CHAPTER I

INTRODUCTION AND DESIGN OF THE STUDY

1.1 INTRODUCTION

A financial market is one which acts as the intermediary between the household and firms. Financial markets enable transferring domestic sector or household savings into the firm’s capital. This happens through the Primary and Secondary markets. In other words, this initiative happens at two levels: the market for Initial Public Offering (henceforth IPO), the Secondary or Seasoned Equity Offering and the Secondary Trading Market. When companies require capital in the forms of shares, they go for an Initial Public Offer. IPOs are vehicles which enables the companies to come to the market for the first time. When companies seek a public offering more than one time, this is called a Seasoned Equity Offering. In these two cases, the companies and the shareholders have a direct dealing. The companies participate in this dealing through the banks, insurance companies and equity research firms and merchant banks. This is not the case with the secondary markets. In the secondary markets, shares are traded on the stock exchanges. Shareholders (otherwise called investors) buy and sell shares and thus trading takes place in the stock exchanges.

As an important intermediary in the capital markets, a stock exchange provides an organized market place for transparent price discovery, where trading members use a trading platform, typically an electronic one to trade securities such as equities or bonds either on behalf of their clients or on their own account. The capital markets are bound by institutional framework, the legal and regulatory framework. The secondary markets determine the market price of the transactions. The transfer of ownership of financial assets from one economic agent to another in the most efficient manner is also provided by the secondary markets. Prices are functions of individual utility functions and preferences, structure of the assets, structure of the transactions and state of the economy. Thus the market price is the benchmark price that the models serve to explain and match. There are risks attached to trading in the secondary markets. These are classified as unsystematic and systematic risk. When one company or one industry faces risk, it is unsystematic risk. Excess of foreign exchange exposure by a few Indian companies come under this category. The second type, called the systematic risk is common to all the companies. Research focuses on measuring systematic risk and equity premiums better and to use these models to design new instruments and
markets to improve the efficiency of market prices. Such efforts have given rise to the literature on Efficient Market Hypothesis, Trading Strategies, Asset Pricing Theories (Capital Asset Pricing Model and Arbitrage Pricing Theory) and Market Microstructure. These entire hypotheses benchmark themselves against the market price behavior.

The short run behavior of investors reflects their buying and selling of shares. Investors buy and sell shares without holding them for long. This denotes the short run behavior of investors. It reflects the instantaneous matching of supply and demand from a group of investors who are trading the individual assets at a given point in time. In financial markets, the heterogeneous behavior of the traders is a crucial issue in the working of actual markets as it affects the important variables like volume of trade, degree of liquidity, the transaction cost, price fluctuations (volatility) and information processing. Heterogeneous behavior of investors include their levels of risk aversion, that is, whether they are willing to take risk or not, their need for liquidity, that is when there is no change in price of the asset during its sales, asset preferences, (assets includes shares, bonds, futures, options, currency), beliefs, information as well as learning process. In markets which are efficient, the fundamental value of a security fluctuates randomly.

1.2 STATEMENT OF THE PROBLEM

A stock exchange is a critical institution of the capital markets in a modern economy and India is no exception. In India, capital markets are increasingly playing an important role, determining the pace and pattern of economic growth.

The oldest stock exchange in India, the Bombay Stock Exchange (henceforth BSE) was founded in 1854 and recognized as a stock exchange in 1956. But the major reforms in the exchanges started only during late 1980s and early 1990s. This period has seen remarkable changes on how capital is raised, how securities are traded and how transactions are cleared and settled. One of the most important reforms in the stock exchanges was the establishment of the Capital market regulator, Securities and Exchange Board of India (henceforth SEBI). There was a tremendous growth in the stock markets during the past two decades and SEBI playing a major role. The efficiency of the stock exchanges in India has resulted in better resource allocation, faster, safer and cheaper transactions, and drastic increase in the number of investors, also called traders and stock exchanges becoming global. Overall, the Indian markets have become larger, deeper, diversified and more modernized
exchanges. Historically, exchanges in India, as elsewhere in the world, were not-for-profit organizations. There were members and brokers, who operated the exchange for the benefit of brokers. This, unsurprisingly, gave rise to a number of governance problems. Over the past two decades, security exchanges throughout the world have been demutualizing and converting from non-profit to for-profit shareholder enterprises. The exchanges are entrusted with vital economic functions, dispersed ownership structure has been adopted by the stock exchanges the world over so that there is no undue influence of any single individual on decision making.

The National Stock Exchange of India (henceforth NSE) was incorporated in 1992 and registered as a stock exchange under the Securities Contract (Regulation) Act 1956, in 1993 on the recommendation of Pherwani committee. It is managed by professionals who do not directly or indirectly trade on the exchange. It is the 16th largest stock exchanges in the world by market capitalization and largest in India by daily turnover and number of trades, for both equity and derivative segments. During October 2010, a 15 minutes pre-open trading session was launched, where investors can bid for stocks before the market opens.

Indian stock market is a relatively highly volatile market and lacks market making system. These factors make the National Stock Exchange of India an interesting place for studying the listing and trading process and its contribution in making stock market more efficient. Though the NSE is one of the largest exchanges for developing markets, the price formation and trading activity are not clearly understood. There arises a necessity to study the NSE at a micro structural level which would help investors better understand the markets and the policy makers to monitor the performance of the NSE better. In such a context, the issues raised below gain relevance:

1. Understanding the Bid Ask Spread for all the shares traded on the NSE.
2. Relating spread with Market Microstructure variables.
3. Trading on the Futures and Options segment and relating spread in F & O segment with strike price, number of trades, and number of shares, open interest and capitalization.
4. Impact of corporate announcements on spread.
5. Impact of Foreign Institutional Investment on spread.

1.3 REVIEW OF LITERATURE
Although a large number of research papers are found in security index investigations, a dearth of research initiatives is observed in one of the most important segments of the financial markets that is the futures markets. The research on futures involving various aspects like hedging effectiveness, dynamic interactions and causal relationship of stock index futures with spot market volatility is subject matter for research. Market Microstructure on futures markets is a rare research.

Amihud and Mendelson\(^1\) (1980), on analyzing the market structure of the New York Stock Exchange and the inventory issues faced by the investors, show that the investors are risk neutral and still set prices to manage their inventory positions, because they face constraints on the maximum inventory they can hold.

Amihud and Mendelson\(^2\) (1986) study the effect of securities’ bid ask spread on their returns. They model a market where rational traders differ in their expected holding periods and assets have different spreads. The ensuing equilibrium has the following characteristics: (i) market observed average returns are an increasing function of spread (ii) asset returns of their holders, net of trading costs increases with spread (iii) There is a clientele effect, whereby stocks with higher spreads are held by investors with longer periods (iv) Due to the clientele effects, returns on higher spread stocks are less spread-sensitive, giving rise to a concave return spread relationship.


