Chapter – II

REVIEW OF LITERATURE

2.1 Introduction

In this chapter, the researcher discusses the past studies related to the current research area of price discovery and hedging effectiveness. It includes different studies on the mechanism of price discovery and hedging effectiveness in different countries spot and futures trading in stocks, commodity and currency markets in global perspective. Many of the studies investigate the relationship between the spot and futures market for stock and commodity and examine the risk level of stocks and commodities in the futures market. This chapter highlights on the purpose, methodological tools and the outcome of the results in the various spot and futures markets. Further, the researcher classifies the reviews into five categories, such as

1. Studies on price discovery
2. Studies on lead-lag relationship
3. Studies on long run relationship and linkages between spot and futures market
4. Studies on volatility modelling
5. Studies on hedging effectiveness

2.2 Studies on Price Discovery

Alphonse (2000)1 focused on the efficient price discovery in the French Equity Stock Index and futures markets. A co-integration test of Johansen was used for analyzing the relationship between two markets. For testing the feedback effect
between the cash and futures market, the Error Correction Model (ECM) was employed. The Vector Moving Average (VMA) has been tested for the evaluation of the contributions to the price discovery. Intraday transaction prices with 50,020 price observations for the CAC 40 index futures were obtained from MATIF SA for the period from January 3rd, 1995 to March 31st, 1995. The empirical evidence revealed an existence of cointegration between the cash and the futures market. The researcher has concluded from the results that the futures lead the spot and at least ninety-five percent of the price discovery is attained in the futures markets.

Roope and Zurbruegg (2002)² have investigated by comparing of the information efficiencies between the Singapore exchange and the Taiwan futures exchange for Taiwan Index futures listed in both markets. The sample period covered from January 11, 1999, to 31 June 1999 for both TAIFX and Singapore futures contracts. The results provide a strong evidence to suggest that price discovery primarily originates from the Singapore futures market.

Raju and Karande (2003)³ studied the price discovery mechanism and volatility in the National Stock Exchange (NSE) futures market. The researcher used cointegration and Generalized AutoRegressive Conditional Heteroscedasticity (GARCH) technique to attain the objective of the study. The daily closing price of the future index has been collected from the NSE website for the period of June 2000 to October 2003. They found that the futures market responds the deviation from equilibrium and price discovery occurs in the both markets.

Hodgson et al. (2003)⁴ attempted to evaluate the dynamic nature of the price discovery process across the Australian stock index futures market and large, medium, and small stocks during different trading phases (bear – and bull – market phases). The two research problems have been examined in the study. First, whether information
search and price discovery change across stock markets in a bull phase, and second, whether trading activity in futures market decreases the relative proportion of informed trading according to the market phase. A multivariate cointegrated Vector Error Correction Model (VECM) and variance decomposition techniques were used to test the data statistically. A sample of fifteen-minute observation was considered for the period April 1, 1992 through March 30, 1993. The analysis revealed that price discovery process varies with different trading phases. In the short term, futures prices play a dominant role in the transmission of price information. The futures market heavily influences stock prices in the bear phase, whereas the homogeneity of stock prices, rises substantially in the bull phase. The futures price influence has declined due to increase in the autonomy of small stocks in the bull phase.

Kenourgios (2004)\textsuperscript{5} described the cointegration test and an ECM to examine the relationship between price movements of FTSE/ASE-20 three-month futures index and the underlying cash market in Athens Stock Exchange (ASE). Price data on the FTSE/ASE-20 stock index and the three-month FTSE/ASE-20 index futures contract are from the ASE and the Athens Derivatives Exchange (ADEX) respectively. Daily data are used during the period from August 1999 until June 2002. The results show the presence of a bi-directional causality between stock index spot and futures markets, indicating that the newly established ADEX can provide futures contracts that serve as a focal point of information assimilation and fulfil their price discovery.

Gupta and Singh (2006)\textsuperscript{6} have analysed the Indian equity market efficiency by price discovery. They chose the near month contract of Nifty index futures and 24 stock futures on a daily basis from June 2000 to February 2005. Johansen’s cointegration and ECM are applied to test the causality between futures and cash market. They found through analysis the futures contracts have worthy trading volume.
Pradhan and Bhat (2009) observed the price discovery, information and forecasting in Nifty futures markets. They used Johansen’s (1988) VECM to examine the causal relationship between spot and futures prices. The study also compares the forecasting ability of futures prices on spot prices with three major forecasting techniques such as Autoregressive Integrated Moving Average (ARIMA), Vector Autoregressive (VAR) and VECM model. The main dataset for the study consists of the daily closing values of the Standard and Poor (S&P) CNX Nifty index futures and spot Nifty index, which is considered from June 12, 2000, to November 28, 2007. They found from VECM that the spot market leads the futures market and spot prices tend to discover new information more rapidly than futures prices. The VECM perform well on a post-sample basis against the univariate ARIMA model and a VAR model. The results show clearly the importance of enchanting into account in the long-run relationship between the futures and the spot prices in the forecasting future spot prices.

Christos (2009) has evaluated the price discovery between futures and spot markets in South Africa over the period from 2002 to 2006. They employed four empirical methods such as cointegration test, VECM, Granger causality test, and an ECM with Threshold GARCH errors. Empirical results show that FTSE/JSE Top 40 stock index futures and spot markets are cointegrated. Furthermore, the Granger causality, VECM and ECM-TGARCH (1,1) results suggest a bidirectional causality (feedback) between futures and spot prices. The study shows that futures and spot play a strong price discovery role in FTSE/JSE Top 40 futures prices lead spot prices and vice versa.

Caporale et.al (2010) examined the role of crude oil spot and futures prices in the process of price discovery by using a cost-of-carry model, unit root test, and VECM. The sample consists of daily price of crude oil from January 1990 to December 2008.
The study proves that futures markets play a more important role than spot markets in the case of contracts with shorter maturities, but the relative contribution of the two types of market turns out to be highly unstable, especially for the most deferred contracts. The implications of these results for hedging and forecasting crude oil spot prices were also discussed.

**Chinn and Coibion (2010)** have investigated the predictive content of futures prices for commodities, including energy, precious and base metals, and agricultural commodities. This study examined whether futures price was an unbiased and accurate predictor of subsequent spot prices. Precious and base metals fail in most of the tests of unbiasedness and were poor predictors of subsequent price changes. In contrast, energy futures and to a lesser extent, agricultural futures fare much better. The results showed that these differences reflect liquidity conditions across markets. In addition, a broad decline in the predictive content of commodity futures price since, the early to mid-2000s was authenticated.

**Srinivasan (2012)** investigated the price discovery process and volatility spillovers in Indian spot-futures commodity markets through the Johansen cointegration test, VECM and the Bivariate Exponential Generalized Autoregressive Conditional Heteroscedasticity (BEGARCH) model. The study used four futures and spot indices of the Multi Commodity Exchange of India (MCX), representing relevant sectors like agriculture, energy, metal, and the composite index of metals, energy and agro-commodities. The presence of long-term equilibrium relationships between the futures price and its underlying spot price of the commodity markets was confirmed from the Johansen cointegration test. Commodity spot markets of agriculture, energy, metal, and the composite index of metals, energy and agro-commodities played a dominant role and served as effective price discovery vehicle, implying that there was
a flow of information from spot to futures commodity markets which was found using VECM. The BEGARCH model indicated that although bidirectional volatility spillover persists, the volatility spillovers from spot to the futures market were dominant in the case of all MCX commodity markets.

