Chapter 4
Survey of Literature on the Effect of Derivatives Trading on Underlying Spot Market

The following chapter contains a survey of literature on the impact of derivatives trading on underlying spot market. This chapter is divided into two sub-sections. In the first part we discuss the relevant literature on the impact of derivatives trading on the volatility of underlying spot market. The related review of literature on lead-lag relationship and volatility spillover between derivatives and corresponding spot market is arranged in second part.

Part A
4.1 Impact of Derivatives Trading on the Volatility of Spot Market

Most of the studies investigating the relationship between a derivatives market and its corresponding cash market basically concentrate on three main aspects: first, investigating the effects of introduction of derivatives on the volatility of underlying spot market; second, probing derivatives (futures/options) trading stabilization or destabilization effects on cash market fluctuations; and third, studying the causal relationship, long-run cointegration, volatility spillover and price discovery leadership between spot and derivatives segments.

Compared to spot markets, lower transaction costs, higher leverage and simpler speculative trading of futures markets are motivations that catch the attention of spot market traders and consequently lead to information transmission from futures markets to spot markets. As a corollary, this information transmission might be a decisive factor in stabilization and destabilization of spot price movements over a period of time. Therefore, the review of the studies in this part is basically arranged according to the stabilizing or destabilizing effects of futures and options trading on spot market volatilities and also the investigation of lead-lag relationship between two markets. This stabilization and destabilization effects are very controversial issues in the literature of the studies in different market and time settings. In this part, the studies have been arranged on theoretical and empirical basis.

4.1.1 Theoretical and Empirical Evidences of Destabilization Effects

Some theoretical studies argued that the destabilization expectations on spot prices movements followed by the speculative activities in futures markets (Hellwig, 1980; Figlewski,
Figlewski (1981) stated that uninformed speculators have been attracted by motivating factors to the futures markets and therefore destabilize spot price movements. Similar opinions have been affirmed by Stein (1987) who debated that high leverage of futures markets serve as an attractive motivation to absorb uninformed traders from cash market and lead to market destabilization. Though discussion of Harris (1989) appears to be different, stating that however, the spot price volatility has increased statistically after the introduction of futures trading; this destabilization effects seem economically negligible.

Above and beyond the theoretical discussions, substantial empirical studies attempted to achieve a broad consensus on these debatable issues. Kamara et al. (1992) investigated the impact of S&P 500 stock index futures market on the underlying cash index from 1976 through 1988. To analyze these effects, they applied two methods. First, they compared unconditional volatility of cash market of pre-futures introduction period to that of the post-introduction period. Second, after controlling macroeconomic factors, they compared conditional volatility of cash market’s two sub-periods (pre-futures and post-futures). They evidenced that the volatility of daily returns during post-futures sub-period (April 21, 1982 to December 31, 1988) was higher than during pre-futures sub-period (January 1, 1976 to April 20, 1982); however, the volatility of monthly returns remained unchanged during post-futures sub-period. Chatrath et al. (1995) studied the effects of options trading on underlying spot prices of S&P 100 index and also examined the expected intensifier role of options trading on the rate of change in the cash market. They evidenced that an increase in options trading volume led to higher volatility in the cash market. Furthermore, they found that options trading did not possess the intensifier role in the rate of change in the cash market. Antoniou and Holmes (1995) investigated whether FTSE-100 stock index futures trading reduced the underlying spot prices volatility. To analyze this volatility, they applied GARCH (1, 1) model. They found that futures speculative trading destabilized the cash market volatility only in the short-run. Their results also suggested that futures trading improved the quality and speed of information flow to spot markets. Smit and Nienaber (1997) examined the association between futures trading activities (expected and unexpected trading volumes) and spot price volatility on Johannesburg Stock Exchange (JSE) three main indices. The results showed that larger futures trading activities led to higher volatility of spot prices. Their results also indicated that unexpected futures trading activity had
more significant impact on spot volatility than expected ones. Bae et al. (2004) discussed the impact of introduction of index futures trading on cash price volatility and market efficiency of KOSPI 200 stocks. They also compared the results with those non-index stocks. To analyze these effects, they employed an event study approach and a matching-sample approach for the market data during the period of January 1990 to December 1998. They found that futures trading led to higher market efficiency; while spot market fluctuation significantly increased after the introduction of futures trading. However, they concluded that index stocks prices experienced higher market efficiency and lower fluctuation than non-index stocks. These discrepancies obtained from the results of two categories of stocks whose volatilities have reduced or even totally disappeared after options listing date. Nath and Lingareddy (2007) indicated destabilization in agri-commodities spot price volatilities (gram and wheat) after the commencement of futures trading in the market.

4.1.2 Theoretical and Empirical Evidences of Stabilization Effects

In contrast to destabilization point of view, there is another debate in theoretical literature of the study, arguing that futures trading activities provide stability in spot price fluctuation (Turnovsky, 1979; Bray, 1981; Turnovsky and Campbell, 1985; and Mueller, 1989). Pioneering theoretical contribution conducted by Turnovsky (1979) discussed that the provision of information by futures markets provides efficient forecasts which, in turn, facilitate both production and storage decisions and ultimately results in the stability of spot prices. Since there is no unified conclusion in theoretical arguments, it is required to make inferences via empirical studies in different times and market settings. Several empirical investigations have been conducted to examine these theoretical arguments. A large part of these empirical studies have been carried out in developed economies; however, a considerable vacuum in the literature is found in the emerging markets like India. Powers (1970) investigated whether futures trading reduced the fluctuation in live beef and pork bellies cash markets. He found a decrease in the volatility after the introduction of futures. It has not been statistically evidenced that this reduction was due to information disseminated by futures markets. He also argued that the more informed market participants, the higher the possibility that prices reflect true supply and demand; the less informed they are, the greater the possibility that prices will diverge from the true equilibrium price. Bray (1981) proposed a model that supports stabilization effects of futures trading on spot market volatility. In this model, sufficient conditions are established for
informational efficiency of futures market, which is taken to mean that futures prices involve sufficient information about spot prices. Bessembinder and Seguin (1992) discussed the relationship between futures trading activity (represented by open interest and volume) and equity price volatility. They found that stock price volatility was positively related to unexpected futures trading activities but was negatively affected by predictable futures trading. Their results are consistent with the theories of market depth and liquidity suggested by Grossman (1988). Spyros (2005) debated the effects of introduction of futures trading on spot market volatility. He investigated the structural changes in the volatility of spot prices rather than the volatility per se. His results evidenced that spot market volatility remained unaffected and almost declined after the commencement of futures trading.

However, theoretically it has been claimed that derivatives trading is associated with spot market destabilization, some studies suggested that the speculation in derivatives markets leads to stabilization in spot market volatility. Antoniou and Foster (1992), using GARCH (1, 1) model, examined the effects of the introduction of futures trading on the price volatility of Brent crude spot oil market. The weekly data from January 1986 to July 1990 were taken. They evidenced that futures markets have a significant role in improving pricing efficiency and providing a hedging vehicle which reduces the importance of volatility. Kasman and Kasman (2008) studied the association between the introduction of stock index futures and the volatility of Istanbul Stock Exchange (ISE). The results obtained from EGARCH (1, 1) model indicated a significant reduction in the conditional volatility of ISE spot market. Moreover, their findings about long-run and short-run causality relationships, illustrated that spot prices led futures prices in ISE market. Dawson and Staikouras (2009) investigated whether the onset of the volatility of derivatives trading has conveyed enough information to alter S&P 500 spot market volatility. They evidenced that the volatility of cash market has decreased after the onset of the volatility of derivatives trading and the introduction of such volatility significantly reduced the impact of shocks to the volatility. Their analysis also showed that the volatility is mean reverting, while market data support the impact of information asymmetries on conditional volatility. Alexakis (2011) evidenced that index futures trading reduced the fluctuation of spot market. His results are aligned with efficient market principles and showed that futures trading activities facilitate to enhance the quality and speed of information dissemination. He opined that these results were not a guarantee of the full disappearance of spot market volatility after introduction of
derivatives trading, but it may lead to higher market efficiency. Some basic theories argued that futures trading activities have provided the arbitrage opportunities and integration between futures and cash markets, and consequently these trading activities would reduce the fluctuation in the spot markets. Some other opinions assumed that risk transferring features, progressing market efficiency, enhancement in the liquidity of the markets and storage decisions might help investors and policy makers in minimizing the spot market volatility. Therefore, the results of many academic investigations like Shastri et al. (2008), Kalantzis and Milonas (2013) and Khan and Abbas (2013) are proper supportive findings for such hypotheses. Shastri et al. (2008) analyzed information generating role of futures market on 137 single stock futures (SSF) over 31 months period of time. They evidenced that information revelation increased with the ratio volumes of futures to spot, and decreased with the ratio of spreads and volatility of the spot market. They indicated that the quality of underlying stock market and overall market efficiency improves significantly subsequent to the introduction of SSFs. Kalantzis and Milonas (2013), using VECM-GARCH model, analyzed the effects of electricity futures trading on the spot price variations of French (Powernext) and German (EEX) electricity markets. They indicated that futures trading had a significant impact on both electricity cash markets and offered a volatility reduction contribution in 2009. Khan and Abbas (2013) examined the changes in beta coefficients (systematic risk) of the underlying stocks post-SSFs listing in Pakistan’s market. They employed a model that accounts for non-synchronous trading and varying market conditions (like bull and bear markets). They evidenced that systematic risk for the majority of underlying stocks decreased after futures introduction. By taking a control group, they also indicated a decline in the volatility of many of non-SSFs listed stocks. Based on these results, it can be found that the changes in systematic risk coefficients for SSFs-listed stocks might not necessarily be due to the introduction of SSFs trading for those stocks, but could be attributed to other market-wide factors that have affected the overall market.