Amihud, Mendelson and Murgia\(^3\) (1990) study the impact of the stock market microstructure on return volatility and on the value discovery process on the Milan Stock Exchange, in the call market which is followed in the exchange. This is preceded with the trading in continuous market. They find that the opening transaction in the continuous market had the highest volatility and that opening market with the call transaction seems to produce relatively lower volatility.

Antonia et.al (2007)\(^4\) addresses the link between the noise traders and volatility following the introduction of index futures. The authors employed a particular non
fundamental trader type called feedback traders as a proxy for noise trading. (Feedback traders base their decision upon recent trends. Positive (negative) feedback trading implies that investors buy when prices rise (fall) and sell when they fall (rise)). The design used here is the interaction of feedback traders with rational traders, controlling for volatility persistence over time, and is tested in a series of developed capital markets. Their results indicates that the significant presence of feedback traders prior to the launch of index futures with this significance disappearing post futures. The authors report no evidence of feedback traders migrating to the futures segment following the launch of futures markets.

Back (1993) analyze the impact of asymmetric information on the performance of the options which form the S&P index. He classifies the investors based on the information they receive, as informed and uninformed investor. The informed investors are better informed than the others. They are subject to receiving of private signal about the future movement of the shares. The uninformed investor, otherwise classified as the liquidity trader, do not get any immediate information about the company. So they trade just because they require cash or have

investible funds which need to be utilized immediately. Back argue that trades in an options market and the underlying asset convey different information. This implies that option trading can affect the underlying security prices because it changes how information is revealed in prices and trading volume.

Awartani, Corradi and Distaso (2004) study the relationship between liquidity and microstructure effect for Dow Jones Industrial Average for a period from 1997 – 2002. This one of the strongest databases as this set contains high frequency data for nearly seven years.


A study on the impact of micro structural effects on liquidity concludes that they find no clear relationship between liquidity and microstructure effects, measured by spread.

Beygelam$^7$ (2005) find that the true option prices are on average closer to bid than to ask quotes indicating that mid quotes are indeed proxies for the true option prices. The market participants adjust their trading strategies in times of high option price asymmetry.

Black$^8$ (1989) argues that the transaction data which includes the selling and buying prices, the number of trades and the number of shares traded, occurring in financial markets are often contaminated by market microstructure effects, such as bid-ask spreads, liquidity ratios, turnover, and asymmetric information. The author suggests that such data are often contaminated by disturbance in trading. This disturbance deviates the characteristic of the security from its original value and causes fluctuations. This term is called “Noise”. Noise is present in almost all transactions. This concept is supported by Hasbrouck (1993).

__________________
7. Raisa Beygelman, ‘Bid Ask spread and Asymmetry of Options Prices”, working paper, Department of Economics, , Goethe Univeristy, Germany, November 2005..

Blume, Easley and O’Hara$^9$ (1994) analyze the importance of trading volumes in options market. In the study of the movements of options prices, they show that trading volumes provide information quality that cannot be detected from prices. This suggests that trading volume in options could provide information about the prices in the underlying security.

Bai, Russell and Tiao $^{10}$ (2000), on studying the importance of transaction prices, argue that the observed transaction price can be decomposed into efficient one plus a “Noise” due to microstructure effects. The transaction prices are inefficient and incomplete. They do not reflect the full information of the security. There is a portion of noise in the price of security. They say of the relevance of the microstructure noise, especially when dealing with high frequency data.
Bossaerts and Hillion\textsuperscript{11} (1991) study the microstructure of foreign exchange markets and examine the four continental European currencies with French franc. They study the Friday effect on spread. They analyze how the exchange rates behave on Friday, as the next two days are trading holidays. They conclude that bid-ask spreads on Fridays were documented. Reliable evidence of asymmetric bid-ask spreads for all days of the week were present. The bid-ask spread on Fridays are different from the rest of the week. Fridays showed extraordinary trading effects.

Brock and Kleidon\textsuperscript{12} (1992) analyze the pattern of bid ask spread on intra-day basis. They show a U shaped intra-day pattern in the New York Stock Exchange stock prices bid ask spread. They argue that high spreads are a response of market makers to the increased order flow at open and close periods. On the other hand, low spread is an attempt to avoid exposing themselves to the risk of holding unwanted inventory positions.

Chakrabarty and Jain\textsuperscript{13} (2004) analyze the microstructure of Indian markets. For around 800 shares that were studied, they find the median spread to be 0.45 rupees in the Limit Order Book and 0.72 rupee according to Roll’s estimator. The difference is consistent with a U shaped pattern of intra-day spreads. The LOB spread represents 0.77\% of the median price in the limit order book. Rupee spread increases with price and returns variance and decline with market capitalization, trading volume and the number of trades.
Chang, Jain and Locke\textsuperscript{14} (1995) report that volatility in the S & P 500 index futures follows a W shaped (a U shaped pattern during most of the day before the close of NYSE and a mini U Shaped pattern until the close of the futures market). This evidence suggests that closing irrespective of the trading mechanism, is associated with greater volatility. Other studies have also examined the intra-day pattern of the price movements in the S & P 500 and MMI index futures separately for various periods. However, these previous studies examine only one single index futures at a time. These studies also report a significant increase in volatility during the time when stock index Futures and Options expire simultaneously, called “Triple witching Hour”. Such situations does not arise in the Indian markets as the expiry of the options and futures contracts takes place on the same day.

\begin{itemize}
\end{itemize}

Cherian and Jarrow\textsuperscript{15} (1998), on studying the implied volatility in the options markets, identifies two types of informed traders. First, directional traders who have perfect information about the underlying asset futures price movements but imperfect information about volatility, so they buy (sell) options if their estimate of the options value, given their private information as above (below) the quoted ask (bid) price. Second, volatility traders who have perfect information about volatility but do not know how underlying price will move, which buy (sell) options when implied volatility is lower (higher) than their estimation. They consider only volatility traders.

Chiyachantata et.al\textsuperscript{16} (2004) examines the impact of institutional trades on volatility in international stocks across 43 countries. They find that the trade imbalances, enforcement of insider trading laws, stock prices and emerging markets are positively associated with temporary volatility increases whereas the presence of market makers reduces such increase.
They show that institutional traders, in the long term, do not stabilize markets as the levels of volatility after their trades are almost identical to their pre-decision levels.

Barbedo and Lemgruber\textsuperscript{17}(2007), estimate the bid ask spread for the Telemar options in the Brazilian market. The database consists of intra-day prices of stocks and options traded in the BOVESEPA exchange. They find that when spread is taken into account, the underlying asset implied volatility significantly reduces to consistent and steady values.


Copeland and Galai\textsuperscript{18}(1983) study the impact of information on spread. Information asymmetry is one of the major reasons for spread. By characterizing the cost of supplying quotes, as writing a call or put option to an information motivated trader, it is shown that the bid ask spread increases with price level and volatility but decreases with market activity, depth, continuity and the degree of competition. So higher volume measured by the number of transactions is associated with lower spreads. They predict that market makers are assumed to optimize his position by setting a bid ask spread which maximizes the difference between revenues received from liquidity motivated trader and information motivated trader.