Lee et.al. (2013)\textsuperscript{12} have focused the information effects on the futures and its spot market. They used intraday data for examining the relationship between the returns and trading activity of Taiwan stock index futures and the spot returns. The results of the overall market indicate that the futures market leads the spot market. This paper shows that informed traders do choose to trade in the futures market. In particular, foreign institutional traders tend to be better informed on both spots and futures price movements.

Kumar Mahalik et.al. (2014)\textsuperscript{13} have investigated the price discovery and volatility spillovers in Indian spot-futures commodity markets. They used four futures and spot indices of Multi commodity Exchange (MCX), Mumbai. This study also employs VECM and BEGARCH model EGARCH to analyse the price discovery and volatility spillovers in Indian spot-futures commodity market. The results of VECM show that agriculture future price index (LAGRIFP), energy future price index (LENERGYFP) and aggregate commodity index (LCOMDEXFP) effectively serve the price discovery function in the spot market implying that there is a flow of information from future to spot commodity markets but the reverse causality does not exist. There is no cointegrating relationship between metal future price index (LMETALFP) and metal spot price index (LMETALSP).

Arora Sunita, and Narender Kumar (2014)\textsuperscript{14} have analyzed the futures market role in price discovery. They took the non-precious metals of copper and aluminium for this study. The closing price of the non-precious copper and aluminium
was taken from MCX from the period of January 2006 to December 2011. The price discovery has been found out by cointegration, VECM and the Granger causality test. The results suggest that there is a bi-directional causality between both markets but the futures market is found to be more sound in terms of discounting new information than the spot market.

Joshy and Ganesh (2015)\textsuperscript{15} have pinpointed the price discovery process of gold in the Indian commodity market. The purpose of the study was to analyses the price discovery process of gold and the dynamic relationship between spot and futures markets. The researchers have used VECM to examine the price discovery and they have employed GARCH model for evaluating the volatility of spot and futures markets. The results of VECM indicate that the spot market is dominant in the price discovery process. It implies the information efficiency of the spot market. The findings of GARCH model highlight the significant price volatility impact of both futures and spot market prices on the returns.

Sehgal et.al (2015)\textsuperscript{16} examined the price discovery and volatility spillovers in spot and futures prices of four currencies namely, USD/INR, EURO/INR, GBP/INR and JPY/INR)and between futures prices of both stock exchanges namely, Multi-Commodity Stock Exchange (MCX-SX) and NSE in India. The researchers have applied co integration test of Johansen’s along with VECM to investigate the price discovery. GARCH-BEKK model is used to examine the volatility spillover between spot and futures and between futures prices. The results of the study show that there is long-term equilibrium relationship between spot and futures and between futures markets. Between futures and spot prices, futures price appears to lead the spot price in the short-run. Volatility spillover results indicate that the movement of volatility
spillover takes place from futures to spot in the short-run while spot to futures are not found in the long-run.

**Kothari Anil and Kothari Ranjana (2016)**\(^{17}\) in their paper investigated the long-term equilibrium relationship between India IVIX spot and IVIX futures contracts prices. This study is based on time series data which is considered from 26\(^{th}\) Feb 2014 to 26\(^{th}\) Feb 2016. The researcher examines the long-term and short-term relationship between the IVIX and IVIX futures by Granger cointegration test and ECM. The results show that the IVIX and IVIX futures prices demonstrate proof of significant co-movement, however, the spot IVIX values are more volatile than IVIX futures contract prices. The study concluded that the spot IVIX and IVIX futures price have a positive relationship and are cointegrated revealing long-term equilibrium relationship between them. However, the degree of cointegration depends on the expiration period. Shorter maturity futures contract prices have higher cointegration with IVIX.

**Clapham et.al. (2016)**\(^{18}\) have attempted to analyse the price discovery and price convergence in securities trading in multiple venues. The listed blue chip stocks are taken for the period of 2009 to 2013 from different venues. The paper empirically discovers a persistent price leader-follower relationship not only during intraday auctions but also in subsequent continuous trading. They find that trading on alternative venues instantly dries out in case the dominant market switches to a call auction. In these situations, alternative markets await and adopt the official price signal of the dominant market although prices on alternative venues still indicate a certain extent of price discovery.
2.3 Studies on Lead-lag Relationship

M. Thenmozhi (2002)\(^9\) has attempted the lead-lag association among the NSE Nifty stock index spot and futures index returns. The purpose of the study is to investigate the volatility of spot market and analysis the lead-lag relationship between the spot index and futures index returns. The researcher takes the daily closing price of Nifty spot and futures index from June 1998 to July 2002. The results show futures index returns lead the spot index returns. It is also shown that the spot index does not lead the futures index returns.

Brooks et.al (2001)\(^{20}\) have conducted a study on the lead-lag relationship between the spot index and futures contract for the FTSE 100 index. They applied Engle-Granger cointegration and ECM, the cost of carry ECM, ARMA and VAR to examine the objective. They used 10-minutes interval of stock price observations from June 1996 to 1997. The result brings out that there is a strong relationship between spot and futures prices. Besides, they found that the futures reruns lead the spot returns, while the lead–lag relationships between spot and futures markets do not occur for more than half an hour.

Floros and Vougas (2007)\(^{21}\) have done a study on the lead-lag relationship between futures and spot markets in Greece. For both available stock index futures contracts FTSE/ASE- 20 and FTSE/ASE Mid 40 of the ADEX, they employ a BGARCH model to explain price discovery of futures market over the crisis period from 1999 to 2001. Empirical results confirm that futures market plays a price discovery role, implying that futures prices contain useful information about spot prices.
Swaroop Debasish (2009) has evaluated the lead-lag relationship between the NSE Nifty stock market index and its related futures and options contracts. The purpose of the study was to investigate the lead-lag relationship between the NSE Nifty stock index and futures index and to analyse the interrelation between derivative markets in NSE Nifty index. The researcher has used the serial correlation of return series and autoregressive moving average model for studying the lead-lag relationship between hourly returns on the NSE Nifty index and its futures and options contracts. The ARMA model result shows that the NSE Nifty derivatives markets tend to lead the underlying stock index. The futures market clearly leads the cash market although this lead appears to be slightly over time. Although the options market leads the cash overall, there is some feedback between the two with the underlying index leading at times. Further, it is found that the index call options lead the index futures more strongly than futures lead calls, while the futures lead puts more strongly than the reverse. The study concludes that the derivative contracts on NSE Nifty lead the underlying cash market. Thus, the derivative markets are indicative of futures price movements and this will certainly be helpful to potential investors to design their own portfolio.