4.1.3 Neutral Effects and Mixed Results

In addition to the stabilization and destabilization effects, some investigations supported neutral effects of futures and options trading activities on spot price movements (Kan, 1997; Lee and Tong, 1998; Rahman, 2001; Mazouz, 2004; Mazouz and Bowe, 2006; Illueca and Lafuente, 2008; and Mallikarjunappa and Afsal, 2008). Kan (1997) examined the effects of index futures trading on the volatility of constituents of Hang Seng Index (HIS) before and after the
introduction of HIS futures trading. His results revealed that there were no significant changes in the fluctuation of HIS components after the introduction of futures trading. Lee and Tong (1998) documented that there were no significant effects of stock futures trading on underlying spot markets of three countries --Australia, Hong Kong and Sweden. Their results evidenced that stock futures trading provided benefits to almost all players in the market. Rahman (2001) investigated to find the impact of DJIA index futures trading on the volatility of underlying spot prices of constituent stocks. They used the intraday return data of 30 components of DJIA for April to June 1997 (pre-futures period) and April to June 1998 (post-futures period). Using the GARCH (1, 1) model, they estimated the parameters of conditional volatility during pre-futures and post-futures periods and compared to determine whether the estimated parameters have changed significantly after the introduction of futures. The results suggested that the volatility of underlying stocks have not changed in the post-futures periods. Illueca and Lafuente (2003) investigated the intraday association between cash market fluctuation and trading volume in Spanish stock index futures market. Their findings showed that there were no significant linkage between spot market fluctuation and index futures trading volume. Mazouz (2004) examined whether options listing in NYSE had any significant effects on spot market volatility. His empirical results indicated that options listing on NYSE had neither effect on spot prices volatility nor on spot prices’ speed of adjustment to the new information over the time. Mazouz and Bowe (2006) investigated to find the effects of LIFFE’s introduction of stock futures on risk specifications of stock trading on London Stock Exchange (LSE). By employing GJR-GARCH (1, 1), they indicated that introduction of futures trading led to an increase in the market efficiency, but there were no evidence that information transmission from futures contracts may have any effect on either systematic risk or permanent component of the residual variance of returns. Illueca and Lafuente (2008) investigated whether mini futures trading activities destabilized the conditional volatility of spot returns and they also analyzed the possible contribution of mini futures trading activities in the price discovery procedure. Using non-parametric approach proposed by Garman and Klass statistic (1980) and 15 minute intraday data, they indicated that the conditional volatility of spot returns did not depend on the trading activities of mini futures contracts and consequently spot price variations might not rationally be attributed to these trading activities. Moreover, their results showed that the price discovery function received a contribution by adding a mini futures contract to the trading activities. Bohl
et al. (2011), using Markov-switching-GARCH approach, investigated whether the introduction of index futures trading in Poland influenced the conditional return volatility of the underlying stock index market. They suggested that there is a doubt on conclusions drawn from the empirical evidence in the existing literature, which uses dummy variables in augmented GARCH-type models, as the one-step dummy variable approach cannot capture a gradual adjustment to a new volatility regime and does not allow for a transitory volatility change. They employed a Markov-switching-GARCH approach, which allows for endogenous volatility regime shifts and revealed whether the volatility structure has changed transitorily or permanently. They evidenced that the introduction of index futures trading in Poland’s market neither increased nor decreased the volatility of the underlying stock market.

Furthermore, some people like Edwards (1988b), Karma et al. (1992), Fleming and Ostdiek (1999), Sim and Dennis (1999) and Gulen and Mayhew (2000) found mixed results. Edwards (1988b) found that both daily and intraday price volatility cannot be attributed to the futures trading activity. It is alleged that the increase in stock market volatility cannot be attributed to the futures trading activities; however, during the futures expiration days or else “Triple Witching Hours”, he found some evidence that short-run fluctuation in spot prices could be the result of the futures trading activities. However, this did not hold for long-run periods. Ultimately, he explained that these instabilities in share market prices may occur due to macroeconomic factors rather than futures trading volume. Karma et al. (1992) investigated the effects of futures trading on the stability of S&P 500 underlying index. Their results revealed a reduction in the daily volatility after the launch of futures trading. Such a reduction can be attributed to the futures trading activities. However, monthly returns volatility of spot market remained almost unchanged in the post futures period. Therefore, they concluded that market regulators must concentrate on depth of stock market liquidity rather than increasing the cost of trading in futures markets. Fleming and Ostdiek (1999) examined the impact of energy derivatives on crude oil market volatility. They analyzed their study in three parts. In the first section their results indicated an unpredicted increase in the fluctuation of crude oil spot prices during three successive weeks after the onset of the crude oil futures (the volatility was anticipated to rise from 6.87% to 8.14%, but unexpectedly it rose to 13.16%). They also found that one year increase in the volatility of crude oil prices co-occurred with the enhancement in the energy derivatives market. Given the results, they concluded that higher volatility might not
be attributed to the energy derivatives market activities. They found that following the introduction of crude oil futures, there was little evidence that derivative introductions had any effect on the crude oil volatility. In particular, it was found that the crude oil options introduction findings evidenced no significant effects on the volatility of oil spot prices. These results are against some theoretical points of view that believe in stabilization and destabilization effects of commodity derivatives trading on the volatility of cash market. They found a positive significant association between crude oil futures trading volume and volatility of oil spot prices; however, the relationship between open interest and spot volatility was negative and significant. Sim and Dennis (1999) examined the effects of introduction of share futures on cash market volatility. They reported that there was no significant effect of futures trading on share market fluctuation in majority of the cases in Sydney Stock Exchange. However, some mixed results have been found in a few stocks. Gulen and Mayhew (2000) examined the relationship between volatility of some international equity markets and stock index futures trading. They evidenced that futures trading was positively related to spot index volatility in United States and Japan. However, the results of all the rest cases did not indicate the significant effects. Pinjisakikool (2009) investigated whether the launch of futures reduced the volatility of underlying agricultural commodities spot prices. Their empirical investigation conducted on Agricultural Futures Exchange of Thailand (AFET). To evaluate the effects of futures trading on the cash market volatility, they applied ARIMA (p, d, q)-GARCH (p, q) and ARIMA (p, d, q)-TGARCH (p, q) models. In addition, they incorporated a dummy variable in the model as a proxy of existence (i.e. 1) and nonexistence (i.e. 0) of futures trading. They indicated that the volatility of three commodities increased after the futures trading came into existence. According to non-significant dummy coefficients of Ribbed Smoked Sheet no.3 and White Rice 5%, it could be concluded that the volatility of cash prices of these two commodities might not be attributed to the agricultural Thai futures market. Conversely, the coefficient of Tapioca Chip showed positive and significant; however, the effects of futures trading activities on spot price volatility appeared to be negligible in this commodity. Therefore, they concluded that futures trading could not be a significant cause of stabilization in agricultural spot prices volatility. Gokbulut et al. (2009) examined the effects of stock index futures trading on spot market volatility and trading volume in Istanbul Stock Exchange. They incorporated dummy variables as proxies of stock index returns and trading volume in ARCH type models. Their results showed that the volatility has not
significantly changed after the introduction of futures; however spot trading volume increased in the post-futures sub-period.

