CHAPTER 2

REVIEW OF LITERATURE

2.1 Introduction

Derivative is an exceptionally emerging terminology in the world of the financial market which till now has been used in chemical sciences till now. Derivative is defined in the Merriam-Webster dictionary as “a chemical substance related structurally to another substance and theoretically derivable from it”. In the world of financial market, derivative is defined as an instrument which derives its value from the underlying assets. These underlying assets may be Indices, financial securities, currencies, commodities and so on. Now a days, a new derivative class has been evolved where the underlying asset is temperature level, rainfall in millimeter etc. Generally, derivative trading is available through three instruments; namely options, futures, and forwards. In India, commodity derivative is allowed only through futures and forward contracts which have become standard risk management tools that enable risk sharing and thus facilitate the efficient allocation of capital to productive investment opportunities. Large MNCs have long been using the derivatives to manage a variety of risks. But these sophisticated financial instruments have also begun to play an increasingly important role in the everyday lives of an ordinary person, although many may not yet be completely aware of this fact.

Various popularly known organizations have collapsed due to exposure in commodity derivative market which triggers the interest of regulators, media, industry, and public at large in it. It is alleged that derivatives are the chief architect of the collapse of bearing banks. Similarly, these securities have also been at the forefront of bringing Long-Term Capital Management (LTCM) at the brink of collapse. Investment world was shaken when the celebrity investor, Mr. Warren Buffett, gave some scorching remarks on these securities by categorizing them as ‘the financial weapons of mass destruction, carrying dangers that, while not latent, are potentially lethal’ in the 2002 annual report of Berkshire Hathaway. Therefore, a thorough understanding of derivative securities is must on the part of users to extract the benefits offered by these securities.

Derivatives are defined by the Securities Contracts (Regulation) Act (SC(R)A), 1956 as-
1) A security derived from a debt instrument, share, loan whether secured or unsecured, risk instrument or contract for differences or any other form of security.

2) A contract which derives its value from the prices, or index of prices, of underlying securities.

Derivatives are securities under the SC(R)A and hence the trading of derivatives is governed by the regulatory framework under the SC(R)A. Securities and Exchange commission of USA (1994) defined derivatives as an instrument whose value is based upon, or derived from, some underlying index, reference rate (e.g. interest rate or foreign exchange rates), security, commodity or other assets.

All the derivatives have *three essential characteristics:*

1) The type of contract, namely forward, futures, options;

2) The type of asset underlying the security namely equity derivatives, interest rate derivatives, commodity derivatives and currency derivatives; and

3) The market in which transactions occur, namely exchange traded and over-the-counter (OTC).

Derivatives are not simple instruments. The complex form of derivatives are known as exotic derivatives and the most simple form of derivatives are termed as plain vanilla derivatives viz., forward, futures, and option contracts. Brief of these contracts is given below:

*i) Forward Contract:* This contract is a transaction in which the buyer and seller agree upon the delivery of a specified underlying asset at a specified future date on a pre-determined price. These contracts are generally bipartite contracts with no intermediary and are not traded on exchanges. As all the financial risk is borne by the parties in the contracts, which may result in the inclusion of some sort of risk premium factor. These contracts are traded on over-the-counter (OTC). The specifications of these contracts like, price, quality, and delivery terms are negotiable between the buyer and the seller at the time of initiation of the contract. In Indian context, these contracts are more popular in currency and commodity market. For example, a company XYZ Ltd. imports a machinery from USA and the payment is to be made after three months. The company enters into a contract for buying $1 million at Rs. 49 per dollar with STT Bank for delivery of dollars after three months. This way XYZ Ltd. has booked the rate of exchange now, i.e. Rs. 49 per dollar, at which it would be buying the dollars after three months. In case the rupee appreciated to Rs. 50 per dollar after three
months, XYZ Ltd will make profit of Rs. 1 per dollar, i.e. total Rs. 1 million, by virtue of its entry into forward contract. This situation would reverse if the rupee appreciates. Such contracts may be settled either by delivery or setting off of gains or losses.

ii) **Futures contract**: A futures contract is a firm contractual agreement between a buyer and seller for a specified asset for a fixed date in future. This can simply be characterized as the standardized form of forward contract. The standardization may be in terms of minimum contact size, maturity, trading mechanism, delivery terms, etc. The contract price will vary according to the market price but it is fixed when the trade is made. Essentially, both the parties have the right as well as the obligation to perform under the futures contract. In the abovementioned example of XYZ Ltd, if the same contract is entered on the exchange floor or through terminal, it would tantamount to futures contract, exchange imposes the margin on both the parties to the contract and follows mark to market system to ensure that the contract is settled at the time of maturity. The futures contracts offer liquidity to the parties entering into the contract and immunity to counter party risk.

iii) **Option**: Unlike futures contract, an Option contract separates the right and obligation between the two parties. It confers the right upon the option buyer, but not the obligation to buy (call option) or sell (put option) a specific underlying asset at a specified price, known as strike price or exercise price, up to or on a specific future date. It can simply be described as an insurance policy bought by the option writer, who takes over the obligation under the contract. In case the right is exercisable only on the maturity, it is termed as European option, while on the other hand if the right is exercisable any time up until the maturity then it is termed as American option. In India, Options are not available when the underlying is a commodity, although it is available for the other underlying like currency, equity, and interest rate etc.

iv) **Exotic derivative**: These are derivatives with more complex structure than the standard contracts like futures or option. Their payoff is a complex function of one or more underlying. Therefore, it is obligatory on the part of parties entering into such arrangements
to understand the terms of the contracts. Some of the examples of exotic derivatives include 

Binary option\textsuperscript{2,1}, Asian option\textsuperscript{2,2}, Quanto option\textsuperscript{2,3}.

The present chapter is organized into eight sections. The present section covers the introduction of the chapter. Section 2.2 traces the evolution of derivative securities followed by next section (2.3) on the evolution of commodity derivatives in India. Section 2.4 and 2.5 document the risks in the derivative market and the volatility dynamics of these securities. Section 2.6 covers the favorable impact of derivative markets in terms of providing price discovery and hedging effectiveness which is the central theme of the present research work. Section 2.7 and 2.8 document the research gaps and the concluding observations.

2.2 Evolution of derivative securities

Although generally considered as a high-tech financial trading tool, derivatives have been around for quite a while. Though the rationale for using these securities has remained, by and large, the same. The use of derivatives as a risk hedging tool starts with a farmer who borrows money to sow the seeds while the harvest is after some time period. During the time interval of sowing and harvesting, the farmer faces major risk from weather, insects and the prices at which he would be able to sell the harvest. He cannot tolerate volatility, because of perennial debt. Derivative contracts enable the farmer to least escape the uncertainty of proceeds of selling.

