Chapter-1
Introduction

One of the important reasons for the development of derivatives worldwide is economic risk associated with trading in financial assets and commodities. In the last few decades, financial markets have undergone a tremendous change. On one hand, financial markets have been deregulated and on the other hand, financial innovation coupled with advancement in computing technology has made trading mechanism easier and automated. This has led to increased volatility in the financial markets. Fluctuations in economic variables such as interest rates have further increased risk. Management and measurement of risk have undergone a huge change. To mitigate the risk associated with the rapid fluctuations in the financial markets the demand for hedging instruments have increased. One of the most important such risk mitigation instruments is a futures contract.

A futures contract, as against a spot transaction which is an agreement to buy/sell an asset today, is an agreement to buy/sell an asset at some future date at a specified price. The person who agrees to buy/sell the asset holds a long/short position. Futures contracts are called exchange traded derivatives because they are traded on an organized exchange.
Futures contracts are standardized contracts defined by the exchange on which they are traded. In particular, the exchange defines the following:

**The Underlying Asset:** The underlying asset in a futures contract may be a commodity such as crude oil or a financial asset such as a stock or stock index.

**The size of the contract:** How much of the asset is to be delivered in one futures contract is decided by the exchange.

**Delivery:** For commodities, the exchange specifies the delivery procedure including the period during which delivery can be made and where delivery will be made. However, futures contracts on financial assets such as index futures are cash settled.

As a futures contract approaches its maturity or delivery date, its price converges to the price of the underlying asset in the spot market. And on the delivery date, the futures price is equal or almost equal to the spot price. The convergence of futures and spot prices is depicted in figure 1.1. The figure depicts that the difference between futures and spot prices, called basis, reduces with the passage of time and finally on the expiration of the contract basis becomes zero.

### 1.1 FORCE BINDING SPOT AND FUTURES PRICES—THE COST OF CARRY

The theoretical relationship between index futures prices and the prices of the underlying index is governed by the cost of carry model (Stoll and Whaley, 1990). Mathematically, the relationship can be described as follows:

\[ F_t = S_t e^{(r-q)(T-t)} \]

Where,
F_t = price of the futures contract at time t

S_t = price level of the stock index at time t

r = risk-free rate of return

q = dividend yield on the stock index

T = duration of the futures contract so that (T − t) is time to maturity

**Figure 1.1: Convergence of Futures and Spot Prices**

Source: Compiled by Author

The above cost of carry model summarizes the relationship between the prices of a futures contract and the underlying index. The model holds if dividend yield and risk-free rate of return are known and non-stochastic. The force binding the futures and spot prices together is 'arbitrage'. If the futures price is higher than what is implied by the cost of carry above, then risk-free profit can be earned by buying the stocks making up the index and selling the associated futures contract. On the contrary, if the futures price is less than what is implied by the cost of carry, then risk-free profit can be earned by buying the futures contract and selling the stocks comprising the index.
1.2 PRICE DISCOVERY AND LEAD-LAG RELATIONSHIP BETWEEN SPOT AND FUTURES MARKETS-

Spot and futures markets deal in the same asset traded at different points in time. Because the same asset is traded in the spot and futures markets, there should be some kind of a co-movement in the prices in these two markets. Therefore, these spot and futures markets should react to the new information in similar ways. It implies that the price in the spot market of an asset must move in unison with the price of its associated futures contract in the derivatives market; otherwise arbitrage opportunities would exist.

However, when price changes in one market are followed by price changes in another market, then a lead-lag relationship exists. The market in which price changes occur first is called the leading market and the market which follows is called lagging market.

When it is said that market i leads market j, it implies that market i is more informationally efficient. It can also be stated that price discovery takes place in market i which implies that new information is first impounded into the prices of market i and subsequently transmits to market j.