4.1.4 Indian Studies

Globalization and international free market conditions made Indian markets fluctuated. The price volatility risk management was the main objective of derivatives introduction in Indian market. As stated earlier, besides hedgers, speculators are another major player in Indian derivatives market. Speculative activities of emerging Indian derivatives markets may affect their underlying spot markets more significantly than those of developed markets. Therefore, investigations are required in different time settings to find the relationship between futures trading activities and spot market volatility in Indian market. Bandivadekar and Ghosh (2003) studied the impact of commencement of index futures on spot market volatility. They analyzed their study using CNX Nifty, BSE Sensex indices and GARCH model. They analyzed two indices as controlling market-wide factors namely BSE 200 and Nifty Junior to find whether the decrease/increase in spot market volatility was only attributed to the introduction of futures. They evidenced a significant decline in BSE Sensex spot market volatility during post-futures sub-period attributed to futures trading effects. However, a reduction in CNX Nifty volatility could be attributed to both market factors and futures effects. This was due to the increase and decrease in recent and old news effects, respectively. Mallikarjunappa and Afsal (2007) studied the impact of derivatives on underlying index in Indian market using CNX IT index. They applied GARCH model to examine the volatility behavior of CNX IT index. They evidenced that volatility of spot market increased subsequent to the introduction of futures trading. The significant coefficients of ARCH and GARCH indicated that prices were sensitive to recent innovation (ARCH), but did not depend on old news (GARCH). They also indicated that volatility persistence behaved differently before and after the introduction of futures. The results of chow test suggested a structural change in the spot market volatility after futures listing. Mallikarjunappa and Afsal (2008) examined the volatility behavior of CNX Nifty index after the introduction of derivatives using GARCH model. They also examined the volatility persistence and clustering before and after the introduction of derivatives by incorporating dummy variables as proxies of futures and options in GARCH (1, 1) model. Contrary to the findings of Mallikarjunappa and Afsal (2007), their results indicated that the spot market volatility neither stabilized nor destabilized after the introduction of derivatives in Indian market. They showed
that spot market volatility was more determined by recent news than old ones during post-futures sub-period. The results of chow test evidenced that nature of the spot volatility changed following the introduction of derivatives. Srinivasan and Bhat (2008) investigated the impact of futures trading on spot market volatility of the selected commercial banking stocks of India using EGARCH (1, 1) model. The volatility of most stocks reduced after the introduction of futures. Moreover, they indicated that there were no asymmetric (leverage) effects in most of the banks stocks. Debasish and Das (2008), by taking a case of BSE Sensex stock index, investigated the impact of futures trading on spot market volatility. They evidenced that the daily volatility increased in the post futures sub-period due to futures trading, whereas the monthly volatility was unaffected. A study on spot volatility of Indian market by Selvam et al. (2009) examined the impact of futures and options trading on their corresponding cash prices using the data of BSE Sensex index. Using GARCH family models, they evidenced that the volatility of spot market either decreased or increased as a result of futures or options trading. They demonstrated that a decrease in the volatility of spot market may be attributed to faster information dissemination of futures market which may make the cash market more liquid and less volatile. Sakthivel and Kamaiah (2009) investigated the relationship between CNX Nifty index spot market volatility and futures trading activity. The GARCH and GJR-GARCH frameworks were employed to examine this association. The expected and unexpected futures trading volume and open interest (as measures of futures trading activity) were incorporated in GARCH framework. The results of this study showed a positive significant linkage between unexpected futures trading activities and spot market volatility. However, it was reported that expected trading volume and open interest reduced the spot market volatility. Debasish (2009) examined the spot market volatility behavior in response of derivatives trading using the selected individual stocks in Indian market. This study also attempted to seek how market efficiency of Indian stock and futures markets has been affected by index futures trading. In addition, by examining the dynamic behavior of spot market volatility, this study tried to find whether market-wide volatility decreased after the recent years’ institutional developments. Using the event study approach, it was found that both the spot price volatility and market efficiency of stock market declined after the introduction of futures. The results suggested a tradeoff between costs and gains related to derivatives trading. Gupta and Singh (2009), using GARCH (1, 1) model, examined the cash volatility behavior of Nifty index after the introduction of futures and options. The results indicated that both conditional and
unconditional volatility decreased following futures and options listings. Srinivasan et al. (2009) investigated the impact of introduction of futures and options trading on the volatility of the underlying spot market using CNX Nifty index and EGARCH (1, 1) model. Either the results of futures or options indicated a reduction in the volatility of spot market after the commencement of derivatives in Indian market. In addition, the results of both futures and options segments indicated no asymmetric effects. They also suggested that derivatives trading may enhance the speed and the quality of information flow into the spot market. These enhancements led to a higher market depth, lower information asymmetry and lesser spot price volatility. Singh and Kansal (2010) examined the impact of derivatives trading on the stock market volatility of India using CNX Nifty index over the period of 1995-1996 to 2008-2009. They found that introduction of derivatives trading led to a reduction in the stock market volatility in CNX Nifty. They opined that this volatility stability might be attributed to an increase in trading volume of underlying derivatives market. Gahlot et al. (2010) examined the impact of derivatives trading on the volatility of CNX Nifty index as proxy of Indian stock market. The GARCH (1, 1) model was employed to find the nature of volatility and volatility persistence of index prices. They evidenced that the volatility of index prices decreased after futures trading, while the magnitude of this reduction appeared to be very low. However, the volatility structural changes were significant to some extent. Saravanan et al. (2011) used daily data set of CNX Nifty index and GARCH (1, 1) model to examine the behavior of spot market volatility in the post-futures and post-options sub-periods. To remove market-wide effects from the volatility, Nifty Junior and S&P 500 indices were incorporated in the mean equation of the model as national and international market-wide factors, respectively. They indicated that the volatility marginally reduced in the post-futures sub-period. Moreover, the results showed that a decline in the volatility depended more on options trading than futures market. Ray and Panda (2011) examined the effects of derivatives trading on Indian spot market volatility over 1998-2009 period of time using GARCH model. Their findings evidenced that there were structural changes in the volatility of most of the stocks after the launch of derivatives trading. They demonstrated that the volatility persistence became stronger after the introduction of derivatives. Using Johansen Maximum Likelihood Procedure cointegration tests, they found that before implementation of derivatives some stocks had a long-run equilibrium relationship with market benchmark index. However, this relationship appeared to be vanished in the same stocks after the
introduction of derivatives. Srinivasan (2011) employed EGARCH (1, 1) model to examine the impact of futures trading on cash market volatility of selected pharmaceutical stocks in Indian market. The analysis of this study evidenced mixed results about the volatility behavior and asymmetric effects after futures trading. The spot market volatility indicated a significant decline in most of the shares following futures trading. The findings revealed the presence of a positive significant leverage effect in most selected pharmaceutical shares. Debasish (2011) examined the change in the volatility of Indian stock market following the introduction of futures trading. The results showed that there was a significant change in intraday volatility between spot prices and futures prices for all the three NSE indices (Nifty, CNX IT and CNX Bank) over the entire period 2000 to 2010. Singla (2012) examined the impact of futures trading on Indian stock market volatility. To investigate these effects, rolling standard deviations and variances in the daily return data of CNX Nifty index were computed and the results of pre-futures and post-futures sub-periods were compared. This study evidenced a significant decline in unconditional volatility after futures trading; however, it could not be only attributed to futures trading effects. Sehgal et al. (2012) investigated whether Indian agri-commodities spot market volatility is affected by futures trading activities. Their results indicated that about 72% of the commodities spot prices destabilized following unexpected futures trading volume. Besides, they evidenced that the unexpected futures trading volume led to spot price volatility in most of the cases. They argued that spot market volatility affected the futures market liquidity, implying that there were strong speculative interests in the market. This implies that spot market is not well-organized and it suffers from lack of transparency.

4.1.5 Options Listing Effects

However, the existing literature contains voluminous investigations regarding the effects of futures trading on spot market volatility; there are a few investigations on options trading effects. Some theories claim that options’ trading has stabilization effects on cash markets volatility (Grossman, 1988). Empirical investigations on options introduction effects have been conducted based on some aspects such as stock market volatility, bid-ask spread, volume, information dissemination and price effects.

Nathan Associates (1974) considered as the first empirical investigation on the impact of options trading in Chicago Board Options Exchange (CBOE). They evidenced that the underlying stock volatility stabilized subsequent to options listings. This was supported by some
other studies like Bansal et al. (1989), Haddad and Voorheis (1991), Skinner (1989), Damodaran and Lim (1991). They indicated that the volatility of underlying stock declined after the options introduction. This result also was confirmed by studies conducted in other developed markets like England, Canada, Sweden, Finland, Japan and emerging economies like India. Bansal et al. (1989) investigated the influence of CBOE options introduction on the price volatility and trading volume of the underlying equities. They indicated that optioned firms total risk decreased after options commencement; however, there was no change in unsystematic risk. They showed that total trading volume increased after options listing. Skinner (1989) analyzed the variance of returns on common stocks around the date of options introduction. He evidenced that stock return variance declined after the options listing date. He also found that stock market volume increased after the options trading. Conrad (1989) found that the spot return volatility declined and systematic risk remained unchanged after options introduction. They evidenced that the effects of call options after listing date was significantly larger than the effects around announcement, therefore they need to find the difference between the information revealed by actual transactions and the information distributed by the announcement. Damodaran and Lim (1991) investigated the presence of price stabilization after the options listings in CBOE and AMEX between 1973 and 1983. They evidenced that the listing of options caused a significant reduction in the variance of underlying stocks daily returns. They also found that prices adjusted much more quickly to new information and led to higher market efficiency with the advent of options trading. Watt et al. (1992) found that there were lower unsystematic risk, lower total risk and higher market efficiency in post-listing daily returns. On the other hand, they showed that there were no changes in average beta. The reduction in unsystematic and total risk was largely confined to the stocks with high pre-listing volatility. They also found that skewness of returns increased in the post-options sub-period which supported the hypothesis that the introduction of put options increases the speed with which negative information is adjusted to prices. Freund et al. (1994) investigated to find the options listing effects on stock variances. To analyze this influence, they attempted to find whether optioned stocks behaved differently from the control grouped stocks. Their regression model estimated a significant reduction in stock variances after options introduction. They also evidenced that residual variances of optioned stocks behaved significantly different from that of the control grouped stocks in the early years, but not in more recent years. Kumar et al. (1995) investigated whether options introduction affected the volatility
of Nikkei 225 of Japan Stock Exchange. They used 250 days’ data and calculated the variance of return, average trading volume and implicit bid-ask spread. They run cross-sectional regressions to control the changes in spread, volume and price. They evidenced that volatility, trading volume and bid-ask spreads declined for the constituents of Nikkei 225 subsequent to the options listing. Their results supported the theory that the presence of options trading leads to transform speculative forces from spot to options market. Chatrath et al. (1995) investigated whether options trading leads to an increase/decline in daily and intraday cash market volatility, and whether options trading intensifies/reduces the rate of change in cash market prices. They employed put and call options of S&P 100 index and its underlying cash index. They evidenced that options trading led to stabilization in cash market. Elfakhani and Chaudhury (1995) applied distribution-free non-parametric tests to find whether Canadian options listing leads to a decline in the variance and beta of the optioned stocks during the early years of options trading (1970s). A comparison of simultaneous listing of call and put options indicated that beta and variance of the underlying stock reduced only following the put options listing. Chaudhury and Elfakhani (1997) also found that beta risk and variance decreased following the listing of put options. They also indicated that liquidity of the stocks enhanced after the introduction of put options and this liquidity increase led to stock volatility stabilization. Kumar et al. (1998) indicated a decrease in the variance of pricing error after options listing. They also found a decline in the spread and an increase in the quoted depth, trading volume, trading frequency and transaction size after options listing. In addition, they found higher pricing efficiency during post-options period. Contrary to most of the previous studies that investigated a reduction in the volatility of stock market following options listing, Alkebäck and Hagelin (1998), using event study, examined the influence of warrant and options introduction on the underlying stocks in Swedish market and compared the introduction effects between the two. Contrary to the warrants listings, the introduction of stock options had a positive effect on the underlying stocks. The volatility and bid-ask spreads decreased, while results regarding changes in trading volumes were more uncertain. In the options analysis 14% variance reduction was reported. However, some studies found larger decline in total volatility after options listing (Stucki and Wasserfallen, 1994; and Sahlstrom, 2001). Bollen (1998) evidenced that there was no difference between the influence of optioned stocks and a control group on stock market volatility. The findings indicated that market-wide variance was relatively stable for the options listing in the pre-1987 period.
examined by earlier studies; however, market-wide variance increased significantly, on average, for the options listing during 1987-1992. His results showed that in both periods, average change of variance in optioned stocks after options listing was equal to the average change in non-optioned stocks. These results supported the hypothesis that options listing neither stabilize nor destabilize the variance of stock returns. Mayhew and Mihov (2000) reported that exchanges are forward-looking to list options in anticipation of high volatility. Similar to the results of previous studies, they evidenced a significant increase in volume after options listing, perhaps as a result of increased hedging volume. Similar to the studies like Conrad (1989) and Sorescu (2000), they indicated a positive price effect around options listing prior to 1981. However, they showed a negative price effect after 1981, similarly evidenced by previous studies (e.g. Sorescu, 2000). Hwang and Satchell (2000) investigated to find whether there is any change in stochastic volatility of FTSE100 index after options listing. They decomposed volatility of this index into transitory noise and unobserved fundamental volatility. They found that European options stabilized the market fundamental volatility; however there was no change in transitory noise of underlying markets. Sahlstrom (2001) indicated that the volatility of spot prices declined after the launch of options in Finland market. He found a decrease in bid-ask spread following options trading. He argued that these results supported the theory that options listing may enhance the efficiency of underlying spot markets. Liu (2009) examined the impacts of index options on underlying stocks of S&P 100 index. He found that volatility, trading volume and bid-ask spread reduced after S&P 100 index options listed. However, no change was found in beta of the options listed stocks. These findings suggested that informed market participants moved from cash market to the options market. Chevallier et al. (2011), using GARCH (1, 1) models and daily data from April 2005 to April 2008, examined the volatility behavior in European Union Emissions Trading Scheme (EU ETS). They evidenced that the volatility declined after the launch of options in EU ETS. Thenmozhi and Thomas (2004), Gupta and Singh (2009) and Srinivasan et al. (2009) also found a reduction in the spot market volatility after the options trading listing in Indian market. Some studies found no change in the volatility of spot market after the introduction of options (Pierre, 1998; Fleming and Ostdiek, 1999; Rahman, 2001; and Selvam et al., 2009). Chamberlain et al. (1993) investigated the price behavior, trading volume and liquidity of stocks in Canadian market at the time of options listing. Contrary to the results of similar investigations in the United States, they evidenced that there was no effects on liquidity,
volume and volatility associated with options listing. Mazouz (2004) investigated to find the effect of CBOE options listing on the volatility of NYSE traded stocks. He found that both individual stock approach and portfolio approach supported the hypothesis that claims options listing has neither affected the volatility nor influenced the speed of stock price adjustment to information. Sarangi and Patnaik (2007) found no significant changes after the introduction of options in CNX Nifty spot volatility in Indian market; however, small changes were found in the structure of volatility in the post introduction era. Mazouz (2007) investigated the influence of options listing on underlying stocks volatility. His study was centered on portfolio and stock approaches to find such effects. The optioned stocks showed no significant volatility change after options listing. A few studies like Wei et al. (1997) and Faff and Hillier (2005) indicated that volatility increased after the introduction of options. Faff and Hillier (2005) evidenced that in some days after options listing, the underlying asset experienced a higher volatility and trading volume than normal levels. They indicated that the inside spreads of newly optioned firms decreased and there was also a weak evidence of an increase in the depth of the market for those stocks. They also evidenced that the existence of options trading led to a more efficient dissemination of information around earnings announcements. Chen and Chung (2012) evidenced an increase in liquidity in Standard and Poor’s Depository Receipt (SPDR) and improvement in informativeness of SPDR following SPDR options listing. They argued that this improvement in market liquidity may lead to a decline in transaction costs and also induce to larger contribution in price discovery in SPDRs. Their findings implied that developments in derivatives markets may result in enhancements in level of market liquidity and price discovery of underlying stocks.