Engle and Cho\textsuperscript{19} (1999) propose a new market microstructure theory called derivative hedge theory in which options market percentage spread is inversely related to the option market maker’s ability to hedge his positions in the underlying market, as measured by the liquidity of this underlying market. Options spread are a function of moneyness, time to maturity, option prices, hedge ratios and volatility. They find that options market volume is not a significant determinant of option market spreads, which challenges the validity of
volume as a proxy for liquidity. Options market spreads are positively related to spreads in the underlying market. However, option market duration does not affect option market spreads, with very slow and very fast options markets both leading to bigger spread. Inventory models predict big spreads in slow markets. Asymmetric information costs in either market are naturally passed to the other market by market maker’s hedging and therefore it is unimportant where the informed traders trade.


Froot and Perold\(^2\) (1991) on comparing the performance of the spot and futures markets, show that futures market causes an increase in the market depth due to the presence of more market makers in the futures segment than in the cash segment and the more rapid dissemination of information. A market maker is a firm that is ready to buy and sell a particular stock on a regular and continuous basis at a publicly quoted price. So futures markets are more efficient in trading than the spot market.

George and Longstaff\(^2\) (1993) develop taxonomy of spreads for the S&P 100 index options in terms of inventory cost. They study the index option on S&P 100 index. They argue that the cross sectional differences in the S&P 100 index options bid-ask spread should be related to cost related variables. They find that the underlying risks and market structure are held fixed across options. They test the bid ask spread and trading activity of each option as jointly determined variables. They find that the determinants of market making cost explain almost 70 percent of the cross sectional variations in the bid ask spread. Nearly 50 percent of the cross sectional variation in the trading activity is explained by the bid ask
spread and features of the options contracts which includes maturity and nearness to the money.

Ghosh and Herwadkar\textsuperscript{22}(2009) study the impact of the Foreign Institutional Investment on the Sensex. They analyze the effect of portfolio on various segments of the Indian financial markets over the past ten years preceding the global financial crises. Their results suggest that portfolio flows causes changes in the equity prices. A positive shock to net FII flow generally results in increase in equity prices. They find that in the short run, the net FII flows have a positive impact on equity (BSE Sensex) market.


Glosten and Harris\textsuperscript{23} (1988) estimate the Market Microstructure model using the intra-day data and find that significant amount of New York Stock Exchange common stock spreads are due to asymmetric information. They study the reasons for spread and classify the spread reasons under three broad categories. They are inventory holding cost, order processing cost and the cost of information asymmetry. They finally conclude that information asymmetry plays a major role in estimation of the bid ask spread.

Glosten and Milgrom\textsuperscript{24} (1985) and Easley and O’Hara\textsuperscript{25} (1987) develop models where transactions signal information in dynamic settings. Spread increase when an agent wishes to buy. The market maker revises upward his expectation of the asset’s value and moves his quotes accordingly; when an agent wishes to sell, the opposite revision occurs. In modeling the microstructure of a stock market, they allow for fully informed traders, uninformed (liquidity) traders and a market maker, all of whom are risk neutral and competitive. Both trade randomly. The informed receive a signal indicating the true value of the asset but the uninformed does not. Thus information asymmetry arises. It poses an adverse selection process and is the reason for the bid ask spread.


Gupta, et al26 their results show that the correlation among the futures markets exhibit regional linkages. The correlation is higher for intra - regional futures markets while the correlation is relatively low amongst inter regions. Incidentally, the Indian futures markets show a high correlation similar to developed markets. The descriptive statistics shows high standard deviation for the emerging markets like Brazil, Mexico and India when compared to developed futures markets. Accordingly it appears that the associated risk is low in developed futures markets when compared to that of the emerging markets. From their study the authors conclude that India appears to be emerging as an important futures market much like a developed market in terms of efficient absorption of information.

Hasbrouck and Sofianos27 (1993) describe the types of traders, the types of markets, its difference from the other types of markets, and the procedures followed for trading. They classify the trading on the NYSE as the specialist system. They examine the order entry and execution, trade and quote reporting and the rules of trading at the NYSE. They show that the trades in which NYSE specialists participate tend to have bigger and more rapid effect on spreads than trades with no specialist participation.

Huang and Stoll28 (1994) developed a two –equation econometric model of quote revisions and transaction returns and used it to identify the relative importance of different
microstructure theories and to make predictions. Their results show that expected quote return is positively related to the deviation between the transaction price and the quote midpoint while the expected transaction return is negatively related to the same variable.


Chio, H and Subramanyam, A 29(1994) study the trading on the NYSE and examines the impact of futures trading on the volatility and liquidity as measured by bid-ask spread of the spot market. A category of index on the NYSE, called the Major Market Index Futures is studied for volatility and information asymmetry. The results indicate that the average intra-day bid-ask spread in post Major Market Index futures has increased while there is no significant change in volatility. Information asymmetry also has posted an increase due the introduction of futures trading.

In the earlier studies by Demsetz30 (1968) and Tinic31 (1972) the spread was viewed as a consequence of the dealer’s need to recover fixed transaction costs as well as a normal profit. It arises from traders’ desire of immediate execution of orders. Demsetz was one of the first authors to research on Market Microstructure.

Jegadeesh and Subramanyam32 (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 a higher spread during post futures period. Their overall results suggest that the introduction of index futures did not reduce the bid ask spread in the spot market and there is a weak form of evidence that spread might have increased in the post futures period.


Camilleri and Green (2009) examine the various market microstructure issues in emerging markets especially in India at the National Stock Exchange. They find that Monday effect is found in the index but not in the underlying stock indicating index fluctuations are not information related. The findings also suggest that the expected benefits of call auctions may not always materialize, possibly because a liquidity threshold for stocks must be surpassed for the expected benefits to accrue.

Kuldeep Shastri et al (1996) find that the reduction in bid ask spreads during periods in which options trade is associated with a decrease in the asymmetric information component of a spread. This result implies that option trading increases the flow of information to the underlying security. They also suggest that the level of asymmetric information in the underlying stock market is lower and the liquidity of the underlying stocks improves during the period in which the options trade. These results suggest that the options markets have a beneficial impact on the underlying stock market and that options trading have an impact on the information flow to the market.

Kyle (1985) is one of the first to link market microstructure and liquidity. He describes the three dimensions as tightness, depth and resilience. Resilience is a term used to find how soon after a trade executed does the market liquidity reverts to original level. A market that bounces back from a price shock or can absorb a shock and restore the balance amongst orders quickly is a resilient market. Depth measures the ability of the market to accommodate large volumes of trade with little impact on prices. Tightness denotes the cost incurred in a transaction, irrespective of market price. Bid ask spread is an indicator of tightness and a narrow spread indicates a liquid market.