Rather than being the bogeyman of financial destruction, derivatives are financial tools that if used properly make our lives easier. History shows that these financial instruments came into existence to solve real world issues that needed to be solved for business. Historians suggest that forward contracts were first used by Flemish traders who gathered for trade fairs on the land held by the counts of Champagne [291]. The traces of derivatives contracts can be gathered from the history. In the sixth century, Thalus a Greek Philosopher, instrumented an agreement by which he secured the rights of the olive presses. In the twelfth century, in order to bypass the risk of shipwreck and consequent loss, sellers at medieval trade fairs signed contracts, called \textit{letters de}

\textsuperscript{2,1} These are the option contracts with discontinuous payoffs. For example, a cash-or-nothing call pays nothing if asset price ends up below the strike price at maturity and a pre-specified amount, if ends up above the strike price.
\textsuperscript{2,2} These options have payoffs dependent upon the average price of the underlying asset during at least some of the life of the contract. They are relatively cheaper than the regular option contracts and may be more appropriate for some investors.
\textsuperscript{2,3} A Quanto option is one where two currencies are involved. The payoff is defined in terms of a variable that is measured in one currency and the payoff is made in the other currency.
faire, promising future delivery of the items they sold [32]. In the seventeenth century, another example of futures trading was seen in Yodoya Rice market in Osaka, Japan. These contracts were used by feudal lords to protect themselves against the bad weather or warfare. They used to sell the warehouse receipt- rice ticket- that gave the holder the right to receive a certain amount of rice of a specified quality, at a future date at an agreed price. This ensured a steady income for the landlords and a steady supply for the merchants who also made profit by selling the rice ticket in the rice market of Dojima. Formal futures market also appeared in Europe during the 1600s in Netherlands. The Dutch ‘Tulipomania’ of 1636-1637, involving the use of tulip futures, was among the most notable examples of early futures contracts which was also the reason for plunging the Dutch economy into a severe crisis that lasted for many years [123]. Exhibit 2.1 briefly explain the Dutch Tulipmania bubble.

Exhibit 2.1: Story of Tulipomania-the speculative episode
The tulip - Tulipa of the lily family Liliaceae, of which there were around 160 species - rows wild in the eastern Mediterranean countries and on the east from there. Tulips were first introduced to Western Europe in the 16th century when a sultan of Turkey sent bulbs and seeds to Vienna. Shortly after 1554, these seeds were sent to Amsterdam from Constantinople, where their popularity and appreciation of flower began to rise. This appreciation became, in time, very great, enormous prestige was soon attached to the possession and cultivation of the plant. And appreciation of the more exceptional of the flowers rapidly gave way to a yet deeper appreciation by an increase in the price that their beauty and rarity were commanding. For this, the bulbs were then bought, and by mid-1630s the increase seemed to be without limit. In 1637, a single tulip bulb was worth about ten times a craftsman’s annual income and a single Viceroy tulip bulb was allegedly exchanged for “a new carriage, two gray horses, and a complete harness.” Tulip bulb speculation became so widespread by 1636 that they were traded on Amsterdam’s Stock Exchange and in Rotterdam, Haarlem, Leyden, Alkmar, Hoorn, and on the London Stock Exchange. No person of the minimal sensitivity of mind felt that he could be left behind. The speculation became more and more tense. A bulb might now change hands several times at steadily increasing and wonderfully rewarding prices while still unseen in ground. In 1937, it came to end with the default on a tulip bulb contract by a buyer in Haarlem. Again the controlling rules were in command. The wise and nervous began to detach, no one knows for what reason; others saw them go; the rush to sell became a panic; the prices dropped as if over a precipice. This brutal popping of the tulip bulb bubble ended the Dutch Golden Age and hurled the country into a mild economic depression that lasted for several years. Charles Mackay, in Extraordinary Popular delusions and the Madness of Crowds, Boston, 1932, Page 30, remarked,” Substantial merchants were reduced almost to beggary, and may a representative of a noble line saw the fortunes of their house ruined beyond redemption.

Source: [123]

Swan [299] carried out the most comprehensive analysis of the history of derivative securities. He argued against the popular belief that the use of derivatives did not begin in just 17th century Japan or in 19th century Chicago; rather it is nearly 1400 years old. The example of Cuneiform contract for future delivery of barely and Cuneiform Bearer Bond for the delivery of slaves in future dates back to about 1700 BC and 1750 BC in ancient Mesopotamia. Even the clearing house facilities could be traced to this era wherein temples and other administrative officials were
directing the clearing functions for clearing house transactions. Similarly, the OTC derivative contracts could be traced back to third millennium BC in Egypt. The contracts, having flexible settlement system, were recorded in engravings on tombs and temple walls.

By the 19th century, derivative trading shifted from undisciplined trading of Over the Counter (OTC) market to more structured and standardized trading on organized exchanges. In 1848, the Chicago Board of Trade (CBOT) was the first derivative exchange which was formed to provide a place where buyers and sellers could exchange commodities. The earliest trading was in the form of spot trading which subsequently shifted to trading for futures. As per the earliest available records, first CBOT forward contract was made on 13th March 1851 for 3000 bushels of corn to be delivered in June at the price of one percent per bushel. Forward contracts had the limitations of being non-standardized and having counterparty risk. The true revolution in commodity trading took place in 1865 when CBOT made three important changes to the structure of their grain trading market. First, CBOT formalized the futures contracts on grain by standardizing the quantity, quality, delivery time and location. Second, CBOT made an effort to promote market integrity by the introduction of a clearing house to stand between the buyer and the seller and guaranteed the performance of each party. This crucial step eliminated the counterparty risk. The major innovation in derivative market happened when the futures contract was introduced in foreign currency futures in 1972, on the International Monetary Market (IMM), a division of the Chicago Mercantile Exchange (CME). After 1972, new forms of derivatives emerged as Equity Options (1973), Currency Swaps (1981), Futures on Interest Rate Swaps (1989), Captions (1993), Credit Default Options (1994), and Weather Derivatives (1997). Though the journey of derivatives trading started in commodities, but their territory had expanded rapidly with the introduction of foreign exchange and interest rate products. Table 2.1 shows the journey of derivative instruments in modern form.