Malabika and Srinivasan (2009) have analyzed the temporal lead-lag and causality between Mini gold spot and futures market by taking daily closing values for both the indices from the sample period from January 01, 2005 to December 31, 2008, for the MCX of India. The spot and futures market variables were determined by using Augmented Dickey Fuller and Phillip Perron tests which indicated that the two series were stationary at level one. Johansen's cointegration test and VECM were employed to analyze the long run and speed of equilibrium between the bivariate variables. The findings revealed that both the markets are cointegrated and there exists a causal relationship between these two markets in the long run. Unidirectional causality was
running from spot to futures market in long-run dynamics and spot market served as a primary market for price discovery.

**Streeter et.al. (2015)**\(^{24}\) have attempted high-frequency level to examine the lead relationship between price change, trading volume and volatility in S&P 500 index futures. The researchers chose the period of the study from pre-financial crisis and the data comprised from 2008 a period of 2005 to 2007. It includes the 3, 27,860 observations during the period. They found the bidirectional shock upto three to four lags in a minute at return level. About the volatility level the researchers found that trading volume has predictive power to forecast the return at lag three levels.

**Zhou and Wu (2015)**\(^ {25}\) have examined the intraday dynamic relationship CSI 300 index futures and spot market in china. This study used five-minute interval frequency data. The researchers used VAR and Multivariate Generalized Autoregressive Conditional Heteroscedasticity (MGARCH) models. The result shows that there are bidirectional price causal relationships between the CSI 300 index futures and spot markets, the index futures return shock affects the spot market more severely than the spot return shock affects the futures market, indicating that the index futures market dominates the price discovery process between the two markets. There are bidirectional volatility spillover effects between the CSI 300 index futures and spot markets, and the spillover effects from index futures to spot almost equal to that from index spot to futures.

**Li et.al. (2016)**\(^ {26}\) have investigated the lead-lag relationship between rebar future and spot prices which is listed in Shanghai Futures Exchange. They analysed the market efficiency rebar futures on the basis of price and cointegration relationship. The result indicates rebar futures price has normally distributed, the rebar futures markets
have weak efficiency, and the rebar futures prices have a long-run relationship with spot prices, one day lagged spot prices are the causes of the variations in futures prices.

### 2.4 Studies on Long-run Relationship and Linkages between Spot and Futures Market

Tan (2002)\(^{37}\) analyzed the temporal causal relationships between spot and futures markets using daily closing prices for both Malaysian Stocks Composite Index (MSCI) and Kuala Lumpur Futures Index (KLFI). The Johansen cointegration was used to test for long run equilibrium. The standard Granger F-statistic, Hsiao’s sequential approach (HSM), including the error correction variable for testing the short and long run causality were employed to evaluate the causal nexus between spot and futures markets. The data for the study period were comprised from 2\(^{nd}\) January 1996 to 29\(^{th}\) September 2000. The empirical analysis indicated that both MSCI and KLFI series are cointegrated. The empirical regression from standard regression causality and Hsiao’s sequential approach (HSM) revealed a bidirectional relationship for the short-run period; while the ECM provides the evidence that the stock index futures KLFI lead the MSCI.

Kavussanos and Nomikos (2003)\(^{38}\) have identified the causal relationship between futures and spot prices in the freight futures markets employing the VECM and General Impulse Response (GIR). Besides, the study compared the forecasting performance of the VECM with that of VAR, ARIMA and Random Walk (RW) models. The data series consists of daily spot and futures prices from 1\(^{st}\) August 1998 to 30\(^{th}\) April 1998. The results showed that futures price tend to discover new information more rapidly than spot prices and information from the futures prices can be used to generate more accurate forecasts of the spot prices.
Ryoo and Smith (2004) have examined the impact on the spot market of trading in Korean KOSPI 200 futures. For testing cointegration and causality and the analysis of lead-lag relationships, a 5-minute data was used from the start of futures trading from May 1996, to the end of December 1998. The data from the Korean Stock Exchange include minute-by-minute KOSPI 200 spot and futures series. The empirical results showed that futures trading increases the speed at which information is impounded into spot market prices, reduces the persistence of information and increases spot market volatility. Besides, the study reveals that the spot and futures prices are cointegrated and there is bi-directional causality between the two markets. The lead-lag relation is asymmetric with a weak evidence that the spot index leads futures and a strong evidence that the stock index futures market leads the spot market.

Wing-Keung et.al. (2004) attempted to find the relationship of Asian emerging countries stock market with the major established economies of the world. For this purpose, they have employed weekly stock prices of the Asian countries from Jan 1981 to Dec 2002. They used cointegration for this purpose to explore the integration in a diverse mix of the Asian countries. The researcher found out that there is a relationship between the emerging equity markets of Asia. However, they said that the emerging markets exhibit some short run integration among them. They also said that their study will be helpful for investors in terms of decision making and foreign investments because they have provided the associations of emerging with the developed equity markets.

Ceylan and Dogan (2004) examined the market co-movement of Organization of Islamic Cooperation (OIC) countries. In this study, the researcher has included Pakistan, Lebanon, Morocco, Jordon, Oman, Kuwait and Egypt equity market.
The researchers proved that the association of Lebanon with Kuwait and their results also reveal the market of Turkey and Egypt.

**Islam et.al. (2005)** studied the exploring relationship of Malaysia, Singapore and India equity markets. In order to explore the dynamics of these equity markets, they used the multivariate approach of cointegration. The Granger Causality test was used to analyse the causality of the equity markets. This study is based on the equity closing price, the daily data taken from July 1997 to Feb 2005. Their results pointed to unidirectional flow from Singapore equity market to Malaysian equity market. While the other market has been found with bidirectional flow.

**Lamba (2005)** analyzed the short and long run relationship between South Asian and developed equity markets such as Japan, UK and US. He used the Granger causality for examining the causal flow of the market. He found that there was only one response from the Indian equity markets to the developed markets while the other markets of Pakistan and Sri Lanka showed no such trend.

**Mukherjee and Mishra (2006)** studied the co-movements of the stock price in both market spot as well as the futures market. The researcher has studied co-movements of spot and futures markets at the index level, industry level and also at the stock level. The study comprises of daily data for Nifty spot index, Nifty futures index, and also the daily prices of some selected stocks listed in both the spot as well as the derivative market, over a period from January 2002 to June 2004. The study applied Engle and Granger’s (Engle and Granger, 1987) test of causality and cointegration, and Geweke measure of feedback to empirically investigate the flow of information among spot and futures market and there was no such cause and effect relationship among the stock prices in those markets. The study found that both the spot and futures price series
possess unit root and both of them are cointegrated in almost all the cases. In the case of Nifty index, they find that neither Nifty index futures nor Nifty spot index lead and there is a strong contemporaneous and bi-directional relationship among the index and index futures market in India. As far as the flow of information for stocks are concerned, it shows mixed evidence. The direction of the flow of information from one market to another keeps changing over a period of time. It also varies from one underlying stock to another.

**Glezakos et al. (2007)**\(^3\)\(^5\) studied the exploring integration of different equity markets of the world in comparison with Athens stock market. In this study they included the developed markets, USA, Japan, France and Germany, England, Spain, Italy, Holland and Belgium with the Athens market for the period 2000-2006. They confirmed the integration of Athens market with different markets. They found the evidence of multidirectional spill over in different markets.