Landsiedl, Felix36 (2005) examine the determinants of options market liquidity and observes the interrelations with the underlying securities’ market characteristics. They analyze a 128 days intra-day sample of quoted and realized option bid ask spreads. They find that the quoted bid ask spread show more regularity and can be better explained than realized bid ask spread, the significance and the size of the estimated parameters are very convincing for both samples. They find that the options mid price and the implied volatility are the driving components of the inventory holding costs. They also find that increased market competition, measures as order book depth, decreases the bid ask spread significantly.

Lease, Masulis and Page37 (1991) investigate the importance of bid ask spread induced biases on event date returns as exemplified by seasoned equity offerings by NYSE listed firms. They document significant negative return biases on the offering day. Buy-sell order flow imbalance is prominent around the offering and induces a relatively large spread.

Lee and Mathur38 (1999) study the influence of information arrival on market microstructure for Major Market Index futures traded on Chicago Board of Trade (CBOT), NYSE and S&P 500 stock index futures market, with special emphasis on effects of opening and closing of trading and expiration of contracts on price movements and trading activities. Their results show that although the opening of the MMI futures market is associated with higher volatility, when the spot market opens, the volatility reaches the highest level. In contrast, the NYSE and S & P 500 continue to trade and reach a peak at the close of the futures market. On focusing on periods of alternate closures between spot and futures, they show that the opening of futures market ahead of the opening of spot market in the NYSE is associated with higher volatility. The overall volatility pattern appears to be a W shaped for the NYSE and the S&P 500.

futures and U + W shaped for MMI. For both the NYSE and S&P 500 index futures, tick volumes follow the same patterns as those of volatility. For the MMI, the morning opening of the futures market also witnesses an increase in trading but the increase is not as great as the increase that occurs when the spot market opens again. In addition, after the peak at the close of the NYSE, the tick volume in the MMI index futures drops consistently until the end of the day while trading in the NYSE and the S&P remains strong. The expiration days of the MMI shows a significant increase in volatility and volume. This is not the case for NYSE and S&P 500 futures.

Lee, Mucklow and Ready 39 (1993) argue that the bid ask spread is only one dimension of market liquidity. A second variable that also impacts liquidity is the number of shares a market maker is willing to purchase or sell at the quoted bid ask prices (depth). They suggest that the bid-ask spread and the market depth are jointly determined with increases in depth, indicating an improvement in liquidity. They also find that around earning announcements (when adverse selection is likely to be the most severe), depth is reduced and spread widen on the NYSE.

Lee, Ready and Seguin 40 (1994) use four different measures of volatility to examine the relationship between trading activity in the options market and stock volatility. These measures are Squared Return, Absolute Return, Price Range and number of quote revisions. Squared return are the square of the return in a time interval, where the return is computed as the difference between the last trade price before the interval and the last trade price in the interval. Absolute return is the absolute return, computed as the difference between the last trade price before the interval and the last trade price in the interval. The Price Range is the absolute difference between the highest and the lowest trade price in the interval and Number of Quote Revision is the number of revisions to the mid spread (midpoint between the bid and the ask prices) of the specialist’s quote.


MacKinnon and Nemiroff (1999) examine the effect of decimalization by the Toronto Stock Exchange. They study the impact of decimalization on liquidity. Spread is a measure of liquidity. They find that after decimalization, effective spreads decrease significantly yet price impact is unaffected, thus reducing transaction costs. So decimalization has reduced the spread, which is a result of reduced transaction costs.

Madhavan and Sofianos (1998) find that specialists participation rate in trading is inversely related to both trading activity and proxies for internal and external competition and positively related to spread indicating that specialists participate more when liquidity is lower. This paper compares and contrasts the execution costs in Paris and New York. The two markets studied are both auction markets – involving public trade, but differ in the level of automation. New York market follows a floor based trading system. Their results indicate that execution costs are higher in Paris than in New York.

Manaster and Mann (1996) find that contrary to the implication of the pure inventory theory, market markers with long (short) position tend to sell at relatively large (buy at small) prices. The authors use futures transaction data to investigate cross-sectional relationship between market maker inventory positions and trade activities. They show that the traders control inventory throughout the trading day. Their results are consistent with the models and that the correlation between inventory and reservation prices is positive.


Garman, Mark\textsuperscript{44} (1976) coined the phrase “market microstructure” as the title of his article on market making and inventory costs. This phrase later became the descriptive title for the investigation of the economic forces affecting trades, quotes and prices. In his study, the author assumes that a collection of market agents are treated as a statistical ensemble. Their market activities depicted as a stochastic generation of market orders according to a Poisson process, and to study the moment to moment trading activities in the stock exchanges. Two basic models called the “Dealership” market and the “Auction” markets are put forth and implications are drawn.

Morse and Ushman\textsuperscript{45} (1983) examine the affect of information announcements on the bid-ask spreads. They find no significant changes in the bid ask spreads surrounding quarterly earnings announcements, but significant increase in the size of the bid ask spread on the day of large price changes.

Krinsky and Lee (1996)\textsuperscript{46} study the behavior of the components of the bid ask spread around the announcement of earning news. They conclude that the period prior to earning news is characterized by greater information asymmetry among market participants and thus increases adverse selection cost. They also find the impact of earning announcement on information asymmetry increases significantly before and after the announcements. Because of the lower inventory holding and order processing cost, the quoted bid ask spread is less pronounced, although earning news results in increased information asymmetry among market participants. So they conclude that total spread is not an accurate measure of information asymmetry.

\begin{itemize}
\item \textsuperscript{46} Itzhak Krinsky and Jason Lee, “Earning Announcement and the Components of the Bid Ask Spread”, \textit{Journal of Finance}, Vol.51, no.4, 1996, pp 1523-1535.
\end{itemize}
Neal\textsuperscript{47} (1987) studies the effect of multiple listing on options market spreads using 43 options listed on the American stock exchange for a three week transaction data. He examines the bid ask spread for 26 AMEX and 15 CBOE options. He finds that the spreads on multiple listed options are lower than those on single listed options, even when there is a high concentration of trading volume on a single exchange.

Orlowski, Piotr\textsuperscript{48} (2009), on verifying the selected market microstructure for a Warsaw Stock Exchange traded stock find that in the transaction process of a very liquid stock, very little amount of information are revealed through each trade. In the price change process, the probabilities of price changes react only marginally to changes in exogenous variables. The stock price does not reflect all available information available to investors who should observe other market characteristics, such as trading volume and trading intensity.

Pinder, Sean\textsuperscript{49} (2003) examine the determinants of the bid-ask spread in the Australian options market before and after it switched from a quote driven, floor traded market, and find that both call and put options bid ask spreads are positively related to the value of the option and negatively related to the level of trading activity. Bid ask spread in the Australian Options market is also positively related to the options’ term to maturity. With regard to the impact of changes in the market microstructure upon the determinants of the bid ask spread, this paper reports that spreads are generally smaller when market makers are obliged to maintain a continual presence in the market.

\begin{flushright}
\end{flushright}

\begin{flushright}
\end{flushright}

\begin{flushright}
\end{flushright}
Roll\textsuperscript{50} (1984) assumes a simple order processing costs model in which bid ask bounces, induces negative serial correlation in price changes. The order processing costs are basic operation costs relating to the trading mechanism.

