td>
<td>ITC</td>
</tr>
<tr>
<td>Company</td>
<td>Industry</td>
<td>Code</td>
</tr>
<tr>
<td>------------------------------</td>
<td>---------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>National Aluminium Co. Ltd.</td>
<td>Aluminium</td>
<td>NATIONALUM</td>
</tr>
<tr>
<td>Reliance Industries Ltd.</td>
<td>Refineries</td>
<td>RELIANCE</td>
</tr>
<tr>
<td>State Bank of India</td>
<td>Banks</td>
<td>SBIN</td>
</tr>
<tr>
<td>Tata Motors Ltd.</td>
<td>Automobiles - 4 wheelers</td>
<td>TATAMOTORS</td>
</tr>
<tr>
<td>Tata Steel Ltd.</td>
<td>Steel and steel products</td>
<td>TATASTEEL</td>
</tr>
<tr>
<td>Tata Tea Ltd.</td>
<td>Tea and coffee</td>
<td>TATATEA</td>
</tr>
<tr>
<td>Nifty</td>
<td>-</td>
<td>NIFTY</td>
</tr>
</tbody>
</table>

The Time series of the MIBOR was also collected for the same period from the web sites of Clearing Corporation of India. The interbank money market and the stock markets have a few differences in terms of their working days. The interbank money market is open for six days in a week and the stock markets are open five days in a week. Apart from this the bank holidays are sometimes different from holidays in the stock markets. Inevitably, stock markets are always closed when banks are closed but banks have more holidays than stock markets and thus are closed for more days than stock markets. Given these differences in the working times of the banks and the stock markets, the matching of data from money markets and stock markets was an issue to be resolved. The days on which banks were closed when the stock markets were open the MIBOR rate of the previous working day was considered as the current rate. All the data for MIBOR that was available when the stock markets were closed was deleted and the data of futures prices, spot prices and MIBOR was matched with the dates. Thus data was consolidated date wise.
2.6 SCOPE AND LIMITATIONS OF THE STUDY

The study is restricted to the most liquid stocks which are part of the NSE's Index NIFTY and they are selected in such a way that they represent different industries / sectors. The study takes one aspect of the futures valuation, which is the cost of carry model and one data analysis approach the correlation approach. Therefore the inherent limitations of the cost of carry model and correlation also apply to the research work.

Trading in NIFTY futures was started in June 2000 and trading in single stock futures started in November 2001, this research work takes into account data from July 2002 to June 2006 therefore the data from the market is in the nascent stages of futures trading in Indian Stock markets.

As of July 2002 only 31 individual stocks were traded in the futures and options segment of NSE and by June 2006 the number of single stock futures permitted had grown to 118 stocks. The total number of stocks traded in the National Stock Exchange being 936 in July 2006, the number of stocks where futures were allowed up to June 2006 works out to 12.6% of the listed stocks. From these statistics it is evident that the Futures and Options segment in the Indian stock markets is still in the developing mode. Thus a study conducted before a market matures may not be entirely applicable when the market matures.

The choice of MIBOR also puts some limitations on the study. MIBOR (Mumbai Inter Bank Offer Rate) was considered as a benchmark risk free return as this is a market determined rate and is robust enough to be considered as a benchmark. The limitation though is that the unorganized
part of the Indian economy is bigger than the organized part and MIBOR would represent the organized benchmark. Whereas investors would look for a benchmark in the unorganized economy and unorganized economy would not be able to provide a “benchmark rate” for analysis. Therefore the choice of MIBOR is the closest one could get to reality on the ground and that has been considered as the benchmark.

After the conclusion of this study as the market develops and matures and more of the unorganized economy starts becoming the part of the organized economy there is scope of further research in using advanced techniques to determine the lead-lag relationships between spot and future prices and other such research approaches in the valuation of futures in Indian stock markets.