Chapter 7

Conclusions, Implications and Scope for Further Research

Prior literature has examined the informational role of derivatives market in length. However, it is focussed towards equity linked stock options, index options and index futures contracts and deals with directional information in particular. Single stock futures (SSFs) remains overlooked despite it being a less costly and more flexible way to take equity market exposure and, options contracts have been ignored in terms of examining the potential volatility informed trading of them. This study examines the informational role of derivatives in three different ways.

7.1 Conclusions

The first study (chapter 4) examines the role of implicit spot market prices embedded in SSFs prices in predicting the equilibrium prices of the underlying assets. The implied stock prices are computed using cost-of-carry model of futures pricing and their time series behaviour is examined since they constitute the potential rate of returns coupled with literary evidence of seasonal anomalies in series of stock returns. The implied prices are further compared with observed stock prices in the market of underlying assets which reveals that implied prices contain better information about equilibrium stock prices than that of observed stock prices in spot market. The study uses the SSFs daily trading data for firms trading on National Stock Exchange (NSE) of India during January 2004 through December, 2011 and demonstrates that the pricing errors (deviation of observed market prices from the cost-of-carry relation) are useful to enhance the portfolio returns. The study is extended performing the time series investigation
of the information content in pricing errors using Carhart four factors model. A significant alpha is observed implying that large pricing errors produce high returns.

We conclude that perceived mispricing in the SSF market is profitable for traders in the spot market. Our results show that the implied stock prices computed using closing futures market prices possess information regarding equilibrium stock prices above and over the information already contained in closing spot market prices of stocks. We present a twofold explanation of information content in the pricing error. First, as the transactions in the two markets do not always take place at the same time, the additional information might merely represent the more recent information. However, the closing futures price revealing the best estimate of equilibrium stock price is possible due to preference of trading futures contracts by traders having private information about firms.

We separate the information effect from the effect of non-synchronous observations and then test whether the information in implied price helps investors to enhance their portfolio returns by buying the portfolio at the closing price on the day the implied prices are calculated and selling on the next day. Our results show that it is possible to earn excess returns within a span of 24 hours based on information contained in implied prices. Moreover, even on day t+2 the portfolio returns ranked as predicted however, it didn't indicate that the mean returns of the portfolios are significant.

Our results also indicate that the deviation of implied stock price from observed stock price is due to demand of additional risk premium by equity investors for the risks that are not captured
by popular Carhart’s four factors model. The long-short portfolio investment strategy results indicate that making riskless profit based on signal of price discrepancy in stock and stock futures market is quite possible in Indian market. We conclude that the closing prices of single stock futures are informative about next day equilibrium stock prices and it provides significant profitable opportunities for traders.

The second study (chapter 5) investigates the trading in options market based on information about future volatility of returns in spot market. We compute Common Implied Volatility (CIV) of returns for each day using daily data of Nifty Index options traded on National Stock Exchange (NSE), India for the period January 01, 2004 to December 31, 2011; and examine the relationship between CIV and the aggregate measures of trading activity (i.e. Number of contracts traded which is denoted as total volume and Changes in Open Interest (COI) simultaneously). We examine the relationship for Call and Put options separately and find that CIV, number of contracts traded and COI are significantly contemporaneously related. Tri-variate Vector-auto Regression (TVAR) Framework is used to find the evidence of volatility informed trading or hedge based trading of options based on leading or lagged variables of implied volatility, total volume and COI. We observe a feedback relationship between CIV and measures of trading activity in vector auto regression which suggests both the information related and the hedge related uses of options in India. We further consider the options moneyness classes (At-the-Money, In-the-Money and Out-of-the-Money) and market trends (Up, Down and Recovery) in TVAR analysis to examine if the trader's preference of options changes with change in description of options intrinsic value (moneyness) and market environment (trends).
We find the relationship to be varying when market trends and options moneyness classes are considered. It indicates that traders are not indifferent in placing their trades when market conditions and other factors change. Out-of-the-Money options are found to be most attractive options contract of traders in terms of both information and hedge related uses in the Indian market. The contemporaneous regression results show options volume having significant relationship with returns volatility in future and it is consistent across market trends for both call and put options. The positive relationship between options volume and implied volatility of returns can be attributed to shift of liquidity from the spot market to the options market. This subsequently results into increase in the options volume and the spot market volatility. Moreover, the theoretical positive relationship of volatility with options prices also justifies our empirical findings.

We also find that COI is related with volatility only in case of put options but turns out insignificant during Downtrend. Moreover, when data post January, 2011 (relatively smaller downtrend) is dropped from analysis, COI is significantly affecting volatility only during Up period. This suggests COI as a contemporaneous predictor only in good times. The lead lag relationship based on TVAR model suggests the predictability of options trading activities for future volatility indicating volatility informed trading in options. However, feedback relationship is also observed in certain cases that suggest both information and hedge based uses of Nifty index options.

When options are classified based on moneyness, we find OTM call options are the most prominent contracts preferred by both informed traders and hedgers. The sign and significance of
the coefficients vary with varying market trends and options moneyness suggesting that trader's preference changes with changing market environment. Based on our empirical analysis we conclude that Nifty index options have got both the information based and the hedging based use in the Indian market and it is consistent with the leverage (information based trading) and the liquidity (hedge related trading) hypotheses in literature.

The third study (chapter 6) investigates the role of options market activity in price discovery of underlying assets trading in spot market. We account for different options moneyness and market cycles and follow the framework developed by Chen, Chung and Tay (2005). We first test the contemporaneous relationship between index returns and options trading value ratio to verify the simultaneous information impounding. It followed by test of lead lag relationship between the two variables, to identify the market where information first gets reflected. We do not find strong evidence of Indian options market being a venue of information based trades in general but got some interesting results from the study.

