CHAPTER TWO

LITERATURE REVIEW

Effort has been made in this chapter to review available studies pertaining to any aspect of commodity exchanges globally as well as pertaining to India. The chapter has been divided into four sections. The first three sections deal with literature review based on commodity exchange which is organized as characteristics specific, commodity specific, and geography specific respectively. The last section identifies the gap for this research.

2.1 Commodity Exchange characteristic specific:

This section is organized into eight parts based on the relevant characteristics of the commodity exchanges. These are Performance and role of commodity exchanges; Price discover/price stabilization/price efficiency; Relationship with spot market and spot/cash prices; Impacts of futures trading (risk/reward/inflation); Volatility in trade on commodity exchanges; Comparison with equity market/assets/financial instruments/exchange rate; Hedging on commodity exchanges; and Delivery/warehousing and warehouse receipts.

2.1.1 Performance and role of commodity exchanges: Studies conducted on various performance and roles of commodity exchanges are mentioned in this section.

Electronic trading system was implemented in the U.S. exchanges and studies were conducted to observe the implications of this system on market performance, especially pricing efficiency. Sporleeder (1984) reviewed the empirical evidence garnered from adoption of electronic trading systems through changes in certain structural variables. Study was limited to a theoretical analysis only due to the lack of data. It revealed that electronic trading could reduce buyer and seller concentration and information asymmetry but increase pricing efficiency. The last day of open outcry trading on WCE was on December 17, 2004, after which it shifted to electronic trading. Similar study was carried out by Thomas (2008) using daily closing prices for 500 trading days.
before and after the date of shift to electronic trading for Western Barley (AB), Canola (RS) and Feed Wheat (FW) from the Winnipeg Commodity Exchange (WCE). This reduced the impact of other events that may have affected the relationship between the prices. The various cash and futures prices were tested for their order of integration using the Augmented Dickey Fuller test (ADF) and the Philip Perron (PP) test static, after which they were tested for structural change and co-integration. The results showed that the shift to electronic trading did not significantly affect the cash-futures relationship of the commodities traded on the WCE. It also showed that any change in the co-integration relationship would affect the hedge ratio, or the basis, thus affecting the ability of futures to predict futures cash prices or act as a hedge to traders of commodities. Limitation of the study was that it did not look at the impact of electronic trading on aspects like volatility and liquidity.

Courts and regulators of US had debated on the issue of whether brokers have a duty to prevent "unsuitable" customers from trading commodity futures or not. Greenough (1992) argued that such decisions, and the policy considerations underlying them, indicated that the duty of brokers should be limited to disclosure of the risks of trading. It should be left to the customers themselves to determine whether they are willing to accept those risks or not. Previous international brokerage models were considered no longer to be as appropriate a benchmark to guide India’s development of its brokerage industry. Working of brokers on Indian commodity exchanges was compared to that of international experiences of Australia, Malaysia and the USA and the results revealed that many of the traded commodities and most of the existing contracts on Indian commodity exchanges were specific to India only. Mecklai and Chin (FMC, 2000) recommended that the creation of successful brokerages relies on successful exchanges. FMC had also been requesting SEBI to permit brokers in the securities market to take up membership of commodity exchanges and engage in the business of intermediation in the commodity markets as well. Ramamoorthy (FMC, 2003) also recommended participation of securities brokers in the commodity futures market.

One of the main participants on any commodity exchange is the farmers since they drive the markets and the success of any exchange is directly related to the degree of participation of farmers on the exchange. The relationships between farmers' behavioral
attitudes and use of futures contracts, taking into account non-directly observable variables and the heterogeneity of farmers were tested by Pennings and Leuthold (2000) on a stratified data sample of 440 farmers using cluster analysis and covariance structure equation models to validate the relationships. The study revealed that the farmers were found not to be homogenous regarding the factors influencing their use of futures. Furthermore, study also concluded that several psychological constructs for farmers related to market orientation, risk exposure, market performance and entrepreneurial behavior played important roles in their use of futures contracts.

Many of the commodity futures exchanges in India failed to provide an efficient hedge against the risk emerging from volatile prices of many farm products in which futures trading was carried out. A study by Sahadevan (2002) was undertaken to investigate into the problems and prospects of the futures market in agricultural commodities in India. A more focused and pragmatic approach from the government, the regulator and the exchanges was recommended after the review of the nature of institutional and policy level constraints facing this segment. As per the study, this would make the agricultural futures markets a vibrant segment for risk management which can then play an important role especially in an agriculture dominated economy of India. Kabra (2007) observed that policymakers in India have overlooked wider considerations involving the discipline of checks and balances during trade on the exchanges. Study provided a reference to the factors that could have been behind the snags afflicting the present commodities futures policy, and suggested how the needs of the real economy can be satisfied by strengthening the forward trade.

Three attributes of futures contract behavior important for market performance—liquidity, volatility, and convergence were investigated before and after the 2005 increase in speculative position limits for corn, soybean, and wheat contracts at the Chicago Board of Trade. Irwin et al. (2007) noted that for wheat, the picture that unfolds relative to convergence patterns is not only one of weakness, but failure to accomplish one of the fundamental tasks of a futures market. The persistence and growing magnitude of the delivery location basis in wheat suggests a problem with the contract specifications. For maize and soybeans a weakness (but not a failure of convergence) occurred. The authors came back to the issue in 2008 and discussed four
solutions: 1) encourage longs to liquidate; 2) cash index rather than certificates market; 3) limiting hedge exemptions; 4) expanding delivery capacity. In March 2009, the team concluded that changes implemented by the CME (Chicago Mercantile Exchange) appeared to have been sufficient to address problems in the maize and soybean markets, but still these markets should nevertheless be closely monitored. For wheat, however, the study considered that "a major change in delivery terms is needed in order to address the underlying structural problems in the contract".

A study by Commission Staff Working Document (CSWD) of European Communities (2009) focused on those regulatory issues and policy initiatives that most specifically relate to derivatives for agricultural commodity markets. Based on a review of developments that had occurred as well as on a series of consultations with the main stakeholders, the study provided background analysis and some recommendations on those issues. Considering the linkage with the food chain, a few key commodities used for food/feed prices were selected, especially wheat and maize. The study found that exchanges for agricultural commodities are less active in the European Union and explained it by historical and policy developments. Some of the regulatory issues identified in follow up of the speculation part of the Communication on food price were also addressed in proposals put forward by the Commission and the US Treasury to strengthen financial supervision and transparency.

There is an extensive literature on modeling the stochastic process of commodity futures. It has been shown that models with several risk factors are able to adequately fit both the level and the volatility structure of observed transactions with reasonable low errors. One of the characteristics of commodity futures markets is the relatively short term maturity of their contracts, typically ranging for only a few years. This poses a problem for valuing long term investments that require extrapolating the observed term structure. Cortazar and Eterovic (2010) studied extensive literature on modeling the stochastic process of commodity futures and revealed that there has been little work on how to effectively do this extrapolation and in measuring its errors. Using prices of long term oil futures contracts, the study analyzed to help estimate long term copper and silver future prices. The multi-commodity model was analyzed and applied to oil-copper and oil-silver which have much lower correlation than the WTI-Brent contracts.
Findings of the study revealed that for commodities with lower correlation, the multi-commodity model did not seem to be effective. A modified multi-commodity model was proposed with a much simpler structure which was easier to estimate long term copper and silver futures prices, achieving a much better fit than using available individual or multi-commodity models.

The first decade of the 21st century has perhaps witnessed more structural change in commodity futures markets than all previous decades combined. Not only have trading volumes and open interest increased markedly, but this time period also saw historic changes in both trading and participants. The available literature indicates that the irrational and harmful impacts of the structural changes in commodity futures markets over the last decade have been minimal. In particular, there is little evidence that passive index investment caused a massive bubble in commodity futures prices. There is intriguing evidence of several other rational and beneficial impacts of the structural changes over the last decade. Irwin and Sanders (2012) studied existing literature on structural changes in commodity futures market. The study observed that there were several beneficial impacts of the structural changes; the expanding market participation had decreased risk premiums, and thus, the cost of hedging, reduced price volatility, and better integrated commodity markets with financial markets. However, there was little evidence that passive index investment caused a massive bubble in commodity futures prices.

There have been number of studies on performance and roles of commodity exchanges but very few studies on Indian commodity exchanges have been undertaken. Studies mainly covered the performance of the commodity markets of Europe, USA and UK. The studies show that the commodity markets in developed countries helped in reducing risks, lowering cost of hedging, reducing price volatility etc. but in a country like India, the scope has become narrow. This is due to lack of adequate participation of the hedgers, because of which many of the commodity futures exchanges fail to provide an efficient hedge against the risk emerging from volatile prices though the turnover of the commodity futures market had grown exponentially in a short span of time.
2.1.2 Price discovery/price stabilization/price efficiency: an important function of any commodity exchange is price discovery or price efficiency of commodities traded on that exchange. All the users participate in buying and selling of commodities based on various domestic and global parameters such as price, demand and supply, climatic and market related information. These factors, together, result in efficient price discovery, allowing large number of buyers and sellers to trade on the exchange. The exchange is communicating these prices all across the globe to make the market more efficient and to enhance the utility of this price discovery function. Various studies covering the price aspect of commodity exchanges are covered in this section.

There are three fundamental aspects to price trends in the market: first, actual underlying factors of supply and demand, second, expectations regarding the underlying fundamentals, and third, market conduct such as speculation and/or manipulation. The reason for having commodity exchanges in the first place is to create a fair, orderly and efficient system for matching supply and demand in order to enable what we call price discovery. However, what influences price discovery are the other two factors: expectations and market conduct. Expectations and how they are formed and informed is a science unto itself. However, part of what a commodity exchange can and must do is to regulate market conduct, which is its purview. (Gabre-Madhin, 2008)

Leuthold and Hartmann (1979) analyzed whether or not forward pricing is a primary role of livestock futures markets. A semi-strong form test of efficiency examined whether or not the prices in a market reflect all publicly available information. An econometric forecasting model was constructed to serve as a norm against which futures market forward-pricing abilities were tested. The study utilized alternative methods of evaluation and revealed that the live-hog futures market is inefficient as it cannot be relied upon to reflect accurately and consistently subsequent cash prices. Four hypotheses about the price-forecasting performance of live cattle and hog futures were tested by Martin and Garcia (1981) using disaggregated data. Live cattle futures were found to have inadequate forecasting performance for each hypothesis and did not provide better forecasts than lagged cash prices. Live hog futures performed well for three hypotheses, but not when economic conditions were unstable. Hog futures provided better forecasts than lagged cash prices. The study concluded that the analysis
did not support the contention that these futures markets were agencies for rational price formation. Investigating the spatial price discovery mechanism in the livestock market, Koontz et al. (1990) found that there was high degree of interaction between cash and futures prices using Geweke’s causality test. It was observed that the price discovery process is dynamic and the structure of the market influences it.

There is a tendency for the price of most commodity futures contracts to rise during the final weeks of trading by a small but statistically significant amount relative to the futures price of the next maturity. Paul (1986) reported this by examining four explanations and found that two squeeze theories were least plausible in the light of available evidence. The other two theories, one a variant of the Keynes-Hicks hypothesis, the other a theory based on the overlap of trading and delivery, were more plausible. Yet they differed in character, generality, and in their implications for market efficiency. The study concluded that more data was needed to examine this phenomenon.

Movements in prices for long-maturity futures contracts provided information about the equilibrium price level, and differences between the prices for the short- and long-term contracts provided information about short-term variations in prices. Schwartz and Smith (2000) developed a two-factor model of commodity prices that allowed mean-reversion in short-term prices and uncertainty in the equilibrium level to which prices revert. Although these two factors were not directly observable, they were estimated from spot and futures prices for oil futures contracts. The model was applied to some hypothetical oil-linked assets to demonstrate its use. The study observed that this model did not explicitly consider changes in convenience yields over time. Evidence from the study by Koekebakker and Lien (2004) suggested that agricultural futures price movements have fat-tailed distributions and exhibit sudden and unexpected price jumps by studying the wheat futures. The study including both seasonal and maturity effects in the volatility specification and observed time-dependence of the volatility of futures prices, both, as a function of calendar-time (seasonal effect) and time to maturity (maturity effect). It was observed that both, in-sample and out-of-sample procedures to fit market option prices showed that the suggested model outperformed previous published models. Kumar and Pandey (2011) studied the price discovery role of the
Indian commodity futures markets through return and volatility spillovers between spot and futures prices. For agricultural commodities, the price discovery takes place in both spot and futures markets. However, in the harvest period, when the futures trading volume is high, the futures market leads the spot market whereas in the lean period both markets jointly perform a price discovery. For the precious metals and energy commodities, the futures markets lead the price discovery role. In the case of industrial metals, LME spot prices (which are taken as spot prices for settlement by Indian exchanges) play a significant role in the price discovery process in the Indian market.

Electronic trading could reduce buyer and seller concentration and information asymmetry but increase pricing efficiency (Sporleder, 1984). Also for a given government expenditure, subsidized private storage was the most efficient way to stabilize market price. For a given deadweight loss, a program of direct payments was the most efficient stabilizer of the effective farm price; this program did not stabilize market price. Glauber et al. (1989) compared the effects of four alternative price stabilization programs for soybeans using a rational expectations model and simulation. Study revealed that all four programs, including a buffer stock program and one involving both direct payments and buffer stocks, tend to destabilize quasi-rent. Programs that involved an initial build-up of stocks, increased producer benefits but consumers were hurt.

Substantial evidence of presence of mean reversion in commodity futures price movements was provided by applying asymptotic regression to corn, soybean, wheat, live hog, and live cattle futures prices (Irwin et al, 1996). Alternatively, the Monte Carlo regression analysis did not provide support for the existence of such mean reversion in commodity futures prices. The study thus implied that the asymptotic regression results are misleading because the small sample distributions of test statistics were not well approximated by assumed asymptotic distributions.

Issues of price discovery have been extensively researched for mature markets with greater focus on equity markets. The work is very limited for commodity markets in emerging markets in general and India in particular. A commodity future trading has played an important role in economic development because of its eco-system linkages.
and role in employment generation. These trading platforms have also helped in integrating Indian markets with the world markets, thus, reducing any price distortions. In a study conducted by Silvapulle and Moosa (1999) and Karande (2006) a lead was found in the futures prices implying that price was being discovered first in that market and latter in spot market. Fu and Qing (2006) studied the price discovery process and volatility spillovers in Chinese spot-futures markets through Johansen co-integration, VECM and bi-variate EGARCH model. It was indicated in the results that there was a long-term equilibrium relationship and significant bidirectional information flows between spot and futures markets in China, with a dominant role played by futures market. Although innovations in one market could predict the futures volatility in another market, the volatility spillovers from futures to spot were more significant than the other way round.

Price discovery and risk transfer are considered to be two major contributions of futures market towards the organization of economic activity (Garbade and Silber, 1983). They used simultaneous price dynamics to model spot and future prices, in which changes in spot and futures prices on t are a function of the basis on t-1, this model was extended on four storable agricultural commodities to examine the characteristics of spot and future characteristics. They suggested that price discovery role of future market might be affected by liquidity and market size. Moosa (2002) with the objective to find out if crude oil performed the function of price discovery and risk transfer re-examined the Garbade and Silber (1983) model. With the daily data he found that sixty percent of the price discovery function was performed by the futures. It was also discovered in the results that there was a fairly elastic supply of arbitrage system and that Garbade and Silber model was more suitable for intraday behavior of spot and future prices.

Co-integration between futures and cash prices suggested that the sugar futures contract is a useful vehicle for reducing overall market price risk faced by cash market participants selling at the world price. Zapata et al. (2005) showed evidence that changes in the cash price caused changes in futures price by examining the relationship between eleven sugar futures prices traded in New York and the world cash prices for exported sugar. The study found that the futures market for sugar led the cash market in price discovery. Further, using the impulse response functions, study observed
reliability on the usefulness of the WSF as a price discovery market i.e. a shock in the futures price innovation generates a quick (one month) and positive response in futures and cash prices.

Even though commodity exchanges in India were operational for a long time, however they were more region-specific unless in 2003 when national exchanges came into operations. Being an emerging economy, price discovery was the main function that commodity exchanges were expected to perform and thus various studies were conducted on the effect of trading on the prices of the commodities. Thomas and Karande (2001) analyzed price discovery in India’s castor seed market and concluded that markets that trade exactly the same asset in the same time zone, do react differently to information. Also study revealed that small markets may lead the large markets in terms of price discovery. Indian agricultural commodities future markets are not yet mature and efficient (Kumar and Sunil, 2004). This was concluded by examining the price discovery for five commodities in six Indian commodities exchanges. Daily futures and comparable ready prices were used in the study. The ratio of standard deviations of spot and future rates were taken for empirical testing of ability of futures markets to incorporate information well. The study also empirically analyzed the efficiency of spot and future markets by employing the Johansen co-integration technique and revealed the inability of future market to fully incorporate information and confirmed inefficiency of future market.