**Pradhan and Bhat (2007)**\(^3\)\(^6\) have pinpointed the causal relationship between spot and futures markets for underlying 31 individual stocks of S&P CNX Nifty. They employed Johansen's cointegration test and VECM to examine the objective of the study. The daily closing data are taken from November 9, 2001, to September 29, 2005, for investigation. The results revealed mixed findings. It is concluded that the futures lead the spot in case of nine individual securities, spot leads futures in case of seven individual securities and that a feedback relationship exists between the two markets in case of nine individual securities.

**Chang and Lee (2008)**\(^3\)\(^7\) said that the threshold error-correction model (TECM) was used to investigate the asymmetric causal relationship between spot and futures in Taiwan by using the intraday data running from Jan 2001 to May 2005. The empirical results found the existence of cointegration and a bidirectional feedback causality.
relationship between spot and futures markets from the Granger-Causality tests based on the corresponding TECM.

**Ismail and Rahman (2009)**[^38] made an attempt to explore the Asian equity markets and the well-established market of US. They have used four markets; Hong Kong, South Korea, Malaysia and India. Their study was undertaken by using monthly indices from 1996 to 2008. They found the evidence of the relationship of US market with Asian by using the analyses of VAR model.

**Srinivasan (2009)**[^39] has analysed the causal relationship between Nifty spot index and index futures market in India. Johansen’s Cointegration and VECM are employed to investigate the causal relationship between spot and futures prices. The empirical analysis was conducted for the daily data series from June 12, 2000, to September 12, 2008. The observed results reveal that there exists a long-run relationship between Nifty spot and Nifty futures prices. Further, the results confirm the presence of a bidirectional relationship between the Nifty spot and Nifty futures market prices in India. This study concluded that both the spot and futures markets play a leading role through price discovery process in India and are said to be efficient information efficient and respond more quickly to each other.

**B. Kumar and Pandey (2011)**[^40] investigated the cross-market linkages of Indian commodity futures for nine commodities with futures markets outside India. These commodities range from highly tradable commodities to less tradable agricultural commodities. The cross-market linkages in terms of return and volatility spillovers were analysed. The nine commodities consisted of two agricultural commodities like Soybean, and Corn, three metals like Aluminum, Copper and Zinc, two precious metals namely Gold and Silver, and two energy commodities such as

[^38]: Ismail and Rahman (2009)
[^39]: Srinivasan (2009)
[^40]: B. Kumar and Pandey (2011)
Crude oil and Natural gas. Using the Johansen’s cointegration test, ECM, Granger causality test and variance decomposition techniques return spillover were investigated. The BGARCH model was applied to investigate volatility spillover between India and other World markets. It was found that futures prices of agricultural commodities traded on the National Commodity Derivatives Exchange (NCDEX), India and Chicago Board of Trade, prices of precious metals traded on the MCX, India and New York Mercantile Exchange (NYMEX), prices of industrial metals traded on the MCX and the London Metal Exchange (LME) and prices of energy commodities traded on MCX and NYMEX were cointegrated. For commodities, the world markets showed to have a bigger (unidirectional) impact on Indian markets. Bi-directional return spillover between MCX and LME markets was found using a bivariate model. However, the effect of LME on MCX was stronger than the effect of MCX on LME. Results of return and volatility spillovers indicated that the Indian commodity futures markets function as a satellite market and assimilate information from the world market.

Natanelov et.al. (2011) have discussed the perception of co-movement of commodity prices, particularly the study focused on price movements between crude oil futures and a series of agricultural commodities and gold futures. A comparative framework was applied to identify changes in relationships through time. Johansen cointegration test, causality from VECM and Threshold cointegration were employed. The results indicated that co-movement was a dynamic concept and that some economic and policy development may change the relationship among commodities.

Byrne et.al. (2011) have analyzed the co-movement and determinants of commodity prices. They used non-stationary panel methods, the study is statistically significant degree of co-movement due to a common factor. Within a Factor Augmented VAR approach, real interest rate and uncertainty, as assumed by a simple
asset pricing model, were both found to be negatively related to the common factor. The results were robust to the inclusion of demand and supply shocks, which both positively impact on the co-movement of commodity prices.

Sharma (2011)\(^4\) studied the integration of Asia emerging equity markets with US equity market. The researcher used the cointegration for exploring the associations between these equity markets. His analyses confirmed that the emerging markets are influenced by the US market. So the emerging market investors cannot earn benefit by investing in US market.

Ali et.al. (2011)\(^4\) studied the integration of Pakistan market with a diverse mix of economies. They used the developed market of US, Japan, UK and China and other markets of India, Indonesia, Singapore, Malaysia and Indonesia for this purpose. The monthly data taken from 1998 to 2008 have been analyzed by using the cointegration analyses. They found that the equity market of Pakistan is not integrated with the equity market of Singapore, UK, USA, Malaysia and Taiwan.

Hussain et.al (2012)\(^4\) empirically examined the association of Pakistan equity market with the East Asian Stock Markets. The researcher took stock indices monthly data from the year 2000 to 2010. They used cointegration and error correction technique. Their analyses confirmed no relationship between the equity markets of East Asia. However, they found unidirectional flow from Japan to equity market of Pakistan and to equity market of China.

Khan and Aslam (2014)\(^4\) carried out a study for finding integration among developed equity markets and Karachi Stock Exchange for the period from 1999 to 2012. They have applied cointegration analyses for this purpose. They found that Pakistan equity market is weakly integrated with the developed stock markets. They
also found that KSE has an influence on France stock market, London stock market and US stock market.

Sehgal et.al (2015) have investigated the long-run equilibrium and volatility spillovers in spot and futures prices of four major currencies such as USD/INR, EURO/INR, GBP/INR and JPY/INR and between futures prices of two stock exchanges MCX-SX and NSE in India. The researchers applied the Johansen’s cointegration test along with VECM to investigate the price discovery. The results suggested that there was a long-run equilibrium relationship between currency spot and futures markets.

Hammoudeh et al. (2016) have studied the global linkages of BRICS stock markets with US and Europe. The sample period covered from 29 September 1997 to 10 September 2015. All the data were sourced from Datastream International database. The results indicated the evidences of the leverage effects and fractional integration in conditional volatility for all markets. The market linkages at the group level, represented by the anticorrelation coefficient, change over time, with an increasing tendency after the onset of the GFC 2008–09, which confirms certain degree of contagious effects across markets.

Thomas and Chen (2016) have investigated the dynamic conditional correlation of China market and international stock market returns. The data used in this empirical study include stock indices for emerging markets and some major Asian markets including China. The data covered the daily trading stock indices from May 12, 1998 to July 31, 2015 with a total of 4494 observations, including the Shanghai stock index (China A-shares), the Hang Seng index (Hong Kong), the Taiwan weighted stock index (Taiwan PI) the Korea SE composite index (South Korea), the Tokyo stock index (Japan), the emerging markets stock index, the southeastern Asia market index,
the Euro STOXX 50, and the S&P 500 composite (US). The results found that the Asymmetric Dynamic Correlation Coefficient model (ADCC) indicate that all correlations are time-varying. Second, the dynamic correlations display a level shift or smooth transitional upward changes over time. The evidences confirmed a structural change right after China’s adoption of a higher degree of financial liberalisation, such as China’s admission to the World Trade Organization (WTO) at the end of 2001 and the implementation of the QFII scheme beginning in 2003. The study suggested that the risk from the US market, as proxied by VIX from the US market, played a significant role in explaining the dynamic correlation function.

