"A STUDY ON CAUSAL RELATIONSHIP BETWEEN SPOT AND FUTURES PRICES OF NIFTY 50 INDEX OF NSE"

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By

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DECLARATION

"I hereby declare that the dissertation titled **"A Study on Causal Relationship Between Spot and Futures Prices of Nifty 50 Index of NSE"** is an original and independent research work done by me during the period 2021-2022 under the guidance of Dr. SRIRAM PADYALA, Assistant Professor, Department of Commerce, Goa University, and also that it has not previously formed the basis for the award of any degree or diploma in Goa University or any other university or elsewhere."

Date:

Place: Goa University

Taleigao, Goa

Yakshita Kiran Vengurlekar

Roll No: 68-2020

Master of Commerce

Semester IV

CERTIFICATE

This is to certify that the dissertation "**A Study on Causal Relationship Between Spot and Futures Prices of Nifty 50 Index of NSE**" is a bonafide record of the research work done by Ms**.** Yakshita Kiran Vengurlekar during the period of study under my supervision and that this study has not been formed the basis for the award of any degree, diploma, associateship, fellowship or similar title to the candidate and also that the dissertation represents independent work on the part of the candidate.

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Acknowledgement

This acknowledgement is a small effort on my part to do justice to and to thank all those who helped me in the accomplishment of this my project. “It is not possible to prepare a project report without the assistance and encouragement of other people. This one is certainly no exception.”

On the very outset of this project report, I would like to extend my sincere and heartfelt obligation towards all the personages who have helped me in this endeavour. Without their active guidance, help, cooperation and encouragement, I would not have made headway in the project.

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Executive summary

This study is carried on Spot and Futures market with reference to Nifty 50 index.

Chapter 1: gives an overview of Indian Stock Market. It includes brief information about Stock market, introduction of stock market in India, Derivatives market, History of Derivatives market, Derivatives market in India, type of Derivatives contracts, Participants in a Derivative market, Regulatory framework of Derivatives market and Volatility of stock market.

Chapter 2: includes literature review, need and scope of the study along with objectives and methodology of study. Various techniques used in the study are also discussed in chapter 2.

Chapter 3: deals with Data Analysis and Finding of various techniques used in study such as Descriptive statistics, Unit root test, Johansen's co-integration test, Vector Error Correction Model, Granger Causality test, OLS Model and GARCH Model.

Chapter 4: give conclusion of overall study on the basis of techniques used in the study.

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CHAPTER 1

INTRODUCTION

Chapter 1: gives an overview of Indian Stock Market. It includes brief information about Stock market, introduction of stock market in India, Derivatives market, History of Derivatives market, Derivatives market in India, type of Derivatives contracts, Participants in a Derivative market, Regulatory framework of Derivatives market and Volatility of stock market.

1.1 Indian Stock Market

Stock market is a place where traders can buy and sell financial assets. In India there are two main stock exchanges where maximum trade take place. One is Bombay Stock Exchange (BSE) and the National Stock Exchange (NSE). The BSE is the oldest stock exchange in existence since 1875. The NSE, on the other hand, was founded in 1992 and started trading in 1994. As of November 2021, the BSE had 5,565 listed firms, whereas NSE had 1,920 as of Mar. 31, 2021. However, both exchanges follow the same trading mechanism, trading hours, settlement process. At both exchanges, trading takes place through an open electronic limit order book, with the trading computer matching orders. There are no market makers, and the entire process is order-driven, which means that market orders are automatically matched with the best limit orders put by investors. As a result, both buyers and sellers maintain their anonymity. T+2 rolling settlement is used in equity spot markets. This means that any trade made on Monday will be fully completed by Wednesday. Trading takes place from Monday to Friday, between 9:55 a.m. and 3:30 p.m. Shares are delivered in dematerialized form, and each exchange has its own clearing house, which serves as a central counterparty and absorbs all settlement risk.