Reinganum\textsuperscript{51} (1991), in his study on market microstructure and asset pricing indicate in his research that (i) among small firms, the average returns of NYSE exceeds the average returns of similar sized NASDAQ securities. (ii) the return differentials between NYSE and NASDAQ securities diminishes as stock ‘s market capitalization increases and (iii) among similar sized firms, the return differentials between NYSE and NASDAQ securities persists even after controlling for various risk and liquidity related measures. A major difference between the NYSE and NASDAQ firms is the market microstructure in which their securities are traded. The NASDAQ market is often described as a competitive, multiple dealership market, whereas the NYSE is often characterized as a monopolistic specialists system. Neither NYSE nor NASDAQ unambiguously dominates the other in providing liquidity. Rather, any liquidity advantages seem to depend on the market capitalization of the stock.

Ait - Sahalia Yu et.al.,\textsuperscript{52} examine the extent to which the high frequency statistical estimates that will be constructed will correlate with the various financial measures of liquidity, and whether they contain new or different information, that is, whether high frequency estimates of microstructure noise contain a systematic, market wide risk factor and whether that risk factor is priced in the market, meaning that stocks that co vary with the high frequency measures of liquidity tend to get compensated in the form of higher returns.


Shastri et al\textsuperscript{53}(1996) provide insights into the impact of options trading on the underlying security by comparing the differences in the volume, volatility, bid ask spreads and depth of the stock market during periods in which options trade with intervals during which options do not trade. They find that when options trade; the underlying stock is more

\textsuperscript{53} Shastri et al (1996)
liquid. The bid ask spread (quoted depth) are negatively (positively) related to option trading volume. The lower spread in periods of options trading are related to lower levels of information asymmetry and a higher probability that a transaction would take place inside the spread. Their results indicate that the level of information asymmetry in the underlying stock market is lower and the liquidity of the underlying stocks improves during periods in which options trade. These results suggest that options markets have a beneficial impact on the underlying stock market and that an option trading has an impact on the information flow to the market.

Steigerwald and Vagnoni\(^{54}\) (2001) focus on the role of private information in the formation of securities price. Their model captures the link between asset prices and informational asymmetries among traders. In actual markets, the arrival and existence of private information is not easily captured. The possibility of multiple, overlapping information events occurring introduces significant complexity. Further, a wide spread consensus that adverse selection problems faced by market makers are not solely responsible for bid ask spreads; rather they are a result of multiple additional factors, including market inventory considerations and market power.

\[\text{\underline{---}}\]


Stoll, Hans,\(^{55}\) (1978) in an investigation of the determinants of the bid ask spread concludes that the greater the competition among the market makers, the lower the spread. They also find that the bid ask spread increases with the size of the trades with both risk aversion and volatility while it does not depend on the size of the inventory.

Thenmozhi\(^{56}\) (2002) studies the effect of infrequent trading and the bid-asks spread and concludes that they follow an ARIMA process. For lags beyond two, the coefficients are
close to zero and hence reinforce the fact that serial correlation problems do not persist in the Nifty returns.

Abhyankar et al (1997), on studying the intra-day variations in the bid ask spread, trading volume and the volatility of returns, based on 835 stocks traded during the first quarter of 1991, find that the average bid ask spread shows a U shaped pattern during the trading hours. This pattern is found in many other markets. The spread is highest at the opening and comes down during the day to a constant level and increasing at the end of the day. The trading volume shows a double humped pattern during the day, with highest values at the starting and end of the day. Return volatility shows a U pattern


The Indian capital markets have witnessed many changes in the reforms undertaken by Securities and Exchange Board of India. One of the major reforms was the setting up of derivatives trading in a phased manner. The Indian markets have also witnessed many new developments. Unfortunately, these developments are understood by very few investors. The impact of trading behavior is a point of very rare discussions. Numerous papers have examined the relationship between spread and microstructure variables for equity markets. Empirical evidence to date is studiesd although a majority of studies have focused on developed markets. As far as the Indian markets are concerned, there is a dearth of research
on this topic with very few studies on this issue. Earlier research was carried out in other markets like the exchange rate. Another issue that is inadequately addressed is the derivatives segment. To the author’s best of knowledge, this is one of the premier researches on the futures and options market which considers the market microstructure variables. The third issue which has received very little attention is the impact of corporate announcement on spread. Prior research was carried out to find the impact of earning announcement and announcements on mergers and takeovers on the performance of the company, but this again in one of the few researches to study the impact of corporate announcement of any kind and a microstructure based analysis. The impact of Foreign Institutional Investment on spread is an unexplored area. Though the impact of foreign Institutional Investment on other aspects is already researched, a combination of FII and microstructure would throw light on the important of FII in the stock and derivatives markets.

1.4 SIGNIFICANCE OF THE STUDY

Market microstructure features like market liquidity and price informativeness, which influence the performance of the share and are important for selection of stock, is a vital issue of the present study. It helps in gaining a better understanding of the capital markets, price formation issues, liquidity issues, inventory issues and information asymmetry issues. It enables investors to get an insight on how deep and efficient NSE is, and how the market integrations has to be to all fair pricing and quoting of prices. It also considers liquidity determinants which lead to increased savings and investments. The empirical analysis and finding provide new evidence of Market Microstructure affecting the trading decisions.

Futures and Options of most liquid securities are studied, which enables the investor to get a better understanding of the derivatives markets. This could improve the understanding on derivatives markets.

Results of this study will help to achieve the goals of law makers who want to increase the efficiency of the secondary markets. Organizations entrusted with the job of regulating the market also need a clear idea regarding the pattern of volatility for framing policies to protect the interest of investors. So an understanding of the market volatility is thus important from the regulatory policy perspective as well.
Foreign Institutional Investors invest only in the most liquid shares and large capitalization companies. A better understanding of Market microstructure could influence their decision to invest in other emerging and growing companies.

Market Microstructure is a branch of finance dealing with features of market liquidity and price informativeness and is important for selection of stock. Market microstructure helps in gaining better understanding of the capital markets, price formation issues, liquidity issues, inventory issues and information asymmetry issues. Market microstructure studies how prices are determined, how price setting rules evolve in the market and why prices exhibit a particular time series properties. These issues have important implications for market regulations and for the design of trading mechanism.

The interaction between the organizational features of a market and the behavior of heterogeneous traders is a crucial issue in the working of actual markets as it affects important variables like volume of trade, degree of liquidity and transaction costs, price volatility and information processing. Heterogeneity concerns risk aversion, need for liquidity, asset preferences, beliefs, information as well as learning process and reaction dynamics.

Besides information efficiency, one of the main issues of market microstructure literature concerns market liquidity and transaction costs, usually measured by the size of the bid ask spread and their influences on transaction prices and returns. Market microstructure suggests that the market structure matters a great deal in the analysis of agent behavior and the properties of asset prices. In particular, it analyzes the arrival and dissemination of information, the generation and arrival of orders, and how orders are transformed into trades.