Table 2.1: Evolution of derivative market

<table>
<thead>
<tr>
<th>Year</th>
<th>Derivatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1865</td>
<td>Corn, Oats and Wheat Futures</td>
</tr>
<tr>
<td>1870</td>
<td>Cotton Futures</td>
</tr>
<tr>
<td>Year</td>
<td>Contract Type</td>
</tr>
<tr>
<td>------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>1874</td>
<td>Futures on Butter and Egg</td>
</tr>
<tr>
<td>1882</td>
<td>Coffee Futures</td>
</tr>
<tr>
<td>1933</td>
<td>Silver Futures</td>
</tr>
<tr>
<td>1956</td>
<td>Platinum Futures</td>
</tr>
<tr>
<td>1961</td>
<td>Pork Belly Futures</td>
</tr>
<tr>
<td>1964</td>
<td>Live Cattle Futures</td>
</tr>
<tr>
<td>1966</td>
<td>Live Hog Futures</td>
</tr>
<tr>
<td>1978</td>
<td>Heating Oil Futures</td>
</tr>
<tr>
<td>1975</td>
<td>Treasury - Bond Futures</td>
</tr>
<tr>
<td>1983</td>
<td>Options on Equity Index, Options on T-Note Futures, Option on Currency Futures, Interest Rate Caps and Floors</td>
</tr>
<tr>
<td>1989</td>
<td>Futures on Interest rate swaps, Quanto Options</td>
</tr>
<tr>
<td>1993</td>
<td>Captions</td>
</tr>
<tr>
<td>1994</td>
<td>Credit Default Options</td>
</tr>
<tr>
<td>1996</td>
<td>Electricity Futures</td>
</tr>
<tr>
<td>1997</td>
<td>Weather Derivatives</td>
</tr>
</tbody>
</table>

Table 2.1 is by no means a complete picture of the evolution of derivatives in their modern form but it definitely indicates the phases and sequence of such development. The growth in the derivative contracts is unending. All over the world, new exchanges are coming into existence. New contracts are being introduced from time to time. In the history of financial markets, no market has ever grown or evolved rapidly as derivatives market. Started with the commodity as underlying assets, nowadays, derivatives are also available on weather and temperature. This is a testament to the efficacy and flexibility of these instruments, the resourcefulness, and professionalism of the new breed of financial engineers. Derivative securities are appreciated by financial managers for being an importance tool of financial risk management in volatile interest rate, exchange rate, and commodity price environment.

### 2.3 Evolution of commodity derivative market in India

Derivatives are considered as the fulcrum of a robust financial market. Healthy derivative markets are an essential prerequisite for placing the economy on a higher growth orbit. Compared
to other commodity markets, Indian commodity market has a long chequered history. India’s venerable open market tradition can be traced to the 4th century BC, when the esteemed scholar and statesmen Viṣṇugupta, or Chanakya, wrote the *Arthashastra*. In the later part of 19th century, the forward market developed in India, majorly as a financial activity of traders without any active role of cultivators.

The evolution of organized commodity market commenced with the establishment of Bombay Cotton Trade Association Ltd as a joint stock company in the year 1875. After cotton, in 1900, Gujarat Vyapari Mandali was set up as a first exchange to trade in oil seed derivatives at Bombay which later carried out futures trading in ground nuts, castor seeds, and cotton. The wheat futures market at Hapur began functioning from 1913. The Hapur market always served as a price setter for wheat in the country. The Calcutta Hessian Exchange Ltd, established in 1919, was the first organized exchange to regulate futures trading in raw jute. In 1927, East India Jute Association was established to trade in Calcutta. In 1921, trading in futures contract in cotton was started in Mumbai under the auspices of the East India Cotton Association (EICA). Bombay Bullion Association has been functioning since 1920 for derivative trading in gold and silver. In 1975, first futures trade in spices was organized by India Pepper and Spice Trade Association (IPSTA) in Cochin.

During the period of First and Second World War, the futures market in India flourished throughout the country. After the Second World War, futures trading of major commodities was prohibited under the Defence of India Act 1943 to control the delicate supply situation. After independence, the commodity futures trading again picked up and was thriving in the financial market. Most of the commodity futures markets were established by the beginning of the twentieth century and were regulated by close-knitted social groups. In order to provide a stable commodity market, a comprehensive legislation was enacted by the Bombay state in 1947 in the form of the Bombay Forward Contracts Control Act. Later, on the inclusion of the subject, “Stock Exchanges and Futures Markets” in the Union List, a central legislation called Forward Contract (Regulation) Act 1952 was enacted. Forward Markets Commission (FMC) was set up in 1953 in Mumbai as the regulator with the sole objective of providing the legal framework for organizing forward trading in the country. One of the important features of FC(R) Act was to notify a commodity for prohibition or regulation of forward contract. Under these provisions, a large number of commodities were notified for prohibition during the 1960s which left only a handful of
insignificant commodities open for forward trade. Under the Essential Commodities Act (ECA), 1955, free trade in many commodity items was restricted. This scenario continued for about four decades although the Dantawala Committee (1966) and Khusro Committee (1980) had given some recommendations to revive futures trading in more agriculture commodities. On the recommendation of Khusro committee, futures trading was reintroduced in most of the major commodities like potato, castor seed, and gur (jaggery). Khusro committee also marked that structural derivative institutions remained urban metropolitan entity because the cultivators could not take any advantage of futures trading.

After the introduction of economic reforms in 1991, a number of steps were taken to liberalize the commodity trade and industry in both the domestic and external sector. In this backdrop, the Government of India set up an expert committee on forward trading in commodity market under the chairmanship of Prof. K.N. Kabra. The committee submitted its report in 1994 with the major recommendation of the introduction of futures trading in 17 selected commodities. United Nations Conference on Trade and Development (UNCTAD) and World Bank Joint Mission Report (1996) “India: Managing price risk in India’s liberalized agriculture: can futures market help?” highlighted the role of futures markets as market-based instruments for managing risks and suggested the strengthening of institutional capacity of the regulator and the exchanges for efficient performance of these markets. Other committees namely, National Agricultural policy, 2000 and Guru Committee, 2001 also emphasized the need for futures trading to manage the price risk. In 1999, Government of India decided to replace the Minimum Support Price (MSP) as a price-hedging instrument with derivatives markets. After this commodity trading was allowed in different commodities time to time viz., in April 1999 futures trading in various edible oilseed complexes was permitted and in May 2001 futures trading in sugar was permitted.

Year 2003 was considered to be the impetus year for commodity market as a prohibition on futures trading has been completely withdrawn and three exchanges were recognized as National commodity electronic exchanges namely Multi commodity exchange (MCX), National Commodity and Derivative Exchange (NCDEX) and National Multi Commodity Exchange (NMCE).

In the year 2008, FMC issued guidelines on setting up of new National Multi Commodity Exchanges. In the year 2009 and 2010, Commission gave recognition to Indian Commodity Exchange Ltd (ICEX) and ACE Derivatives and Commodity Exchange (ACE) as 4th and 5th
National Exchange respectively. In the year 2012, a new exchange was established named United Commodity Exchange Ltd (UCX). With the development of these national exchanges, trading of commodity futures shifted from single commodity trading regional exchanges to multi-commodity trading national exchanges which also smoothen the processes of trading and clearing. Table 2.2 exhibits the evolution of Indian commodity derivative market.