4.1.6 Expiration Effects

Generally, the expiration days’ effects of derivatives on spot market have been investigated based on volatility, trading volume, price effects and returns. A large number of studies have been conducted on expiration days’ effects of futures and options in different markets. Most of the studies showed that trading volume increased significantly as they approach the expiration days (Triple Witching Hours). Mixed results of the expiration days’ effects on volatility, price behavior and returns are observed in a variety of time and place settings. Pope and Yadav (1992) investigated the effects of options expiration on the returns distribution and trading volume of underlying stocks in UK market. They indicated a downward price pressure
exactly before the expiration day. The results of volume evidenced an abnormal increase immediately before the expiration day and a decrease immediately after the expiry date. Their trading volume results were in line with the hypothesis of a causal association between higher sellers initiated volume of trading (without additional information) and associated negative price pressure. Stoll and Whaley (1997) investigated the expiration-day effects of Sydney Futures Exchange’s All Ordinaries Share Price Index (SPI) futures and discussed alternative futures settlement procedures. Their results evidenced that there were abnormal changes in trading volume prior to expiration day; however, prices did not behave differently around the expiry date from the other trading days. The results of price effects were different from those obtained from US markets. They also discussed that single price settlement appeared to be more appropriate than average price settlement for Australian stock market as a computerized continuous auction market. The average price procedure also has a disadvantage as it introduces basis risk. Lien and Yang (2005) investigated whether there was the expiration-day effects of stock options traded on the return, volatility, trading volume and temporary price changes of individual stocks in Australian Stock Exchange. They found that options expiration had a significant effect on return and volatility of the underlying stocks in absence of individual stock futures. These effects decreased after the introduction of a cash-settled stock futures contract. The effects on returns, volatility and temporary price changes around expiration days increased subsequent to the introductions of stock futures. They also evidenced that options expiration days have a small impact on trading volume. Similarly, Vipul (2005) examined the effects of expiration of options and futures on price, volatility and volume of the underlying shares in Indian market. He revealed that the underlying share prices tend to decrease immediately before the expiry date and increase one day after the expiration day. High abnormal returns were found after the expiration day and high abnormal trading volume initiated one day before expiry date and continued one day after the expiration day. The volatilities of underlying shares one day before and one day after the expiration day behave differently from other trading days. Some studies found an increase in the volatility of underlying stocks on the expiration dates (Thenmozhi and Thomas, 2004; and Jindal and Bodla, 2007). However, during the weeks around the expiry dates, the volatility relatively declined. Debasish (2010) examined the expiration effects on NSE Nifty index by comparing the trading volume and return process at the expiration with a comparison group. The sample of the study which covers the expirations from June 2001 to May 2009 was
divided into two sub-periods. Larger trading volumes were found on the expiration days and around the expiration weeks compared to other groups. In the first sub-period of the study, he evidenced higher volatility on the expiration days and during the expiry weeks than other normal trading days. In the first sub-period, the expiration weeks experienced significantly lower returns than comparison weeks; however, no evidence of price reversal was found.

4.1.7 Leverage Effects

Besides destabilization and stabilization effects, we can segregate the effects into the asymmetric effects reflected by positive and negative news. In the pure GARCH (1, 1) model developed by Bollerslev (1986), it is assumed that volatility is symmetrically affected by either positive or negative news. However, it is violated in the real world and particularly it is found that stock price volatility is more influenced by negative information than the positive ones. It is so called leverage effect. This term appeared for the first time in Black (1976) which implies negative returns are attributed to large proportion of debt which leads to higher volatility. The presence of leverage effect led to develop a number of parameterized extensions of the standard GARCH model to capture the asymmetric effects of good and bad news (see EGARCH by Nelson (1991) and GJR-GARCH by Glosten et al. (1993)). Many empirical investigations have been conducted in the literature of relationship between futures and spot markets about these effects by generally employing GARCH family models such as GJR-GARCH, EGARCH, and APGARCH. Koutmos and Tucker (1996) analyzed whether the volatility of S&P 500 index futures affected S&P 500 index volatility. Using EGARCH model, they also examined the existence of leverage effect in spot market volatility. It was found that leverage effect was presented in the volatility of spot and futures markets which implies that bad news increased the volatility more than the good news and the degree of asymmetry was larger for the futures market. Pilar and Rafael (2002) examined the impact of the commencement of derivatives in the Spanish market on the volatility and on the trading volume of underlying spot index. To analyze these effects, GJR-GARCH (1, 1) model was employed. Their findings indicated that asymmetric coefficient increased and conditional volatility of the spot market decreased subsequent to the introduction of derivatives. Kang and Yoon (2007) investigated whether the information efficiency improved and spot market volatility declined subsequent to the commencement of futures trading. They also investigated the effects of futures trading on asymmetric variation of five Asian cash markets by applying GARCH, GJR-GARCH and
APGARCH models. They found positive and significant effects of futures trading on asymmetric volatility of Asian spot markets. They also concluded that advancement in information efficiency was not significantly due to futures trading activities. Mall et al. (2011) examined the persistence of time varying volatility and its asymmetric effects by employing GARCH, EGARCH and T-GARCH models. They evidenced that negative news increased the volatility significantly in Indian stock index futures market. Sahu (2012a) investigated whether equity derivatives introduction affected Indian stock market volatility by using daily returns of seventy three selected stocks. The GARCH (1, 1) and GJR-GARCH (1, 1) models were employed to capture conditional volatility and asymmetric effects, respectively. To remove market-wide factors the return series of CNX Nifty index were incorporated in mean equation of the models. The results of his study are consistent with the theoretical hypothesis that predicts a significant reduction in stock market volatility after derivatives trading. The asymmetric effects are found to be negligible.