Market microstructure analysis represents an attempt to study and to incorporate in formal analysis, the specific arrangements that make the actual markets work. It is the only theory that considers all microstructure variables. Perceptions vary about the dispersion of Indian stock prices. Increased participation of institutional investors, at the level of investors, frequent and wide stock market variations cause uncertainty about the value of the asset and affect the confidence of the investors. Risk averse investor may shy away from market with frequent sharp price movements.

1.5 OBJECTIVES OF THE STUDY
This study is undertaken with the following objectives.

1. To assess the bid ask spread for all stocks traded on the National Stock Exchange of India.

2. To evaluate the relationship between the spread and the Market Microstructure variables. Market Price per Share, Market Capitalization and Volume (Number of shares) are the Market Microstructure variables.

3. To estimate the spread on intra-day data.

4. To analyze the spread for the Futures and Options segment.

5. To study the impact on spread during Corporate Announcements.

6. To find the impact of Foreign Institutional Investments on spread.

7. To offer suggestions to policy makers.

1.6 SCOPE OF THE STUDY

The study consists of all the shares that are traded in the National Stock Exchange. The period for the study is March 2010. On an average, 1394 shares were traded on the NSE. After removing the other instruments other than the equity shares and the incomplete data, the number of securities was reduced to 1290 shares. During the period of study, there were a few companies which were listed in the NSE for the first time. If they were traded for more than 10 days, (50% of the trading period) they were included in the list otherwise they were excluded. These shares are also classified according to their industry.

Futures and Options (F & O) contracts are also traded on the National Stock Exchange. F & O contracts were introduced in the NSE during early 2000s. Futures and Options contracts have three trading cycles – the near month, the next month and the far month cycle. Previous research works were done taking only the first month contracts as they were most liquid and most traded contracts. But this research is done taking two trading cycles, because the third month cycle has very few trading.

NSE was incorporated in 1992 and was recognized as a stock exchange in 1993. It is a completely order driven electronic market. NSE operates in four different segments – equity, Futures and Options, wholesale debt market and the currency derivatives segment. The
capital market segment of the NSE had an average daily turnover of Rs 16959 crores during 2009-10. Market capitalization of the listed companies during the same period was Rs 6,009,179 crores.

The Futures and Options contracts include all the shares that form the Nifty. Nifty is the index of the National Stock Exchange and is formed with most liquid, frequently traded shares. The derivatives contracts on these 50 shares taken for analysis.

1.7 LIMITATIONS OF THE STUDY

The NSE commenced operations and started functioning as a fully fledged exchange during 1994. Though it was set up after a century of commencement of stock trading in India, it became the largest exchange in terms of daily turnover and number of trade for both equities and derivatives segments. Among the two major stock exchanges in our country, it was feasible to consider the operations at the National Stock Exchange alone. The study on Market Microstructure on the Bombay Stock Exchange could not be taken for study.

The NSE provides that data on Trades and Quotes (TAQ) on an annual bases. The data is disseminated annually from 1 April to 31 March. At the time of starting this research, the latest data available was for March 2010. Due to extremely large volumes of data sorting if the data was a very big challenge and time consuming process. It was not possible to bring out the results immediately. During the twenty days trading period, which is taken for this study, the average trading per day was 51,13,847 transactions. In the Indian financial system, March and April are high volatile periods as they represent the period of year ending and the beginning of the financial year. The results here are prone to high volatility.

The behavior of investors in the stock exchanges is subjective in nature. A few investors get access to information faster than the rest. So these investors move the price of the asset according to their preferences. The rest follow the crowd. So the transactions do not reflect the true behavior of investors.

In the National Stock Exchange of India, the trading was divided into four categories, which includes equity, futures and options, wholesale debt markets and Currency. Trading on equity shares and derivatives alone were taken for the study. The other instruments were ignored. Even though in the equity markets there are other instruments like warrants, debt, shares, that are traded, these instruments were ignored. Equity markets is one of the most
studies markets. The first trading on Monday mornings represents the accumulated trading for Friday evening, Saturdays and Sundays. In case of Futures and options, the contracts for the first two months were considerable. There was almost no trading for the third month. So the contracts expiring on the third month are ignored. In case of options instrument only 50 of the 190 shares are mostly traded. The rest of securities, were removed from the study. Due to the voluminous nature of the data, it was out of scope to analyse in detail the shares in which FIIs preferred to invest. It is possible to only analyze the impact of FIIs on the overall spread.

1.8 OPERATIONAL DEFINITION OF CONCEPTS

1.8.1 Bid ask spread

Bid ask spread is the compensation to market makers (investors) for providing liquidity. Investors quote different prices for the bid and the ask to cover three types of cost. They are the order processing cost, the inventory costs, and the asymmetric information cost.

1.8.2 Call options and Put Options

A Call option gives the buyer or the holder the right but not the obligation to buy a given quantity of the underlying asset at a given price at given future date. A Put option gives the holder of the option the right but not the obligation to sell the asset at a future date and at a predetermined price.

1.8.3 Contract cycle

Contract cycle refers to the period over which the contracts mature. The stock futures and options on the NSE have three expiry cycles – one month or near month, two months or next months and three months or far month maturity cycle. The contracts expire on the last Thursday of the month. If the last Thursday is a holiday, the preceding day would be treated as the expiry day. For example, a stock that is traded on the 10th March 2010 has the expiry for the first month contract on 25th March 2012, its expiry for the second month contract on 29th April 2010 and its expiry for the third month contract on 27th May 2010. Similarly, a stock that is traded on 28th March 2010 has its expiry for the first month on 29th April 2010, its second month expiry on 27th May 2010 and the third month expiry on 24th.
June 2010. As soon as a contract expires, new contracts will be floated on the next trading
day. Thus at any point in time, three contract cycles exist in the NSE.

1.8.4 Impact cost

The market impact cost is the best measure of the liquidity of a stock. It accurately
reflects the costs faced when actually trading a share. For a stock to qualify for inclusion in
the S & P CNX Nifty, it must have a market impact cost below 0.50%, when doing S & P
Nifty trades of Rs 20 million. The current impact cost of the S & P CNX Nifty for a portfolio
size of Rs 20 million is 0.13%. Impact cost is the cost of executing a transaction in a security
in proportion to its index weight, measured by market capitalization at any point in time. This
is the percentage markup suffered while buying or selling the desired quantity of a security
compared to its ideal price. The ideal price is (best buy + best sell)/2.

1.8.5 Institutional investors

Institutions which trade on stock exchanges are called institutional traders. Usually
financial institutions like Mutual Funds, Insurance companies, Banks and other Non Banking
Finance companies trade in Stock Exchanges and are called Institutional Investors. They
hold and manage the majority of assets and account for the bulk of share volume. They tend to
trade in large quantities with minimum trading costs and benefitting from any private
information.