Table 2.2: Evolution of Indian commodity derivative market

<table>
<thead>
<tr>
<th>Year</th>
<th>Derivative Organizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1875</td>
<td>Bombay Cotton Trade Association Ltd</td>
</tr>
<tr>
<td>1900</td>
<td>Gujarat Vyapari Mandali</td>
</tr>
<tr>
<td>1913</td>
<td>Hapur wheat futures</td>
</tr>
<tr>
<td>1919</td>
<td>Calcutta Hessian Exchange Ltd</td>
</tr>
<tr>
<td>1921</td>
<td>East India Cotton Association (EICA)</td>
</tr>
<tr>
<td>1920</td>
<td>Bombay Bullion Association</td>
</tr>
<tr>
<td>1945</td>
<td>East India Jute and Hessian Exchange Ltd</td>
</tr>
<tr>
<td>1975</td>
<td>India Pepper and Spice Trade Association (IPSTA) established in Cochin for Spice futures trade</td>
</tr>
<tr>
<td>2003</td>
<td>National Commodity Electronic Exchanges namely MCX, NCDEX and NMCE.</td>
</tr>
<tr>
<td>2009</td>
<td>Recognized ICEX as fourth national commodity exchange</td>
</tr>
<tr>
<td>2010</td>
<td>Recognized ACE as fifth national commodity exchange</td>
</tr>
<tr>
<td>2012</td>
<td>Recognized UCX as sixth national commodity exchange</td>
</tr>
</tbody>
</table>

2.4 Risks in derivative trading

Commodity derivative is a double edged sword. It can be used to hedge the possible risk and also have a huge potential of being misused. A survey conducted by Bodnar, Hayt and Marston [42] exhibits that a significant portion of derivative users is finding derivatives helpful in risk
management. The results of the survey shown in Table 2.3 indicate that foreign exchange risk is the risk most commonly managed by the derivatives followed by interest rate risk, commodity risk, and equity risk.

Nevertheless, derivative users are concerned about a number of factors with regard to derivative trading that includes valuation, transparency, and reliability of accounting disclosure of commodity derivative transactions, liquidity, understanding of the risk factors inherent in derivatives and extent of loss potential among others. The OTC derivatives being extremely complex in nature, have posed a challenge before the regulators all over the world because this segment has grown at a faster rate as compared to its counterpart, exchange traded derivatives. In the words of Warren Buffett, “the reinsurance and derivative business are similar: like Hell, both are easy to enter and almost impossible to exit,” [57].

Table 2.3: Risk management across risk classes

<table>
<thead>
<tr>
<th>Risk Class</th>
<th>Percent of derivative users active in that class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreign Exchange Risk</td>
<td>83%</td>
</tr>
<tr>
<td>Interest Rate Risk</td>
<td>76%</td>
</tr>
<tr>
<td>Commodity Price Risk</td>
<td>56%</td>
</tr>
<tr>
<td>Equity Price Risk</td>
<td>34%</td>
</tr>
</tbody>
</table>

Source: [57]

A study conducted by Horowitz and Makay [156] concluded that the commodity derivatives trader face same type of risk that public or private institutions face in their traditional business-credit, market, operational and legal risks. Hentschel and Smith [151] highlighted the five major types of risk associated with derivatives trading namely, price risk, default risk, liquidity risk, operations risk and systemic risk. They argued that derivatives are equivalent to the combinations of already existing securities. Therefore they do not introduce any new or different risk into the financial system. Tufano [310] observed that energy derivatives and foreign exchange derivatives are the most complicate derivatives, and if not managed correctly, they can create bigger problems than the one they purport to solve.
Like foreign exchange, gold and real estate, derivatives have also become a subject of speculation [180]. While the risk management using derivatives surely offers benefits, it may have certain risks as well. The complexity and leverage of derivatives can pose substantial risks if they are used improperly [25]. Recent derivative disasters have led corporates and their boards to review corporate risk management strategies carefully. All the investigations relating to these huge losses seem directed towards ferreting out mischievous rogue traders [310]. However, users of derivative securities cannot ignore the disastrous effects of derivative securities any longer. Some of the pervasively known losses in derivative trading are given in Table 2.4.

Table 2.4: Corporate losses attributed to derivatives

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Corporation</th>
<th>Loss( $ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Metallgesellschaft, AG</td>
<td>1000</td>
</tr>
<tr>
<td>2.</td>
<td>Baring Bank, UK</td>
<td>1330</td>
</tr>
<tr>
<td>3.</td>
<td>Yakult Honsha, Japan</td>
<td>523</td>
</tr>
<tr>
<td>4.</td>
<td>Natwest, UK</td>
<td>127</td>
</tr>
<tr>
<td>5.</td>
<td>Codelco, Chile</td>
<td>200</td>
</tr>
<tr>
<td>6.</td>
<td>Gibson Greetings, USA</td>
<td>20</td>
</tr>
</tbody>
</table>

Source: [196,168]

What are the reasons for these losses? The answer to this question requires a deeper insight into the risk associated with the derivative trading. A study conducted by Daigler and Wiley [84] exhibited that the less informed traders cause higher price volatility in futures market because of greater dispersion of beliefs that lead them to trade over a wide range of prices around the fair value of futures contracts. Lack of understanding of the terms of a deal by the participants may be another area of concern in derivative trading.

2.5 Volatility dynamics in derivative market

Volatility dynamics is an appealing topic among researcher as it is possible to model them to a certain extent. Lots of research related to presence of volatility dynamics in derivative market have already been conducted in mature countries but the evidence concerning emerging countries is much less advanced. The studies documenting the volatility dynamics can be divided into two parts: 1) stylized facts of volatility 2) impact of informational flow on volatility dynamics.
2.5.1 Stylized facts of volatility

Cont [77] defines stylized fact as a “property common across a wide range of instruments, markets and time periods”. A variety of stylized facts namely volatility persistence or clustering, mean reversion, fat-tailed distribution, and leverage effect have been documented in previous research papers. A brief review of literature is given below.

2.5.1.1 Persistence and mean reversion

In a first ever study conducted to examine the persistence in volatility by Mandelbrot [218] reported that the large changes in the price of assets are often followed by other large changes while the small changes are often followed by small changes. A study conducted by Crato and Ray [81] on commodity futures and currency futures found the presence of persistence in both the markets but the volatility was comparatively more persistent in the commodity market.

Karali and Thurman [171] investigated the existence of volatility persistence in Chicago Lumber market and found that time gap between arrival of news and delivery time of futures contract is the fundamental variable in explaining the volatility persistence. The presence of this phenomena is examined by many researchers in different financial market. Pati and Rajib [248] studied the volatility persistence in Indian equity market and confirmed its presence. Rao [263] studied the volatility persistence and spillover across equity market of Arabian Gulf Cooperation council (AGCC) and found the presence of persistence and cross-volatility spillover across six AGCC countries. It has been observed that volatility tends to cluster in developed countries and seems to be even more persistent in emerging countries [82].