4.1.8 Currency Derivatives and Spot Market

Several studies were conducted on the relationship between currency derivatives and underlying spot markets. Clifton (1985) evidenced a relationship between the fluctuation of exchange rates and currency futures trading volume. He found a significant influence of the currency futures trading activity on spot exchange rate changes. McCarthy and Najand (1993) investigated the relationship between daily currency futures trading volume and its underlying spot exchange rate changes. They revealed a positive causal relationship between all currencies futures trading volume and absolute price changes other than Yen. Chatrath et al. (1996) examined the effects of currency futures trading on the variability of underlying spot exchange rates. They found a positive association between currency futures trading and spot exchange rates volatility. Jochum and Kodres (1998) investigated the ability of currency futures trading in sustaining the stability of spot currency market. They examined the effects of Mexican Peso, Brazilian Real, and Hungarian Forint currency futures on their underlying currency spot markets. The estimated coefficients obtained from SWARCH framework indicated that two out of three currencies were not significant. It means that currency futures trading neither stabilized nor destabilized the currency spot market. Similar consequences were achieved by Adrangi and Chatrath (1998). They studied the effects of currency futures trading on spot exchange rates variability. They evidenced that an increase in futures commitments has not led to destabilization
in the currency markets. Their results suggested that large speculator’s and small trader’s participation led to more fluctuation in the currency spot markets. They also found the persistence of these positive shocks over several trading days. Sarwar (2003) examined the interrelationship between the future volatility of USD/British Pound exchange rate and trading volume of currency options for British Pound. Their results demonstrated a positive relationship between the exchange rate changes trading volume of put options and in-the-money options. The major outcome of their study was that British Pound put and in-the-money options realized information based options for traders and arbitragers. Bhargava and Malhotra (2007) discussed the linkage between futures trading activity and exchange rate volatility. They incorporated open interest and futures trading volume as proxies of hedging and speculative activities, respectively. Three different measures were employed to estimate the volatility-extreme value estimator for intraday volatility, historical volatility and conditional volatility. They found that speculators (day traders) destabilized the market and increased the volatility by increasing the trade volume. As a result, demand for futures daily trading reduced, as it increased intraday fluctuation. Although, the open interest significantly caused the volatility, there was no consistent finding to either indicate stabilization or destabilization of the currency market volatility. Finally, the results of GARCH (1, 1) model indicated that both trading volume and open interest caused the instability in the volatility of exchange rate market. Chen and Gau (2010) provided an empirical investigation to examine the price discovery between EUR/USD and JPY/USD currency spot and futures markets. They showed that Euro and Japanese Yen spot trading contributed the price discovery process more than currency futures trading. On the other hand, they found that currency futures trading held leadership position in the price determination procedure during the time of releasing macroeconomic news as GDP, employment reports, etc. Their findings also indicated that currency futures contributed price discovery relatively more than cash prices when the currency spot market fluctuated more than futures markets. Contrary to the hypothesis that claims the lower transaction cost in a market, the higher the traders are being attracted to the market; they concluded that currency market were not influenced by transaction costs changes. Chen et al. (2011) argued the behaviors of major traders (investment companies, banks, and foreigners) and return volatility of Won/USD futures in South Korean currency market. Their findings illustrated a positive and significant relationship between currency rates fluctuation and currency futures unexpected trading volume as well as unexpected open interests. Sharma (2011)
analyzed the impact of USD/Indian Rs. futures trading activity on the spot exchange rates volatility. His results showed bidirectional causality between the volatility of the spot exchange rate and the trading activity in the currency futures market. Sahu (2012b) indicated that currency futures trading had no effect on currency spot exchange rate in Indian market and also reported that impact of recent news on the volatility of spot exchange rates increased after the introduction of futures trading. However, the effects of old information on spot currency rates reduced after the commencement of futures. Boyrie et al. (2012) investigated the role of price discovery between currency spot and futures markets in Brazilian Real, South African Rand and Russian Ruble. Different methods were used to analyze the leadership of price discovery in each market: VECM along with structural breaks analysis, multiple structural changes and computation of information shares. First, they examined the presence of multiple structural breaks and consequently separated the full-sample into different sub-periods. These structural breaks contributed sweeping up the difficulty of existence of perplexing and spurious results which may be obtained from a long sample. Finally, they found different results in different currencies. They indicated that the currency futures played a prevailing role in the Brazilian Real; however, currency spot market played a leadership role in case of Russian Ruble.
Part B

4.2 Price Discovery and Causal Relationship

The causal or lead-lag relationship, volatility spillover, short-run and long-run dynamics between spot and futures markets have occupied a very significant room in the literature of the theoretical and empirical studies. On a theoretical basis, Hull (1997) stated that the futures prices move along with the spot prices to prevent arbitrage usage. Many theoretical viewpoints such as Cox (1976), Ross (1989) and Stoll and Whaley (1990) argued that in information dissemination process, futures market reacts to new information at the quicker pace than spot market. As a result, futures market plays a leading role in the price discovery procedure. For commodities futures and spot prices, there are many other affecting factors like seasonality, durability, storability and market expectations that have likely considerable effects on their relationship. There are numerous empirical studies conducted to shed more lights on the literature of the causal association between futures and cash markets. Majority of these studies have been investigated on the long-run relationship between spot and futures markets. There already exist many investigations to find price discovery between futures and spot markets as well.

4.2.1 Futures and Options Lead Effects

A considerable share of the recent studies about the relationship between spot and futures, follow the model introduced by Garbade and Silber (1983) who investigated dynamic relationship between daily futures and cash prices for four storable commodities (oats, wheat, orange juice and corn). They found that futures markets have played a leading role in cases of wheat, orange juice and corn; however, a bilateral relationship was found in case of oats market. Stoll and Whaley (1990), using 5 minute intraday data, investigated the lead-lag relationship between S&P 500 stock index futures returns and its underlying stock index and also between MMI (Major Market Index) stock index futures and its corresponding stock index. The results of their study indicated the leading role of futures markets in both S&P 500 and MM indices by about five minutes. The results also showed that S&P 500 and MM futures indices tend to lead the returns of highly active stock returns like IBM. A weak positive effect of stock index returns on futures index returns was found; however, this effect has been decreasing as the futures contract approached maturity. Schroeder and Goodwin (1991) examined the dynamic linkage between live hogs futures and underlying cash market prices. To find the long run relationship,
the cointegration function and Engle & Granger test were applied. As they found on an average 65% of new information disseminated from futures to cash market, it could be concluded that price discovery leading role may be ascribed to the live hogs futures. Unlike these results, during some periods with higher volatility, the futures prices more relied on cash markets prices. In the case of long-run dynamics, they found low cointegration and opined that it was not an unexpected result. Since according to the theories, the larger the time to delivery, the more deviations between spot and futures prices will be. Martikainen et al. (1995) studied the dynamics of stock index futures and underlying individual stock returns in Finnish market. They employed Granger causality model to test both short-run and long-run association between spot returns and stock index futures. They found that causality direction was dominant from futures to cash markets and also speed of adjustment to new information in the futures markets was significantly higher than spot returns. Chatrath and Song (1998) investigated the direction of volatility spillover between spot and futures markets and also argued whether the regulation of futures market may affect the fluctuation of the spot market. Their study advocates this theory that information transmission plays a very crucial role in the volatility spillover and price discovery between spot and futures markets. Their empirical findings indicated that futures market led to higher movements in the spot market prices, meaning that futures market may react more efficiently to new information transmission. Booth et al. (1999) examined the intraday price discovery process among stock index, index futures and index options using high-transaction data set of Deutscher Aktien index (DAX), futures DAX (FDAX) and options DAX (ODAX) taken from FSE and DTB of German market, respectively. The VECM model was applied to describe the long-run relationship among cointegrated price series. The information shares findings indicated that 50% of the common factor was contributed by DAX and 48% by FDAX, leaving but 2% provided by ODAX. They evidenced the dominant role of futures market in the price discovery process. The dominance of FDAX in the price discovery process is consistent with transaction hypothesis. Yang and Leatham (1999) indicated that futures markets developed the price discovery function. They found that three U.S. wheat futures markets were driven by an equilibrium price in the long-run, but no equilibrium relationship of prices across wheat cash markets was found. Brooks et al. (2001) investigated the causal relationship and a profitable trading strategy between spot market and index futures market using 10 minutes intraday interval data modeled by cost of carry error correction methodology (ECM-COC). It
was found that index futures prices led spot prices and contributed in forecasting the cash market changes. They presumed that the forecasting power of index futures prices might be used to develop a cost-effective trading strategy in the real world. Lastly, it was indicated that the returns obtained from their predictive model were significantly higher than passive benchmark; however, they could not outperform the benchmark in the presence of transaction costs. Mattos and Garcia (2004) investigated the linkage between Brazilian agricultural spot and futures markets. They found that futures prices played a more crucial role than cash prices in the price discovery matter. However, in the markets with relatively smaller trade activity, they found that there were neither co-integrations (i.e. long-run association) nor short-run relationships. Zhong et al. (2004) examined whether futures market provided a price discovery foundation in Mexican underlying stock market and also tested the hypothesis of the likely long-run dynamics between spot and futures prices using EGARCH (1, 1) model. Their findings advocated the theoretical arguments, stating that futures market plays a causal function in the price discovery of spot market. However, their findings indicated that more futures trading led to higher volatility of underlying cash market. Kang et al. (2006) examined whether KOSPI200 futures and options returns and volatilities led the returns and volatilities of underlying KOSPI200 index. They took transaction price data of the futures and options indices and 5 minutes intraday data of spot index from Korean Stock Exchange (KSE). To estimate these relations, they employed OLS regressions used by Stephan and Whaley (1990). Rather than option pricing model used in Stephan and Whaley’s study, they used put-call parity relation to extract implied forward prices. The results showed that KOSPI200 futures and options returns and volatilities led the returns and volatilities of KOSPI200 index by 10 and 5 minutes, respectively. They also evidenced that futures index dominated options index. Given these results, they assumed that the lower transaction costs in derivatives market may facilitate faster information dissemination and leadership role in the price discovery process. Floros and Vougas (2007), by employing bi-variate GARCH (1, 1) model, attempted to find the price discovery effects between Athens Stock Exchange futures indices (ASE-20 and ASE-Mid 40) and their corresponding spot indices. The results evidenced the cointegration between spot and futures markets and also confirmed that the futures markets played a predominant role in the price discovery process in Greece market. A large number of studies were conducted on the relationship between stock and futures markets. The investigation like Chung et al. (2007) is viewed as very few studies contributing price
discovery function between bond futures and underlying spot markets. They analyzed an empirical investigation to evaluate the relative information content adjusted at a quicker pace either in bond futures or in underlying bond spot prices. They found that about 70% of the price discovery leaderships were attributed to bond futures market due to lower spread and higher trading volume. They also argued that lower transaction costs of bond futures market was the main reason for its leadership role in the price discovery procedure. Schlusche (2009) examined the process of price discovery in the spot (ETF market) and futures market in Germany which are related by cost-of-carry relationship. To investigate the price discovery in the new environment of electronically traded basket of securities, they estimated VECM approach using high-frequency transaction data of ETF (DaxEx) and DAX futures (FDax). The results of VECM model indicated that futures prices led ETF market in terms of their relative contribution to price discovery process. Theissen (2009) investigated the price discovery leadership between spot and futures markets, in particular under arbitrage operations. The results obtained by error correction model showed that futures played a leading role in the price formation function and this predominant role of futures in the price discovery seemed to become more significant in the presence of arbitrage activities. He opined that the more the divergence of spot from futures prices, the higher the intention of the spot prices to adjust to the futures prices. Using Granger causality test Hernandez and Torero (2010) attempted to find the direction of information transmission between agricultural spot and futures markets. They found that variations of spot market explained by futures market seemed to be more significant than what were done in the reverse direction. Therefore, it was stated that futures market dominated spot market in the price discovery process. Analogous to the investigation done by Brook et al. (2001), Lai and Li (2012) analyzed the lead-lag association and an optimal trading strategy between Taiwan Stock Index Futures prices and underlying spot markets. The investors’ sentiments were also taken into account in their model. They found the long-run dynamics between MSCI Taiwan Stock Index Futures prices and cash market prices. They evidenced that index futures maintained the leadership role in the price discovery process and possessed the predictive ability. In contrast to highly significant relationship between the investors’ sentiments and market returns in the long-run, they presented low and negligible linkage in the case of short-run. They also argued that as abnormal risk presented in the market, the price leadership stood in the same direction and indicated third and fourth days’ lags played a leading role in the price discovery procedure both
positively and significantly. Silverio and Szklo (2012) empirically examined the effects of the oil futures market on the price determination process in the underlying spot market. In consistent with the findings obtained by oil futures market flourishing time, they found that the oil futures market led the oil cash prices, but this leading role of futures trading varied across different periods of time. However, this dominating function of futures trading increased within the duration of 2003 to 2008, reduced after the financial crash in 2008 and again improved in 2009 after financial revival regained. The results of an investigation carried out by Chevallier (2012), are consistent with the theories argued that futures market dominates spot due to less transaction costs and simpler trading process. He extended his own findings using linear VECM model in 2010. He accepted the hypothesis of threshold cointegration in the favor of null hypothesis of linear cointegration. Furthermore, he investigated an appropriate cointegration relationship model between spot and futures prices in which the structural changes were taken into account. In VECM linear model with the structural breaks, it was indicated that there were long-run associations between futures and spot prices where futures prices played the leadership role in the price discovery process. He found that the structural change occurred in July 2008 could be attributed to financial crash in 2008. He finally argued that a trader could find a cointegration between futures and spot prices affected by the existence of structural breaks and different thresholds. Rittler (2012) examined the long-run cointegration, informational role and volatility spillover between spot and futures prices using high frequency data. To analyze these three subjects, he employed VECM, Granger causality tests and UECCC-GARCH model, respectively. He indicated that about 70% of price discovery was served by futures prices. The findings about volatility transmission analysis are consistent with the results of price discovery. Moreover, the results evidenced a highly significant cointegration linkage between spot and futures prices over the time.

