SYNOPSIS

Over last few years financial markets have exhibited exponential growth in the trading of homogeneous or closely linked assets such as equity linked derivatives in parallel markets. Though the prices of derivative securities depend on the prices of underlying assets yet, the trading of derivative securities are hypothesized to affect the prices of underlying security in literature for several reasons. Among others, one of the most important reasons is that the informed traders are presumed to prefer trading in derivatives market given the inherent rewards of trading derivatives over underlying stocks such as greater financial leverage and lower cost. Such trading by informed traders makes the prices and trading activities of derivatives market informative about prices and trading activities in the market of underlying assets. We in this study examine the information content in equity derivatives market of India with a focus on the Single Stock Futures (SSFs)-the least researched derivative contracts worldwide and the index options. The main study is divided into three parts: study on information content of SSFs, study on volatility informed trading in options market and study on directional information based trading in options considering both price and trading activity variables collectively. Next we present the extended summary of each of these studies.

In the first study we examine the information content of SSFs prices to forecast underlying stock prices. Our focus on the information content of SSFs comes from the important role of equity derivatives in price discovery documented in the literature on options (Chakravarty et al., 2004; Chen et al., 2005; Ni et al., 2008). It is likely that informed traders would prefer to trade in derivatives market given the incentives associated with the trading derivatives over underlying
stocks. These incentives stem from higher financial leverage, lower transaction cost, limited downside risk and the fact that taking a bearish position on negative news is possible through derivatives without being subject to the short sales restrictions subsisting on trading of underlying assets (Balck, 1975, Sarwar, 2005; Chen et. al., 2005; Shastri et. al., 2008). Numerous studies\(^1\) examine the information content of derivative assets. To the best of our knowledge, there is no study that measures the information content of SSFs in predicting equilibrium stock prices. We investigate this issue in the emerging economy, India due to the popularity of SSFs in Indian market compared to other developed economies. It is noteworthy that in the year 2010 the national Stock Exchange (NSE), India stood second to New York Stock Exchange (NYSE) - London International Financial Futures Exchange (LIFFE) in terms of number of SSF contracts traded. Unlike developed economies such as US, UK and Australia, one plausible reason of SSFs being popular in Indian market is the familiarity of Indian traders with Badla\(^2\) (Vipul, 2005). Moreover, compared to options, the less complex payoff structure of futures contracts coupled with lower financial literacy in emerging markets like India might have resulted in the preference of SSFs trading.

We follow Manaster and Rendleman (1982) to investigate the above mentioned issues. We calculate implied prices of underlying stocks using the cost-of-carry (COC) model of futures pricing. If SSFs are actually priced according to the model, then implied stock prices will be the futures market assessment of equilibrium stock values. We argue that if SSFs market is venue for informed traders to place their trade and if the information is incorporated into prices through

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\(^1\) Chen et al. (2005); Ni et al. (2008); Kumar and Tse (2009), Shastri et al. (2008), Wang (2011), Theissen (2011), Cummings and Frino (2011)

\(^2\) Badla trading was a form of leveraged trading that involved buying stocks from borrowed money at an interest rate determined by demand and supply of the particular stock and where stock exchange acted as an intermediary. Here, the broker was supposed to maintain mark to market margin.
trading, then the implied prices may differ from spot market prices due to the better or more recent information contained in implied prices as a result of such information based trading. Since the spot and derivatives markets are linked through arbitrage relationship, such informed trading in derivatives market enables the prices and trading activities from derivatives market to affect the prices in the spot market. Thus, the price differences between implied stock prices and observed stock prices (hereafter pricing errors) can reveal information about future stock prices.

Based on our investigation we find that implicit stock prices embedded in stock futures prices are informative about future movement of stock prices in the spot market. We first examine the time series behaviour of pricing error (theoretically implied price minus observed market price) since they constitute the potential rate of return and we have evidence in literature about seasonal anomalies in series of stock returns\(^3\). Next, we form quintiles based on ranking of pricing errors and compare their returns. We find the lowest ranked quintile earning the lowest return and the highest ranked quintile earning the highest returns which indicate the existence of information content in pricing error about future price movement. The highest pricing error quintile stocks significantly outperform the lowest pricing error quintile stocks by, on average, 0.057% per day. This finding is robust after controlling for Carhart (1997) four factors model. We report the following important findings from this study.