Ghoshray [129] studied the impact of international shocks (Events) on international commodity prices and found that persistence of shocks depends on the individual commodity and the time period. Many empirical studies [104, 241, 59, 5, 311] showed that volatility is not constant and display clustering which is also referred as intermittency and long memory.

Poterba and Summers [257] demonstrated that volatility is weakly serially correlated which implies that the impact of the shock on the volatility does not last long and the prices ultimately come to their original level. This phenomenon termed as Mean Reversion and it was first documented in the US market by deBondt and Thaler [87]. It was concluded in his work that, in the long run, past losing stocks outperform the past winning stocks.

Balvers et al. [21] also found the evidence of mean reversion while studying eighteen developed equity markets and advocated the use of parametric contrarian investment strategy for
predicting the future equity prices. Fama and French [106] also have reported the existence of mean reversion in the US equity market by using long-horizon regression.

The results of previous studies on mean reversion [105, 255] have been criticized of small-sample biases by some researchers [264, 265]. Many researchers also criticized the results because standard econometric tests do not have sufficient power to discriminate a mean reversion process from a random walk process.

2.5.1.2 Leverage effect

Black [38] introduced the leverage effect first in equity market which later tested by many researchers in another financial market. According to Engle and Ng [101] a bad news creates more volatility as compared to the good news of the same magnitude in US equity market. Few other studies [74, 280] also affirmed this volatility asymmetry. Pindyck [251, 252] and Ng and Pirrong [239] conducted a study on physical commodities and found the evidence that high volatility periods are followed by high volatility periods and vice-versa. Many researchers opined that leverage effect is often reversed in emerging countries, i.e. the correlation between returns and volatility tends to be positive [26, 136]. Girard and Biswas [132] reaffirmed the results of leverage effect and also reported that returns in emerging markets exhibit a positive skewness.

A comparative study of the equity market and commodity market by Hunjra et al. [160] on gold price, cotton prices and sugar price along with KSE 100 index indicated that asymmetric and seasonal effect are more prominent in equity market than commodity market. The reason may be the equity market is more structured and organized as compared to the commodity market.

2.5.2 Impact of informational flow on volatility dynamics

The relationship among price volatility, trading volume, and open interest have been extensively investigated in developed countries for equity and futures market. Karpoff [174] provided a broad literature review on the relationship between trading volume and price volatility in equity and futures market. He found the positive relationship between volume and price change in the equity market. Foster [119] found the positive relationship between contemporaneous volume and price volatility for crude oil futures by using GARCH(1,1) and generalized methods of Moments models. He further confirmed the existence of Mixed Distribution Hypothesis (MDH) in crude oil futures. He also found that there is a significant relationship between lagged volume and price volatility.
Researchers have used different models and techniques to determine the relationship among volume, open interest and volatility. Mc Carthy and Najand [222] investigated currency futures using state space model and found no relationship between price variability and volume. A similar result is found by James and Edmister [162] and Wood et al. [320] in the equity market.

Fung and Patterson [121] investigated the dynamic relationship among volume and price volatility in the presence of open interest by using VAR and found that volume plays a predictive role in the determination of price volatility. While the most of studies have documented the positive relationship between trading volume and volatility, the seminal finding of Lamoureux and Lastrapes [199], that is, the GARCH effect vanishes or becomes insignificant, is empirically ambiguous. Several studies do not empirically support this notion. Sharma et al. [286] showed that inclusion of trading volume in the variance equation is not able to diminish the volatility persistence completely. Sabbaghi [273] investigated the impact of information flow on equity market volatility of five developed (G5) markets and provided evidence that trading volume fails to reduce the volatility persistence. Girard and Biswas [132] studied the asymmetric volatility and the degree of volatility persistence for 22 matured and 27 emerging markets and found that asymmetric volatility and the level of volatility persistence are higher in developed stock markets. Similar findings are documented by Ahmed, Hassan and Nasir [4] for Kuala Lumpur Stock Exchange.

Girma and Mougoue [133] suggested that current trading volume and open interest do not remove the GARCH effect in three out of the four energy product spreads traded in New York Mercantile Exchange (NYMEX).

Watanabe [318] conducted a study with Nikkei 225 stock index futures and found the significant negative relation between volatility and expected open interest. However, the results provided evidence that the relation may vary with the regulation.

Lee and Swaminathan [202] conducted a study with the firms listed with NYSE and American Exchange (AMEX) to find out the relationship between monthly returns and daily trading volume. He found that trading volume helps in predicting the return in equity market. Bekaert and Wu [27] supported these findings and added that a relatively greater response is generated to negative shocks in volatility than positive shocks of an equal magnitude and evidenced speed of information transmission in markets.
Mubarik and Javid [230] extensively studied the return, volume and volatility relationship at market and firm-level for Karachi Stock Exchange listed 70 firms by using granger causality test and EGARCH model. They found the empirical evidence that inclusion of trading volume in conditional volatility equation does not diminish the persistence of volatility for the majority of the stocks. The results also suggested the lead-lag pattern between return volatility and trading volume.

Thus, the findings of past studies are strong indications of informational role played by the volume and open interest and they can be used by investors to earn an abnormal profit.

Time and again, considerable efforts have been devoted to study the impact of volume and open interest on price volatility of emerging commodity market. Basci et al. [23] conducted a study in the Turkish market and found the cointegration relation between the price level and volume. Saatcioglu and Starks [272] conducted a study in Latin America and found the positive relation between price changes and volume. Their findings evidenced the positive price-volume relation.

Volume is an important statistic for market participants, regulators and futures exchanges. Chan et al. [62] conducted a study in four commodity futures (soybean, copper, mung beans and wheat) in Chinese commodity market and found a positive relationship between volume and volatility and negative relationship between open interest and volatility. Liu et al. [210] found that the large trading volume is an important determinant of volatility. Deo et al. [88] questioned the dynamic relationship among trading volume, volatility and price change in Asia-Pacific stock market between 2004-2008 and found the evidence of a contemporaneous relation between trading volume and the absolute value of stock returns. Thus, their findings supported the Mixed distribution Hypothesis (MDH).

Xiangli and shouyang [324] studied the correlation among return, volume and open interest in Chinese commodity futures market and found that impact of open interest on volatility and volume is weak but they found a strong correlation between volume and absolute return.