4.2.2 Futures and Options Lag Effects

Quan (1992) found that, in the presence of new information, the spot crude oil prices led the crude oil futures market. The results obtained from causality function of futures to spot indicated negative and insignificant effects. Graham-Higgs et al. (1999) examined the causality relations between spot and futures markets, long-run cointegration and futures market efficiency using VECM and Granger (1988) causality model. They indicated that the causality direction run from spot to futures prices. The investigation of Khan (2006) was aimed at finding the evidence
of lead-lag relationship between spot and futures markets and estimating the predicting role of stock futures prices. The VECM and GARCH (1, 1) models were used to estimate causal associations and analyze the volatility relationship between two markets, respectively. The findings of his study advocated the school of thought that believes new information is reflected in the spot market at the quicker pace than what is done by the futures segment. Moreover, he evidenced that the higher volatile spot market, the larger fluctuated futures price is. Ansi and Ben Ouda (2009) reviewed the literature of empirical analyses into three aspects --i.e. the effects of options trading activities on spot prices liquidity, price dynamics and volatility. As the options trading have been initiated since about two decades ago; the findings of their survey on the existing empirical investigations show no consensus. They debated some conflicting conclusions of spot market leadership role that are not consistent with the majority of theoretical points of view. Cabrera et al. (2009) investigated the dominating role of futures and spot market in the price discovery in Euro and Japanese Yen currencies. They found that cash prices played a leading role in price determination process.