Since India is one of the largest consumer as well as producer of many agricultural commodities, time is ripe for India to take a dominant role in price leadership at international level. Poor flow of information may consequently affect the price discovery process in such markets. Price information was discovered in the futures market of India. Co-integration and cyclic graphs were applied on daily data to explore empirically the incidence of price discovery for black pepper in spot market in Kerela, the nearby, and the first distant future market. This study by Chopra and Bessler (2005) found the results in these three markets tied together in one co-integration relationship, the spot and first distant future contract did not respond to perturbations in the co-integrating on but the near future contract adjusted to shock in the long run relationships, hoarding these three markets together.
New commodity futures markets in developing economies like India usually have thin volumes and low market depth, lack of well developed spot markets, poor delivery systems, policy restrictions and taxes on the movement of commodities, and other market imperfections. Given these differences, researchers have investigated empirically the Indian commodity futures markets so as to shed light on the role played by the futures markets in the price discovery and price information process. Assessing the impact of future trading on agriculture commodity prices, Sen (2008) mapped twenty one commodities with regard to the events of futures trade in these using the trend growth of Wholesale Price Index (WPI). It was observed that reasonable degrees of liquidity in most of these commodities came much after they were notified for futures trading. For some commodities, even after some liquidity was observed, this did not grow or stabilize continuously thereafter. Trend analysis was carried out at macro rather than specific commodity level taking August 2004 as the cut-off point to divide pre-futures and post-futures periods. Two opinions emerged: the advocates of commodity markets opined that speculators take up the hedger’s risk and provide liquidity to the markets and enable futures markets to perform the dual functions of price risk management and price discovery; however, those who oppose these markets expressed that speculators can create havoc in physical market segment by increasing price volatilities on one hand and on the other by creating inflationary pressures on the economy. Study concluded that data was insufficient to arrive at any one conclusion.

The statistical analysis on price discovery indicated that price discovery did not occur in agricultural commodity futures market. The exchange-specific problems like thin volume and low market depth, infrequent trading, lack of effective participation of trading members, non-awareness of futures market among farmers, no well-developed spot market in the vicinity of futures market, poor physical delivery, absence of a well-developed grading and standardization system and market imperfections were found as the major deficiencies retarding the growth of futures market (Easwaran and Ramasundaram, 2008) observed four contracts of castor, cotton, pepper and soya each traded on MCX and NCDEX. The interaction between volatility, return, market depth and trading volume was estimated econometrically. Bartlett’s homogeneity of variance test was used to test the integration between spot and futures markets. The econometric
analysis showed that the market volume and depth were not significantly influenced by the return and volatility of futures as well as spot markets. The Bartlett’s test statistic was found insignificant in both the exchanges, signifying that the futures and spot markets were not integrated. The study recommended a more focused and pragmatic approach from the government for the future of futures market in respect of agricultural commodities in India.

Studies were carried out to examine whether the national exchanges organized futures markets are efficient and therefore perform adequately the intended functions. Also researchers observed whether the changes in the market conditions adequately reflect changes in prices or whether the price discovery mechanism has been efficient. Indian Institute of Management, Bangalore (IIMB, 2008), on behalf of FMC used secondary data to study the impact of futures trading in gram, sugar, guarseed, wheat, urad and tur. Primary data was used to find out how futures trading was helping major stakeholders in the value chain of these commodities. These crops, except sugar, witnessed higher price increase in the post-exchange period compared to the pre-exchange period. While the changes in the fundamentals seemed to be the main reason for this change, the role of futures trading on the extent of this change was seen unclear. Market co-integration analysis showed that long run equilibrium between spot and futures existed in all the commodities. Study also found that spot price volatility increased after introduction of futures in case of wheat and urad. However, it did not find any major change in volatility for gram, excepting an abnormal rise in FY 2006-07, or for tur and sugar. In case of guar seed, volatility was in fact found lower after introduction of futures trade. Also study revealed that many contracts traded on Indian commodity exchanges do not satisfy a fairly minimal condition for these to be attractive for hedging by those holding physical commodities.

Sehgal, Rajput and Dua (2012) examined the price discovery relationship for chana, guar seeds, soya bean, kapas, potato, turmeric, black pepper, barley, maize, and castor seeds traded on NCDEX. Natural logarithm of daily prices was taken to minimize the heteroscedasticity in data. Study tested whether or not the spot and futures price series were co-integrated and also the time series stationarity of sample price series using Augmented Dickey Fuller (ADF). The results of the study confirmed price discovery
for all commodities except turmeric. The findings had implications for policy makers, hedgers and investors and will help in deeply understanding the role of futures market in information dissemination. The study recommended the following: commodity exchanges must strengthen their surveillance system; FMC should be given adequate powers to regulate commodity market; spot markets must be developed, ensuring transparency and trading efficiency; electronically traded spot exchanges must be developed; and warehousing, testing labs and other eco-system linkages must be established to strengthen the derivative market trading mechanism for efficient price discovery mechanism.

There are numerous studies that have been explored in the ascertainment of whether the price information is reflected in the spot market or in its underlying futures market under various interval of time since the introduction of futures in Indian commodity market. Issues of price discovery have been extensively researched for mature markets. The work is very limited for commodity markets in emerging markets in general and India in particular. Also there have been contrary views on impact of derivatives trading. A number of studies have been done to study the impact of introduction of future trading in commodity markets on the price volatility. However, studies are mainly focused on agri-commodities. Studies covering other commodities have not been found. Studies of the foreign researchers suggest that the price discovery, stabilization or efficiency is still an elusive factor in the commodity markets. In case of Indian market, some commodity showed the traits of price discovery but more studies should be undertaken to arrive at any fixed conclusions. The above studies suggest that there is indeed a gap, which exists between the global commodity market and the Indian commodity market.

2.1.3 Relationship with spot market and spot/cash prices: a commodity exchange is expected to work in close coordination with spot markets and cash prices. This section pertains to literature based on this aspect of commodity exchanges.

In studies conducted by Silvapulle and Moosa (1999) and Karande (2006), a lead was found in the futures prices implying that price is being discovered first in that market and latter in spot market. The study observed impact of futures prices of crude oil and
castor seed on their respective spot prices and revealed that the futures prices play a dominant role and lead spot prices. The primary reason cited by the study for presence of a lead-lag relationship between the two markets was that it is less costly since transaction cost is lower and the degree of leverage attainable is higher. Thomas (2003) reported that major stumbling blocks in the development of derivatives market in India, were the fragmented physical/spot markets. Supporting this view, Lokare (2007) suggested that national level derivative exchanges cannot be founded on fragmented localized cash markets. Because of fragmentation, prices of major commodities vary widely across *Mandis*. These differences arose because of poor grading; differential rates of taxes and levies, and inadequacy of storage facilities. Adding to the production and inventory decision factors that affect the spot and futures prices, Dasguptha (2004) in his study on the role of commodity future market in spot price stabilization, production and inventory decisions with reference to India showed the future price elasticity of production has always been greater or equal to one and increasing profit by increasing price is not possible.

Cost of carry has been identified as an important element along with futures prices to determine the cash price of commodities. LME lead cash prices, lead futures prices, lead inventory and UK treasury bill rates were collected over the period 1964 to 1995 and various predictive models relating futures price to cash price were described, including univariate and multivariate error correction models by Heaney (2002). Inventory, cash price return variance, cash price return first order auto-correlation and interest rates were used to proxy carrying costs in a test of the ability of commodity futures prices to predict cash prices. Analysis of the data confirmed the importance of the cost of carry model elements as well as futures price in forecasting cash price. Dasguptha (2004) also showed that the future price elasticity of inventory was inversely related with the carrying cost. It was concluded that, unnecessary hoarding will increase the carrying cost, leading to a lower responsiveness of inventory to future prices.

There was a need for development of nation-wide, information technology enabled spot markets for future exchanges to perform the functions of price discovery and price risk management efficiently (Sinha, 2009). The market behavior and causality effect between spot and futures prices in Indian commodity markets was examined by Dash
and Andrews (2010) and it was found that the pattern was different for different commodities. Study concluded that causality in commodities markets can be used to either hedge or speculate price movements and recommended that commodities that suffered from chronic backwardation must be analyzed in more detail, in order to understand the causes, and then controls should be instituted for the same. Singh et al. (2005) attempted to look into the mechanism of movement of spot and futures prices for maize and wheat in Indian agriculture using the ADF test. Most of the time series have been observed to follow the stationary pattern at the first difference.

The government’s decision to allow setting up of modern national commodity exchanges in 2002 helped revival of futures markets after nearly 40 years with more than 100 commodities covered under futures trading. Future trading in agricultural goods and especially in food items has neither resulted in price discovery nor less of volatility in food prices. Sen and Paul (2010) observed the steep increases in spot prices for major food items in India using a granger causal link from future to spot prices for commodities on which future data was available. The study noticed a pattern where investments in stock markets have links with those in the commodity market via portfolio adjustments. Study also revealed that with the opening of cross-border trade, commodity prices were guided by the upward movements in prices in international markets. The study had implications for India, encouraging further opening of the future market in commodities in India, but with caution, in order not to let speculators have a wider playground to play with. Kumar and Pandey (2011) studied the price discovery role of the Indian commodity futures markets through return and volatility spillovers between spot and futures prices. For agricultural commodities, the price discovery takes place in both spot and futures markets. However, in the harvest period, when the futures trading volume is high, the futures market leads the spot market.

The live hog futures contracts were examined to study how cash settlement affected the ability of the futures market to predict future spot prices. Adopting the Geweke feedback measure Chan and Lien (2001) found that the feeder cattle futures contract improved its price discovery function after the cash settlement was adopted in August 1986. Moreover, spot and futures markets became more integrated thereafter. The study also considered the case in which the cash-settled lean hog futures contract replaced the
physical delivery-settled live hog futures contract in December 1996. The conclusion was drastically different since study revealed that after cash settlement was adopted, the futures market was less effective in price discovery. Study also concluded that spot and futures markets were more segmented in this case. A literature review by Carter and Mohapatra (2008) of Chicago Mercantile Exchange hog futures contract was divided on whether or not futures prices for non-storable provide reliable forecasts of cash prices. Study revealed that from 1998 to 2004, the hog futures market was an unbiased predictor of cash prices.

Casassus and Collin-Dufresne (2005) studied crude oil, base metals and precious metals and characterized a three-factor model of commodity spot prices, convenience yields, and interest rates, which nested many existing specifications. The model allowed convenience yields to depend on spot prices and interest rates. It also allowed for time-varying risk premia. Empirical results of the study showed strong evidence for spot-price level dependence in convenience yields for crude oil and copper. The results implied mean reversion in prices under the risk-neutral measure. Silver, gold, and copper exhibited time variation in risk premia that implied mean reversion of prices under the physical measure. Applying the generalized forecast error variance decompositions, Yang et al. (2005) examined the lead-lag relationship between futures trading activity (volume and open interest) and cash price volatility for major agricultural commodities in the United States of America and revealed the presence of a weak causal feedback between open interest and cash price volatility for most commodities. Using GARCHX, Granger causality, and forecast error variance decomposition on wheat, sugar, turmeric, raw cotton, raw jute and soybean oil, Sahi (2006) observed that there is a causal effect from unexpected increase in open interest to cash price volatility for wheat, turmeric, raw jute and soybean oil. The findings were found consistent with researches done earlier that stated that futures trading has a destabilizing effect on agricultural commodities.

Applying the Granger causality tests it was observed that an unexpected increase in futures trading volume uni-directionally caused an increase in cash price volatility for most commodities in the Unites States of America (Yang et al., 2005). The study by Zapata et al. (2005) examined the observations taken from January 1990 to January
1995 of eleven future prices traded in New York and the world cash prices for exported sugar. They observed that future market for sugar led the cash market in price discovery. A unidirectional causality from future price to spot was revealed in the study.

One of the recurring arguments made against futures markets, that they give rise to price instability was examined by Sahi (2006) using GARCHX, Granger causality, and forecast error variance decomposition on wheat, sugar, turmeric, raw cotton, raw jute and soybean oil. It was observed that while the nature of spot price variability may not have changed significantly with onset of futures trading in India, certain findings were consistent with destabilizing effect of futures trading on agricultural commodity markets. Empirical evidence from GARCHX methods suggested that in wheat, turmeric, sugar, cotton, raw jute and soybean oil, the nature of spot price volatility did not change with the onset of futures trading. However, in wheat and raw jute, a weak destabilizing effect from futures to the spot with the onset of futures trading was found. Granger causality test results showed that an unexpected increase in futures trading volume uni-directionally caused an increase in cash price volatility for wheat, turmeric, sugar, raw jute and soybean oil. The efficiency of the futures market for twelve (12) agricultural commodities, traded on NCDEX was studied by Ali and Gupta (2011) using Johansen's cointegration analysis and Granger causality tests. The causality test distinguished and categorized the commodities based on direction of relationship between futures and spot prices. The analysis of short-term relationship by causality test indicated that futures markets have stronger ability to predict subsequent spot prices for chickpea, castor seed, soybean and sugar as compared to maize, black lentil and pepper, where bi-directional relationships exist in the short run.

For a commodity exchange to work effectively and achieve operational efficiency, studies have confirmed that co-integration should exist between spot and futures market prices. Futures and cash prices of eleven future prices traded in New York and the world cash prices for exported sugar from January 1990 to January 1995 were found to be co-integrated which suggested that sugar future contract is a useful vehicle for reducing overall market price risk faced by cash market participants selling at the world price (Zapata et al., 2005). The co-integration test on various contract months for maize
and wheat crops observed that the futures contract behave in an expected manner and there exists a mechanism for long-run equilibrium in the maize as well as wheat crops. This phenomenon of price convergence clearly stated that the farmers are mitigating price risk as spot prices and future prices converges (Singh et al., 2005). Fu and Qing (2006) studied the price discovery process and volatility spillovers in Chinese spot-futures markets through Johansen co-integration, VECM and bi-variate EGARCH model. The study concluded that there is a long-term equilibrium relationship and significant bidirectional information flow between spot and futures markets in China. It also revealed that futures market plays a dominant role. The study concluded that although innovations in one market could predict the futures volatility in another market, the volatility spillovers from futures to spot were more significant than the other way round. A study by Lokare (2007) found that although Indian commodity market is yet to achieve minimum critical liquidity in sugar, pepper, gur and groundnut, almost all the commodities showed an evidence of co-integration between spot and future prices revealing the right direction of achieving improved operational efficiency, but at a slower pace. Study observed that in a few commodities, the volatility in the future price was substantially lower than the spot price indicating an inefficient utilization of information.

The impact of electronic trading on the relationship between the cash and the futures prices was studied by Thomas (2008) using data from the Winnipeg Commodity Exchange (WCE). A linear relationship was developed and the structural change tests needed to study the changes in a linear relationship was presented. Chow test showed the co-integrated relationship of the cash and the futures prices and also that the shift to electronic trading had not significantly affected the cash-futures relationship of the commodities traded on the WCE. Any change in the co-integration relationship would have affected the hedge ratio, or the basis, thus affecting the ability of futures to predict futures cash prices or act as a hedge to traders of commodities. While the study did not look at the impact of electronic trading on aspects like volatility and liquidity, it showed that the basis and the hedge ratio have remained constant. The study has also lent support to the fact that in commodities, the cash and futures prices are indeed co-integrated. The efficiency of the futures market for twelve (12) agricultural
commodities, traded on NCDEX were studied by Ali and Gupta (2011) by applying the ADF and non-parametric Phillips-Perron to examine whether futures and spot prices were stationary or not. The hypothesis, that futures prices are unbiased predictors of spot prices was tested. Results showed that co-integration existed significantly in futures and spot prices for all the selected agricultural commodities except for wheat and rice. This suggested that there was a long-term relationship between futures and spot prices for most of the agricultural commodities like maize, chickpea, black lentil, pepper, castor seed, soybean and sugar.

The national exchanges equipped with modern technology helped taking futures market to many targeted participants which were possibly outside the domain in the earlier era. The functioning of futures markets came under scrutiny during 2006-07 and government had ordered for delisting of futures contracts in agricultural commodities like urad, tur, wheat and rice in early 2007 with a suspicion that futures trading in these commodities had been contributing for the rise in their domestic spot prices. Nath and Lingareddy (2008a) attempted to explore the effect of introduction of futures trading on the spot prices of pulses in India. WPI series were taken for the commodities under study covering a period from January 2001 to August 2007. Data series on Comdex, a comprehensive index on all groups of commodities on MCX was collected from the website of MCX. Data was analyzed using various methods including simple percentages, percentage variations, correlations, regression analysis and Granger causality test. The study found that volatilities of urad, gram and wheat prices were higher during the period of futures trading than that in the period prior to introduction as well as after the ban of futures contracts. The study also tried to find if the seasonal/cyclical fluctuations in these commodities prices have been affected by the introduction of futures in those commodities. Hodrick-Prescott filter was used to differentiate the general trend and seasonal/cyclical fluctuations in prices and it was observed that tests of causality showed that the volume of futures trading had positive and significant causal impact on both the average level of spot prices and their volatility in case of wheat and urad though not in case of gram. Nonetheless, since some other tests were inconclusive, it was concluded that while futures trading did lead to increase in urad prices there was ambiguity in case of wheat, probably because of fall in supply.
EC (2008) study on agricultural commodities did not find any conclusive evidence between futures trading and their price level. Study did not show any clear evidence of either reduced or increased volatility of spot prices due to futures trading; the fact that agricultural price inflation accelerated during the post futures period does not, however, necessarily mean that this was caused by futures trading. One of the reasons for the acceleration of price increase in the post futures period was attributed to the immediate pre-futures period which had been one of the relatively low agricultural prices, reflecting an international downturn in commodity prices.