Of late, the emerging futures market of India has been the interesting area for researcher and investors, because of the improved capital market, improved trading settlements, computerized system, effective corporate governance and transparent and effective disclosure standards. A number of researches have been done to investigate the relationship between volume-open interest and volatility.
Kumar and Pandey [192] studied the impact of volume and open interest in selected eleven commodities of Indian commodity market. He found the positive relationship between lagged unexpected volume and volatility. He also found that open interest data is not a proxy of market depth in Indian commodity market.

Salman [277] investigated return, volume and volatility relationship in Istanbul Stock Exchange on Index data from 1992 to 1998. He reported a positive contemporaneous relation between return and trading volume when the volume is taken as a proxy for the information arrival into the market.

Sabri [274] tested the various predicting factors of stock return volatility by using monthly data of five different emerging markets including Turkey, Mexico, Malaysia, Korean and South Africa. According to his findings, trading volume could be an important source to predict return volatility in Turkey.

Pati and Rajib [248] conducted a study to investigate the volume-volatility relationship for NSE Nifty index futures and found that there is a substantial reduction in volatility persistence by using contemporaneous volume in conditional variance than lagged trading volume.

Gupta and Rajib [143] studied the influence of volume, open interest and time to maturity on return volatility on 8 commodities futures (aluminum, nickel, copper, gold, silver, natural gas, crude oil and wheat) by using GARCH family model. He found that trading volume has a significant impact on volatility compared to the time-to-maturity or open interest.

Maitra [215] studied the impact of expected and unexpected volume and open interest on volatility in Indian commodity market. He found that unexpected volatility and open interest has positive relationship with volatility, and the unexpected component of volume having greater impact than expected component of the trading volume. Whereas, expected open interest is negatively related to volatility.

Results obtained from the study conducted in emerging markets are somewhat different from a study conducted in the developed country. The most promising reason for these differences may be the loose standard of trading and unavailability of information to all the traders equally.

Hong [155] developed a dynamic model to study the effect of speculation on various aspects of returns and trading in futures. The model found that uninformed investors trade only for hedging reasons. The study concluded that in the markets where the information asymmetry among the investors is small, the return volatility of futures contract decreases with time to maturity.
However, in a market where the information asymmetry among the investors is large, the Samuelson’s effect need not hold. The study also concluded that new futures contracts tend to result in lower spot price volatility that increases the willingness of investors to take on larger spot positions.

Relationship among volume, open interest and volatility has been investigated in the past, but individual commodity futures are not adequately researched because of their recent introduction in the Indian financial market. A further investigation in context of Indian commodity market, especially in the light of global financial crisis, may extend the literature.

2.6 Favorable impact of commodity derivative market

The dramatic growth of commodity derivative markets in recent past can be attributed to the functions they perform. Derivative market not only reduces the volatility in spot market but it also enhances the liquidity of spot market and makes it more efficient [221]. The recent studies of commodity derivative market have led to broad consensus that they provide numerous benefits namely, risk management, price discovery and hedging effectiveness to the end users.

2.6.1 Price discovery

It has been found that the prices and/or volume tend to reflect new information more quickly after the introduction of derivative securities. According to Mayhew [221], futures or forward contracts reduce the transaction cost associated with taking a position in the market and their introduction is expected to increase the flow of information into the market leading to better price discovery. The role of the futures market in providing the effective price discovery has been an area of extensive empirical research. Many researchers have studied the role of the futures market in price discovery function in the context of developed and developing countries. A brief review of literature is given in following subsections.

2.6.1.1 Review of literature in the context of developed countries

Pizzi et al., [253] referred futures market as the stabilization agent because price discovery took place first in futures market then transmitted to spot market. Tse [309] evidenced that the market information is reflected more quickly in the futures market than spot market because of low transaction cost and absence of short sale restrictions.
Many researchers [96, 153, 176, 179, 297] supported the fact that information flow to the low transaction cost market plays a leading role for high transaction cost market and termed it trading cost hypothesis (TCH). However, the efficient market hypothesis favors the contemporary reflection of information in both futures and spot market. But some frictions of the market lead to the return or volatility spillover across the market.

Garbade and Silber [127] have done a seminal work of cross-market price discovery in New York stock exchange. They examined four commodities namely, wheat, corn, oats and orange juice to analyze the lead-lag relationship between spot and futures prices. They found that futures market dominates the spot market for wheat, corn and orange juice while the results for oats were not clear. They also argued that the elasticity of supply for arbitrage services is constrained by both storage and transaction costs. However, it is the time lag which impacts the degree of integration. They found that futures contracts do not, in general, provide perfect risk transfer facilities over short-run horizons. However, over the long run, cash and futures prices should be integrated. Studies conducted by Oellermann et al. [240] and Schroeder and Goodwin [279] also acknowledged the result of Garbade and Silber [127] for livestock contracts.

Brockman and Tse [53] studied lead-lag relationship between futures and spot prices in four agricultural commodities like canola, oats, barley, and wheat. By using VECM and Hasbrouck information model, they concluded that for all the four agricultural commodities the futures market plays the role of leader and the information reflects in spot market through futures. The lead-lag investigation has been conducted by Fortenberry and Zapata [112] for cheddar cheese, diammonium phosphate and anhydrous ammonia from the period June 1993 to July 1995. With the cointegration techniques, they evidenced the existence of cointegration relationship between futures and spot prices of diammonium phosphate and anhydrous ammonia markets while no cointegration relation was found between spot and futures prices of cheddar cheese.

Mattos and Garcia [220] studied the Brazilian agricultural market with six commodities namely, arabica, corn, cotton, live cattle, soybeans, and sugar to investigate the effect of trading activity on price discovery of futures markets. Their findings suggested that the price discovery function largely depends on the trading volume, as high trading volume results into the long-term relationship between futures and spot prices. However, thinly traded market shows no long term relation and displays a weak short-term interaction.
The linear and nonlinear causal linkages between daily spot and futures prices are investigated by Bekiros and diks [28] for maturities of one, two, three and four months of West Texas intermediate crude oil for the periods of October 1991 – October 1999, and November 1999 – October 2007 by using the techniques of VECM and GARCH – BEKK models. The results suggested that there was causality between spot and futures prices in both the periods. They also concluded that the futures market plays a bigger role in the price discovery process than spot market. A study conducted by Azizan et al. [15] in the Malaysian futures market using bivariate ARMA (p, q)-EGARCH (p, q) model suggested that there is bidirectional information flow in spot and futures market of crude palm oil.

If the return analysis is inconclusive for price discovery function, volatility spillover provides an alternative measure to study information transmission [63]. Spot and futures prices are impacted by the instantaneous and lagged effect of shocks and such information is used in decision making regarding hedging activities [314].