**Teng et al. (2016)** have attempted to analyses the dynamic linkages and volatility spillover between China economic activities with five Asian countries stock market. This study covered monthly data from January 1991 to March 2015. The results indicated that the VAR model Granger causality test observed no volatility spillover from Chinese economic activities to the ASEAN-5 stock markets, except for Malaysia and the Philippines. However, the ASEAN-5 stock markets’ volatility exerted a significant influence on China’s economy, except for Singapore’s stock market volatility. This study revealed that ASEAN-5 has gradually become the preferred destination for diversifying equity portfolios for investors in China.

**S. Rajamohan and G. Arivalagan (2017)** have analyzed the long-run relationship of the Midcap50 index and their corresponding individual stock returns. This study covered from January 1, 2008, to December 31, 2016. The daily closing price of the midcap index and its stocks were collected from the official website of NSE. The researchers have used the Granger causality test to estimate the causal relationship between the midcap50 index and its stocks. The results concluded that 18
companies stock having the unidirectional causality relationship with the midcap50 index. The Tata chemical stock and midcap50 index have the bidirectional causality.

S. Rajamohan and G. Arivalagan (2017) have examined the co-movement between the Asian continent stock exchange indices. The researcher covered the Asian continent countries such as China, India, Japan, Korea, Indonesia, Malaysia, Pakistan, Russia and Singapore and the stock exchange indices price were collected from the respective stock exchanges for the period from April 2003 to March 2016. From the results, it is understood that Straits Times Index (STI) and Sensex have the highest returns among other stock indices and RTS had the highest standard deviation among other indices. The Granger causality test concluded that the Sensex had the unidirectional relationship among all stock markets.

2.5 Studies on Volatility Modelling

Bekaert and Wu (2000) investigated the leverage effect and time-varying risk premium explanations of the asymmetric volatility. They concluded that the mechanism behind asymmetry for the high and the medium leverage portfolio is covariance asymmetry. They also concluded that negative shocks increase conditional covariance substantially, whereas positive shocks have a mixed impact on conditional covariance.

Karmakar (2005) analysed the heteroscedastic behaviour of the Indian stock market using GARCH. The various econometric models are used to see whether the market volatility is asymmetric or not. It was found that the asymmetric volatility occurs in the market because of the impact of past information about the market performance and its rise during the period when the market declines.
Floros and Christos (2008)\textsuperscript{55} examined the application of asymmetric GARCH models for modelling volatility and explained the financial market risk. They used two major indices such as CMA General index from Egypt and TASE-100 index from Israel. The results from the study provide strong evidence that asymmetric GARCH models can better explain volatility in two countries stock markets. The results of the study also conclude that increased risk will not necessarily lead to increased return in the market.

Goudarzi et.al (2011)\textsuperscript{56} examined market volatility of BSE 500 stock index during the financial crisis of 2008-09. The researcher analysed the market effects by good and bad news about the market trend. The EGARCH and TGARCH models were shown in the BSE 500 indexes where volatility is increased by the bad news of the market.

Mehta and Sharma (2011)\textsuperscript{57} discussed that Indian stock market has witnessed various confrontations during last two decades resulting in occurrence of alternate phases of the market cycle. They documented that the Indian equity market has witnessed the prevalence of time varying volatility where the past volatility has more significant impact on the current volatility.

Nawazish and Mawal Sara (2012)\textsuperscript{58} examined the volatility patterns in Karachi Stock Exchange using GARCH framework between 2004 and 2012. This implied that all estimates of risk in this period based on standard deviations must be flawed and would have understated the actual risk. They proposed that higher order moments of returns should be considered for prudent risk assessment.

Abdalla and Suliman (2012)\textsuperscript{59} made an attempt to model volatility in Saudi stock market TAS Index. They applied various asymmetric GARCH models like EGARCH, TGARCH and PGARCH. They observed that the persistence of conditional
volatility and the results of their studies were in favour of 'positive correlation hypothesis' which established a positive relationship between volatility and expected a stock return. Their studies also confirm the presence of leverage effect in market returns.

**O. Kalu and Stephen Friday (2012)**\(^6\) analyzed the response of volatility to negative and positive news in Nigerian stock exchange (NSE) by using daily closing prices from January 2\(^{nd}\) 1996 to December 30th, 2011. Results of their study supported the presence of an asymmetric effect in the NSE stock returns but the study did not confirm the presence of leverage effect. The study provided evidence in support of positive news producing higher volatility in the immediate future than negative news with the same magnitude.

**Som Sankar and Tanmay (2012)**\(^6\) attempted to find the asymmetry and leverage effect of Sensex. The outcome of the study expressed the returns of Sensex were serially correlated and there is volatility clustering in the study period.

**Singhania and Anchalia (2013)**\(^6\) have analyzed volatility in Asian stock markets and global financial crisis. They used EGARCH model. The analysis is done by using time series data of daily returns for the period 2005-2011 of the major indices of these countries (Hang Seng, Nikkei 225, Shanghai Composite and Nifty for Hong Kong, Japan, China and India, respectively). The results found that the sub-prime crisis had a positive impact on the volatility of returns of Japan, China and India while it had no impact on the volatility of returns of Hong Kong. In addition, it is interesting to see that the period of Eurozone debt crisis has had a negative impact on the volatility of already highly volatile stock returns of countries such as India and China.

**Singhania and Prakash (2014)**\(^6\) have conducted a study on cross-correlation of South Asian Association for Regional Cooperation (SARRC) countries stock returns.
The data consist of stock indices from India, Bangladesh, Sri Lanka and Pakistan, the daily closing price covered from 2000 to 2011. The results indicate the presence of serial autocorrelation in stock market returns, implying dependence of current stock prices on stock prices of previous times and leads to rejection of Efficient-Market Hypothesis (EMH). Correlation between stock indices of SAARC economies is found to be low which is in line with intra-regional trade being one of the lowest as compared to other regional groups. The study concluded towards a greater need for economic cooperation and integration between SAARC countries. Greater financial integration leads to the development of markets and institutions, effective price discovery, higher savings and greater economic progress.

Yao and Yao (2016) have studied the impact of the future stock index on spot market volatility. The researcher used GARCH model with dummy variables. The dataset comprised of CSI index from 2005 to 2015. The result indicates that after the launch of the CSI 300 index futures, the stock market volatility increased in the past five years. Policy measures such as improvement of both spot and futures market are necessary to contain the risks.

G. Arivalagan and S. Rajamohan (2015) have investigated the volatility pattern of the BSE index of Sensex. The researchers have taken Sensex closing price of Sensex for the period of 1997 to 2016. The Sensex closing price retrieved from the official website of BSE. Three models are used to test the volatility of the Sensex in this study. The models are such as ARCH, GARCH and TGARCH. Hence, among these three models, TGARCH is the suitable model to identify the volatility of Sensex. Overall results present that the BSE Sensex returns have the volatility and previous day news affects the next day returns.
2.6 Studies on Hedging Effectiveness

Ruttachai (2000) has studied the hedging performance of All Ordinaries Share Price Index (SPI) futures contract of the Australian derivatives market. The researcher employed the Variance Minimization strategies for examining the objective of the study. The data used for the analysis covered the period from January 1992 to July 1998. The empirical results reveal that the Working’s strategy enhances the performance of hedging over the naïve strategy. Besides, the variance minimization model is found to perform better than the naïve model in terms of risk reduction.