Though the volume of commodity futures trade in India increased exponentially since its launch in 2003, the functioning of the futures market came under scrutiny during 2008-2009 due to price rise and the role of futures market in stabilizing spot prices was widely discussed. Kaur and Rao (2010) tested the weak form of Efficient Market Hypothesis in the context of NCDEX. The study considered daily spot and futures prices of pepper, refined soya oil, guar seed and chana traded on NCDEX over a 13 month period (the futures contracts originating and expiring during the period July 2008 to July 2009). Also twenty-seven (27) future contracts for the above four commodities were analyzed using autocorrelation and Run test to test the efficiency of the agricultural commodity market. The results indicated that both spot and futures prices are weak form efficient. The coefficients were found high for lags in the beginning and the values continued to fall as the lags increased. However, it was observed that the fall in values of autocorrelation coefficients was not much. Information embedded in longer period of lags would be as influential in determining future price as that of information embedded in short lag periods. Testing again the weak form of Efficient Market Hypothesis, Sajipriya (2012) considered daily spot and futures prices of pepper, crude palm oil, steel, silver and Chana traded over a twelve month period (January 2011 to December 2011) on NCDEX. Theoretical basis of the weak-form efficient hypothesis stated that the successive prices were independent and past prices had no predictive content to forecast commodity price. The non parametric run test for the full sample period indicated that both future and spot price for all selected commodities were efficient in weak form.
Nakajima and Ohashi (2012) proposed a commodity pricing model that extended the Gibson–Schwartz two-factor model to incorporate the effect of linear relations among commodity spot prices, and provided a condition under which such linear relations represent co-integration. The study derived futures and call option prices for the proposed model, and indicated that the linear relations among commodity prices should affect commodity derivative prices, even when the volatilities of commodity returns are constant. Using crude oil and heating oil market data, the study estimated the model and applied the results to the hedging of long-term futures using short-term ones.

Various researches mentioned above suggest a close relation between the commodity market and the spot market. The studies conducted in Indian context also confirm this relationship; however focus was on the agro commodities and their trading impact on spot or future markets. Other commodities like base metals, precious metals and energy were not studied as compared to the studies of the foreign researchers, which also observed the behavior of other commodities apart from the agro commodities.

2.1.4 Impacts of futures trading (risk/reward/inflation):

In recent years, commodity market booms and busts have inspired significant interest in this asset class amongst academics and practitioners. As an individual asset class, commodities showed several features that distinguish themselves from financial assets. This section delves into studies analyzing and observing the risk/reward impact of trading on commodity exchanges.

While commodity futures have moved into the investment mainstream only over the last decade, the academic debate over the existence and source of a commodity futures risk premium has been intense ever since the 1930s. The first hypothesis for the source of a commodity futures risk premium was the risk transfer or hedging pressure hypothesis of Keynes (1930) and Hicks (1939), where the risk premium accrued to speculators as a reward for accepting the price risk which hedgers sought to transfer.

The controversy over whether speculators in a futures market earned a risk premium within the context of the capital asset pricing model developed by researchers. Under the approach, the risk premium required on a futures contract should depend not on the
variability of prices but on the extent to which the variations in prices are systematically related to variations in the return on total wealth. Dusak (1973) estimated the systematic risk for a sample of wheat, corn, and soybean futures contracts over the period 1952 to 1967 and found it to be close to zero in all three cases. It was found that average realized holding period returns on the contracts over the same period were close to zero.

Evaluating how the returns on commodity futures compared with returns on common stocks, study observed that, over the period 1950 to 1976, the mean return on the benchmark portfolio of commodity futures was about the same as the mean return on common stocks (Bodie and Rosansky, 1980). Results showed that the futures tended to do well in years when the stocks were doing badly, and vice versa. Switching from an all-stock portfolio, to one invested 60 percent in stocks and 40 percent in futures, an investor could reduce his return variability by one-third without sacrificing any of his return. Four of the best years of commodity futures coincided with four of the seven years of the highest acceleration in inflation. While the dispersion of the real returns on the commodity futures portfolio was smaller than the dispersion of its nominal returns, the reverse was true for both stocks and bonds. The mean rates of return and variability of the twenty three (23) individual commodities in the sample were distributed over a wide range. Eggs had a negative rate of return for the 27-year period. Hardly any of the individual commodities showed significant correlation with each other. Study concluded that commodity futures were very good inflation hedges. Investment benefits from trading live cattle, hog, corn, and soybean futures contracts were considered by Fortenbery and Hauser (1990) under the assumption that the investor's risk/return evaluation is relative to a highly diversified stock portfolio. The study used a mean-variance approach to find the "optimal" mix of investments for the initial stock portfolio and for portfolios which might include both stocks and futures and revealed that the addition of futures contracts to the portfolio rarely increased the portfolio return. This finding was consistent with risk-premium results of previous studies. However, investment benefits from agricultural futures were in the form of a reduction in the portfolio's nonsystematic risk.
Commodity futures permit for a stockholder reduction of risk through diversification and recommended that for the commodities investor, such risk diversification can come only through investing in gold or Treasury bill futures. Whether the investor should be on the short or long side of the market is a matter of forecast analysis and was beyond the scope of the study undertaken by Lee and Leuthold (1981). They applied the market model to forty two (42) selected commodity future contracts from 1972-1977 with three objectives: test the relationship between investment horizon and alternative risk-return measures; describe the probability distribution of price changes in futures over different interval lengths; and explore the sensitivity of the results to alternative measures of wealth. The stock index used for the study was the Stanria-d and Ptor Composite Index of 500 industrial common stocks. Study calculated and analyzed the discrete (arithmetic) and continuous (logarithmic) rates of return. Also the average rate of return, standard deviation, co-efficient of variation, skewness, and kurtosis were estimated. Study observed that the rates of return for the forty two (42) contracts showed strong systematic (non-diversifiable) risk with respect to the commodity futures index, but in general only nonsystematic (diversifiable) risk with respect to the stock index.

Spectral analysis used to investigate the risk and return seasonality of agricultural futures contracts, indicated that neither the expected return nor the contribution of agricultural futures to the risk of diversified investment portfolios vary seasonally. The findings of this study by Murphy (1987) have important implications for speculators, hedgers, and researchers, since authors, in previous studies had hypothesized that seasonality might exist.

Efficacy and performance of commodity derivatives in India in steering the price risk management has been tested by researchers. The depth/extent of liquidity in Indian commodity derivatives markets was examined by Lokare (2007) by analyzing the trends in the proportion of value of commodities traded in relation to Gross Domestic Product (GDP) and volumes traded in relation to the production. The study attempted to assess the performance of these markets by analyzing the risk involved in the spot, derivatives and basis of commodities. In the case of some commodities, study observed that the volatility in the future price was substantially lower than the spot price, thus
indicating an inefficient utilization of information by the markets. Several commodities also appeared to attract wide speculative trading. Study concluded that hedging is an effective proposition in respect of some commodities, while others entail moderate or considerably higher risk.

To analyze the factors that may influence the optimal allocation in equity and commodity futures markets, a bi-variate GARCH model that simultaneously estimates the conditional expected returns and the conditional variance-covariance matrix was used and it was found that investors in commodity futures markets earned significant risk premia over the period 1979-2004 (Chong and Miffre, 2007). They studied the conditional risk premia of commodity futures and the variation over time in their correlations with traditional asset classes. Study also revealed that the conditional correlations between commodity futures and equity returns fell over time, a sign that commodity futures have become better tools for strategic asset allocation. The correlations with equity returns also fell in periods of above average market volatility. This was seen as welcome news to long institutional investors as they need the benefits of diversification most in periods of high market volatility.

The understanding of joint asset return distributions is an important ingredient for managing risks of portfolios. Although this is a well-discussed issue in fixed income and equity markets, it is a challenge for energy commodities. In their study, Börger et al. (2009) described the joint return distribution of energy-related commodities futures, namely power, oil, gas, coal, and carbon. The objective of the study was threefold; i) conduct a careful analysis of empirical returns and show how the class of multivariate generalized hyperbolic distributions performs in this context; ii) present how risk measures can be computed for commodity portfolios based on generalized hyperbolic assumptions; and iii) discuss the implications of findings for risk management analyzing the exposure of power plants, which represent typical energy portfolios. Main observations of the study were that risk estimates based on a normal distribution in the context of energy commodities can be statistically improved using generalized hyperbolic distributions. The analysis of the market suggested that carbon allowances can be a helpful tool for controlling the risk exposure of a typical energy portfolio representing a power plant.
Commodity futures risk premiums vary across commodities and over time depending on the level of physical inventories, as predicted by the Theory of Storage. Using a comprehensive dataset on thirty one (31) commodity futures and physical inventories between 1969 and 2006, Gorton *et al.* (2007) showed that the convenience yield is a decreasing, non-linear relationship of inventories. Study observed that price measures, such as the futures basis ("backwardation"), prior futures returns, and prior spot returns reflected the state of inventories and was informative about commodity futures risk premiums. Positions of futures markets participants were correlated with prices and inventory signals, but Keynesian "hedging pressure" hypothesis that these positions were an important determinant of risk premiums, was rejected.

Dynamic trading strategies were investigated based on structural components of returns, including risk premia, convenience yields, and net hedging pressures for commodity futures. Significant momentum profits were identified in both outright futures and spread trading strategies when the spot premium and the term premium were used to form winner and loser portfolios. Switzer and Jiang (2010) observed that existence of profits from active trading strategies based on momentum was consistent with behavioral finance and behavioral psychology models in which market participants irrationally under-react to information and trends. Results showed that high returns from a popular momentum trading strategy based on a ranking period of twelve months and a holding period of one month dissipated after accounting for hedging pressure effects, consistent with the rational markets model. Basu and Miffre (2011) constructed factor-mimicking portfolios that captured the hedging-pressure-based risk premium of commodity futures using Friday settlement prices of twenty eight (28) commodity futures as obtained from Datastream. The cross section was chosen based on the availability of hedgers’ and speculators’ positions in the CFTC Commitment of Traders Report which included twelve (12) agricultural commodities, five (5) energy commodities, four (4) livestock commodities, five (5) metal commodities, milk and random length lumber. The study sorted cross section of up to twenty eight (28) commodity futures on the contract’s hedging pressure and went long the backwardated commodities and short the contangoed commodities. Single sorts were considered based on the open interests of hedgers or speculators, as well as double sorts based on
both positions. Strong evidence for a risk premium arising from the combination of the two positions was found. Hedging pressure-based risk premium rose with the lagged volatility of commodity markets and that the cross-sectional price of commodity risk was positive. Risk premium was also found to explain part of the performance of active portfolios based on momentum and/or term structure.

The daily price information in spot and futures markets, for a period of seven years (2004 – 2010), for nine (9) major agricultural commodities, taken from different categories of agri-products, were studied by Mukherjee (2011) and incorporated into various econometric models. The study revealed that even though there was inflationary pressure on agricultural commodity, prices went up sharply after the introduction of commodity futures contracts, the destabilizing effect of the futures contract was casual in nature and tend to vary over a long period of time. The empirical findings showed the comparative advantage of futures market in disseminating information, leading to a significant price discovery and risk management. The study concluded that the commodity futures market can always be suggested to strengthen the market structure to achieve the broader target.

Various studies have been undertaken to investigate the long term returns to commodity futures and most of the studies revealed that the futures trading accompany huge risks. However of the studies mentioned above, none of the studies could actually comment on whether or not such risks actually reap rewards. There are mixed notions of the authors regarding the same. Studies have also been conducted to study the correlation of commodity futures returns with stocks and bonds over various investment horizons. Most of the studies suggest that careful hedging helps a stock trader to reduce risk and earn good. Few studies mentioned above which highlight the Indian market, say that hedging proves to be an effective proposition for some commodities but for other commodities it carries a moderate or considerably high risk.

2.1.5 Volatility in trade on commodity exchanges: The section below deals with literature on the effect of commodity exchanges on volatility of the trade. Volatility of futures prices is a measure of the emergence of new and unexpected market information. Hieronymus (1971) notes that, “If all things were foreseeable and their effects on prices
perfectly discounted, the results would be unchanging prices at equilibrium levels and relationships.” Some level of price volatility is desirable and necessary to attract trading activity, but extreme volatility can also discourage participation by some sectors of the market.

Existing literature on commodity futures price volatility emphasized the time to expiration and the resolution of uncertainty. Hennessy and Wahl (1996) stressed the supply and demand inflexibilities in futures market arising from decision making. A decision made on the supply (demand) side made future supply (demand) responses less elastic. Study of corn, soybean, and wheat futures observed that a shock arising after a decision is made was more effective in changing the futures price than a shock before the decision is made. The results supported the time-to-maturity hypothesis, but did not conflict with the state variable hypotheses of futures price volatility.

Commodity derivatives in general and futures trading in soya bean oil in particular require larger participation, liquidity and efficient trading platform. Depth of the Indian commodity markets need to be broadened by allowing participation of banks, mutual funds, primary dealers etc. An efficient markets lead to higher volumes of trading, greater market liquidity and tighter bid-ask spread. In a liquid and efficient market, cost of capital is also reduced. Nitesh (2005) studied the implications of soya oil futures in Indian markets using simple volatility measures and concluded that the futures trading was effective in reducing seasonal price volatilities but did not bring down daily price volatilities significantly. Using a volatility spillover model, Wu et al. (2011) found evidence of significant spillovers from crude oil prices to corn cash and futures prices, and that these spillover effects were time-varying. Results from the study revealed that corn markets became much more connected to crude oil markets after the introduction of the Energy Policy Act of 2005. Furthermore, when the ethanol–gasoline consumption ratio exceeded a critical level, study observed that crude oil prices transmitted positive volatility spillovers into corn prices and movements in corn prices were more energy-driven. Based on this strong volatility link between crude oil and corn prices, a new cross-hedging strategy for managing corn price risk using oil futures was examined and its performance was studied. Results showed that this cross-hedging strategy provided only slightly better hedging performance compared with traditional
hedging in corn futures markets alone. The implication of the study was that hedging corn price risk in corn futures markets alone can still provide relatively satisfactory performance in the bio-fuel era.

An exploratory study using a three-equation structural model to examine the impact of Commodity Transaction Tax (CTT) on certain dimensions such as trading volume and volatility only for five top selected commodities namely gold, copper, petroleum crude, soya oil, and chana (chickpea) traded in one futures exchange was undertaken by Sahoo and Kumar (2008). It was suggested that there is a negative relationship between transaction cost and liquidity, and a positive relationship between transaction cost and volatility. If the government imposed CTT, it would lead to higher volatility and lower trading activity, affecting market efficiency and liquidity. However, as per data, it was found that agricultural commodities such as refined soya oil and chana were least affected in terms of volume and volatility in response to the imposition of transaction tax. Study concluded that increased volatility may lead to more speculative activity and fail to achieve the price discovery and resource allocation objectives of the commodity markets. The granger causality results revealed the efficiency of futures markets but did not provide any conclusive evidence about the nexus between price rise and futures trading. It was suggested that the results of this study need to be reinforced by further research undertaken for a larger number of commodities and other futures exchanges.

Inventory and delivery decisions can impact volatility of commodities being traded on the exchanges. The difference in the volatility dynamics of CBOT corn, soybeans, and oats futures prices across different delivery horizons studied via a smoothed Bayesian estimator revealed that futures price volatilities in these markets were affected by inventories, time to delivery, and the crop progress period and that there were important differences in the effects across delivery horizons (Karali et al. 2010). It was also observed that price volatility was higher before the harvest start in most cases compared to the volatility during the planting period. Results were proposed to have implications for hedging, options pricing, and the setting of margin requirements.
While the increased participation of index fund investments in commodity markets represented a significant structural change, this has not generated increased price volatility, implied or realized, in agricultural futures markets. Increased index fund activity in 2006-08 did not cause a bubble in commodity futures prices. Irwin and Sanders (2010) undertook a preliminary study which aimed to clarify the role of index and swap funds in agricultural and energy commodity futures markets. Based on new data and empirical analysis, the study found that index funds did not cause a bubble in commodity futures prices. No statistically significant relationship was found indicating that changes in index and swap fund positions increased the market volatility. The evidence presented was strongest for the agricultural futures markets but not in the two energy markets because of considerable uncertainty about the degree to which the available data actually reflect index trader positions in these markets. The study revealed the existence of a possibility that trader positions are correlated with some third variable that is actually causing market volatility to decline. This finding was contrary to popular notions about the market impact of index funds, but was not so surprising in light of the traditional problem in commodity futures markets of the lack of sufficient liquidity to meet hedging needs and to transfer risk. Further research was recommended to understand better these recent structural changes in futures markets and how they may impact on the dynamics of price formation.

Data from the same time period of 2006-08 was used to assess the extent to which index trader trading activity (volume) had caused increases in futures price volatility. Power and Turvey (2011) identified the impact of index traders during their period of greatest activity, that is, 2005 to 2006, using aggregated volume data that were filtered using wavelet transforms. The filtering decision rule was guided by the Commodity Futures Trading Commission's (CFTC) finding that index traders do not engage in short-run trades. A joint model of futures (filtered) volume and (unfiltered) price volatility was estimated by 2SLS to account for the endogeneity of prices and volume. As a robustness check, both log-range and GARCH measures of volatility were used. The evidence provided no support for the claim that index traders have increased price volatility for storable commodities (grains/oilseeds) and only weak support in the case of non-storable commodities (meats).
Colbran (2011) studied whether the financialization of agricultural commodity futures trading contributed to the sudden price rises in 2006-2008. The study also discussed the effect of financialization on the functioning and usefulness of futures markets, and considered whether speculation could affect price volatility. Without using detailed economic analyses or econometric modeling, the study only discussed on agricultural commodity markets and their impact on food security and developing countries more generally.