A study conducted by Chan et al. [63] to examine volatility spillover among S&P 500 Index stock and futures markets by utilizing the GARCH models. They found that innovations in either market spillover to the other, suggesting significant informational roles for both spot and futures markets. In contrast to Chan et al. [63], Koutmos and Tucker [184] showed that there is only unilateral volatility spillovers from the futures market to the spot market and any innovations originating in the spot market have no impact on the futures market. Arshanapali and Doukas [14] examined whether the S&P 500 index futures and the underlying spot index have the same volatility process. They reported the evidence against interdependence of volatilities in futures and spot markets.

In the currency futures market, Chatrath and Song [64] examined volatility spillover relationships between the spot and futures markets for Japanese Yen versus the US Dollar and argued that the futures volatility influences the spot due to the faster incorporation of market-related information, such as macroeconomic announcements in the US.

An interesting question in empirical financial economics is how the efficiency of the futures market play an important role in price discovery function. Any information comes in the financial market ultimately reflects in both the market but the lead-lag relationship between spot and futures market indicates whether the flow of information is uni-directional or bi-directional. Researchers have shown that the price discovery function depends on the efficiency of the futures market which
can be measured by long-term efficiency and unbiasedness. According to Kumar and Seppi [195], both futures and spot market contribute to the discovery of common and unobservable price which is termed as efficient price. Which market will play the role of price discovery depends on the microstructure of these markets. Microstructure studies how specific trading mechanisms affect the price formation process” [242]

Beck[24] suggested using cointegration techniques and Error correction model to test the efficiency and risk premium hypothesis. McKenzie and Holt [223] extended the Beck work by using cointegration techniques for estimating long-term efficiency whereas error correction model with GARCH in mean is used for testing short term efficiency. Frank and Gracia [120] enhanced the McKenzie and Holt [223] work by accounting for a structural break in the series. They found that bias in the futures market is not related to the risk premium but the information inefficiencies. The long-term market inefficiency may be because of less developed futures commodity market, market manipulation by large traders and government regulations [326, 316, 37]

2.6.1.2 Review of literature in the context of India

The empirical literature on price discovery and market efficiency for Indian commodity futures market is very sparse. Raju and Karande [262] used Cointegration and GARCH techniques to study price discovery function in Index futures and BSE 100 Index. They found that the futures market try to make the equilibrium and play the role of leader. They also concluded that introduction of derivative trading has significantly reduced the volatility in the spot market.

Thenmozhi and Thomas [302] analyzed the lead-lag relationship between spot and futures prices of Nifty and S&P CNX Nifty futures by using the VECM-SURE and EGARCH models. VECM-SURE evidenced the existence of bi-directional Granger causality between spot and futures market, but spot market plays an important role in price discovery. By using the impulse response function, they concluded that it is the spot market which dominates the futures market prices. By using the EGARCH, they showed that volatility spillover between spot and futures market is bidirectional.

Praveen and Sudhakar [259] investigated the lead-lag relationship between spot and futures prices of Nifty index of National Stock Exchange (NSE) and found that both the market work independently from each other.

Pradhan and Sham [258] studied the Nifty spot and futures market by using Johanson cointegration test and VECM model. The study found that futures market plays a dominating role
in price discovery process. Uma and Jaiswal [312] reconfirm the finding by using generalized impulse response analysis.

Most of the study conducted in Indian context deal with warehousing facility, policy issues like imposing of different taxes on commodity futures contract, restriction of cross-border movement of commodities etc. A study conducted by Thomas [304] emphasized the importance of price transparency, institutional setup, cash settlement and dematerialized warehouse receipts for the development of the futures market in India.

Roy and Kumar [270] studied the integration among wheat spot and futures markets by using the Johansen cointegration methodology. They used Garbade-Silber [127] model to study the lead-lag relationship between spot and futures prices. It was found that the cointegration across spot markets has increased after the introduction of the futures market. Lead-lag relationship between spot and futures markets was mixed and wheat futures contracts have low hedging effectiveness. Most of the studies conducted in Indian context are either had serious procedural limitations or addressed to problems of regional exchanges which had low liquidity because of the absence of an electronic trading platform. After the inception of three national exchanges in 2003, trading in futures contracts has increased many folds. In the context of these exchanges, there is a need to investigate the linkage between spot and futures markets afresh.

Karande [172] employed the cointegration technique to study the linkage between Indian castor seeds futures and spot market. They found that there is unilateral causality from futures market to spot market.

Price discovery function has been studied by Iyar and Pillai [161] in Indian commodity market for copper, gold, silver, chickpeas, nickel and rubber. They concluded that in the case of copper, gold, and silver, the rate of convergence of the information is almost instantaneous during the expiration week. However for rest of the commodities, the rate of convergence of information slack during the expiration week.

Price discovery function is also examined in the context of Indian commodity markets, viz. Gold, Silver, Crude oil, Castor seed, Jeera and Sugar by Shihabudheen and Padhi [287]. The study suggested that futures price efficiently perform price discovery function in the case of Gold, Silver, Crude oil, Castor seed, Jeera. They found that the volatility spillover exists from futures to spot market in all cases except sugar. Kumar and Arora [194] investigated the price discovery in Indian precious metal by using Johansen cointegration and Granger causality test. He concluded that spot
and futures prices are cointegrated in Indian precious metal and futures market play a leading role. Sehgal et al. [282] conducted a price discovery study on Indian agricultural commodity and concluded that the Indian agricultural market is still in its nascent stage and policymakers should support the trading to curb the inflation in the market by providing the supportive infrastructure for trading.

An extensive literature review showed that numerous studies have been done on equity market but the number is meager in the commodity market. Maximum studies conducted in commodity market have been limited to regional exchanges and for a few commodities with small samples from the period prior to setting up of national exchanges [303, 275, 233]. The Indian commodity futures markets have since matured as trading volume increased manifolds. The lead-lag relationship in returns and volatility between spot and futures markets has also not been explored extensively by the earlier studies on Indian commodity markets. Many researchers have empirically studied the price discovery and volatility spillover in older regional commodity exchanges [233] but the fewer studies [282, 93, 213, 190] have been conducted to analyze the price discovery function of the newer national multi-commodity exchanges. It is well acknowledged that changes to market microstructure take time for full adoption, particularly in markets where participants have lower access to information.

2.6.2 Hedging effectiveness

Hedge ratio and hedging effectiveness is not a new phenomenon in the futures market. In the developed countries, a number of studies have been conducted on the issue of hedging effectiveness with futures [107, 231, 232, 246, 72, 110]. However, in the Indian context, the literature of hedging effectiveness is not extensive.

The main theoretical issue which has been discussed in the literature revolves around the techniques to be used to calculate optimal hedge ratio. A number of techniques have been discussed by the scholars on the basis of particular objective function. The most widely used hedging strategy is based on the objective of minimization of the variance of the hedged portfolio [94, 166, 232]. But the ignorance of expected return value in this approach makes this hedge ratio inconsistent with mean-variance framework.