Variables which have a strong co-movement and are bound by some force which does not allow them to drift apart too far away are said to be cointegrated. In the short run, cointegrated variables may deviate from their relationship, but in the long-term, they are bound to return to the equilibrium relationship. Spot and futures prices are bound by cost of carry relationship. If spot and futures price series could drift apart without any bound, then arbitrage opportunities would exist.
According to Stoll and Whaley (1990), infrequent trading of the component stocks of the index and presence of transactions cost are some of the reasons for violation of the cost of carry relationship. Bhatia (2007) has reviewed extensively the reasons for the lead-lag relationship between futures and spot markets. Market with lower transaction costs, greater liquidity and lesser restrictions is likely to process information with greater speed and accuracy, thereby playing a more important role in price discovery. Viewed from this perspective, futures market is more likely to assimilate new information because it has lower transaction costs, in-built leverage and fewer restrictions. However, changes in the spot prices constitute part of the information set used by traders in the futures market, therefore, spot market may also lead futures market.

1.3 NEED AND PURPOSE OF THE STUDY

Understanding the relationship between futures and spot markets is of paramount importance for hedgers, speculators and arbitrageurs alike. Especially, the characteristics of returns and volatility of financial markets have implications for regulators and portfolio managers. The dynamic relationship between futures and spot markets helps to understand the information transmission mechanism.

CNX Nifty is the most recognized barometer of stock market activity in India. CNX Nifty futures allow portfolio managers and hedgers to economically execute trading strategies based on Nifty. Therefore, it is important to investigate the informational role of the futures and spot market. More specifically, there is a need to study the intraday price discovery and volatility spillovers between the markets. Understanding information transmission mechanism may enable investors to more successfully implement Nifty trading strategies. In other words, Investors can formulate better
trading strategies if they have better understanding of the information transmission mechanism.

The present study is an attempt to investigate the temporal relationship between futures market and the underlying spot market in India. Although considerable attention has been given to examine the relationship between stock index and stock index futures, only a few studies have examined the relationship between individual stock and stock futures.

This study investigates the empirical intraday returns and volatility relationship between CNX Nifty Futures and its underlying Index as well as relationship between returns and volatility of individual stocks that constitute CNX Nifty.

The present study is different from prior studies in several ways. Firstly, the study has considered individual stocks along with stock index for investigating the temporal relationship. Secondly, the study has utilized high frequency (5-min) data which is of paramount importance these days. Finally, the study has also examined the second moment linkages, i.e., volatility relationship between the two markets.

The present study is an attempt to characterize empirically the dynamic interactions and interdependence of the stock market and the futures market returns. The primary objective is to find out whether futures price changes provide predictive information regarding spot price changes and/or vice versa. Specifically, the study addresses the following questions:

Is there any equilibrium relationship between the spot and futures markets? Specifically, Are the spot and futures markets cointegrated?
Is there any lead-lag relationship between the two markets? Specifically, are past returns of one market helpful in predicting future returns in the other market?

Are the two markets interlinked through their second moments? Specifically, does volatility in each market spillover to the other market?

Do good and bad news influence the markets in a different way? Specifically, are there any asymmetric influences exerted by each market on the volatility of another market?

To answer these questions, the study employs a number of tools & techniques of time series econometrics.

1.4 CHAPTER SCHEME

The thesis is divided into six chapters. A brief outline of each of the chapters is given below:

Chapter 1 (Introduction) introduces the study. It describes the basic relationship between futures and spot markets and presents the need and purpose of the study.

Chapter 2 (Review of Literature) describes and extensive survey of previous researches relevant for the study.

Chapter 3 (Research Methodology) lists the objectives and hypotheses. It also discusses in detail data used and methodology employed.

Chapter 4 (Empirical Evidence on Returns Relationship between Futures and Spot Markets) analyzes the returns relationship between futures and spot markets for CNX Nifty and all its fifty constituent stocks.
Chapter 5 (Empirical Evidence on Volatility Spillover between Futures and Spot Markets) presents empirical evidence regarding volatility linkages between the two markets for the index and individual stocks.

Chapter 6 (Findings and Conclusion) summarizes the study and discusses findings and conclusion. It also lists the limitations of the study and suggests areas for future research.