- The implied stock prices embedded in closing prices of stock futures possess information regarding equilibrium stock prices.

\(^3\) Kohli and Kohers (1992) and others show the evidence of week of the month effect using S&P composite index data whereas researchers like Kyimaz and Berument (2003) show day-of-the-week effect on returns and volatility on major market indices.
- The deviation of futures market's implied prices from observed spot market prices is due
to demand of additional risk premium for the equity investment related risks that are not
covered by popular Carhart four factors model.
- The riskless profit making is possible by use of long-short portfolio strategy based on
  price discrepancy signals.

We conclude that perceived mispricing in the SSF market is useful for traders to profit in the spot
market.

The second study investigates the trading in options market based on information about volatility
in future in the spot market. We conduct this study using options due to the fact that options are
securities with non-linear payoff structure. As a result, a volatility informed trader can only bet
on his information in options market unlike a trader with directional information besides options,
can also trade stocks or futures (Ni et al., 2008). We compute Common Implied Volatility (or
CIV-the *Vega* weighted average of implied volatility estimates from different options trading on
a day) using daily closing data of S&P CNX Nifty Index options traded on National Stock
Exchange (NSE), India. We examine the relationship between CIV and the aggregate measures
of trading activity i.e. total number of contracts across series of options (volume) and aggregate
Changes in Open Interests (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 lagging 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 information and hedge related uses of options in India. We further consider the options moneyness classes (At-the-Money or ATM, In-the-Money or ITM and Out-of-the-Money or OTM) and market trends (Up, Down and Recovery) in TVAR analysis to examine if the trader's preference for options changes with change in its 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. OTM options are found to be the most attractive options contracts for traders in terms of both information and hedge related uses in the Indian market. We report the following findings from this study

- Both call and put options volume on average, predict the contemporaneous expectation of future volatility. However, the predictability of changes in open interest is limited to put options and only in good times.

- 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 the literature.

Based on our results we conclude the existence of volatility informed trading in options market. However, our results are limited to market wide information as we have considered the index options for the study.

The third study examines whether informed traders prefer derivatives (options) market and if yes to what extent the trading activity from this market affects the prices of underlying assets. We investigate the superiority of options market towards contribution in price discovery and its
rapidity in impounding the new information compared to spot market. Unlike many previous studies in this area we follow Chen et al. (2005) framework in current study where both price and trading activity are considered together to determine the information based trading in options market. Chen et al. (2005) derive a unique variable named value ratio (VR) which indicates that market participants can infer the relative magnitude of unobservable probabilities of price changes by observing the ratio of call to put options trading values. We use VR measure in our study as it turns out to be a better measure of market activity because volume alone cannot represent the true sentiments of the market. Volume at different strike prices gives a better picture of market sentiment and option trading value ratio (hereafter VR) incorporates it. This study uses the data of most popular S&P CNX Nifty index and its options traded on NSE, India for this purpose.

We also account for various market conditions (i.e. Uptrend, Downtrend and Recovery) and for the categories of options moneyness (i.e. ATM, ITM and OTM options) to determine the informational role of derivatives market (if any exists). We employ the linear regression and the vector-auto-regression (VAR) techniques to investigate the contemporaneous relationship and the information content of the two markets respectively. We find the contemporaneous relation between trading activity (measured by Option Trading Value Ratio or VR) and spot returns to be significant in case of the two most liquid option contracts based on moneyness i.e. ATM and OTM options. However, we find change in magnitude and direction of this relationship when market cycle is taken into consideration. VAR results suggest that ATM options are the favourite contracts of informed traders in the Indian market consistently across periods of study.
However, we find spot market is leading significantly for the ITM and OTM classes of options and across market trends. The findings of this study can be summarized as follows.

- The spot and the options markets partly incorporate the information simultaneously.

- ATM options which is the most liquid options in Indian market and more sensitive to underlying volatility show consistent bi-directional flow of information between spot and options markets and supports the liquidity hypothesis.

The consistent positive lead of VR and negative lead of spot returns for ATM options imply that informed traders might be using ATM options for hedging purposes and not for aggressive trading or speculation in Indian market.