Price movements in many commodity markets exhibit significant seasonal patterns. Back et al. (2012) analyzed an extensive sample of soybean and heating oil options to observe the effects of seasonal volatility on models’ option pricing performance. In terms of options pricing, a deterministic seasonal component at the price level can be neglected. In contrast, the study found that this was not true for the seasonal pattern observed in the volatility of the commodity price. The study found that seasonality in volatility is an important aspect to consider when valuing the options contracts. The inclusion of an appropriate seasonality adjustment significantly reduced pricing errors and yields and showed more improvement in valuation accuracy than increasing the number of stochastic factors.

The impact of derivatives trading on the volatility of the underlying spot market is intensely debated. There are studies with diverse viewpoints relating to stabilization and destabilization in spot market prices because of derivative trading. From the above studies, it is observed that the price volatility exists in commodity exchanges at the time of trading. Volatility in trade and prices are dependent on various factors like type of commodity, seasonality, etc. It is seen that in emerging commodity derivatives markets, the issue of volatility has not been researched sufficiently, probably owing to features of markets like emaciated in terms of volume and number of derivatives products and in terms of participation also it is very limited. Emerging commodity markets in general and India in particular are generally disparaged for speculative activity and destabilizing role of derivatives in spot market through increased price volatility. The studies on the global markets have considered a wide variety of commodities like energy, oils, agro as well as equity but the studies on Indian commodity futures market are mainly concentrated on the agro commodities. Though some researchers have been
able to point out that the seasonal volatility comes down with futures trading in agro commodities, but the fate of other commodities are largely unknown.

2.1.6 Comparison with equity market/asset/financial instruments/exchange rate:
Commodities are considered as separate asset class. To obtain economic exposure to commodity asset, commodity derivatives is a very useful tool. There are many instruments traded in these markets which include financial instruments such as futures and forward contracts, options, swaps, and physical instruments like inventories. Future contracts are among the most important of these instruments, and provide significant information about cash and storage markets. Many studies compare commodity exchanges with equity markets or other financial instruments. Few such studies are covered under this section.

Although agricultural commodities are often assumed to have flexible prices, little has been done to estimate exchange rate pass-through. Perfect commodity arbitrage opportunities imply complete pass-through; imperfect opportunities could lead to incomplete pass-through. Analysis of commodity price and exchange rate adjustments for five commodities exported to Japan by the United States was undertaken by Jabara and Schwartz (1987) which revealed that during the 1970s, commodity prices were generally flexible. Specifically, an exchange rate increase was passed through for some commodities but not a decline. Arezki et al. (2012) examined the relationship between volatility of South African Rand and gold price volatility using monthly data for the period 1980-2010. The main finding of the study was that prior to capital account liberalization, the causality ran from South African Rand to gold price volatility but the causality ran the other way around for the post-liberalization period. These findings suggested that gold price volatility played a key role in explaining both the excessive exchange rate volatility and current disproportionate share of speculative (short-run) inflows that South Africa was coping with since the opening up of its capital account.

Several studies highlighted the growing cross-market correlations not only within different types of commodities, but also between commodities and other classes of financial assets. The benefits of including commodity futures and assets from emerging markets in an investment portfolio were analyzed by Satyanarayan and Varangis (1994)
by calculating the optimal composition of assets. The calculated optimal weights showed that a considerable proportion of an investment portfolio could be invested in commodity futures and emerging market assets. The weights calculated were higher than those funds usually used, signifying the potential for further expansion of these assets in a portfolio. Including commodity futures and assets from emerging markets in investment portfolios produced a significant risk/return benefit. UNCTAD (2011) found that over 30 days, the 1-day rolling correlation between crude oil and other financial assets, like currencies and the S&P 500, had grown steadily since 2004. Tang and Xiong (2011) found similar results by looking at 1-day rolling correlations between crude oil and selected soft and hard commodities over 1-year. These two studies mostly attributed the structural change to the financialization of commodity markets. Study also argued that portfolio rebalancing by index investors can act as a channel to spillover shocks from outside to commodities markets and across different commodities.

Commodity futures markets responded to surprise increases in the federal funds rate target by raising the inflation rate expected over the next 3 to 9 months. There was no such evidence from the results for the real interest rate response in the study by Armesto and Gavin (2005) that constructed daily measures of the real interest rate and expected inflation using commodity futures prices and the term structure of Treasury yields. The study found data from the commodity futures markets to be highly volatile, thus evidencing that one can substantially reduce the noise using limited information estimators such as the median change. Also, the basket of commodities actually traded daily was thin and study was limited to whether or not the observable rates of the commodities were closely connected to the unobservable inflation and real rates that affect consumption and investment decisions.

Increasingly close interconnection between commodity markets and financial instruments markets led Rejnus (2006) to discuss the importance of commodity exchange trading and to prove that at present, commodity markets cannot be seen as strictly separate from markets trading in financial instruments, as there are increasingly close links between the two, which effectively lead to the transfer of financial resources invested in the financial market into the real economy. The study analyzed the most
significant ties that already exist between the commodities and financial investment instruments in the financial and capital market, as well as the links that are very likely to come into existence in the near future.

The returns on the U.S. equally-weighted commodity futures index maintained their basic properties, when translated into Yen. The returns on Japanese stocks and bonds, the commodity futures index, translated into Yen continued to display equity-like returns, but with slightly less volatility as per Gorton et al. (2005). Also Yen-based commodity futures returns showed essentially zero correlation with Japanese equities and negative correlation with bonds. While the risk premium on commodity futures was essentially the same as equities, commodity futures returns were negatively correlated with equity returns and bond returns. Gorton and Rouwenhorst (2005) analyzed that this was due to different behavior over the business cycle using data from database maintained by the Commodities Research Bureau, to study simple properties of commodity futures as an asset class from July 1959 to December 2004 of the London Metals Exchange. An equally-weighted index of commodity futures monthly returns over this period was analyzed and found that fully-collateralized commodity futures have historically offered the same return and Sharpe ratio as equities. Study also observed that commodity futures were positively correlated with inflation, unexpected inflation, and changes in expected inflation.

The difference in commodity futures and equity markets was studied by Shen et al. (2007) and it was found that momentum profits in commodities were highly significant for holding periods as long as 9 months, and returns to momentum strategies were roughly equal in magnitude to those that were reported in stocks. The profits documented were too large to be subsumed by transactions costs. As per the study, although the momentum strategies appeared to be quite risky, their profitability cannot be fully accounted for in the context of a market factor model. Momentum profits eventually reversed if positions were maintained long enough after portfolio formation.

Amidst a sharp rise in commodity investing, the issue challenged is whether commodities move in sync with traditional financial assets. Büyükşahin et al. (2008) provided evidence that challenged this idea. Using dynamic correlation and recursive
co-integration techniques, the study found that the relation between the returns on investable commodity and U.S. equity indices had not changed significantly in fifteen years. Study found no evidence of any secular increase in co-movement between the returns on commodity and equity investments during periods of extreme returns.

Literature supports diversification benefits of adding commodity futures to an existing portfolio. Yet no empirical work was performed to test if the benefits were statistically significant. Cheung and Miu (2010) undertook study to ascertain whether the alleged diversification benefits actually existed and if yes, were they statistically significant; to what extent were the diversification benefits unique to US investors and would investors of a resource-based economy like Canada also benefit from adding commodities to their portfolios. Study indicated that correlations among international equity returns were higher during bear markets than during bull markets. This type of regime-switching correlation behavior meant lower diversification benefits from international investments when investors faced a bearish environment at home. The research questions studied were: Do commodity futures display the same type of regime-switching behavior? To what extent do commodity futures offer real diversification benefits that are robust over time and across regimes? Results of the study revealed that the diversification benefit of commodities was a far more complex phenomenon than often understood in the finance literature.

Using daily data from CFTC, Büyükşahin, Haigh and Robe (2010) documented that the correlation between equity and commodity returns increases sharply in the fall of 2008. Using non-public data from the CFTC, Büyükşahin and Robe (2011) showed that the daily correlation between the returns on commodity and equity indices soared after the demise of Lehman Brothers, and remained exceptionally high through the winter of 2010. Explanation of the persistence of this trend until December 2011—except for crude oil in early 2011, which coincided with the uprising in Libya—remained a limitation for the study. The econometric analyses suggested that, besides macroeconomic fundamentals, hedge fund positions helped explain changes in the strength of equity-commodity linkages. Findings of the study added to the growing empirical evidence supporting the idea that the financialization of commodity markets has an impact on the price determination process. The need for further research was
recommended to get a complete understanding of the mechanisms at work behind this structural change. UNCTAD (2012) added to Büyükşahin and Robe (2011) by analyzing the intraday co-movements between returns on several commodity markets - including oil, corn, soybeans, wheat, sugar and live cattle and on the stock market in the United States over the 1997-2011. Rolling correlations were used and a synchronized structural break was observed and documented, characterized by a departure from zero, which started in the course of 2008 and continued thereafter. The result of the study was consistent with the idea that recent financial innovations on commodity futures exchanges have an impact on these correlations.

Commodity derivatives, as an alternative financial asset class, have gained increasing importance. A review of the existing literature shows that commodity exchange trading is gaining ground in the current economy and that this trend is likely to continue in future. Studies observed that a similarity exists between the commodity markets and the equity markets. One of the most attractive attributes of commodity futures is widely believed to be their ability to offer diversification benefits to traditional financial portfolios comprising equities and bonds. Along this line, the academic literature on commodity futures covers a wide range from studying commodity futures markets to investigating individual futures contracts, and from the risk management perspective of portfolio diversification to the active strategies of abnormal return maximization.

Post the liquidation of Lehman Bros, we cannot see these markets as separate entities, as there is an increasingly close link between the two which helps in transferring final resources invested in the financial market into the real economy. Studies have been carried out to understand the differences between these two markets but apart from the profit factor there were no other notable differences observed. Some researchers observed commodity acts as an asset to the investors with high risk taking capacities which is as similar to an equity market. Recent studies have examined correlations between individual commodity futures and the indices of other financial asset classes and correlations between commodity futures indices and equity indices from a limited number of developed markets such as US and Canada. Very few studies on Indian commodity exchanges were found and the ones which were reviewed failed to point out any similarity or dissimilarity effectively between the two markets.
2.1.7 Hedging on commodity exchanges: Hedging is an integral activity of any commodity exchange. This section pertains to studies based on hedging.

Literature review on the implications of individual risk preferences for commodity hedging decisions suggested that when cash and futures positions were treated as endogenous, the optimal hedge ratio was found independent of the risk parameter (Bond and Thompson, 1985). Under similar conditions, the study demonstrated that the existence of nonlinear transaction or storage costs made the decision maker's attitude toward risk, a relevant determinant of the size of the optimal hedge ratio.

Since farmers are the main hedgers on commodity exchanges, studies on farm products were carried out to ascertain the effectiveness of hedging for farmers. Gardner (1989) observed soya bean, corn and cotton futures contracts and revealed that sequential rollover of annual futures positions provided farmers or others with a means of long-term hedging. It was observed that year-to-year basis risk existed, which could render rollovers ineffective in hedging. Rollovers were found effective at locking in an initial price for a three- to six-year period but were ineffective in routine hedging over a series of successive three- to six-year periods. Study concluded that the absence of multi-year futures markets might not be a serious problem. Turvey and Baker (1990) also investigated the relationships of farm programs and farm finance on farmers' decisions to hedge with futures or options. Study of a two-period discrete sequential stochastic programming model of the farm firm indicated that farmers' use of futures and options decreased in the presence of loan rates and target prices. Also farms with high debt were found to hedge more than farms with low debt. The results implied that evaluating farmers' use of futures and options based solely on market risks may exclude important information, namely participation in farm programs and the farm's capital structure.

There was a growing involvement of new types of non-commodity-sector-related players in commodity futures markets which included managed funds; commodity warrants; and direct involvement of banks. The more erratic commodity markets of the 1990s might have provided a boon for the careful and well-prepared hedger, but those which did not hedge at all, or naively continued the simple hedging strategies of the 1980s might find themselves worse off in the new market situation generated by the
emergence of investment fund interest in the commodity markets. The impact of speculation on the price formation process on commodity futures markets was examined by Rutten (2003), and conclusions were drawn as to the use of these markets by commodity sector actors. Study concluded that due to increased investment fund activities, hedging became cheaper and hedgers have more open possibilities. Hedgers were recommended to be more careful in terms of the timing of their entering and exiting markets and both physical and futures markets have to be monitored closely. The study was limited to the examination of various forms of new, non-trade related investment fund activities in commodity futures markets only.

Investigating into the problems and prospects of the futures market in agricultural commodities in India, Sahadevan (2002) observed that many of the commodity futures exchanges failed to provide an efficient hedge against the risk emerging from volatile prices of many farm products in which futures trading was carried out. The advocates of commodity markets in India opined that speculators take up the hedger’s risk and provide liquidity to the markets and enable futures markets to perform the dual functions of price risk management and price discovery (Sen, 2008). Many contracts traded on Indian commodity exchanges do not satisfy a fairly minimal condition for these to be attractive for hedging by those holding physical commodities (IIMB, 2008).

Using CFTC’s COT data, Gurrib (2007) analyzed whether or not large hedgers and large speculators were influenced by major economic events of the 1990s. Eight major economics events were studied over a ten year period. The findings of the study supported that the informed players were hardly affected by major events. The trading determinant model, mean equation model, and risk and return relationship model suggested that the behavior and performance of these key market players were stable, and any significant structural break were short lived. The use of standard deviation as a measure of risk captured more breaks in the risk and return relationship model, due to its higher sensitiveness to futures prices in the twenty-nine U.S. futures markets.

Hedging is an important aspect in any commodity exchange. The literature reviewed above shows that many foreign researchers have studied the complex hedging system, and the benefits associated with hedging. Most of the studies were focused on
agricultural commodities being hedged on various commodity exchanges. Other commodities were not a subject of interest for researchers with respect to hedging. Moreover, it was also observed that an in-depth study on Indian commodity exchange regarding hedging has not yet been carried out.

2.1.8 Delivery/warehouse and warehouse receipts: This section pertains to studies on delivery, warehousing and warehouse receipts for a commodity exchange.

Principal objectives of the consultancy assignment by FMC were to assess the feasibility of the warehouse receipt system in the commodities markets with specific emphasis on edible oilseeds, oils and oil cakes, cotton and gur; to promote the warehouse receipt system in India; and to formulate a detailed and phased action plan for implementation. Ramachandran’s (2000) study aimed at studying these objectives and the improvement of the commodity futures exchanges in India. Coffee was added since the domestic coffee exchange had implemented a system of deliveries through warehouse receipts. The commodities studied collectively accounted for twenty percent of India's index of agricultural production. India can use warehouse receipts to make it more attractive for banks to lend to the agricultural sector, to reduce the cost of public support for agricultural marketing, to reduce transaction costs, and to improve price-risk management. Study further concluded that warehouse receipts can also play an important part in new policies which would make Indian agriculture more responsive to market opportunities and more competitive in relation to world markets.

Field visits to East India Cotton Association (EICA), Mumbai; the Bombay Oilseeds and Oils Exchange Limited (BOOE), Mumbai; the SOPA Board of Trade (SBOT), Indore; Coffee Futures Exchange India Limited (COFEI), Bangalore; and The Chamber of Commerce, Hapur, Ghaziabad were undertaken for an in-depth study into the existing warehousing facilities in India. These were augmented by field visits to other centers pertinent to commodity trading, storage, analysis and testing as well as discussions with other policymakers, regulators and stakeholders that have an economic interest in warehouse receipts and commodity contracts. Coulter and Ramachandran (FMC, 2000) recommended that the existing Government warehousing companies should play a leading role in the development of warehousing. Study recommended that
private operators should be involved; particularly those who were already providing storage facilities and divestment should be pursued with a view to increasing their private sector orientation and autonomy. It suggested a time bound action plan for this. This was also reiterated by Ramachandran (2000) wherein study recommended that while Government warehouses mainly served the public sector, they also constituted a major asset and can be used to further the employment of warehouse receipts.

Frida’s (2006) integrated study on Indian commodity exchanges recommended that FMC should enable and encourage the vigorous use of warehouse receipts for effective deliveries to enable better management of delivery risk faced by members of the exchanges. Also, FMC should encourage and enable investments by warehousing corporations, companies and co-operatives in commodity exchanges. Study recommended that where a system of warehouse receipts cannot be implemented expeditiously, stocks of shorts for delivery should be certified by commodity exchanges before delivery and tendering period begins. The study observed that commodity exchanges in India were sloppy in this regard. Thus, study further recommended that Indian exchanges need to focus on ensuring a good delivery process through a network of approved warehouses and in order for these to be used, deliverable grades of material, deliverable WRs and warrants and approved warehouses must all be published by the exchanges. Moreover, exchanges should have their own warehouse inspection group, which would contain sufficient resources to monitor warehouse activity and look after the registration and liaison relationship with them. Discussing the advantages and disadvantages of warehouse receipt financing in India from small farmers’ point of view, Mor and Fernander (2009) laid stress on some key requirements for implementing a successful warehouse receipt finance program.