Butterworth and Holmes (2000) have analysed the hedging effectiveness of stock index futures contracts of FTSE -100 and FTSE-mid250 traded in the UK. The researchers have used Least Trimmed Square approach (LTS) and Minimum Variance Hedge Ratio (MVHR) model to estimate the optimal hedge ratio. The dataset has been collected from February 1994 to December 1996 for the analysis. The empirical results show that the FTSE-mid250 contracts an additional hedging instrument despite relatively thin trading. The new FTSE-mid250 futures contract is found to be more effective for hedging Investment Trust Companies (ITCs) than the established FTSE-100 contract.

Lien et.al. (2002) have done a study on the hedge ratios for ten futures contracts covering the period from January 1998 to June 1998. The futures contracts consist of three currency futures, five commodity futures and two stock index futures such as British Pound, Deutschmark Japanese Yen, soybean oil, wheat, crude oil, corn, cotton NYSE composite index and S&P500 respectively. The Ordinary Least Squares (OLS) method and constant correlation VGARCH model were employed to estimate the hedge ratios. The empirical results reveal that the OLS hedge ratio performs better than the VGARCH hedge ratio.
Harris and Shen (2003) have made an attempt to the optimal hedge ratio for the FTSE100 stock index futures covering the period from 4th May 1984 to 3rd May 2002. They have employed the standard rolling window approach and robust Exponentially Weighted Moving Average (EWMA) estimator for calculating hedge ratio. The results revealed that the robust Optimal Hedge Ratio (OHR) yields a hedged portfolio variance that is marginally lower than that of the standard estimator. Moreover, the variance of the robust OHR is as much as 70 percent lower than the variance of the standard OHR, substantially reducing the transaction costs that are associated with dynamic hedging strategies.

Pattarin et.al. (2004) have investigated risk transfer functions of futures on the MIB-30 stock index for the period 1994-2002. The study employed Naïve, OLS, the ECM, GARCH and EWMA methods for estimating minimum variance hedge ratios. The empirical results reveal that the EWMA hedge ratios beat Naïve, OLS, ECM and GARCH based hedging strategies. The study concludes that FIB-30 contract is to an effective risk transfer instrument. Five different hedging strategies were considered, and all reduced the index portfolio variance from four to five times. Time-varying hedge ratios based on exponentially weighted moving average estimates of the variances and covariance of returns innovations provided the best hedges on the grounds of thorough in- and out-of-sample comparisons.

Floros et.al. (2004) have conducted study on the hedging effectiveness of stock index futures for the FTSE/ASE20 and FTSE/ASE Mid40 indices traded in Greece. They employed OLS method, ECM, VECM and BGARCH model to estimate the effectiveness of hedging performance. The dataset comprises from August 1999 to August 2001 and January 2000 to August 2001 for the FTSE/ASE20 index futures and FTSE/ASE Mid40 index futures respectively. The analyses reveal that the BGARCH
model provides greater variance reduction in both cases of Greek stock index futures contracts.

Choudhry (2004)\textsuperscript{72} has examined the hedging effectiveness of three large Pacific Basin stock futures for the period from January 1990 to December 1998. To compare the hedging effectiveness, the study estimated hedging ratios from constant, the unhedged, the traditional hedge and the minimum variance hedge models. Besides, the BGARCH model is applied to compute time-varying hedge ratio as it takes into consideration the time-varying distribution of the cash and futures returns. The empirical result shows that the time-varying GARCH hedge ratio out-performs the constant hedge ratios in most of the cases.

Chen et.al. (2004)\textsuperscript{73} have observed the effects of the length of hedging horizons on the optimal hedge ratio and hedging effectiveness using nine different hedging horizons for twenty-five different futures contracts of USA, UK, Canada, Japan and Australia. They applied OLS method to estimate the short- and long-run hedge ratios. The empirical results indicated that the short-run hedge ratios are significantly less than one and increased with the length of hedging horizons. The study also found that hedging effectiveness improved with the length of hedging horizon. However, the long-run hedge ratio is found to be close to the naïve hedge ratio of unity. It is understood that if the hedging horizon is long, then the naïve hedge ratio is close to the optimal hedge ratio.

Agostino and Casillo (2004)\textsuperscript{74} have identified the optimal hedge ratio of FIB-30 index futures contract of the Italian derivatives market. The study used OLS regression model, the Bivariate Vector Autoregressive model (BVAR), the VECM and MGARCH model to estimate hedge ratios. The dataset has been designed from 28
November 1994 to June 2004 for examining hedging performance. The first 2459 observations are used for the in-sample test, leaving the last 30 observations for an ex-ante hedge ratio performance comparison. The analyses reveal that only the GARCH model is able to outperform the OLS model in both the ex-post and ex-ante hedge ratio performances.

Yang and Allen (2005) have examined the optimal hedge ratios for the Australian All Ordinaries Index (AOI) and its corresponding Share Price Index (SPI) futures contracts from four different modelling frameworks such as, an OLS-based model, a VAR model, a VECM and a Multivariate GARCH model. The researchers compared the hedging effectiveness of these hedge ratios using ex-post (in-sample) and ex-ante (out-of-sample) hedge periods based on two differing approaches, the risk-return comparison and the utility-maximization method. The study has covered the time period from 6 June 1992 to 31 December 2000. The data are collected from two different sources and trading dates for one AOI series matched for SPI. After adjustment, there was a total of 2194 observations. Out of a total of 2194 observations, 2174 were used for in-sample estimations, leaving the remaining 20 observations for out-of-sample hedge ratio performance comparison. The analysis revealed that time-varying GARCH hedge ratios performs better than constant hedge ratios in terms of minimizing risks, but when return effects are also considered, the utility-based measure prefers the OLS method for the in-sample hedge, whilst both approaches favour the conditional time-varying MGARCH hedge ratio estimates in out-of-sample analyses.

Lien and Shrestha (2005) estimated the optimal hedge ratios for twenty-four different futures contracts of USA, UK, Canada, Japan and Australia over the period from 1982 to 1997. To examine the objective, the study employed ECM with optimal lags determined by Akaike Information Criterion (AIC) and their proposed Focus
Information Criteria (FIC) respectively. The new methods are applied to both daily and weekly data. The out-of-sample performances of the simple hedge ratio, computed without lags, the AIC hedge ratio, and the FIC hedge ratio is also analysed, with the use of 1 year’ worth of daily and weekly data. In general, both AIC and FIC hedge ratios are found to be larger than the simple hedge ratio. Thus, larger transaction costs are required for both hedging strategies. The analyses reveal that the ECM AIC hedge ratio outperforms the ECM FIC hedge ratio as well as the simple hedge ratios in terms of hedging effectiveness.