Indian companies which invest in shares traded on exchanges are called Domestic
Institutional Investors (DIIs). Foreign companies which invest in shares traded on the stock
exchanges are called Foreign Institutional Investors (FIIs).

1.8.6 Limit order

A limit order to buy sets the maximum price that will be paid and a limit order to sell
sets a minimum price that will be accepted.

1.8.7 Liquidity traders

Liquidity traders trade to smooth consumption or to adjust the risk – return profiles of
their portfolios. They buy stock if they have excess cash or have become more risk tolerant
and they sell stock if they need cash of have become less risk tolerant. Liquidity trader tend
to trade portfolio whereas informed traders tend to trade specific asset in which they have
private information. Liquidity traders loose if they trade with informed traders. They seek to
identify the counter party. Informed traders seek to hide their identity. Many models of market microstructure involve the interaction of informed and liquidity traders.

1.8.8 Market Microstructure

Market Microstructure is the branch of finance concerned with the details of how securities transaction takes place in stock exchanges. It deals with the evolution of price by focusing on the actual trading process.

1.8.9 Open Interest

The Open Interest denotes the total number of options and/or futures contract that are not closed or delivered on a particular day. It also denotes the number of buy market orders before the stock market opens. It is the number of outstanding contracts that are held by market participants at the end of the day. The derivative contracts that have not yet been exercised or fulfilled by delivery are included here. It is used to confirm trends and trend reversal process. It measures the flow of money into the market. When the volume exceeds the existing open interest on a given day, this suggests that trading in that option was exceptionally high that day. Open interest also gives the key information regarding the liquidity of an option. When the open interest is large, it means there were lot of buying and selling activity of the security, which indicates liquidity.

1.8.10 Tick size

The tick size is the minimum allowable price variation. In the National Stock Exchange, the tick size is 1/20th of a rupee – that is the tick size is Re 0.05/-. 

1.9 METHODOLOGY

Methodology includes sample design, the procedure followed to collect data, method of analysis and tools of analysis of the study.

1.9.1 Sample Design

The shares that were traded during March 2010 are taken as the base for choosing the sample. During March 2010, 1394 securities were traded on the NSE. This list includes warrants issued by financial institutions, debt instruments issued by corporate and equity shares issued by companies. Though the NSE has a separate segment called the Wholesale Debt Market, where the debt instruments are traded, the NSE permits trading of these debt
instruments and warrants in the Equity market segment. The characteristics of warrants and debt instruments are different from the equity shares. Since very few number of trading on these instruments is present here, these instruments are removed for the sample.

During March 2010, there were twentyone trading days. This excludes Saturdays and Sundays, which are trading holidays and other holidays. The trading days for the sample were rounded off to twenty.

For the equity shares to be included in the sample, the shares should have at least 15 trading days. The shares which had trading of less than 15 days are excluded from the list. Spread is found using Roll’s formula. The shares which do not have at least one negative correlation day are excluded from the list. This brought the number in the list to 1290. The data consist of tick by tick information which is also called high frequency data. During the 20 day period taken for study, the daily average was 51,13,847 entries. The intra-day data consists of four and five intervals per day for the Equity segment and the Futures and Options segments respectively. Each of these intervals contains all the transactions that took place on a trading day.

The high frequency data is taken for the study because it contains all the information about the trading on the trading day. Economic agents would like to react to the abnormal profits arising in a trading day. These transactions are recorded in the high frequency data. High frequency data is also characterized by abundance of data entries. The high frequency data for the Futures and Options segments too were taken.

The high frequency data are not without problems. While a minute by minute transaction is recorded in the high frequency data, sometimes the problem of non-synchronicity arises. To overcome this drawback, the averages of all transactions are taken. Second, the first set of transaction on Monday mornings or after Holidays represents the transactions for the non trading period too. For example, the first transaction on Monday morning represents the returns of three days – from Friday evening to Monday morning. The interval between the last return of the day and the first return of the day will mean a very large interval. These types of returns have different properties compared to the intra-day return. The method suggested by Anderson and Bollerslev (1997)\textsuperscript{58} is used here by dropping the first observation during each trading day. The first observation represents the overnight expectation of investors.
All corporate actions that were taken during March 2010 are taken for the study. The total number of such actions comes to 21. If the announcements alone were made and the corporate action was left for future date, those announcements were ignored from the study. The average of the amount of funds invested through the Foreign Institutional Investors is also taken for this research.


1.9.2 Method of data collection

This research is fully dependent on data published by the National Stock Exchange of India. The data was collected from Dotex, the database arm of the NSE. The Dotex is responsible for storage and dissemination of trading data. NSE, on request, disseminates the required data through its subsidiary, the Dotex International. The data are given in CDs. Each month and each instrument are given in one or more CDs. Each of the CDs consists of seven directories, which are Bhav Copy Database, Index Database, Masters Database, Order Book Snapshot Directory, Trades Database, Circulars and the Software. The Researcher used five of the seven directories for the study.

The ‘Bhav Copy Database’ consists of summary information about each security for each trading day. The symbol for each share, the series, which represents the class of asset it belongs to, the opening price, the day’s high and low prices, closing price, the last traded prices are given in this directory. The other information on security are the rupee value of shares traded, the number of trades, number of shares and information regarding corporate actions on that particular trading day.

Order Book Snapshots directory consists of Limit order book at many time points in the trading day. The NSE is a limit order book market and is also called “Open Electronic Limit Order Book Market” (OELOB) or to practitioners as a market based on “Electronic Order Matching”. Liquidity on the OELOB market is embedded in the limit orders present at
any point in time. Measurement of liquidity is possible with high accuracy using “Order Book Snapshots”. The order book snapshots give the picture of complete limit order book at a point in time. The order book snapshot can yield the bid ask spread and it can be used to measure market impact cost for buying or selling any desired transaction. The Order Book Snapshots consists of the Order Identification Number, the Symbol, the Series, Quantity, Price, Timestamp, Buy or Sell order, Day Flag, Quantity Flag and Book Types.

Each limit order is given a unique code. The symbol denotes the symbol of each security. Each share is denoted by symbols. The series denotes the type of asset class to which the security belongs. It can be a warrant, equity share, debt, or units of mutual funds. The quantity denotes the size of the limit order. It is different from the total traded value. Price represents the limit price on the limit order. The time stamp is the time at which the order was placed or last modified. The buy and sell orders are denoted as ‘B’ and ‘S’. The ‘Buy’ and ‘Sell’ orders are used to calculate the actual spread. The ‘Day Flags consist of four types of orders. They are the day order, good till date order, cancel order and immediate or cancel order. The most frequently used type of order is the “Day order”. The other types of orders are ignored.

The circulars directory consists of all circulars issued by the National Stock Exchange of by the clearing arm of the NSE – the National Securities Clearing Corporation Limited (NSCCL). This serves as a formal documentation of the history of market design at NSE. Circulars are formal method of communication between the NSE and the trading members. The corporate announcements made during March 2010 are taken from the circulars directory. The data regarding the Foreign Institutional Investors are collected from the website of the Reserve Bank of India.