Warehouse Receipts Program (WHRP) since January 2004, has been referred to as the Agricultural Commodity Financing Program (ACFP) in Europe. Forestier (2004) in a special study for European bank on the WHRP, obtained information from relevant teams and departments in the Bank, as well as from external sector and industry sources, covered the period 2000 to November 2003. Visits, interviews and attendance at international conferences were carried out between April and June 2004 in Ukraine, Bulgaria and Holland. Previous fieldwork which took place in Russia in 2003 was...
extensively used for the purpose of this study. The Bank’s portfolio analysis was based on more recent data. A detailed review of the portfolio’s risk profile and profitability indicated that, based on a risk adjusted return on assets, the ACFP appeared to score very well. Unfortunately, available financial information on the portfolio remained somewhat approximate which limited the study from undertaking the comparative performance analyses with other bank sector activities.

USAID Zambia was searching for a way to support the development of a warehouse receipt program that would involve smallholders and allow them to participate in the market. When an initial intervention through an organization called ZACA (Zambia Agricultural Commodity Agency) was unable to establish an effective warehouse receipt system, USAID used the PROFIT (Production, Finance and Improved Technology) project to work with the private sector to establish a new entity, ZAMACE (Zambia Agricultural Commodity Exchange) with a stronger commercial focus and a link to a regional commodity exchange. The objective of PROFIT (2007) study was to outline some of the lessons around the launch of the new entity and how smallholders will be involved once a functioning commodity exchange and linked warehouse receipt program is established. It also explored ways to link Zambian markets to Agricultural Commodities Exchange for Africa (ACE), a USAID Malawi funded regional trading platform. It was recommended to combine the Warehouse receipts functions of ZACA with a commodity exchange function affiliated to ACE, by creating a new entity that combines both functions. A warehouse receipt system can be a more robust and sustainable function if it is built around an existing marketing system, and not just considered as a financing option, as is the case in many countries. Over time and with rigorous enforcement, the receipt will gain credibility as a respected tradable instrument and make buying and selling more efficient. Because buyers need not take physical delivery of stock in order to trade, stocks may trade several times before they leave the storage site. UNCTAD (2009) study was the result of a review of warehouse receipt, inventory credit and similar initiatives in six countries of Eastern and Southern Africa, including Zambia, Malawi, Madagascar, Tanzania, Kenya and Uganda, the objective of which was to share lessons with practitioners, policy makers and funding agencies. The study covered a review of international experience as well as
a discussion of collateral management and other warehousing systems that have
developed spontaneously in Africa. Extensive desk research was carried out in the UK
and six weeks of fieldwork covering six countries, meeting with banks, microfinance
institutions, government departments, food reserve agencies, agribusiness, development
projects, producers’ organizations, and others. The study concluded with importance
for development and encouragement of warehousing—both private and public;
improvements in the policy framework to increase the effectiveness of these initiatives,
and notably in the area of microfinance; need to re-evaluate the level of storage losses
at farm level, and the efficacy of different approaches to their reduction, including the
use of hermetic structures; prioritize countries with prospects for developing or
establishing the WRS in the near future; and UNCTAD to support a training program
for practitioners.

Delivery process can embed a valuable real option on the long side—the option to
exchange the deliverable for another futures contract. As the relative volatility of cash
and futures prices increased, this option increased in value, which disconnected the
cash market from the deliverable instrument in a futures contract. Aulerich et al. (2011)
described this by studying the delivery process for selected corn, soybean, and
wheat commodity contracts. The estimates of this option's value showed that it may
create significant price divergence. The study parameterized an option pricing model
using data on these three commodities from 2000 to 2008 and showed that the option
model fit closely to non-convergence, which lend support to the importance of real
option effects.

There have been very few researches that study the importance of delivery and
warehousing services for any commodity exchange. A review of above studies show
that limited researches have been carried out which indicate that Indian Warehousing as
an industry is yet to be developed to help in growth of commodity markets. Studies
reveal the benefits of warehousing receipts and recommend how Government should
work closely with private sectors to develop the commodity markets. Studies also
provide a good insight into how the developing economies are working to develop the
warehouse receipts programs and highlight that globally very few researchers have
found this area of research to be of interest.
2.2 Commodity-specific: The literature that falls in this system on ‘commodity-specific’ is organized into three sections. The first focuses on metals, the second on energy and the third on weather.

2.2.1 Metals futures exchange: Studies undertaken on metals futures markets are mentioned in this section. The literature on commodities has concentrated on price co-movements and their roles in transmitting information about the macro economy. The researches cover a wide scope of commodities including agricultural commodities, base metals, industrial metals and energy.

Within the literature that looks at the modeling of cash and futures prices in commodity markets, the use of GARCH models to capture volatility clustering in metal prices has become common in recent years. There are important gains to be made from a time-varying optimal hedging strategy that incorporates the information from the common jump dynamics. Based on the fact that price risk is an important factor for both copper purchasers, who use the commodity as a major input in their production process, and copper refiners, who deal with cash-flow volatility, Chan and Young (2006) used information from NYMEX cash and futures prices from January 2, 1975 to July 18, 2003, inclusively to examine optimal hedging behavior for agents in copper markets. A bi-variate GARCH-jump model with autoregressive jump intensity was used to identify the features of the joint distribution of cash and futures returns over two sub-periods with different dominant pricing regimes. Findings of the study revealed that during the earlier producer-pricing regime, this specification was not needed, whereas for the later exchange-pricing era, jump dynamics stemming from a common jump across cash and futures series were significant in explaining the dynamics in both daily and weekly data sets.

Base metals are important in the world economy and while they can be stored for considerable periods of time, their prices can be quite volatile. Commodity pricing models generally explain the link between commodity prices and stock levels in terms of a stock-out constraint or a convenience yield. Analysis of this link was provided by Heaney (2006) using monthly LME copper, lead, and zinc prices obtained for the period November 1964 to December 2003. A Markov model, fitted to these data,
supported the existence of two distinct pricing regimes while the impact of convenience yields was also identified.

Aluminum and copper are the two most important metals traded in the LME, they share common business cycle factors and are traded under identical contract specifications. Dynamic representation of spot and three-month aluminum and copper volatilities was studied by applying bi-variate FIGARCH model which allowed parsimonious representation of long memory volatility processes. Figuerola-Ferretti and Gilbert (2008) observed that spot and three-month aluminum and copper volatilities followed long memory processes; they exhibited a common degree of fractional integration; and the processes were symmetric. Study also revealed that there was no evidence that the processes were fractionally co-integrated. Study concluded that this high degree of commonality might be a result of the common LME trading process.

Commodity markets experienced exceptional price hikes and volatility between 2006 and 2008. During this period, energy, metallurgic, agricultural, and other commodities reached unprecedented price levels, causing concerns about the effectiveness of commodity markets. Theorists in finance generally cite two reasons for this phenomenon: rapidly growing demand for these commodities in emerging economies such as China and India, as well as rampant speculation and arbitrage trading activities in derivative markets (Henriques, 2008; Ruggiero, 2008). Both may have important effects on the pattern of information flows across financial markets. A number of studies have documented a recognized information flow pattern from larger, more liquid, and efficient markets such as that of the United States to others that are less liquid and less efficient. Fung et al. (2010) examined the information flow and market efficiency between the metallurgical futures markets of the United States and China over a ten-year span from 1999 to 2009. Study observed structural breaks in the aluminum and copper futures price series for the NYMEX and Shanghai Futures Exchange (SHFE) between 2006 and 2008. Study also revealed that the New York and Shanghai markets are co-integrated, indicating an equilibrium relationship between the two markets. Trading strategies based on the co-integrating relationships between the futures price series were implemented to explore the error-correction process. The overall results showed that U.S. and Shanghai futures prices were closely related and
both markets were comparably efficient on a daily basis. The U.S. market did not appear to be more efficient than the Chinese market in incorporating information into prices.

Research on industrial commodities such as oil, copper and precious metals, among others, is much richer on explaining their co-movements and information transmissions than on illustrating their volatility and correlation dependency and interdependence. Moreover, research on volatility is more extensive for oil and energy than for precious metals. Within the precious metals, the research on volatility primarily employs univariate models of the GARCH family, addresses volatility dependency but not interdependency and focuses on one or two precious metals, neglecting other major ones such as platinum and palladium. Hammoudeh et al. (2009) examined the conditional volatility and correlation dependency and interdependency for the four major precious metals, gold, silver, platinum and palladium, while accounting for geopolitics within a multivariate system. The implications of the estimated results for portfolio designs and hedging strategies were also analyzed. The results showed significant short-run and long-run dependencies and interdependencies to new and past volatility. These results became more pervasive when the exchange rate and Federal Fund Rates (FFR) were included. Moreover, it was observed that monetary policy also had a differential impact on the precious metals and the exchange rate volatilities. The applications of the results showed the optimal weights in a two-asset portfolio and the hedging ratios for long positions.

The prices of several commodities such as wheat, cotton, copper, gold, crude oil, lumber and cocoa are likely to move together. Pindyck and Rotemberg (1990) suggest that the co-movement of the commodity prices is caused in part by herd behavior of traders in the financial markets. Although linkages among the agricultural commodity futures prices have been examined since the finding of Pindyck and Rotemberg (1990), not much attention has been paid to non-agricultural commodity futures prices. Tsuchiya (2010) investigated whether or not prices of non-agricultural commodities moved independently in the long run using Johansen’s co-integration analysis. Study of the past literature on agricultural commodity futures prices provided mixed results. The study used the price indexes for four precious metals commodity futures contracts
traded at the Tokyo Commodity Exchange (TOCOM). The findings reveal that the prices of the four precious metals futures contracts moved independently. It also suggested that there is no long-term relationship among the four futures contracts.

Above researches on metal future markets highlight factors like price risk, commodity pricing models and price regimes which work while trading metals on commodity exchanges. Researchers have discussed the conditional volatility and co-relation dependency among the metals. Majorly, the studies are focused on base metals like copper and aluminum and on precious metals only, whereas other base metals have not been considered for study. Moreover, there has been no research pertaining to the metals futures market of India.

2.2.2 Energy futures exchange: This section pertains to literature on energy futures exchanges including natural gas, electricity and oil.

Lucia and Schwartz (2002) examined the importance of regular pattern in the behavior of electricity prices, and its implications for the purposes of derivative pricing. Study analyzed the Nordic Power Exchange's spot, futures, and forward prices and concluded that the seasonal systematic pattern throughout the year was of crucial importance in explaining the shape of the futures/forward curve. One and two factor models were analyzed in the study and found that a simple sinusoidal function was adequate in order to capture the seasonal pattern of the features and forward curve directly implied by the seasonal behavior of spot electricity prices. Further investigated the pricing of electricity futures at the European Energy Exchange (EEX) over the period 2002 through 2004, Wilkens and Wimschulte (2007) used the reduced-form models of Lucia and Schwartz (2002) to calculate theoretical contract values. A thorough empirical analysis by means of an out-of-sample test was conducted for both one- and two-factor models, incorporating a constant non-zero price of risk. Although the models were proven to capture all basic spot market characteristics and provide an accurate in-the-sample fit to observed futures prices, the forecasting performance was subject to biases.

In commodity futures markets, contracts with various delivery dates trade simultaneously. Researchers typically discard the majority of the data and form a single
time series by choosing only one price observation per day. This strategy failed to provide a full understanding of the futures markets and was also capable of inducing complicated nonlinear dynamics in the data. Smith (2005) introduced the partially overlapping time series (POTS) model to corn futures at CBOT to model jointly all traded contracts. The POTS model incorporated time-to-delivery, storability, seasonality and GARCH effects. The results revealed that there was substantial inefficiency in delivery on corn futures. The results also supported the theory of storage and the Samuelson effect of commodity pricing. Relying on the cost of carry model, the long-run relationship between spot and futures prices was investigated by Coppola (2008) and the information implied in these co-integrating relationships was used to forecast out-of-sample oil spot and futures price movements. A vector error correction model (VECM) was applied, where the deviations from the long-run relationships between spot and futures prices constituted the equilibrium error. To evaluate forecasting performance, the random walk model (RWM) was used as a benchmark. It was found that in-sample, the information in the futures market could explain a sizable portion of oil price movements; and out-of-sample, the VECM outperformed the RWM in forecasting price movements of 1-month futures contracts. Analyst forecasts in the natural gas storage market were investigated and the contribution of analysts in facilitating price discovery in futures markets was studied by Gay et al. (2009). Using a high-frequency database of analyst storage forecasts, study showed that the market appeared to condition expectations regarding a weekly storage release on the analyst forecasts and beyond that of various statistical-based models. Further, it was observed that the market looked through the reported consensus analyst forecast and placed differential emphasis on the individual forecasts of analysts according to their prior accuracy. Moreover, the market also appeared to place greater emphasis on analysts’ long-term accuracy than on their recent accuracy.

The POTS model of Smith (2005) was used by Suenaga et al. (2008) to examine the volatility dynamics of NYMEX natural gas futures prices. Study showed that volatility is greater in the winter than in the summer, and is persistent of price shocks. Also correlations among concurrently traded contracts displayed substantial seasonal and cross-sectional variation in a way consistent with the theory of storage. It was
demonstrated that, by ignoring the seasonality in the volatility dynamics of natural gas futures prices, previous studies have suggested sub-optimal hedging strategies. Trading profits, trader experience and sophistication, and dual trading had a positive effect on the probability of trader survival; scalpers were less likely to exit trading in pure open outcry trading, but were more likely to fail than traders who held open positions longer in side-by-side trading; and traders trading in multiple energy futures markets and those who used both the exchange floor and electronic trading appeared to have a survival advantage in side-by-side trading (Boyd and Kurov, 2012). The study analyzed the adaptation of traders and the determinants of trader survival during a period of changing market structures of the electronic trading in the NYMEX energy futures market. A unique sample of transactions level data was used and the results showed that most floor traders adapted to the side-by-side electronic and open outcry trading, although trader attrition increased and the profitability of surviving traders declined dramatically. Moreover, crude oil futures contract prices on NYMEX were found to be co-integrated with spot prices and unbiased predictors of future spot prices, including the period prior to the onset of the Iraqi war and until the formation of the new Iraqi government in April 2005 (Switzer and El-Khoury, 2007).

Among commodities traded in financial markets, oil is one of the most important, and has been studied in the literature extensively. Its relevance induces innovations in financial markets, generating new oil contingent claims that should be used in the estimation of the stochastic behavior of oil prices. One important source of information for the study of oil prices is the futures market. When new contracts are introduced there is no historical information. In addition, not all futures contracts trade every day. If a complete data set of prices is to be used, some prices need to be discarded or aggregated, with great information loss. Thus, it would be desirable that the estimation procedure uses all price information available. Oil prices are very volatile, have a high degree of mean reversion, and exhibit complex dynamics. Thus, it is important to analyze the number of risk factors required to model this stochastic behavior.

Several models of the stochastic process followed by commodity prices have been proposed by various researchers. They differ in how they specify spot price innovations and how they model the cost of carry. Cortazar and Naranjo (2006) studied the daily oil
futures price transactions from 1992 to 2001 to observe the ability of an N-factor Gaussian model to explain the stochastic behavior when estimated with the use of all available price information, as opposed to traditional approaches of aggregating data for a set of maturities. A Kalman filter estimation procedure that allows for a time-dependent number of daily observations was used to calibrate the model. The study observed that the model performed very well, requiring at least three factors to explain the term structure of futures prices, but four factors to fit the volatility term structure. The model was also used to compare results with daily copper futures transactions for the same period and study observed that the model performed very well for daily copper futures transactions as well.

Although the persistence behavior in returns and volatility has been widely analyzed in stock and equity markets, only a few authors have examined persistence in energy markets. Cunado et al. (2010) examined the possibility of long-range dependence in some energy futures markets for different maturities. In order to test for persistence, a variety of techniques based on non-parametric, semi-parametric and parametric methods were used in the study. The results indicated that there was little or no evidence of long memory in gasoline, propane, oil and heating oil at different maturities. However, when study focused on the volatility process, proxied by the absolute returns, strong evidence of long memory in all the variables at different contracts was found.

A number of studies have appeared that have addressed the efficiency of the oil futures market. However, the literature to date does not provide any clear consensus. Moreover, no studies have appeared that examine market behavior during periods of sustained extreme conditional volatility or of the effectiveness of alternative hedging models during such periods. Switzer and El-Khoury (2007) investigated the efficiency of the NYMEX Division light sweet crude oil futures contract market during periods of extreme conditional volatility. Crude oil futures contract prices were found to be co-integrated with spot prices and unbiased predictors of future spot prices, including the period prior to the onset of the Iraqi war and until the formation of the new Iraqi government in April 2005. Both futures and spot prices exhibited asymmetric volatility
characteristics. Study also revealed that hedging performance was improved when asymmetries were accounted for.

Dealing with the risk associated to illiquid financial products always involves a basis risk, since a perfect hedge is not possible due to the lack of a related futures market. In this case, the only way to hedge a position is to find a product which is highly correlated with the underlying; in other words, it is necessary to find a market which is very similar to the original one. In their study, Scarpa and Manera (2008) discussed a simple strategy for pricing and hedging a swap on the Japanese crude oil cocktail (JCC) index. The empirical performance of different econometric models was compared in terms of their computed optimal hedge ratios, using monthly data on the JCC over the period January 2000–January 2006. The study provided an explanation to how to compute a bid/ask spread and to construct the hedging position for the JCC swap contract with variable oil volume. Also the study evaluated the swap pricing scheme with back-testing and rolling regression techniques. The empirical findings showed that the price-level regression model permitted to compute more precise optimal hedge ratios relative to its competing alternatives.