**Laws and Thompson (2005)** have studied the efficiency of hedging stock portfolios using futures stock indices covering the period from January 1995 to December 2001. The hedged portfolios consisted of the assets of seventeen investment companies quoted on the London Stock Exchange and two portfolios, which were assumed to match exactly the corresponding cash index. Two futures indices were used to hedge the funds namely FTSE100 and FTSE250 futures indices which are quoted on London International Financial Futures and Options Exchange (LIFFE). Weekly observations were used for providing 365 observations for each variable. The total sample was split into two sections. The first 261 observations were used to estimate the optimal hedge ratio (i.e. the in-sample period) providing 260 returns for each variable and the remaining 104 (i.e. the post-sample period) observations were utilized to check the efficiency of the estimated hedge ratio. In addition, a second estimation window was tried using the last 30 observations of the in-sample period. The study estimated the optimal hedge ratio including OLS, methods allowing for the existence of Autoregressive Conditional Heteroscedasticity, and an EWMA. The analysis reveals the following conclusions that the FTSE250 index provided a better hedge than the FTSE100 index, the hedge ratios for the investment companies portfolios were
considerably less than unity; This is contrasted with the position for the two composite portfolios; The degree of protection in the form of risk reduction afforded by hedging was quite small for the investment companies portfolios; This also is contrasted with the hedging results for the two composite portfolios where higher levels of risk reduction were obtained and Using a shorter period for estimation of the hedge ratio yields little improvement in the resulting hedge.

In and Kim (2006)\textsuperscript{78} in their paper evaluated the hedging effectiveness of the S&P 500 stock index futures contracts using wavelet analysis over the period from 21 April 1982 to 31 December 2001. The empirical findings reveal that each hedging horizon has a unique hedge ratio; the long-horizon hedge ratio converges to one, and hedging effectiveness converges to one as the hedging horizon (wavelet time scale) increases. The study concludes that the investor with extremely low-risk repulsion has most effective hedging at the short-term scale, whereas an investor with extremely high-risk repulsion can achieve the most effective hedging at the long-term scale. However, an investor with moderate risk aversion has the highest utility at the intermediate-term scale. Therefore, the hedging effectiveness depends not only on the time scale but also on the risk repulsion coefficient of the individual investor.

Hatemi-J et.al. (2006)\textsuperscript{79} have pinpointed the optimal hedge ratio for the Australian Share Price Index (SPI) futures contract during the period from 1 January 1998 to 8 September 2001. They have employed the fixed coefficient model and Kalman Filter approach for estimating the optimal hedge ratio. The analyses reveal that the use of the Kalman Filter approach for estimating time-varying hedge ratio performs better than the constant or fixed coefficient model.

Cotter and Hanly (2006)\textsuperscript{80} have conducted a study on the hedging effectiveness of futures market with the use of an extensive set of performance
evaluation matrices across seven international markets. The hedging performances for short and long hedgers are compared with the use of traditional variance-based approaches together with modern risk-management techniques, including Value at Risk (VaR), Conditional Value at Risk (CVaR) and approaches based on Downside Risk. They used daily stock index and stock index futures contracts from seven major indices spanning the period from 1 January 1998 to 31 December 2003. The analyses revealed that the use of various performance metrics based on the variance, the semi-variance, Lower Partial Moments (LPM), VaR and CVAR to evaluate hedging strategy are found to be better when compared with the traditional variance measure. Also, significant differences in performances between short and long hedgers are found.

Bhattacharya et.al. (2006)\textsuperscript{81} estimated the optimal hedge ratio for Indian futures market involving a cross-section of seven firms across a spectrum of industries. The study employed unconditional and conditional versions of the bivariate BEKK-GARCH model of Engle and Kroner for computing risk minimizing hedge ratios. The dataset for the study has been considered from January 2002 to September 2005. The results show significant improvement in the estimation of the time-varying hedge ratio over static hedge ratios, which corresponds to the error correction types of models. The study concludes that the time-varying hedge ratios calculation makes perfect sense in terms of portfolio allocation decision.

Ripple and Moosa (2007)\textsuperscript{82} investigated the effect of the maturity of the futures contract used as a hedging instrument. The daily and monthly data on the West Texas Intermediate (WTI) crude oil futures and spot prices were used to work out the hedge ratios and the measures of hedging effectiveness. The study used the near-month contract and a more distant (6-month) contract in order to calculate various measures.
The results showed that futures hedging were more effective when the near-month contract was used. The hedge ratios were lower for near-month hedging.

Gupta and Singh (2007) have investigated the optimal hedge ratio for Indian traders through the examination of three indices (namely; Nifty, Bank Nifty and CNX IT) and eighty-four most liquid individual stock futures traded on NSE of India. The study compares the efficiency of hedge ratio estimated through OLS, VAR, VECM, GARCH (p,q), EGARCH (p,q) and TGARCH (p,q) models in the minimum variance hedge ratio framework. The study has covered the time period from January 2003 to December 2006. The empirical results confirm that unconditional hedge ratio outperforms the conditional hedge ratio after controlling basis risk. The study results favour the hedge ratios estimated through VECM because of the presence of cointegration between spot and futures markets.

Sultan and Hasan (2008) have investigated the optimal hedge ratios for selected four European stock index futures contracts like AEX, DAX, CAC-40 and the FTSE-100. The study employed Naïve, OLS, BGARCH, ECM and GARCH-X model to estimate the hedge ratios. The daily dataset for AEX and FTSE-100 index futures contracts covers the period from January 1990 to 2006. For CAC-40 stock index futures, the sample period covers from August 1999 to January 2006 and for DAX index futures from November 1990 to January 2006. The empirical results reveal that the GARCH error correction model is shown to offer superior risk reduction compared with the competing models in three out of four cases. The empirical results suggest that in several cases the dynamic hedging outperforms the conventional hedging by a significant margin. The results also suggest that a dynamic hedging strategy should be the choice of a hedging method for large investors looking to minimise the risk of their sophisticated bets that combine both primary and secondary markets. For a small
investor, care must be exercised to determine the appropriateness of the conditional hedging model.

Kumar et al. (2008)\(^8\) have evaluated the hedging effectiveness of constant and time-varying hedge ratios in Indian stock and commodity futures markets. The researcher estimates the hedge ratio for S&P CNX Nifty index futures, Gold futures and Soybean futures. They used OLS regression model, the VAR, the VECM to estimate constant hedge ratios and VAR-MGARCH model is applied to estimate dynamic hedge ratio. The analyses result reveals that the VAR-MGARCH model estimates of time-varying hedge ratio provide the highest variance reduction as compared to hedges based on constant hedge ratio.

Kenourgios et.al. (2008)\(^8\) estimated the hedging effectiveness of the S&P 500 stock index futures contracts using weekly settlement prices for the period from 3 July 1992 to 30 June 2002. The hedging effectiveness and the stability of optimal hedge ratios are examined by time and in-sample forecasting analysis for the hedging performance. The hedging performance of this contract is examined by considering alternative methods, both constant and time varying, for computing more effective hedge ratios. They used simple OLS, the ECM, the ECM with GARCH errors and the GARCH and Exponential GARCH models for competing for more effective hedge ratios. The study reveals that the ECM is superior to the other models employed in terms of risk reduction. Finally, the results of testing the stability of the optimal hedge ratio obtained from the ECM suggest that it remains stable over time.