4.2.3 Bi-directional and Neutral Causal Effects

Covey and Bessler (1995) showed that there is no long-run equilibrium (cointegration) between futures and cash markets. They argued that cointegration between spot and futures returns depended on the storability of the underlying asset. Zurbuegg and Sim (1997) studied the time-varying conditional correlations, price discovery leadership and volatility transmission between the futures and corresponding stock markets using multivariate GARCH (1, 1) approach. Their findings showed a significant time-varying conditional correlation between the index futures market and stock index returns. Furthermore, they did not find any significant volatility spillover between the markets. However, they expressed that applying close to close returns might be a rational reason for the reduction of true volatility transmissions from US S&P 500 to Australian markets. Conover and Peterson (1999) investigated the lead-lag relationship between the options and spot markets by using changes in put-call parity, a control option methodology and Berkeley options data base. This investigation was done for 17 trading days prior to substantial earnings surprises. Their results showed the dominant role of the options market in the period of time before the passage of the Insider Trading Sanction Act (pre-ITSA) for the negative surprises, while they indicated the leading role of stock market for positive surprises. However, the results of post-ITSA indicated that neither the options market nor the
stock market played a leading role. Sim and Zurbruegg (1999) studied the market co-movements, causality leadership and volatility spillover between Australian and Japanese local and foreign spot and futures markets. The model employed to investigate the relationship between different markets is useful for the futures traders to analyze the impact of foreign cash, futures and the local cash markets on the local futures market in a single coherent framework. Their results indicated that Australian markets were more sensitive to the movements of the prices in Japanese markets. Therefore, an Australian trader must suspect volatility spillover effects from Japanese spot to futures market and the reverse direction. Turkington and Walsh (1999) drawn conclusions about the high frequency causal relationship between All-Ordinaries Index in Australian market and share price futures index accounting for the effects of market structure and nature of cost-of-carry approach. Overall, the causal relationships were found bi-directional between two series. They found that time to be taken for absorption of new information depended on whether the shock appeared in one market pertains to its own or to the counterpart market. Tse (1999) investigated the price discovery process over DJIA index as one of the most reliable benchmarks over the financial markets universe. They examined minute-by-minute price discovery and volatility spillovers between DJIA cash and futures markets. Using bi-variate EGARCH (1, 1) model, they evidenced that the new information originating in one market would increase the instability in the other market; however, the spillovers from futures to spot index were more significant than the reverse direction. Based on these findings, the presence of bidirectional causal relations is declared. These results are in contrast with those of Hasbrouck (1995) models’ arguments which claimed that the futures market plays a predominant role in the price discovery process. Furthermore, they found that bad news in either futures or stock markets would increase the volatility more than good news. Opposed to the analysis of Hasbrouck (1995), his findings evidenced the presence of bidirectional causal relations regarding volatility spillover between spot and futures markets using bi-variate EGARCH framework. It means that the new information disseminated in one market can be useful in anticipating the volatility in the other market. Their results also indicated the existence of leverage effects in both markets where the volatilities were influenced more by negative news than positive ones. Yang et al. (2001) examined the price discovery performance of futures markets for storable and non-storable commodities in the long-run allowing for the compounding factor of stochastic interest rates. They evidenced that asset storability did not have any effect on the cointegration or long-run
association between futures and spot markets. Chatrath et al. (2002) investigated the relationship between futures and cash market in S&P 500 index using intraday data. They concluded that when the market was bullish, the index futures market played a leading role. On the contrary, more significant results of spot market leadership over index futures prices were found in the bearish situations. They also found that most leadership imbalances were observed during the moments with higher fluctuation like opening and closing times of trading days. Moreover, they evidenced a positive and significant association between basis and volatility. Yang et al. (2005) investigated the lead-lag association between futures and cash prices of main agricultural commodities. They indicated that the higher unexpected futures trading volume led to an increase in the volatility of spot markets. Furthermore, they evidenced that cash price volatility led unexpected futures trading volume and unexpected open interest for just few commodities. Among many studies conducted on the lead-lag relationship between futures trading volume activities (i.e. trading activities of hedgers and speculators) and volatility of the market, investigation of Hsueh et al. (2008) is significant. They estimated futures volume trading measure using the ratio developed by Garcia et al. (1986) and employed the models exercised by Garman and Klass (1980) and Schwert (1990) for the measures of cash market volatility. Their findings showed that how different the results obtained from US and Hong Kong markets were, regarding degrees of sophistication. They indicated that futures trading hedging activities dominated S&P 500 spot index. However, they evidenced that Hong Kong market was influenced by futures speculative activities. Finally, they found different directions in causal relationship between trading volume and market volatility under different market composition, information and trader-types. Bekiros and Diks (2008) estimated the causal relationship between spot and futures market both on linear and nonlinear basis. Their scope of study contains one, two, three and four months of West Texas Intermediate (WTI) crude oil. The Granger causality test was applied for investigating linear associations. Besides, a nonparametric approach developed by Diks and Panchenko (2006) was employed to test nonlinear causality linkage between two segments. Before testing the hypothesis of nonlinear causality, they checked the nonlinearity nature of the series. After controlling conditional heteroscedasticity and cointegration, the results obtained from GARCH-BEKK and VECM models indicated neither linear nor nonlinear causality relationship between crude oil futures market and its underlying cash market. In a similar investigation Kaufmann and Ullman (2009) attempted to find the origin
of new information dissemination between different crude oil cash and futures segments and to estimate the causality association between them. To test the hypothesis of causal relationship between spot and futures crude oil prices and to evaluate the long-run cointegration between them, modified Granger causality test and VECM model were used, respectively. The results showed the presence of new information initially in the Dubai-Fateh market and subsequently disseminated to the rest of crude oil spot and futures settings. They evidenced that there was a relatively low significant long-run linkage between spot and futures markets. Rosenberg and Traub (2009) investigated the price discovery between foreign currency futures and spot market. Contrary to the results obtained in 1996 what evidenced the dominance of currency futures trading in price formation, the findings obtained after 2006 illustrated a leading role of spot market in the price discovery process. They attributed this reversion in the role of price discovery to the improvement in the spot market transparency. Floros (2009) estimated the price discovery directions between daily spot and stock index futures traded in South African Stock Exchange (JSE) by employing cointegration test, Granger causality test, VECM technique and ECM-TGARCH model. His empirical results indicated the presence of long-run cointegration and highly significant estimates either from index futures to spot or the reverse. Kumar (2009) examined the dynamic linkage between commodities cash markets volatility and futures trading activity including agricultural commodities, precious metals, metals and energy commodities. To analyze the relationship between spot market volatility and futures trading activity, he employed futures trading volume and open interest factors as proxies of futures trading activity in GARCH family models. In addition, the lead-lag association between spot and futures prices was investigated by applying VAR models. A positive contemporaneous linkage between expected and unexpected trading volatility was found for non-agricultural commodities. On the other hand, in the case of agricultural commodities, he found that unexpected trading volume had a positive relationship with spot price volatility. Regarding lead-lag relationships, he concluded that futures trading volumes positively dominated the spot prices volatility in the majority of the commodities. Mallikarjunappa and Afsal (2010) investigated the lead-lag relationship between Indian spot and futures markets. They applied cointegration tests and VECM-EGARCH model to determine the causal relations between the two markets. To analyze their study, intraday data was taken from NSE. With respect to the theoretical points of view, information attraction process is mostly dominated by futures market due to lower transaction costs and hedging
advantages. However, their results showed that neither futures nor spot prices played the leadership role in the price discovery process. Evidently, a contemporaneous and bidirectional relationship was found between them. They also concluded that there was a substantial two-way volatility spillover relationship between the two segments. Furthermore, their results evidenced the presence of asymmetric volatility effects where the greater effects relied on the bad news than good ones. Goyal and Tripathi (2012) investigated the association between crude oil spot and futures market. They illustrated the mixed results out of two different approaches -- i.e. Granger causality test and error correction technique. The Granger causality results evidenced a bidirectional price discovery linkage between spot and futures; however, the estimates of error correction model indicated that crude oil spot market played a dominant role in the price determination process. Kumar and Chaturvedula (2013) evidenced a bidirectional cointegrated long-run association between spot and futures markets in India. Using Information Share approach, developed by Hasbrouck (1995), they found that in the price discovery process 36% share was explained by futures market. However, 64% share showed the predominant role of spot segment in price determination procedure. Their results are not consistent with theoretical viewpoints (e.g. Cox, 1976 and Ross, 1989) which expected futures market plays the leading role due to the nature of cost effectiveness of the market. Kang et al. (2013) empirically investigated the association between futures and spot prices in Korean market. Particularly, they provided empirical evidence in the volatility spillover between spot and futures prices using high frequency intraday data of KOSPI 200 futures contracts and their underlying stock prices. In the case of causal relationship, they indicated that there was a bi-directional linkage between both markets and also suggesting synchronization in information transmission of spot and futures markets.

4.2.4 Arbitrage Opportunities and Misprricing Effects

Besides speculation and hedging, arbitrage is an important function which facilitates futures and spot markets to converge and form equilibrium in the long-run. Generally speaking, there is a futures-spot arbitrage opportunity when a futures deviates from its value calculated by cost of carry model. In other words, an arbitrageur transacts into two markets at the same time to earn profit from the price differences of these markets. To find the arbitrage effects, many studies were conducted based on the traditional cost of carry model. The most preliminary studies using this model were done by Cornell and French (1983) and Cornell (1985). They
assumed that market is perfect which implies that there are no taxes, no transaction costs and no short selling restrictions and dividends are paid continuously. To conduct empirical investigations, they used the contracts of S&P 500 and New York Stock Exchange composite indices which are considered as leading indices for arbitrage investigations. They evidenced that discrepancies between futures and spot markets were due to time of payments. They argued that spots are required to pay today; however, futures’ due amounts need to be paid at the time of expiration. They evidenced that spot and futures series diverged from each other because stockholders were paid dividends while futures contract owners did not receive dividends. They also indicated that futures prices were below what have been predicted using perfect market models. Figlewski (1984) examined the basis and different sources of basis risk on S&P 500 index contract to find arbitrage opportunities between futures contracts and spot markets. He argued that one of the most important sources of risk in the stock market transactions is risk of disequilibrium between spot and futures prices except on delivery dates. He also stated that the possibility of arbitrage opportunity is closely related to the magnitude of such risk. He evidenced that futures prices were significantly underpriced which was extensively noticeable in the early months of trading and those divergences from the theoretical pricing model have reduced. These results suggested many striking arbitrage opportunities. Similar results obtained by Brennan and Schwartz (1990) who attempted to develop an optimal strategy for an arbitrageur in these contracts by analyzing 16 contracts of S&P 500 stock index futures maturing from 1983 to 1987. Yadav and Pope (1994) investigated the arbitrage opportunities and mispricing using four years of synchronous hourly data from FTSE-100 index of UK. They reported the existence of economically significant arbitrage opportunities. They evidenced that the presence of these arbitrage opportunities closely relied on absolute cash-futures basis which needs to adequately exceed the total transaction costs. Richie et al. (2008) examined the arbitrage opportunities and affecting factors between spot and futures prices using S&P 500 Standard and Poor's Depository Receipt (SPDR) Exchange-Traded Fund (ETF). They indicated that mispricing happened in spite of the option of underlying cash asset, where mispricing existed more negative in the case of SPDR than S&P 500 cash index. Their results also showed that mispricing was significantly related to the magnitude of fluctuation. This implies that more frequent mispriced series were led by higher volatile months. Zhuo et al. (2012), using high frequency data of CSI300 index futures, constructed no-arbitrage band of continuous contract based on cost of carry theory and
investigated future-spot arbitrage. They investigated mean reversion effect of CSI300 index futures’ mispricing and the effect’s time using ADF model. They also investigated some variables which may influence arbitrage opportunities. They evidenced that there were cash-and-carry arbitrage opportunities for a large part of period. They indicated that mispricing mean reversion was significantly influenced by cash-and-carry arbitrage; however, reverse arbitrage did not have such effects. They also showed that arbitrage affected mean reversion mostly 14 minutes after mispricing occurred. Ultimately, they reported that arbitrage opportunities were positively influenced by the first order lag of trading volume, time to expiration and spread between the highest and lowest prices within one minute; however, they were negatively correlated to volume.