Several studies of equity market analysts discuss analyst forecast accuracy. In the crude oil market, prices are principally determined by supply and demand, making analyst supply forecasts directly relevant, whereas equities derive their value from a complex interaction between forecasted future profitability and risk. The impact of analyst forecasts on prices to determine whether investors learn about analyst accuracy was studied by Chang et al. (2009). The straight-forward relationship between supply and price; the economic importance of the market; the predictable timing of forecast error realizations; and, the high frequency of the data made the crude oil market an interesting and advantageous data for observation. Study found that prices rise (fall) when analysts forecast a decrease (increase) in supplies. It was observed that during the 15 minutes following supply announcements, prices rose (fell) when forecasts were too high (low). Study also revealed that both relationships were stronger for more accurate analysts, implying that investors should learn about analyst accuracy. Bhar and Lee (2011) estimated a three-factor model of crude oil prices which incorporated a time-varying market price of risk. The model was able to accurately capture the term
structure of futures prices with evidence suggesting that risk premiums in the crude oil market are time-varying. Using the cross-section of futures prices, the study estimated a time-series of the market price of risk in the crude oil market implied by the model. Findings revealed that the risk premiums in the crude oil market were driven by the same risk factors as equity and bond markets.

The studies on energy futures exchanges are focused on the oil with most of the studies concentrating on crude oil, their pricing strategies and how the prices are being controlled. Also researches on behavior of electricity prices and its implications for the purposes of derivative pricing; and time-to-delivery, storability, seasonality effect on pricing and volatility of natural gas traded in futures market have been found. However these studies fail to provide a detailed insight into the trading of these commodities. Again, there are no studies on the energy futures market of India.

2.2.3 Weather derivatives: Weather derivatives are a fascinating new type of Arrow-Debreu security, making pre-specified payouts if pre-specified weather events occur. The market has grown rapidly. In 1997, the market for weather derivatives was nonexistent. In 1998 the market was estimated at US$500 million, but it was still illiquid, with large spreads and limited secondary market activity. More recently the market has grown to more than $5 billion, with better liquidity. This section delves into literature on Weather derivatives traded on commodity exchanges.

A number of interesting considerations make weather derivatives different from “standard” derivatives. However crucial issue of how to construct good weather forecasts, potentially at horizons much longer than those commonly emphasized by meteorologists has been the topic of research. Campbell and Diebold (2002) took a non-structural time-series approach to modeling and forecasting daily average temperature in ten U.S. cities, and to inquire systematically as to whether it may prove useful for the participants in the weather derivatives market. The study found an affirmative answer to this. Time series modeling revealed both, strong conditional mean dynamics and conditional variance dynamics in daily average temperature. It also revealed sharp differences between the distribution of temperature and the distribution of temperature surprises. It was observed that the model adapted readily to produce the
long-horizon forecasts of relevance in weather derivatives contexts. The study produced and evaluated both, point and distributional forecasts of average temperature, with some success. It concluded that additional inquiry into nonstructural weather forecasting methods, as relevant for weather derivatives, would prove useful.

The failure of private insurance markets to provide affordable and comprehensive crop insurance is well documented in the literature. In particular, high systemic risk and agency problems are often cited as major obstacles to viable crop insurance. Weather derivatives are a type of index contract whose payoff depends on occurrence or nonoccurrence of specific weather events. Recently, weather derivatives have received considerable attention in the literature as potential risk management instruments for agricultural production. Vedenov and Barn (2004) carried out an experimental design study to analyze efficiency of weather derivatives as primary insurance instruments for six crop reporting districts that were among the largest producers of corn, cotton, and soybeans in the United States. Specific weather derivatives were constructed for each crop/district combination based on analysis of several econometric models. The performance of the designed weather derivatives was then analyzed both in- and out-of-sample. The primary findings of the study suggested that the optimal structure of weather derivatives varied widely across crops and regions, as did the risk-reducing performance of the optimally designed weather derivatives. Further, optimal weather derivatives required rather complicated combinations of weather variables to achieve reasonable fits between weather and yield. The study contributed to the existing literature on agricultural applications of weather derivatives by moving beyond pricing issues to consider the efficiency of weather derivatives as risk management instruments for crop production.

Weather conditions directly affect agricultural outputs and the demand for energy products, and indirectly affect retail businesses. Among all the weather derivative transactions, temperature-related deals are the most prevalent, accounting for more than 80 percent of all transactions. Although weather derivatives have gradually gained their importance, there is not yet a compelling and effective pricing method. Based on prior studies, Alaton et al. (2002) construct a relatively complete model which takes into account not only temperature trend, seasonality, and mean reversion but market price of
Huang et al. (2008) extended the long-term temperature model proposed by Alaton et al. (2002) by taking into account ARCH/GARCH effects to reflect the clustering of volatility in temperature. The fixed variance model and the ARCH model were estimated using Taiwan weather data from 1974 through 2003. The results showed that for Heating Degree Day (HDD)/Cooling Degree Day (CDD) the call price was higher under ARCH-effects variance than under fixed variance, while the put price was lower.

Although different pricing methods were employed in pricing weather options, the effects of mean and standard deviation on option prices were mathematically proved to be the same as those in pricing traditional financial derivatives using the Black-Scholes formula. Chincarini (2011) examined the efficiency of the weather futures market traded on the CME in both HDD and CDD futures contracts in eighteen cities across the United States. Efficiency was examined in three ways: i) by comparing the market's implied forecasts for the weather against other forecasts; ii) by looking at whether market's overreact or under-react to temperature surprises; iii) by looking at weather derivative patterns across cities. The study revealed that generally the market seemed very efficient despite its lack of liquidity. The study also found risk premia that seemed to vary across cities and over time.

Weather derivatives differ from most derivatives in that the underlying weather cannot be traded and their market is relatively illiquid. The weather derivative market is therefore incomplete. The traditional way of protection against unpredictable weather conditions has always been the insurance, which covers the loss in exchange for the payment of a premium. However, recently there are many popular new financial instruments linked to weather conditions. Härdle and Cabrera (2012) implemented a pricing methodology for weather derivatives that could increase the precision of measuring weather risk. Study applied continuous autoregressive models (CAR) with seasonal variation to model the temperature in Berlin and with that to get the explicit nature of non-arbitrage prices for temperature derivatives. The study inferred the implied market price from Berlin cumulative monthly temperature futures that were traded at the CME. It was found that the market price of weather risk was different from zero and showed a seasonal structure. With the extract information, other exotic
options were priced, such as cooling/heating degree day temperatures and non-standard maturity contracts. The main explanation of this temporal variation was the risk attitude of consumers and producers in the diversification process and the seasonal effect of the underlying process nature. Study observed a nonlinear relationship between the seasonal variation of the temperature process and the market price of weather risk (MPR), indicating that a significant portion of derivative prices could come from the different time horizon perspectives of market players to hedge weather risk.

Most of the weather derivatives traded are based on temperature among the end users - gas and power, utilities and retail, agriculture, travel, transport and distribution leisure and tourism firms. The mean reverting nature of temperature models, which appear to be a necessary component, tend to drag temperatures back towards average, reducing the possibility of a persistently warmer or colder season appearing in the modeled trajectories (Lee and Craine, 2012). Study observed particularly mild winters or hot summers, and revealed this to be more than just selective confirmation bias – there are certain winters that are persistently warmer than average throughout – an occurrence that may happen more often due to Climate Change. It is possible that by incorporating long range weather forecasts, or by using a variable speed of mean reversion as applied in Zapranis and Alexandridis (2008), this weakness may be overcome. The variability of temperature was shown greatest during the winter periods, which suggested that where a company’s results were correlated with temperature, the use of weather derivatives would be of most benefit during these periods.

Existing literature on weather derivatives delves mainly with how to construct good weather forecasts and study the pricing of weather options that can increase precision of measuring weather risk. Recently, weather derivatives have received considerable attention in the literature as potential risk management instruments for agricultural production. Studies have been carried out to observe how weather derivatives affect agricultural outputs and the demand for energy products, and indirectly affect retail businesses with specific focus on temperature. Studies have analyzed the efficiency of weather derivatives as primary insurance instruments for crops like corn, cotton, soybean, etc and new financial instruments linked to weather conditions. However,
extensive studies related to Indian environment and weather derivative trading on Indian commodity exchanges have been missing, except for one undertaken in 2011.

2.3 Geography-specific – This literature review is organized into four major sections pertaining to literature covering the USA, European Union, Japan, and emerging economies.

2.3.1 USA: This section pertains to studies on commodity exchanges based in the USA.

The commodity markets of developed nations have always been an area of interest for researchers especially to study the success of the commodity exchanges of these nations. Blake and Catlett (1984) examined the use of corn futures contracts to cross hedge both the U. S. hay and New Mexico alfalfa hay. Results showed that correlations between monthly spot U. S. hay prices and corn futures prices ranged from 0.828 to 0.970 and were all significant at the $\alpha = 0.0001$ level. Study used multiple regression to determine the optimal corn futures contract month to cross hedge each spot monthly hay price. Regressions were used to determine the coverage ratio of tons of hay per corn futures contracts. A routine cross hedge was simulated and result showed that cross hedging hay using corn futures increased the gross returns per ton of hay.

A model of marketing firms in the presence of futures markets was presented and tested with data from the U.S. soybean-processing industry. Results of this study by Lence et al. (1992) showed that production would increase if output futures prices rose, material input cash prices fall, or the output cash-futures price relationship becomes more volatile. Sufficient assumptions for these results were expected-utility-maximizing competitive firms with non-increasing absolute risk aversion and non-stochastic Leontief production functions, unbiased futures prices, and linearly related cash and futures prices. The standard marketing margin was found inappropriate for analyzing market structure or risk in the presence of futures markets.

The two main hubs for commodity exchanges in the United States of America are Chicago and the Kansas City. The difference in liquidity costs between these two markets was studied using regression analysis by Thompson et al. (1993) with respect to wheat futures contracts. Regression results suggested that there were significant
differences in liquidity costs between Chicago and Kansas City which were in part due to the lower trading volume at Kansas City. However, there appeared to be a significantly higher cost of doing business at Kansas City which was independent of trading volume. The implications of these findings to traders were that transacting is more expensive in Kansas City than in Chicago.

Studies on CBOT corn futures market have revealed that the price-trend parameters of the stochastic process generating the daily returns were nearly stable over time and hence could be estimated using a static procedure. Cabral and Guimaraes (1994) addressed the problem of buying commodities through the futures markets and dealt specifically with a heuristic rule developed for the scenario described as 'purchasing under a deadline'. Analysis presented under the study of 1972-1987 series of CBOT daily soybean futures closing prices strongly suggested that those parameters were unstable, impairing the successful application of the purchasing rule. Study recommended the continuous cumulative sum control chart (CUSUM) monitoring of the purchasing results and proposed a procedure for dynamically calibrating the price-trend and buying parameters. The price-trend parameter estimates were derived from exponentially smoothed sample autocorrelation coefficients of the rescaled daily returns. The results suggested that it led to an improvement on the purchasing results derived from the static parameter calibration procedure formerly adopted.

Few studies have emerged which compare the returns on U.S commodity exchanges with those on the commodity exchanges of other developed nations. Gorton et al. (2005) studied the basic properties of an equally-weighted index of U.S. commodity futures from the perspective of a Japanese investor. It was found that the returns on the U.S. equally-weighted commodity futures index maintained their basic properties, documented in Gorton and Rouwenhorst (2005), when translated into Yen. In particular, looking at returns on Japanese stocks and bonds, the commodity futures index, translated into Yen, continued to display equity-like returns, but with slightly less volatility. In addition, the Yen-based commodity futures returns showed essentially zero correlation with Japanese equities and negative correlation with bonds. Similarly a comparison between long term futures curves for wheat in Euronext and CME markets using a two-factor affine theoretical model was undertaken by Lence et al. (2012) and
observed that the CME futures curve exhibited a long-term equilibrium in contrast to the Euronext whereas the estimated seasonality was relatively similar for both markets. It was recommended that the proposed model can be used to price long-term futures options, long-term price insurance, and long-term swaps, among other applications.

The trading activities on commodity exchanges are influenced to a large extent by the US microeconomic announcements. Such news and forecast are either announced by the government regulatory body or by popular indices and researchers have been studying the impact of these announcements on commodity prices. Hess et al. (2008) investigated the impact of seventeen US microeconomic announcements on two broad and representative commodity futures indices. The study was based on a large sample from 1989 to 2005. It revealed that the daily price response of the Commodity Research Bureau (CRB) and Goldman Sachs Commodity Index (GSCI) commodity futures indices to macroeconomic news was state-dependent. During recessions, news about higher (lower) inflation and real activity led to positive (negative) adjustments of commodity futures prices. In contrast, there were no significant reactions found during economic expansions. The study attributed this asymmetric response to the state-dependent interpretation of macroeconomic news. The findings of the study were proved robust to several alternative business cycle definitions.

U.S. Department of Agriculture (USDA) has been playing a pivotal role in the success of commodity exchanges. The USDA forecasts have been widely known and reasonably accurate, so failure to find significant reaction would indicate that the USDA did not contribute additional news relative to information already possessed by traders. Various t-tests, F-tests, and nonparametric chi-square tests were applied in the study by Sumner and Mueller (1989) to examine the reaction of futures market price data for corn and soybeans to USDA harvest forecasts. Results indicated rejection of the null hypothesis of no significant difference between means of absolute values or variances of changes in closing prices on days following a USDA announcement and other days. Study concluded that significant information was contained in the forecasts. Over the period of time, USDA crop reports appeared to be no longer newsworthy, that is, provided no better production estimates than private forecasts. McKenzie (2008) examined the reason of why futures prices still continued to react to USDA crop
reports. The information value of reports was measured in terms of their influence on rational agents’ harvest-time corn price expectations, which were uncovered using a Hamilton-type modeling approach. Results of the study showed that reports were still newsworthy as they contributed to agents’ price expectations if released a day early. Study concluded that futures price reactions, which closely reflected price expectations, were rational and consistent with efficient markets hypothesis.

Studies have been carried out on factors that potentially inhibited the ability of futures market regulators to access relevant information concerning the related commodity markets, over which the regulators generally did not have authority, but which was found needed to understand fully price formation in a particular futures market contract or to detect manipulative or other abusive trading by market participants holding large positions in those commodity contracts. IOSCO (2008) studied the price changes in commodities to identify reasons for such variations. It concluded that economic fundamentals, rather than speculative activity, were a plausible explanation for price changes in commodities. Given the importance of this issue, and the complexity of the issues raised, continued monitoring was advised. In order to enhance the dissemination of surveillance and enforcement techniques, the study recommended that regulators should meet regularly for the purpose of informal sharing of contemporary market surveillance and enforcement techniques and concerns. Following this study, in September 2008, the U.S. CFTC found cases of main clients of swap dealers for which the combined on-exchange and OTC equivalent positions were above the speculative position limits (seven in the wheat markets, three in the soybeans market, one in maize, and six in sugar). Study found that most of these traders were non-commercial (hedge and pension funds, exchange traded funds) but, this did not mean that the law was not observed, as these cases were covered by exemptions. Analyzing the speculative activities more in detail, CME (2009) studied the influence of large reporting traders on futures markets performance. The study found positive correlation between index trader and/or money manager participation and increased volatility for maize, wheat and cotton. This could be linked to the long only strategy of index traders (followed by money managers) when the market was bullish. However, statistical analysis held little evidence that any group has a sustained influence on prices. In June 2009, a U.S.
Senate sub-committee studied the issues related to excessive speculation in the wheat market to identify the impact of commodity index traders. It concluded that index traders increased futures prices; impeded price convergence; and contributed to unreasonable fluctuations due to the large number of contracts purchased on the CME futures markets.

Being the most developed nation, the U.S. commodity futures market has always been the center of interest for most researches. Of the various studies mentioned above, most of them concentrated on agri-commodities like corn, soya bean and wheat futures. Very few studies observed how the other commodities behaved on the commodity exchanges. Also researchers mainly studied the effect of futures prices on spot prices, development and working of commodity indices, etc. Researchers have also emphasized on the importance of regulating the markets in terms of how to control excessive speculation or the extent of power that brokers should have. However, studies on either specific commodity exchanges or on specific commodity have not been carried out.

2.3.2 European Union: This section deals with literature covering commodity exchanges of European Union.

Given the high level of uncertainty in commodity markets, the need for transparency-boosting measures specifically tailored to commodity and commodity derivatives markets in European Capital Markets Institute (ECMI) was well articulated by Cinquegrana (2008) in his study. One recommendation in particular was that encouraging the creation of a clearing infrastructure for OTC commodity and commodity derivatives markets was desirable. Study also recommended that EU regulators should consider setting up a new, more effective market abuse regime aimed at preventing manipulation in both the physical and financial commodities markets. Also, in cooperation with the G20, EU authorities should consider the creation of an International Commodity Agency to increase transparency and restore confidence in international physical markets for commodities.
Exchanges for agricultural commodities were observed less active in the European Union in a study by Commission Staff Working Document (CSWD) of European Communities (2009) which focused on regulatory issues and policy initiatives that most specifically related to derivatives for agricultural commodity markets.