1.9.3 Analysis of Data

The average measure for each security for each day is calculated. So for each day, the average price of the share is found. Then the average of these daily measures over the entire month for each stock is calculated. For the snapshot data, the average of for each share is calculated which gives the market price for each security for each period during the day.

Spread is calculated for all the stocks traded on the National Stock Exchange of India. Spread is calculated from the Market Price per Share. The data for analysis is collected from the National Stock Exchange of India. Dotex International, a 100% subsidiary of the NSE
disseminates information of trading. Dotex International ltd is a professionally set up 
dedicated solely for the purpose of data and information vending products of NSE.

The formula for calculating Roll’s spread is

\[ S = 2\sqrt{-\text{COV}(\Delta P_t, \Delta P_{t-1})} \]

where \( P_t \) is the transaction price at time \( t1 \) and \( \text{COV}(\Delta P_t, \Delta P_{t-1}) \) is the covariance 
between two successive price changes.

The securities are also classified based on the industry. Spread is calculated for each 
industry. The average number of trades and the market capitalization were also calculated. 
The average number of trades, whether a Buy or a Sell transaction, denotes the number of 
shares that were traded. The average for these trades represents the number of trades for that 
particular trading period. Market Capitalization is the product of number of shares traded and 
the MPS. Here too, the average for a trading day is calculated. The relationship between the 
spread and the capitalization, and the relationship between spread and number of shares 
traded are found.

The Futures and Options which are traded in the NSE are also taken for analysis. 
Nearly 200 securities were traded on the F&O segment. But many of these shares were not 
traded on a regular basis. To ensure uniformity in trading, those 50 securities which form the 
Nifty were alone considered for the study. To have a better understanding of the trading 
months during all maturity cycles, the strike price for all three maturity cycles are taken for 
the futures contract. For the options contracts that are traded, two instruments of options are 
available. They are the put option and the call options. Though options contracts too have 
three maturity cycles, the number of trades during the third maturity month is almost nil. So 
the call options and put options on the first and second maturity month alone were 
considered. This is the first time that the second and the third maturity cycles are considered.
Mahindra and Mahindra is a company which appears in the list of Nifty. There was a stock split of M & M. So this company is excluded for the F & O segment.

Spread is calculated on an intra-day basis too. Spread is calculated during four and five intervals for the equity and derivatives segments respectively. The relationship between the spread and the other variables like market capitalization and number of trades are found using various statistical tools.

Corporate announcements influence the MPS. Earlier studies considered the announcements regarding mergers, acquisitions, board meetings and earnings. Previous studies have classified the corporate announcements as good news and bad news. Researchers have also concluded that good news increases the MPS whereas bad news doesn’t. An attempt is made here to include all the announcements made by the company irrespective of their nature. During the period of study the number of corporate announcements is 34.

Foreign Institutional Investments are the investments of foreign companies in equity markets. Foreign companies are allowed to invest in the equity markets in India. Research shows that the index is influenced by the flow of foreign funds. FIIs also seek to invest in the most liquid, high capitalization firms at the NSE. This doesn’t mean that low capitalization firms are excluded from investments. The impact of foreign institutional investments on spread is analyzed. To the best of the authors’ knowledge, this is the first time that the study on FIIs in derivatives markets is undertaken.

1.9.4 Tools of Analysis

In order to analyze the objectives of the present study, the following tools of analysis were used:

Spread is calculated using Richard Roll’s formula. The formula is given by

\[ S = 2 \sqrt{\text{COV} (\Delta P_t, \Delta P_{t-1})} \]

Where \( P_t \) is the transaction price at time \( t \), \( P_{t-1} \) is the transaction price at time \( t-1 \) (previous time), \( \Delta \) is the change in price. \( \text{COV} (\Delta P_t, \Delta P_{t-1}) \) is the covariance between two successive price changes. The differences between the successive changes in price are used for calculating spread.
Hypothesis is considered as principal instrument used in the research. Hypothesis testing strategy is used for deciding whether the data offers such support for hypothesis so that generalizations are made based on it.

In order to find the relationship between two variables, the data are analyzed using One-Way ANOVA technique. This technique is used to find if there are any significant differences among three or more population means.

Analysis of variance is given by the following formula.

\[
\text{Mean Square between samples} = \frac{\text{Sum of Squares between samples}}{k-1}
\]

where \((k-1)\) represents degrees of freedom (d.f.) between samples and

\[
\text{Mean Square within} = \frac{\text{Sum of Squares within samples}}{n-k}
\]

where \((n-k)\) represents degrees of freedom within samples

\[
F\text{-ratio} = \frac{\text{Mean Square between}}{\text{Mean Square within}}
\]

"t" test is based on t distribution and is considered appropriate test for judging the significance of sample means or for judging the significance of difference between the means of two samples in this study. "t" test is used in this study to find the performance of the companies before and after the corporate announcements.

Formula for "t" test is given by:

\[
t = \frac{\bar{x} - \mu_0}{\left(\frac{s}{\sqrt{n}}\right)\sqrt{(N-n)/(N-1)}}\quad \text{with d.f.} = (n - 1)^{60}
\]


60. Ibid, pp 196 – 199.

Regression analysis is used to determine the statistical relationship between two or more quantitative variables in this study. Regression analysis determines that one variable is
the cause of the behavior of other variables. Regression is used to find the level of significance to compare the relationship among each of the variables.

The formula for regression analysis is

Regression Equation(y) = a + bx

Slope (b) = (NΣXY - (ΣX)(ΣY)) / (NΣX² - (ΣX)²)

Intercept(a) = (ΣY - b(ΣX)) / N

where

x and y are the variables.
b = the slope of the regression line.
a = the intercept point of the regression line and the y axis.
N = Number of values or elements.
Y = Second Score.
ΣXY = Sum of the product of first and Second Scores.
ΣX = Sum of First Scores.
ΣY = Sum of Second Scores.
ΣX² = Sum of square First Scores

61. Ibid, pp 141 – 143.

1.10. Chapter Scheme

The report of this study is presented in six chapters. The first chapter presents the introduction, states the problem, reviews the available literature, details its objectives, the
scope of the study, limitations, operational definition of concepts, sample design, collection of data, method of analysis and tools of analysis. The second chapter presents a theoretical approach to market microstructure. It includes the meaning of market microstructure, the bid-ask spread and how market microstructure is superior and challenges the other capital asset theories. The third chapter classifies spread based on sectors and finds the performance of each sector. It also finds the relationship between the index forming companies and non-index forming companies. The impact of market microstructure variables on spread is analyzed. Spread is calculated on an intra-day basis too. The fourth chapter deals with the calculation of spread on the futures and options segment. The fifth chapter deals with corporate announcements and its impact on spread. The impact of foreign Institutional Investors on spread is analyzed. The last chapter sums up the key findings of the study. At the end of this chapter certain suggestions are given.