The results of contemporaneous relationship are as projected. The spot returns and VR’s are not contemporaneously correlated at aggregate level. It confirms that investors are not indifferent to market environment and contract specific factors. We find evidences of significant contemporaneous relationship for ATM and OTM options contracts. We observe that these two contracts being most liquid options in Indian market with their contract specific benefits attract informed traders. The negative contemporaneous relationship also hints of OTM options being used for arbitrage activities in India. Thus we provide evidence of partial simultaneous information incorporation in the two markets.
The lead lag relationship for entire period, sub-period and for different moneyness classes suggests that ATM options contracts are the only attraction of informed traders during the entire period. However, we find that spot market is leading for different moneyness classes during sub-periods. We take the view that on average ATM being the highly liquid, contract in India having semblance of informed trading. The findings are consistent with liquidity hypothesis and suggest that the informed traders use ATM options in the Indian market. The lead of options market for OTM options only during entire period of study also indicates how the segregation of data may produce meaningful results.

The results of this study are significant in terms of its usefulness for the traders and investors into derivatives market for profit making. A large number of retail traders trade derivative contracts in Indian market. The evidence of informed trading in options market, particularly for ATM options, imply that the traders can maximize their portfolio returns by observing the prices and trading activities of ATM options and placing trades into the spot market based on positive or negative signal indicated by value ratio. Such an indication can also help to hedge the existing exposure of traders in the spot market using options. Thus the traders would be able to enhance their payoffs from the trade using the information impounded in trading of derivatives.

Based on our results of all the three studies we conclude that Indian equity derivative markets are venues of information based trading but not always. Our study contributes to the literature on price discovery role of single stock futures market in India by showing the empirical evidences of the same that signifies profitable opportunities. Evidences of volatility informed trading add to the strength of the study as it remained to be examined in detail in literature.
7.2 Implications

The implications of this study for regulators, traders and other market participants can be highlighted as follows.

- The results of this study indicate that theoretically implied prices deviate from observed prices in Indian equity market. The frequent negative pricing error suggests that one possible reason of such deviation is short sales constraint in the spot market. Our results signify that regulators should reconsider the imposed short selling restriction in an attempt to reduce the prevalent inefficiency in the Indian market.

- The evidence that SSFs prices are indicative of actual stock prices in future, is helpful for portfolio managers, hedge funds and institutional traders in maximizing their portfolio returns.

- The evidence of both volatility informed trading and hedge based trading of index options is helpful for investors in determining the expected future volatility of assets return in the spot market and manage their exposure accordingly.

- Our results suggest that by focussing on value ratio a trader can figure out the market's interpretation (good or bad) of a new information about the assets trading in the market place.

7.3 Scope for Future Research

The present study attempts to answer some of the research questions on the functions of derivatives which have not been explored in depth. However there are certain areas where this study can be extended further.
In Chapter-4 we have examined the information contained in the pricing error of stock futures in isolation. However, an examination of considering deviation from both the stock options implied price and the stock futures implied price in conjunction, may provide a better insight on such information content. During our study period the stock options trading in India remain insignificant compared to total trading in equity derivatives but the proportion is observed increasing around the end of our study period i.e. year 2012 onwards. There is scope to consider studying both futures and options on stocks in Indian market regarding their informational role and contribution in price discovery.

In the second study of this thesis we consider two important factors i.e. options moneyness classes and market trends to examine the dynamic relationship between the spot and the options markets yet, other factors such as options liquidity can be considered to extend the study further. As we use index options data the results are more appropriate for market wide information. A similar study on component stocks may help to know the venue of informed trading regarding idiosyncratic information about firms.

Similarly, our third study can be extended further employing variables VR and stock returns on single stock options along with inclusion of other potential factors that may influence the direction of information flow such as liquidity, information asymmetry etc. It would be insightful in providing better understanding of options market in India in terms of its information content or hedge based uses.
Glossary

- **Arbitrage:** The activity of buying the asset in the underpriced market and selling the same in the overpriced market simultaneously.

- **Basis:** Difference between the spot and futures price of an asset

- **Call Options:** A contract that gives the holder the right to buy the asset by a certain date for a certain price.

- **Cost-of-Carry:** The relationship between the spot and futures price. This measures the storage cost plus the interest that is paid to finance the asset less any income earned on the asset.

- **Futures Contract:** An agreement between two parties to buy and sell a certain asset at a certain time in the future and at a certain price that is determined today.

- **Implied Volatility:** The input parameter of Black-Scholes Options pricing formula measuring expected volatility of stock returns. It can't be directly observed and estimated from the history of stock prices.

- **Index Futures:** Futures contracts written on portfolio of stocks

- **Index Options:** Options contracts written on portfolio of stocks

- **Options Contract:** A contract to buy or sell a certain asset at a certain price in future where buyer has the right and seller has the obligation to perform.

- **Options Delta:** The ratio of the change in the price of the stock options to the change in the price of underlying asset

- **Options Moneyness:** The extent to which the strike price of an options is above or below the spot price indicating profitable opportunities.
• **Put Options**: A contract that gives the holder the right to sell the asset by a certain date for a certain price.

• **Put-Call Parity**: The relationship between prices of call and put options.

• **Single Stock Futures (SSFs)**: Futures contracts written on stocks of companies.

• **Single Stock Options (SSOs)**: Options written on stocks of companies.

• **Straddle**: A strategy that involves buying a call and put options with the same strike price and the same expiry.

• **Strike Price**: The price at which call and put options are traded. Also called exercise price.

• **Value Ratio**: The relative call to put options turnover.

• **Volatility Smile**: The plot of implied volatility of options as a function of its strike price.