Many researchers [60, 158, 157] proposed the hedging strategy which incorporates the minimum variance expected utility function of the hedged portfolio. However, if the futures price
follows a pure martingale process there would be no difference between optimal mean-variance hedge ratio and the MV hedge ratio.

Some researchers [60, 204, 205] proposed the calculation of optimal hedge ratio by maximization of the expected utility. Attempts have been made from time to time to eliminate these specific assumptions regarding the utility function and return distributions. Scholars developed some hedging strategies namely mean extended-Gini (MEG) coefficient, generalized semi-variance (GSV) or lower partial moments for achieving this objective. The above discussion makes it clear that the optimal hedge ratios are determined on the basis of objective function.

In addition to objective function, the assumption about the nature of hedge ratio is also important. Some researchers assume the hedge ratio to be static or constant in nature [29, 128, 157, 182] while other assume the dynamic nature of hedge ratio [18, 60, 283].

Many different techniques have been employed to estimate the hedge ratios, ranging from simple to complex ones. Ordinary least squares (OLS) technique is the most used technique in the literature [29, 217]. However, few others have used more complex methods such as the conditional heteroscedastic (ARCH or GARCH) method [18, 283].

Roy and Kumar [269] examined the hedging effectiveness of wheat futures using OLS and found that hedging effectiveness provided by futures markets was low (15%). Ghosh [128] concluded that a smaller than optimal futures position is undertaken when the cointegration relationship is unduly ignored. He attributed the under-hedged results to model misspecification.

da-Hsiang [83] argues that the estimation of the hedge ratio and the hedging effectiveness may change sharply when the possibility of cointegration between prices is ignored.

Alexander [7] has studied the hedging performance of international equity portfolio with the focus of cointegration relationship. This study concluded that there is long term implications of hedging in the cointegrated market and error correction method based results provide a better indication of cointegrated series.

Lien and Luo [207] have shown that, although GARCH may characterize the price behavior, the cointegration relationship is the only truly indispensable component when comparing the ex-post performance of various hedging strategies.

It has been the long-term interest of researchers to find out the best method to calculate the hedge ratio which reduces the variance. Yang et al. [326] studied the hedging ratio and efficiency for Australian futures markets for the period from January 1988 to December 2000. He conducted
a comparative analysis of four techniques OLS regression, Bayesian Vector Autoregressive (BVAR), Error Correction Model (ECM) and Multivariate Generalized Autoregressive Conditional Heteroskedasticity (MGARCH). The study suggested that the out of three constant hedge ratio provided by OLS regression, Bayesian Vector Autoregressive (BVAR), Error Correction Model (ECM), ECM generated the highest hedge ratio value while MGARCH dynamic hedge ratio provided the greatest degree of variance reduction.

According to Serrano and Martin [284], when the market trend is stable, the hedge ratio becomes smaller, whereas if a big fluctuation in the market takes place it will get larger.

Gagnon et al. [122] and Floros and Vougas [111] examined the hedging effectiveness of German stock Index DAX futures and Greek Stock index futures market respectively and found that the dynamic hedge ratio model (GARCH models) is superior to constant hedge ratio models. The study concluded that time- varying hedge ratio outperforms the constant hedge ratios in the long term.

In equity derivative market, a number of studies have been conducted all over the world but the commodity market is still less researched. A study conducted by Pennings and Meulenberg [249] for potato futures contract concluded both basis and the market depth risk contribute to the relatively inefficient hedging possibilities.

In the Indian context, Several researchers have examined the price dynamics and hedging efficiency between commodity futures and spot prices but time span of these studies was very short as they have been conducted shortly after the start of the national exchanges in late 2003 [93, 213]. A study conducted by Kumar et al. [190] has examined the hedging efficiency of the Indian commodity futures for both agricultural and non-agricultural commodities. This study suggested that the hedging effectiveness of the futures contracts for a non-agricultural commodity is lower than that of an agricultural commodity.

Ripple and Moosa [266] studied the impact of maturity on the hedging effectiveness for the crude oil futures and spot price of NYMEX and found that hedging is more effective with the near month futures. It is also explained that the hedge ratio was lower for near month hedging, which is explained in the terms of Samuelson [278]. Mossa [227] has found in his study that the hedging effective is indifferent to the alternative models.

A study conducted by Bhaduri and Durai [36] measured the hedging effectiveness of Indian stock index futures by using four econometric models; OLS regression, VAR, VECM and
MGARCH for stock index futures of National Stock Exchange. The results suggest that time-varying hedge ratio provides higher mean return and higher average variance reduction across hedged and unhedged position. It was also observed that in terms of variance reduction, GARCH model gives better results only in long-time horizons as compared to the simple OLS method which works well in the short-time horizons. Bose [48] analyzed the hedge effectiveness of commodity futures (MCX) Indices in India. The analysis indicated that the national commodity Indices behave like the equity Indices in terms of efficiency and flow of information. It was also confirmed that futures market helps to reduce volatility in the spot prices of the relevant commodities and provide for effective hedging of price risk.

2.7 Research gaps

An extensive literature survey has suggested that there is a lack of unanimity among the studies conducted across different asset classes, market and time period. Some studies support the influence of informational role by volume and open interest on the persistence and asymmetricity of volatility while some others negate that. Some studies advocate that commodity futures play the major role in price discovery while some others oppose this. The reason could be, the formal Indian commodity derivative market is still in its nascent stage as it was established in the year 2003. Still, the Indian commodity derivative market has not evolved according to market microstructure.

Another gap identified was the absence of enough number of studies which could address the issue of price discovery and hedging effectiveness in the Indian commodity derivatives. Most of the studies conducted in Indian context either had serious procedural limitations or addressed problems of regional exchanges which had low liquidity because of the absence of an electronic trading platform. So literature fails to reflect the true picture of Indian commodity market. An attempt has been made to identify and address these research gaps through the present study.

2.8 Concluding observations

The present chapter has reviewed the literature pertaining to derivatives with a view to study the current state of research. The available literature shows that there is no unanimity among the studies conducted across different asset class, market and time period. In the context of commodity derivatives, most of the trading takes place on OTC exchanges which carry no paper trail because they are private agreements. Even today, international commodity and financial markets, which
have always been a primary focus of derivative dealings, remain beyond the reach of national statistical offices. Thus the literature available for commodity derivative is limited.

Based on the detailed analysis of past studies, a number of issues deserve special attention and warrant empirical examination in the Indian context. However, it is pertinent to acknowledge here the contribution made by the previous researchers in setting the clear agenda for the current research initiative, to expand the body of knowledge further. This study is an effort to measure the informational efficiency, price discovery and hedging effectiveness of Indian commodity market.