The commodity exchanges in the European and Central Asian (ECA) region have been expected to act as a tool for risk management. Studies have been focused on exchanges that provided explicit risk management tools and discussed how the offer of risk management tools (particularly for agriculture) by such exchanges can be improved. Belozertsev et al. (2011) revealed that in EU member countries, the value that international support added to initiatives would be limited, partly because the necessary skills and resources already existed within these countries and partly because the EU had its own regional funds. Azerbaijan was identified as a country where there is scope for establishing an electronic spot exchange (including for fruits and vegetables). Republic of Belarus and Uzbekistan were countries with a potential for improving the existing spot exchanges, but only if the government changes its policies to allow more room to the private sector. Kyrgyzstan and Tajikistan were the countries where relatively small but technically sophisticated exchanges could do much to improve agricultural wholesale trade and finance. Four countries where international support could help to create or strengthen existing commodity futures markets were Kazakhstan, the Russian Federation, Turkey and Ukraine. Study concluded that in all of these countries, exchange development cannot be imposed from the outside and there needs to be political support and a strong buy-in from key areas of the local private sector. It was found essential to reach the critical mass of local support for the objective to be successful.

Comparison between EU and the U.S commodity futures markets have led to few researches during the recent times. One such comparison between long term futures curves for wheat in Euronext and CME markets using a two-factor affine theoretical model was undertaken by Lence et al. (2012). The findings showed that the CME futures curve exhibited a long-term equilibrium; in contrast, the Euronext futures curve did not show a tendency for futures to revert to a long-term equilibrium value; the estimated seasonality was relatively similar for both markets. However, the seasonal
minimum and maximum points in the futures curve occurred one to two months later for Euronext compared to the CME. The futures curve for Euronext had a much more marked seasonality than the CME futures curve. Credible intervals of the futures curves were also estimated and it was observed that the width clearly increased for longer maturities, but it did so much faster for Euronext than for the CME. For long-maturity futures, variability in the parameter estimates (as opposed to the residual errors) accounted for most of the width of the credible intervals, especially for Euronext. It was recommended that the proposed model can be used to price long-term futures options, long-term price insurance, and long-term swaps, among other applications.

Compared to the U.S., researches on European commodity market were few. Above studies reveal that risk management and transparency in commodity exchanges of European Union have been the main focus for researches while studying these exchanges. Also there has been focus on regulatory issues and policy initiatives. Studies have been focused on commodity markets as whole, but there are no commodity specific studies which can highlight the behavior, performance and risks associated with these commodities on the EU commodity exchanges.

2.3.3 Japan: This section covers studies undertaken for Japanese commodity exchanges.

Kaku (2001) studied the broiler futures in Kanmon Commodity Exchange and found that in 1973, in the Japanese Chicken meat market, the share of whole birds, cut-ups, parts and deboned meat and imported chicken meat was 59.3, 37.3 and 3.4 per cent, respectively. However, in 1994 the share shifted to 8.9, 59.7 and 31.4 per cent, respectively. The study concluded that the specification for commodity futures market should be the boneless leg meat of domestic broilers.

Comparing the returns on U.S commodity exchanges with those on the Japanese exchanges, Gorton et al. (2005) studied the basic properties of an equally-weighted index of U.S. commodity futures from the perspective of a Japanese investor and observed that the returns maintained their basic properties, documented in Gorton and Rouwenhorst (2005), when translated into Yen. The Yen-based commodity futures
returns showed essentially zero correlation with Japanese equities and negative correlation with bonds.

On the Tokyo Commodity Exchange, evidence for cross-market trading dynamics in futures contracts written on seemingly unrelated commodities that are consumed by a common industry was found in natural rubber (NR), palladium (PA) and gasoline (GA) futures markets. Study by Chng (2009) found that the automobile industry was responsible for more than 50 percent of global demand for each of these commodities. VAR estimation revealed short-run cross-market interaction between NR and GA, and from NR to PA. Cross-market influence exerted by PA was felt in longer dynamics, with PA volatility (volume) affecting NR (GA) volume (volatility). Further analysis, which benchmarked against silver futures market, TOCOM index and Tokyo Stock Price Index (TOPIX) transportation index, confirmed that the results of this study were driven by a common industry exposure, and not a commodity market factor. The study offered new insights into how commodity and equity markets related at an industry level, and implications for multi-commodity hedging.

From above existing literature, it was observed that there are hardly any studies carried out on Japanese commodity exchanges to deeply understand the functioning and working of the exchanges. However unlike most of the researches, studies on Japanese markets did not focus much on agricultural commodities.

2.3.4 Emerging economies: The characteristics of emerging markets are very different from that of developed markets. According to Bakaert and Harvey (1997) and Antoniou and Ergul (1997), emerging markets are characterized by low liquidity, thin trading volume, higher sample average returns, low correlation with developed market returns, non-normality, better predictability, higher volatility of returns, and small-size sample availability. It is usual to assume that the emerging futures markets exhibit higher price variability and poor information processing capabilities (Tomek, 1980). This section delves into studies covering commodity exchanges in the emerging economies and has been sub-divided to cover specific studies performed for Africa, Brazil, China, Egypt and India.
The relevance and necessity for existence of a commodity exchange and its influence to the economy of Croatia was studied which described the actual situation in Croatia; showed possible benefits that commodity exchange could bring; how the exchange worked; and, what was required to implement commodity exchange in the Croatian economy. This study by Šicel (1994) concluded that commodity exchange was a must for Croatia and Croatian business sector, especially agriculture.

Seven developing countries of India, South Africa, Malaysia, Brazil, Argentina, Indonesia and Thailand have been the main focus for studies on the working and success of their commodity exchanges; to draw lessons out of successful experiences; and apply those to other developing countries. Case studies on each of these seven countries covering the country; new exchange; and contracts to determine whether or not they met the qualifications were studied by Shim (2006). Hypotheses formulated and tested were neither able to predict the future outcome of a new local exchange nor could be used as a clear-cut list of qualifications for decision making purposes, they were at least able to provide guidelines for the developing countries to consider prior to pursuing a local exchange and contract. The study revealed that a contract with an underlying product that is significantly different from existing ones or with a large basis risk is one of the most important success factors. Presence of sufficiently large domestic market was identified as an important factor for success followed by development of financial intermediaries, institutional arrangements and presence of committed actors. Macroeconomic stability turned out to be almost a premise. A low level of industry integration and complementary export-orientation appeared to have a weak correlation with successes found in developing countries.

Similar case study approach was applied for Brazil, China, India, Malaysia and South Africa. Empirical investigation by UNCTAD (2009) focussed on agri-sector with an aim to identify, analyze and assess the impacts made by commodity exchanges in these countries on economic growth, development, and poverty reduction. Of the eighty one (81) hypotheses about development impacts arising from commodity exchanges, evidence was found to support the occurrence of sixty nine (69) of these in at least one of the featured countries. Applying impact assessment research methodology, the study set out a framework for analyzing a broad range of potential development impacts that
may arise from agricultural commodity exchanges. Core recommendations that emerged from the study were embedding a partnership approach between the public and private sectors for the establishment and development of commodity exchanges; heightening recognition by established developing-country exchanges of their actual and potential development impact; maximization of development impacts through innovative applications of products, services, technologies and capacity-building programs; recognition by Government that a robust but flexible regulatory framework, and a rules- or principles-based approach to regulation and governance – as opposed to a discretionary or ad hoc approach – are essential foundations for exchange success.

2.3.4.1 Africa: The literature that follows pertains to studies on commodity exchanges in Africa.

Africa has been the country of study for most researchers as well as the United Nations. These studies include commodity exchanges, feasibility of establishing successful exchanges, comparison between the regional and national exchanges, comparison between exchanges of countries, and efficiency of warehouse receipts.

A study to investigate the feasibility of establishing a regional agricultural commodity exchange in the Common Market for Eastern and Southern Africa (COMESA) Region and, to make proposals and recommendations based on existing and foreseeable demand for a regional agricultural commodity exchange was contracted by African Union (2005). Burundi, Ethiopia, Kenya, Malawi, Rwanda, Tanzania, Uganda, Zambia and Zimbabwe were covered and study focused specifically at coffee, cotton, grains and sugar as the main commodities traded. An analysis of the case for a regional agricultural commodity exchange in the COMESA Region was undertaken. Interviews with potential stakeholders held, revealed that some of the benefits to be derived from conducting trade over an exchange are very highly desirable. The issues raised and perceived to be of paramount importance were reliable market information and the identification of markets and access to them. Problems experienced in these areas greatly increased transaction costs and depressed prices paid to producers. Study suggested that governments within the region will need to play a facilitative role with regard to this initiative.
The conditions that enabled successful exchanges were examined by drawing from the existing literature and using indicative empirics, which highlighted the special challenges to setting up exchanges in Africa; and reviewed alternatives to domestic exchanges. Rashid et al. (2010) argued that many critical preconditions for the successful establishment of commodity exchanges in Africa remained binding in the short to medium term. Study observed that the development of commodity exchanges was impeded by the relatively small size of domestic commodity markets; the weak physical and communication infrastructure; a lack of supportive legal and regulatory environments; and the likelihood of policy interventions, particularly in the staple cereals market. Recommendations highlighted that (a) efforts to launch exchanges in Africa should realistically assess whether basic conditions for success can be met, (b) if the pre-conditions cannot be met, the use of existing exchanges abroad or the development of regional exchanges may be more feasible than the establishment of national commodity exchanges, and (c) the goals of risk management and reduced transaction costs might be achieved more effectively by improving market fundamentals through investments in transportation, information services, or other financial institutions.

Onumah (UNCTAD 2010) commissioned a study to document lessons learned from the experiences of two West African countries Ghana and Nigeria, which UNCTAD should take into account during the formulation of overall strategy in promoting commodity exchanges in Africa. The approach adopted included extensive desk research on international experience on the benefits and perquisites for successful agricultural commodity exchanges. As follow up to the desk review, consultations with key players in the commodity sectors in the target countries were taken up, involving telephone and email consultations and direct meetings with relevant officials during field visits. The stakeholders consulted included officials and promoters of commodity exchanges as well as banks, collateral management companies and regulatory agencies. Study concluded that the development of commodity exchanges could improve the performance of commodity marketing and finance systems.

2.3.4.2 Brazil: This section highlights the studies done on commodity exchanges in Brazil. Not much literature is found that covers commodity exchanges and their
functioning in Brazil. Of the available literatures reviewed, one study that analyzed the important role Brazil’s commodity derivatives play in the economy was by Dodd and Griffith-Jones (2007). Study focused on providing an analytical description of the derivatives markets in Brazil; the way they operate and are regulated; and how they were used by the Brazilian Central Bank (BCB) in the conduct of macroeconomic policy. It was observed that the OTC segment of the derivatives markets was not very transparent due to there being only limited reporting and disclosure requirements; thus, complete information on the size, volume and use of this market was difficult to obtain. Numerous lengthy interviews were conducted with representatives from all the major market participants in the derivatives markets and their key regulatory and supervisory institutions. While the study did not use direct quotes from any of these interviews, much of the description of OTC market reflected learning from these interviews which was then condensed into the descriptive analysis.

2.3.4.3 China: The studies carried out for Chinese commodity exchanges are mentioned in this section. The initial development of the Chinese commodity exchanges – from 1990 until the middle of the decade – took place in a context characterized as “regulatory chaos” (Xueqin and Gorham, 2002). The China Securities Regulatory Commission (CSRC) was not established until October 1992, two years after the first commodity exchange was founded, and with an initial remit to regulate the securities markets only. The first commodity futures contracts started trading in May 1993 and rapidly proliferated in a context lacking a uniform centralized regulatory framework. Only in November 1993 was the CSRC given regulatory responsibility for the commodity futures markets, following a State Council intervention through its “Notice of Firmly Curbing the Blind Development of the Futures Market”. In the early period of its existence, however, “the CSRC exerted little direct control over the new futures exchanges” (Peck, 2004)

Research on the integration of Chinese commodity spot and futures markets carries some contrasting messages. According to data provided by the DCE, soybean showed a strong correlation between spot and futures, indicating a good relationship between the two markets. There appeared to be wider divergence with corn. By contrast, Li (2007) found that whereas corn had an 87 per cent correlation coefficient between the futures
and the spot price, for soybean that figure was significantly lower, at 62 per cent. Research by Zhang (2006) found a strong correlation between spot and futures prices of soybean, and found that the futures price generally had a lead effect on the spot price. Peng et. al (2006), however, concluded that causality tests suggest that there is no link between changes in the futures price and spot price of soybean. They further note that the difference in empirical results may reflect the difference in sample periods. However, it was also noted that their analysis was performed on the less liquid DCE Number 2 (GMO) soybean contract, largely used by importers and crushers that use foreign-produced GMO soybean, rather than the more liquid Number 1 contract, which was used by the domestic soybean producer community.

The launch of the Dalian Commodity Exchange (DCE) corn futures contract had been an important part of China’s strategy for moving towards a liberalized market for corn, meeting its WTO accession commitments to reform the country’s support regime for the corn sector. The DCE contract was launched just after government price protection for corn was removed. It also came after the abolition of export subsidies in early 2004. However, unlike the case of the soybean market, import and export of corn trade was still controlled by the Government. Liberalization was expected soon, as it was anticipated that China would move from its current position of self-sufficiency to becoming a net importer in the next few years. The introduction of the corn futures contract was seen as an important step on the path to market liberalization (Reuters, 2004). As market pricing had developed for both commodities, it had enabled the futures market – rather than the Government – to act as the source used by farmers to guide their cropping and selling patterns. This was expected to reduce the costs and the risks that the previous system of price support generated for the Government.

Chan et al. (2005) studied the establishment and development of the most successful futures market in China and documented the evolution of the market microstructures and the attempts by the Zhengzhou Commodity Exchange's management to improve the performance of the futures market. The findings of the study suggested that if other former centrally planned economies want to establish futures markets, they must think carefully not only of the design and microstructure of the futures market, but also have to choose carefully what contracts to offer.
The high number of “individual” market participants at 95 per cent reflected how speculative participation in the Chinese market largely originated from small-scale retail investors, confirming a similar observation by Peng et al. (2006).

2.3.4.4 Egypt: This section deals with studies in Egypt.

Feasibility and viability of a commodity exchange in Egypt studied by Struyk (2007) revealed that it will be best accomplished using rapid mobilization and simultaneous execution of many activities. The study discussed aspects of the prevailing situation in Egypt at the time of study and assessed the conditions and the potential relative to the formation of a commodity futures exchange. It also presented a conceptual framework of the basic elements that should be considered in establishing a commodity futures exchange. The most optimistic path and circumstances that would allow for a very rapid establishment of a commodity futures exchange was recommended in the study.

2.3.4.5 India: Government of India officials, and international and Indian commodities and securities market experts, conducted a series of studies that, taken together, point to a consensus on several fundamental issues which recommend the development of commodity futures market in India.

A number of committees have been constituted to inspect, control, and standardize this market at numerous occasions at the behest of government of India, namely, A.D. Shroff Committee (1950), M. L. Dantwala Committee (1966), A.M. Khusro Committee (1979), K.N. Kabra Committee (1993), Shankarlal Guru Committee (2001), Habibullah Committee (2003), and lastly Sen Committee (2008). More or less, those committees’ recommendations, inevitably, stand out few indicatives with respect to measuring the efficiency of Indian commodity futures markets, contentions at the back of low extent of participation or on the contrary, unwarranted speculation, and inference behind impositions of ban on several commodities telling to their economic fundamentals and trade-policies

Various studies on the Indian commodity exchanges conducted prior to the inception of national commodity exchanges are listed below:
Khusro Committee Report (1980)

Kabra Committee Report (1994)


FMC (2000): Brokerage

FMC and the World Bank (2000): Clearing Houses

FMC (2000): Improving Commodities Futures Markets

World Bank (2000): Warehouse Receipt Systems

Guru Committee Report (2001)


A snapshot of each of these reports is given below:

The Khusro Committee (1980) had recommended reintroduction of futures trading in most of the major commodities, including cotton, *kapas*, raw jute and jute goods and suggested that steps may be taken for introducing futures trading in commodities, like potatoes, onions, etc. at appropriate time. The government, accordingly initiated futures trading in Potato during the latter half of 1980 in quite a few markets in Punjab and Uttar Pradesh.

After the introduction of economic reforms since June 1991 and the consequent gradual trade and industry liberalization in both the domestic and external sectors, the Govt. of India appointed in 1993 one more committee on Forward Markets under the chairmanship of Prof K N Kabra. The Kabra committee (1994) submitted its report in September 1994. The majority report of the committee recommended that futures trading be introduced in Basmati Rice, Cotton and Kapas, Raw Jute and Jute Goods, Groundnut, rapeseed/mustard seed, cottonseed, sesame seed, sunflower seed, safflower seed, copra and soybean, and oils and oilcakes of all of them, Rice bran oil, Castor oil.
and its oilcake, Linseed, Silver, and Onions. The committee also recommended that some of the existing commodity exchanges particularly the ones in pepper and castor seed may be upgraded to the level of international futures markets.

The Kabra Committee Report (1994) and the World Bank Report (1996) are widely regarded as the principal sources for policies aimed at the rapid modernisation of the agriculture futures markets.