Kavussanos and Visvikis (2008)\(^8\) have discussed the hedging effectiveness of the FTSE/ASEX-20 and FTSE/ASEX Mid-40 stock index futures contracts traded in Greece. The study employed OLS, the VECM, VECM-GARCH and VECM-GARCH-
X models for estimating optimal hedge ratios. The dataset used for the analyses consists of weekly and daily cash and futures prices of the FTSE/ASEX-20 and FTSE/ASEX Mid-40 markets from 1 September 1999 to 7 June 2004 and 1 February 2000 to 7 June 2004 respectively. Using weekly and daily data, both in sample and out-of-sample hedging performances are examined in these markets. The empirical results from in-sample tests indicate that the time-varying hedge ratios outperform alternative specifications in reducing market risk, whereas the out-of-sample tests indicate that constant hedge ratios, coming from simpler models, perform better in terms of maximum variance reduction and utility increases. The results reveal that the two-stock index futures contracts on ADEX serve their risk management function through hedging, as they provide considerable VaR/utility increases in comparison to unhedged positions. The researcher suggests to Investors who are interested in the Greek stock index market can benefit from these results by developing appropriate hedge ratios in each market, in order to reduce their price risk more efficiently.

Bhaduri and Sethu Durai (2008) investigated optimal hedge ratio and hedging effectiveness of S&P CNX Nifty index futures by employing four competing models, such as simple OLS method, BVAM, VECM and a class of MGARCH model. The study considered daily data on NSE stock index futures and the corresponding S&P CNX Nifty Index from 4 September 2000 to 4 August 2005 for the in-sample estimation and for the out-of-sample validation daily data from 5 August 2005 to 19 September 2005 are used. The results concluded that the time-varying hedge ratio derived from diagonal VEC-GARCH model gives a higher mean returns compared to other counterparts. On the average variance reduction front, the diagonal VEC-GARCH model gives better performance only in the long-time horizons compared to the simple OLS method that scores well in the short-time horizons.
Lien (2009) has discussed the comparison of hedging effectiveness of the conventional hedge ratio and time-varying conditional hedge ratios (of which GARCH ratio is a special case). The researcher showed that in large sample cases, the conventional hedge ratio provides the best hedging performance. For small sample cases, a sufficiently large variation in the conditional variance of the futures return is required to produce the opposite result. This result is due to the fact that the hedging effectiveness measure is based upon the unconditional variance; meanwhile, the conventional hedge ratio minimizes the unconditional variance and the conditional hedge ratio aims at minimising the conditional variance.

Copeland and Zhu (2011) have analyzed the hedging effectiveness of six major index futures contracts in globally such as SPI200, S&P500, FTSE100, DAX-30, Nikkei225 and KOSPI100. They employed OLS method and Bivariate-GJR-GARCH model for estimating optimal hedge ratios. They collected data from 7 March 1995 and end on the same date in 2005. But for KOSPI100 and SPI200 index futures, the sample period begins from 3 May 1996 and 2 May 2000 respectively. For out-of-sample testing purposes, the last twelve months were used for all stock index futures contracts. The empirical results of within-sample and out-of-sample comparisons reveal that the time varying error correction hedge ratios have little or no improvement over the OLS-based hedging performance.

Sah et.al. (2011) have investigated the hedging effectiveness of CNX Nifty futures. The researchers used the daily closing price of the CNX Nifty futures for the period of June 2000 to December 2008. They use three models for estimating the hedge ratio and hedging effectiveness such as OLS, ECM and Minimum Variance Hedge Ratio (MVHR). The results indicate that the hedging effectiveness has reduced the amount of risk in the futures contract.
Yaganti et al. (2012) have studied the hedging effectiveness of the spices and base metals commodity in MCX and NCDEX. The required data for maturity month, near month and far month closing prices were collected from the official website of MCX and NCDEX. The OLS regression and ECM are used to find out the optimal hedge ratio of the series. The results showed that cardamom has a poor performance of hedging effectiveness due to low traded volume. The base metals of Lead, Nickel and Zinc are having pretty value of hedge ratio and hedging effectiveness and it increased in the case of nearby and far month maturity periods for the lead.

Kostika and Markellos (2013) have made research on the optimal hedge ratios for three countries stock index futures such as UK Financial Times Stock Exchange Index (FTSE), the US Dow Jones Index (DJ) and the German Deutscher Aktien- Index (DAX). They employed OLS, ECM, Exponential Weighted Moving Average (EWMA), univariate GARCH (1,1), multivariate GARCH-BEKK (1,1) and Autoregressive Conditional Density (ARCD) models to estimate the optimal hedge ratios. The daily dataset for the study covers the period from 4 January 1999 to 20 September 2004, leaving last three month observations for the out-of-sample estimation. The empirical results reveal that the hedge ratios through the ARCD model offer superior in-sample and out-of-sample hedging performances compared to standard estimates that include OLS, ECM, EWMA, univariate GARCH (1,1), and multivariate GARCH-BEKK (1,1) models.

IrfanulHaq (2015) has examined the hedge ratio and hedging horizon in Indian agricultural commodity market. The sample of the study consists of ten agricultural commodities such as Barley, Chana, Chilli, Guar Gum, Guar Seeds, Jeera, Pepper, Soy oil, Soy Bean and Turmeric. The data used in the present study is obtained from NCDEX. He has estimated the hedge ratio with OLS, ECM, and WAVELET. The
results reveal that WAVELET hedge ratio is comparatively larger than OLS and ECM, and as we go on increasing the hedging horizon hedge ratio increases. The hedging effectiveness suggests a good amount of hedging in Indian markets and more particularly in a commodity with high trading volumes.

Bonga-Bonga et.al. (2016) have examined the hedging effectiveness of futures index in emerging markets. The researchers estimate the optimal hedge ratio for the exposure on the financial times stock exchange (FTSE)/Johannesburg Stock Exchange (JSE) Top 40 index between 2008 and 2010. The data period ranges from 2 January 2008 to 31 December 2010 for in-sample data. Out-of-sample data covers sample data from 3 January 2011 to 15 June 2011. The Structural Equation Model with Ordinary Least Squares (SEMOLS) is generally more effective over a one-day hedging period and the VECM and MGARCH are effective over five- and twenty-day hedging periods. This is explained by the SEMOLS straightforward estimation of the hedge ratio interpreted as the slope of the bivariate regression between spot and futures variables. Moreover, volatilities are accounted in a longer period than a short horizon. This reality makes an MGARCH method a preferred method for hedge ratio in the long horizon.

2.7 Conclusion

To sum up, all the reviews undertaken so far in the preceding paragraphs, the common methodology adopted in these studies are found to analyse the price discovery, causal relationship, lead–lag relationship framework, long-run cointegration analysis, hedging effectiveness and the volatility of various markets. The researchers mostly have covered the behavior of equity spot and futures markets in global and domestic perspective. Hence, an attempt has been made to analyse the price discovery and hedging effectiveness of spot and futures stocks of the Nifty 100 Index.
References