### 4.2.5 Indian Studies

Mukherjee and Mishra (2006) investigated the lead-lag relationship between spot and futures market using intraday data of Nifty spot and futures indices. They evidenced that there were bidirectional lead-lag relationship between spot and futures index returns. They indicated that the lead coefficients of futures market in India were found to be more significant (both individually and collectively) than their lagged coefficients. Their results suggested a strong contemporaneous relationship between spot and futures market in India; however, spot market played a dominant leadership role in information dissemination. They also showed that informational efficiency has been increased by the introduction of derivatives in Indian market. They found bidirectional symmetric volatility spillover between spot and futures market in Indian market; however, the spillover from spot to futures markets was found to be relatively stronger than in the opposite direction. Bose (2007) investigated whether CNX Nifty futures index played a predominant role in the price discovery process in Indian market. The study found that information disseminated significantly from futures market to spot market implying that there was a predictive power of futures prices to discover the spot prices. The cointegration relationship between two markets showed bidirectional feedback between them. The leading role of both markets appeared to be equal; however, the contribution of futures market in the price discovery process was slightly higher than those of the spot market. Similarly, Karmakar (2009) investigated the price discovery process of CNX Nifty and Nifty futures. He also examined whether the volatility of one market may be explained by new information of volatility of the other market and also how much and how fast these spillovers transferred between the markets.
The findings of VECM model evidenced that Nifty futures played a leading role in the price discovery process implying that futures market discovered the innovation more quickly than spot market did. The results of bi-variate BEKK model indicated that the past information disseminated from futures had the unidirectional significant effects on the present volatility of spot market; however, the persistent volatility spillovers have taken place bi-directionally between two markets. Jackline and Deo (2011) investigated the lead-lag relationships for the non-storable commodities of lean hogs and pork bellies from January 2001 to May 2010 using Granger causality test. They evidenced that either short term futures prices Granger caused the cash market prices or vice versa. They found that new information disseminated into both markets contemporaneously and markets were perfectly efficient. They also suggested that there were no arbitrage opportunities between the markets. Choudhary and Sushil (2012) investigated the role of spot and futures markets in the price discovery process and information dissemination in Indian market. To carry out their study, five minute interval intraday data of 31 selected individual stocks were taken. To find long-run equilibrium and lead-lag relationship, the Johansen’s cointegration test, Engle and Granger causality test and VECM model were employed. The causality results of all of the securities showed bidirectional information dissemination except Wipro which indicated unidirectional causality from spot to futures market. However, the results of VECM approach indicated that in the case of 12 stocks, futures prices played a leadership role and in 19 securities, spot prices led the futures market. Srinivasan and Ibrahim (2012) analyzed the price discovery process and volatility spillovers in Gold futures and spot markets of National Commodity Derivatives Exchange (NCDEX) using Johansen’s Vector Error Correction Model (VECM) and the bi-variate ECM-EGARCH (1, 1) model. The results of the study evidenced that in the price discovery process spot Gold prices played a predominant role. They found that the spillovers of novel information took place from spot market of Gold to Gold futures market. Choudhary and Bajaj (2013) studied to find the leading role between spot and futures markets in India. To conduct the investigation daily adjusted closing prices of 41 individual stocks and Nifty index were taken. The Engle and Granger Residual Based Approach, Johansen’s cointegration test and VECM model were employed to do the analysis. The price discovery results indicated that in about 50% of the stocks, Nifty index futures prices played the leadership role, and in rest of the cases, 50% of the futures prices were led by stock prices. Kumar and Chaturvedula (2013) investigated to evaluate the information share of spot and
futures markets in the price discovery process in Indian capital market. This investigation was conducted using tick-by-tick transaction data of 46 stocks in NSE market. Contrary to the expectations that believe the futures markets play the leading role for spot market due to their leverage benefits and low transaction costs, the results of information share indicated that spot market was dominant in the majority of the cases i.e. about 64%. Rajput et al. (2013) analyzed the volatility spillover effects for a fairly large period in Indian futures and stock market. A unidirectional volatility spillover was found from spot to futures market and not in the reverse direction. They argued that spot market reacted to new information faster than futures market and served as a price discovery vehicle for futures market.

4.2.6 Mixtures of Distribution Hypothesis and Sequential Information Arrival Hypothesis

An important theoretical hypothesis was introduced by Clark (1973) the so-called Mixtures of Distribution Hypothesis (MDH). He asserted that there is a positive contemporaneous linkage between price volatility and trading volume and assumed that volume-volatility have a joint probability distribution since both are jointly related to a common variable namely new information dissemination. In other words, they simultaneously react to the information arrival. Since information flows are not separable variables from returns, trading volume is used as the proxy of information diffusion. This theoretical hypothesis has been extended by other people in existing literature (Epps and Epps, 1976; Tauchen and Pitts, 1983; Harris, 1986; and Lamoureux and Lastrapes, 1990). Following Clark (1973), MDH model of Epps and Epps (1976) hypothesized that there is a stochastic dependence between trading volume and security price movements. It also advocates Clark’s hypothesis that price volatility depends on trading volume. Most of the studies supported MDH (Omran and McKenzie, 2000; Huang and Yang, 2001; Miyakoshi, 2002; Bohl and Henke, 2003; Wang et al., 2005; and Arago and Nieto, 2005). It is seen that GARCH effects reduced or even totally disappeared after insertion of trading volume in GARCH model. Lamoureux and Lastrapes (1990) reported that volatility was positively affected by trading volume. Subsequent to inclusion of trading volume in GARCH (1, 1) model, GARCH effects showed statistically insignificant in their augmented model. However, a few contradicting results reported that GARCH effects have not disappeared after incorporation of trading activities in GARCH model (Chen et al., 2001).

On the other hand, the sequential information arrival hypothesis (SIAH) or sequential information flow (SIF) of Copeland (1976) and Jennings et al. (1981) hypothesized volume-
volatility relations of the stocks. This hypothesis claims that information innovation disseminates to the traders in sequential and stochastic manner. They assumed that as the new information arrives, the traders adjust their predictions according to that innovation. The traders have different reactions to the information arrival. Subsequent to the completion of all reactions, the equilibrium is restored. According to this hypothesis, trading volumes are predictable using lagged values of the price volatility and vice versa. The notable difference between the aforesaid hypotheses is regarding predictability feature in volatility-volume values after reaching new information. The MDH model in contrast to SIAH assumes that there is no information available in past volatility values to anticipate trading volume values or vice versa. It implies that as new information received by the traders; both volume and volatility react contemporaneously. Besides these seminal theoretical frameworks, majority of the empirical studies found contemporaneous and bidirectional association between price volatility and trading volume and dynamic associations were also found (Jennings et al., 1981; Garcia et al., 1986; Andersen, 1996; Malliaris and Urrutia, 1998; Fung and Patterson, 1998; Gallo and Pacini, 2000; and Lee and Rui, 2002). Kumar et al. (2009) evidenced mixed results which neither entirely rejects MDH nor gives it an unconditional support. Some investigations examined both MDH contemporaneous relations and SIAH causal dynamic associations between trading volume and volatility (Darrat et al., 2003; and Choi et al., 2012). Both studies evidenced a positive contemporaneous linkage between volume and volatility and found trading volume as a forecasting tool for volatility dynamics. However, contrary to MDH assumptions, Bessembinder and Seguin (1992, 1993) suggested that association between volume and volatility depends on the types of traders whether speculators or hedgers, informed or uniformed traders. Following Bessembinder and Seguin (1992) model, Yang et al. (2005) decomposed trading volume into expected and unexpected components for two types of informed (speculators) and uninformed (hedgers) traders. These decomposed components are the proxies of information dissemination. Using Granger causality test and forecast variance decomposition, their results suggested both statistically and economically unidirectional relations run from trading volume to cash price volatility in majority of the cases, while open interest-volatility relations showed negligible effects. Similarly, Sehgal et al. (2012) reported that unexpected futures trading volume affected five out of seven agricultural commodities.
4.2.7 Dynamic Informational Role and Contemporaneous Relations

Informational linkage and spillover associations between cash market volatility and derivative trading activity have been a critical issue over last decades. These critiques basically stemmed from theoretical points of view on volume-volatility positive relations originally proposed by Copeland (1976). Following Copeland prominent related contributions have been given by Stein (1987) and Detemple and Selden (1991). The irregular intensified fluctuations are principally based on speculative activities of uninformed traders in both cash and derivatives markets mainly for arbitrage purposes. Therefore, concerns about unpredicted volatility caused regulators to restrict speculative actions particularly in derivatives markets. Because derivatives markets have attractive features for traders such as low transaction costs. On the other hand, adherents of derivatives trading believe that speculative activities of futures and options markets may reduce the cash price volatility. These theoretical viewpoints have been supported by extensive empirical findings in different settings in terms of time, location and methodology. A large number of empirical investigations regarding volume-volatility relations were conducted using traditional VAR analysis. The traditional VAR model employed in voluminous studies to investigate associations between derivatives trading and cash market volatility (Garbade and Silber, 1983; Schroeder and Goodwin, 1991; Chatrath, Ramchander and Song, 1995; and so on). Originally, Koch (1993) stated that the application of conventional VAR model may lead to misspecified estimates, since he believed that there is a possibility of simultaneous information arrival in the given variables, while simple VAR model does not account for contemporaneous volume-volatility relations. Following Koch (1993), some studies employed simultaneous equation model (SEM) to study the causal relationship between spot market volatility and futures trading (Kyriacou and Sarno, 1999; Sarwar, 2003; Sarwar, 2005; Kim et al. 2004; Buhr et al., 2008; and Parsa and Mallikarjunappa, 2014). Kim et al. (2004) concluded that there was a positive and contemporaneous association between stock and currency markets volatility and derivatives volume; and there was a negative relationship between spot markets volatility and open interest. Their results also showed that trading volume and open interest may be assumed as proxies for speculative and hedging activities, respectively. Kim et al. (2004) concluded that option caused spot volatility. Similarly, Buhr et al. (2008) indicated contemporaneous and casual relations between call options trading volume, implied volatility and TARCH volatility. Parsa and Mallikarjunappa (2014) investigated to find the effects of commodity futures trading on
underlying spot price volatility in Indian market using Iterative-Three Stage Least Square (3SLS). Their estimated positive and significant simultaneous coefficients in unexpected futures trading volume imply that destabilization of spot commodities market can be meaningfully attributed to an increase in unexpected futures volume. These positive coefficients further support the theory that believes spot market volatility is increased by speculative activities. On the other hand, they indicated that the estimated simultaneous coefficients of unexpected open interest components are negative and significant. These negative estimates support the concept behind hedging activities that believe such trading activities may reduce spot market fluctuation.

Place more restrictions on trading in derivatives market is not a proper solution to control destabilizing effects of futures trading on underlying spot market. Such limitations may actually destroy the process of market growth. Instead, an appropriate surveillance will help regulators to keep the spot market protected from unexpected changes and deliberate manipulations. Therefore, the studies like ours have an important implication for the policy makers and the stakeholders. In addition, there is no general empirical consensus on whether futures trading stabilize/destabilize the spot market volatility in India. Therefore, much empirical attempts are needed in this aspect to achieve a consensus which, in turn, can pave the way for the regulators to protect the investors’ capital against sudden fluctuations.

The empirical investigations on the price discovery process between spot and futures markets evidenced mixed results in Indian market. Therefore, lack of consensus in this issue has become a motivation for the researchers to investigate the price determination in different time settings. The recent rapid enhancements in Indian economy also motivated academics and investors to concentrate more on this market. Unlike sizable volume of investigations on developed economies, the empirical literature on the intraday price discovery in India is scarce. Therefore, this study provides a helpful foundation to fill the research gap of lead-lag relationship and volatility spillover between spot and futures market in India.