Indian agriculture futures market was evaluated by UNCTAD (1996) and the study highlighted the role of futures markets as market based instruments for managing risks. It noted that restrictive policies have not provided India's agriculture futures market a chance to contribute to price risk management and discouraged them from upgrading their institutional capabilities. It suggested the strengthening of institutional capacity of the regulator -FMC and the exchanges for efficient performance of these markets. Study was prepared on the basis of a review of available literature, including UNCTAD studies; field visits to a representative cross-section of commodity exchanges; and interviews with government officials, industry participants, and representatives from commodity exchanges. It concluded that government intervention was pervasive in some sensitive major commodities like wheat, rice and sugar and was of the view that future markets in these commodities were unlikely to be viable.

Previous international brokerage models were considered no longer to be as appropriate a benchmark to guide India’s development of its brokerage industry. Working of brokers on Indian commodity exchanges was compared to that of international experiences of Australia, Malaysia and the USA and the results revealed that many of the traded commodities and most of the existing contracts on Indian commodity exchanges were specific to India only (Mecklai and Chin, FMC 2000). The study focused on making recommendations for creating successful brokerages on Indian commodity exchanges. It recommended that the creation of successful brokerages relies on successful exchanges. Also, there should be a transition period of perhaps one year, where the FMC gears up the official exchanges and as they start to succeed, FMC should move more aggressively to limit the Havala markets (or at least increase their regulation to be on par with those of the futures industry). Study also recommended
that India should have three multi-commodity exchanges – and the current structure, implementation could be in four areas: Selection of exchange management and incorporation of existing contracts; incorporating financial futures; incorporating international players/contracts/exchanges; implementing a national education and registration facility for brokers.

Due to lack of adequate secondary data, many researchers opted for collection of primary data by visiting the commodity exchanges of India to identify and document statements in respect of best practice for market surveillance and monitoring, addressing both floor trading environments and electronic markets. Mostly such studies were triggered by FMC and observations of these filed visits were documented for FMC.

Field visits to East India Cotton Association (EICA), Mumbai; the Domestic and the International Commodity Exchange Division of the India Pepper and Spice Trade Association (IPSTA), Kochi; Coffee Futures Exchange India Limited (COFEI), Bangalore; International Castor Oil Division of the Bombay Oilseeds and Oils Exchange Limited (BOOE), Mumbai; and the SOPA Board of Trade (SBOT), Indore were undertaken for a consultancy report by Jeffery and Ramachandran (FMC, 2000) to FMC and the World Bank aimed at strengthening the clearing and settlement process in the commodity exchanges in India. The report was based on extensive discussions with policymakers and regulators, and potential users of commodity derivatives contracts. The purpose was to upgrade and strengthen the clearing functions of the commodity exchanges; to work towards having one or a limited few clearing houses that clear and guarantee the contracts traded in several commodity exchanges; to evolve a system of margins and methods of its payment for the clearing operations; to have an action plan to move from the present system to a new system; to strengthen the capacity of the FMC to assess the quality of clearing house operations and practices by the commodity exchanges; and to hold a workshop where the necessity and importance of clearing is put across and the action plan can be explained along with the role of various functionaries and institutions in this process. The action plan comprised major policies, supporting policies and principal processes that should be addressed and enunciated by the Government of India and the FMC. Study by Burr and Anjaria (FMC, 2000) based
on their field visits observed that Indian commodity exchanges wanted to have the ability to be able to distribute their products to a wider audience - both domestic and international. The principal areas for improvements in market surveillance and monitoring recommended were floor trading practices; strengthening of the executive teams; board structures; prevention of price manipulation; creation of continuous liquid markets; and introduction of openly transparent markets. It also recommended that to achieve this, there has to be a move towards greater standardization of procedure, improved distribution of product and price and an upgrading - to a much more professional level - of the manner in which business is traded, cleared and settled.

Further, based on the field visits to East India Cotton Association (EICA), Mumbai; the Bombay Oilseeds and Oils Exchange Limited (BOOE), Mumbai; the SOPA Board of Trade (SBOT), Indore; Coffee Futures Exchange India Limited (COFEI), Bangalore; and The Chamber of Commerce, Hapur, Ghaziabad, Coulter and Ramachandran (FMC, 2000) undertook an in-depth study into the existing warehousing facilities in the country. These visits were augmented by field visits to other centers pertinent to commodity trading, storage, and analysis and testing as well as discussions with other policymakers, regulators and stakeholders that have an economic interest in warehouse receipts and commodity contracts. The study recommended that the existing Government warehousing companies should play a leading role in the development of warehousing. Study recommended that private operators should be involved; particularly those who were already providing storage facilities and divestment should be pursued with a view to increasing their private sector orientation and autonomy. It also suggested a time bound action plan under which, the date for formal commencement was slated for June 2003. However, although more than 5 years have passed, there is yet no evidence of any concrete action taken by authorities concerned.

Guru Committee (2001) studied the need for and role of futures trading in price risk management and in marketing of agricultural produce. It recommended that it should be left to interested exchanges to decide the appropriateness/usefulness of commencing futures trading in products (not necessarily of just commodities) based on concrete studies of feasibility on a case-to-case basis. It, however, noted that all the commodities are not suited for futures trading.
Though a number of major initiatives were taken to promote commodity futures markets in India in the past, many of the constraints inherited over decades of scarcity mindset generating ‘inward looking’ policies still continued.

Areas relating to commodity forward and futures markets, administration of which is mandated to the Department of Consumer Affairs were studied by Rapuria (FMC, 2001) for FMC. Study recommended the following: the objective should be to move towards a situation where all ‘candidate commodities’ would be automatically allowed for futures trading under the overall regulation of the commodity market regulator; the regulatory framework should to be strengthened further by making the regulator autonomous and by strengthening the interface with other market regulators; the Exchanges and other stake-holders should wake up to the challenges facing commodity futures trading and ‘upgrade’ their action plans to face these challenges; the level of general awareness, particularly that of farmers and their cooperatives, on futures trading and related issues should to be raised for increasing participation in the futures markets.

With the lifting of prohibition on forward trade in all the commodities at the beginning of 2003, the commodity derivatives market was totally liberalized. There was an upsurge of interest in this market. The participants in other financial markets, particularly securities, looked forward to the new emerging opportunities offered by this market. However, there were some regulatory barriers to permit them to benefit from this opportunity. The Government of India had taken major initiatives to activate the commodity exchanges for enhancing the role of commodity futures as a major risk containment tool in the commodity sector. Entry of securities brokers in commodities futures market, though considered generally as a welcome initiative for commodity market development could not be taken forward as the existing legal framework did not permit the engagement of securities brokers in any business other than that of securities.

FMC had also been requesting SEBI to permit brokers in the securities market to take up membership of commodity exchanges and engage in the business of intermediation in the commodity markets as well. SEBI therefore constituted a Committee under the
Chairmanship of K. R. Ramamoorthy (FMC, 2003) to examine the various aspects relating to participation of securities market brokers in the commodity market, with specific focus on the key issues of whether securities brokers could participate in commodities market; what should be the risk containment measures, so that risk of one market does not spill over to the other; and whether the existing infrastructure of stock exchanges could be used for the commodities futures market. The Committee, after due deliberations, has recommended participation of securities brokers in the commodity futures market. While the committee endorsed the first two issues, on the third issue, it opined that it could be taken up for consideration at a future date as the two markets mature further.

Based on the recommendations of the Ramamoorthy Committee, the Government issued a notification and amended the Securities Contract (Regulation) Rule to permit securities brokers to participate in the commodities markets after constituting a separate legal entity. The issue of convergence of securities and commodity derivative markets was discussed at various levels in the Government. The idea of convergence of markets, institutions, players and regulators was proposed by the Finance Minister in a communication to the Minister of Consumer Affairs, Food and Public Distribution, in response to which an inter-ministerial Task Force was constituted under the Chairmanship of Mr. Habibullah (FMC, 2003). The Task Force chalked out its own Terms of Reference and held four meetings. The securities exchanges and commodities exchanges were invited to give their views on the subject. Draft Report of the Task Force was placed on the websites of the FMC and the Department of Consumer Affairs for wider dissemination and for views and comments. The Task Force also visited a few commodity exchanges and the National Stock Exchange to have an on-the-spot understanding of the issue. A panel discussion on the subject was held in the National Conference of Commodity Exchanges organized by FMC in Mumbai on September 2, 2003. The views received from them were considered and discussed in the meetings of the Task Force before drafting the Report.

A review of these reports can be summarized as follows:
Indian agriculture has evolved and is opening up to internationally competitive world markets which present new challenges, because engaging them will require a market-based agricultural sector.

The historic Government of India policy approach is being reconsidered both to foster a market based, internationally competitive, agriculture sector, and because of high fiscal and economic costs of previous policies.

Major advances have occurred in the technology of commodity futures exchange operations elsewhere in the world. Such systems are commercially available, and they can ensure highly reliable, online, electronic trading and margining operations that eliminate certain types of trading abuses that historically plagued commodity futures markets.

Post the inception of national commodity exchanges in India in 2003, one main issue with the Indian commodity exchanges was their autonomous status versus the preferred de-mutualised structure. To deeply study the two structures, case studies of two exchanges, India Pepper and Spice Trade Association and the NBOT were undertaken using the “Structure-Conduct- Performance’ framework by IICM (FMC, 2004). It observed that in spite of a long history, many exchanges lacked in liquidity, volumes and number of trades. The study drew inferences about the operational weaknesses of the commodity futures markets in India. In the older exchanges, right to trade; right to ownership; and right to manage vest in the same set of persons which led to conflict of interest. In their present situation, the exchanges did not seem to be delivering to their full potential. Study recommended that structural solutions were required to strengthen the day-to-day governance and seriously examination of the issue of de-mutulization should be taken up. Study also suggested that converting the exchanges into for-profit corporation would enable them to raise further capital and identified specific actions to be initiated by different entities.

The efficiency of major commodity futures markets in India using the co-integration theory was studied and concluded that a major reason for the poor performance of Indian futures market could be the lack of adequate participation of hedgers in these
markets (Naik and Jain, 2002). The study recommended that the management of the exchanges and the FMC have to find ways to attract hedgers in order to improve the performance of these markets. Jairatt and Kamboj (2005) observed that of the total commodities traded on Indian exchanges, the agricultural commodities accounted for nearly 95 percent during 2002-2003, and reduced to around 92 percent in 2004-2005. Study concluded that with the removal of ban in 2003, share of national commodity exchanges increased from nearly 6 percent and that of regional exchanges declined from 94 to 27 percent during that period. Kabra (2007) observed that the turnover of the commodity futures market in India had grown exponentially in a short span of time.

Studies on the regulatory authority – FMC, its role and functioning in making the agricultural futures markets a vibrant segment for risk management which can then play an important role especially in an agriculture dominated economy of India were carried out. Sahadevan (2002) recommended that a more focused and pragmatic approach from the government, FMC and the exchanges after the review of the nature of institutional and policy level constraints facing this segment. Policymakers in India have overlooked wider considerations involving the discipline of checks and balances during trade on the exchanges (Kabra, 2007).

The objectives of Baskara’s (2007) study were to examine the organizational set up and the mode of working of the national exchanges; assess the share of national exchanges in commodities traded on futures market; and analyze the relationship between spot and futures price of the selected agricultural commodities. Secondary data was collected from the official web sites of FMC and national commodity exchanges in India for the period 2004-2005 to 2006-2007, while the primary data was collected through personal interview of members and clients. The results showed that the share of NCDEX among cereals, pulses and spices was around 63 percent to 99 percent during each year in the total quantity handled. For plantations and oil crops, NMCE witnessed major market share except cashew and palm oil respectively. The Augmented Dicky Fuller (ADF) test used to check the time series data, revealed that most of the series followed the stationary pattern at the first and second difference. Around 67 percent of members expressed that they had problem of deficient technical stall in back office. The problem faced by the client’s difficulties in predicting future market trends was the most
significant one, with 77 percent response. On similar grounds, Patel and Patel (2012) sought to find to which extent major Indian commodity exchanges disclosed their corporate governance practices. Relevant score card method was adopted for comparative study of corporate governance disclosures of MXC and NCDEX. The study examined the annual reports and practices as to adherence to mandatory and non mandatory disclosure norms with inclusion of Clause 49 of Listing Agreement for listed companies or otherwise as to safeguard the interest of investors, society and legislative authorities through enhanced governance practices for FY2010 and FY2011 prior to listing. Study found a substantial scope for corporate governance for shifting from non mandatory to mandatory mechanisms.

Secondary data was used by Indian researchers to study more deeply into the present status, growth constraints and developmental policy alternatives for the commodity exchanges. Secondary data usually was taken from various publicly available websites of recognized commodity exchanges and their organizational and the regulatory set up for futures trading. Mishra (2008) studied secondary data and observed that the factors that drive commodity prices were different from the factors that drive equity prices. This study also explored the advantages and the downside risks of adding commodities to a portfolio of equities in Indian context based on empirical data. It was concluded that the less-than-perfect or negative correlation of commodities with equities made them an excellent choice for diversification; enhanced the risk-adjusted return of a portfolio; provided a significant downside protection; and enhanced skewness and kurtosis of the return distribution. In an almost similar study Bose (2008) analyzed some characteristics of the Indian commodity futures market in order to judge whether prices indicate efficient functioning of the market or otherwise, particularly as this market was less developed compared to the financial derivatives markets. Using the available notional price indices for the commodity market, the study revealed that multi-commodity indices, which have higher exposure to metals and energy products, behaved like the equity indices in terms of efficiency and flow of information. Both the contemporaneous futures and spot prices contributed to price discovery and the futures market could provide information for current spot prices and thus helped to reduce volatility in the spot prices of the relevant commodities and provide for effective
hedging of price risk. Agricultural indices on the other hand did not exhibit such features very clearly. Results helped to build a case for opening up of parts of the Indian agricultural futures market.

The success of commodity exchanges in India has led many researchers to study and concentrate on various aspects of the exchanges. However all studies were focused on the exchanges and there was no research done to study the perception of people associated with these exchanges about the working of the exchanges. Bhanumurthy et al. (2012) empirically investigated the Investors Perception towards commodities futures trading in India and the level of awareness towards commodities futures trading. The research design was descriptive and data was collected using a questionnaire. Convenient sampling method was employed. The statistical analyses were performed by using Chi Square, Weighted average Method, One Way ANOVA and Rank Correlation. Main conclusion of the study was that there was no significant relationship between the gender and the category of investment, however there was a significant difference observed between the perceptions and the saving percentage for the commodity futures. Study concluded that despite a long history of commodity futures trading in the country, futures markets are still viewed with suspicion by many investors.

Developing countries have been the focus of research for most researchers especially since the potential in these countries is still untapped. The above studies on commodity exchanges of emerging economies mainly focused on the need and method of establishment of commodity exchanges in developing countries by studying the success factors of already established exchanges in other developing countries. United Nationals and USAID have conducted various research programs on the feasibility of successful working of commodity exchanges in Africa and India. UNCTAD studies were focused mainly on Africa and development of commodity exchanges in Africa. The studies on Indian commodity exchanges, before the nationalization of exchanges, were fragmented; mostly carried out for FMC; and dealt with organizational setups, price risk functions, role of brokers, warehousing receipts, and overall working of the exchanges in general. Commodity exchanges have gained momentum in the recent years and researchers are now studying various other aspects of these exchanges.
However, studies on any particular commodity in detail or on the perception of participants about the working of commodity exchanges were found to be missing except for one study during 2012 which investigated investors’ perception towards Indian commodity futures trading.

2.4 Gap Identification

Derivatives trading in the commodity market have been a topic of enthusiasm of research in the field of finance. Commodity exchanges will be required to significantly enhance the scope, efficiency and transparency of the commodity derivatives markets in order to enhance participation and bring liquidity.

- A number of studies have been done to study the impact of introduction of future trading in commodity markets on the price volatility; the relationship between spot and futures prices; the risks and rewards associated with trading on commodity exchanges; the effectiveness of hedging on the commodity exchanges; and comparison of commodity exchanges with equity markets and other financial instruments.

- Empirical literature on price discovery mainly deals with developed markets like the U.S. and UK.

- There are very few empirical studies on the performance of Indian commodity derivatives market. In India, significant and relevant literature on commodity market is thin and has mainly focused on agricultural commodities.

- Literature is limited to regional exchanges of India only, outdated (form the period prior to setting up of national exchanges), form a small sample or to very fewer commodities traded on national exchanges.

- Studies and analyses carried out mainly concentrated on Government regulations and the impact of these exchanges on commodity prices.

- There are studies that have been explored in the ascertainment of whether the price information is reflected in the spot market or in its underlying futures
market under various interval of time since the introduction of futures in Indian commodity market. There have been contrary views on impact of derivatives trading.

• Not much work has been existing in literature pertaining to commodity exchanges, particularly with respect to the objectives that the present study seeks to accomplish.

• Analyses on factors like Warehousing facilities etc were restricted to a few articles in newspapers, house magazines, discussions on television channels, etc, but no serious attempts were made by any organization or an individual to study the key operational aspects of the multi commodity exchanges and measure the performance of these aspects.

• Researchers have analyzed, observed and studied the commodity exchanges from an outside perspective. No studies were conducted to assess the attitude and perception of the participants of the commodity exchanges towards the operational issues and problems faced by them while trading on these exchanges, except for one recent study by an Indian researcher published during third quarter of 2012. But again the purpose of this research was to study on investors perception towards commodities futures trading, the level of awareness towards commodities futures trading and to analysis the factors considered by investors, which ultimately influence their investments with special reference to Puducherry.

Thus this research work tries to assess the response of the participants on the Indian multi-commodity exchanges regarding the operational issues, if any, faced by the participants while trading on these exchanges.