1.2 Introduction to Derivatives

The global liberalization and integration of financial markets has led to multiple growth in International Trade. International money and international instruments were in great demand. Changes in interest rates, currency exchange rates, and stock prices on various financial

markets have increased the financial risk faced by investors and business class. Unfavourable changes have put the company's survival in danger. Institutional investors who were active in industrial and emerging markets must protect themselves against both internal and cross-border transactions. Derivatives are the most popular mechanism for market players to control risks in modern securities trading. To manage risk, new financial instruments called Financial Derivatives have been developed. The fundamental purpose of these instrument is that it provides facility to trader to fix price today for trade in future giving him protection against adverse in Future Prices to reduce the risk. Also, give opportunities for those willing to take larger risks to profit by making it easier to shift risk from those who want to avoid it to those who are willing to accept it. Basically, a derivative is an instrument that takes/derives its value from another asset(underlying). The underlying asset may be a financial asset or non-financial asset. The price of a derivative instrument is contingent on the value of its underlying asset. The term derivatives can be defined as, “A contract or an arrangement for exchange of payments, whose value derives from the value of an underlying asset or underlying references rates or indices.” For a variety of reasons, derivatives can be traded. By establishing positions in derivatives markets a trader can hedge against risk in spot market. The derivatives were launched mainly with the twin objective of risk transfer and to increase liquidity thereby ensuring better market efficiency.

1.3 Evolution of Derivatives Market in the World

Every company operation entails some level of risk. The availability of buyers and sellers for a product, as well as credit risk, were previously a source of concern among suppliers in the United States. To address such issues, Chicago businessmen created the Chicago Board of Trade (CBOT) in 1848. The major goal of CBOT was to provide a centralised location where buyers and sellers could meet and negotiate forward contracts. The CBOT in the United States listed the first "exchange traded" derivative in 1864, named "Futures contracts." In 1919, the Chicago Butter and Egg Board, a descendent of the CBOT, was restructured to allow associate merchants to trade Futures. The name of the exchange was changed to Chicago Mercantile Exchange (CME). These two exchanges, the CBOT and the CME, have remained the world's two leading systematised Futures exchanges to this day. In 2007, the COBT and the CME merged to establish the CME group. At the Kansas City Board of Trade, the first stock index futures contract was traded. The Chicago Mercantile Exchange currently trades the most

popular stock index Futures contract in the world, which is based on the S&P 500 index. Financial Futures became the most active derivative instrument in the mid-1980s, with volumes many times higher than commodities Futures. The three most popular Futures contracts traded now are Index Futures, T-Bill Futures, and Euro-Dollar Futures. LIFFE in England, DTB in Germany, SGX in Singapore, TIFFE in Japan, MATIF in France, Eurex, and others are famous international derivatives exchanges.

1.4 Evolution of derivatives in India

Commodities futures' trading in India was initiated in 1950s; however, in 1960s there was great decline in futures trading. Markets were shuttered one after the other, mainly because price spikes in various commodities being linked to speculation. As a result, in 1969, the Central Government issued a notification prohibiting the trade of derivatives.

The late 1990s it showed opposite trends—a large scale revival of futures markets in India, and hence In October 1995, the Central Government revoked the ban on futures trading and the Civil Supplies Ministry agreed in principle to begin futures trading in Basmati rice. In 1996, the Government granted permission to the Indian Pepper and Spice Trade Association to convert its Pepper Futures Exchange into an International Pepper Exchange. As a result, India's first international futures exchange, the India Pepper and Spice Trade Association—International Commodity Exchange (IPSTA-ICE), was formed on November 17, 1997 in Kochi.

The Reserve Bank of India established the Sodhani Expert Group, which urged for considerable forward exchange market liberalisation and the establishment of rupee-based derivatives in financial products. In August of 1996, the RBI approved several of its recommendations. The Securities and Exchange Board of India (SEBI) took a significant step forward in this respect when it appointed the Dr. L.C. Gupta Committee (LCGC) to develop a suitable regulatory framework for derivatives trading in India by decision dated November 18, 1996. While the Committee's primary focus was on equity derivatives, it kept a broad view of derivatives in general. On May 11, 1998, the SEBI Board adopted the recommendations of the Dr. L.C. Gupta Committee and approved the phased introduction of derivatives trading in India. Stock index futures, index options, and stock options was recommended in that order. The Board also adopted the Committee's recommendations for 'Suggestive Bye-Laws' for the regulation and control of derivatives trading and settlement in India. Following that, the SEBI established the

J.R. Verma Commission to oversee the operational aspects of derivatives markets. In December, 1999, the new framework has been approved and 'Derivatives' have been accorded the status of 'Securities'.

1.5 Derivatives trading in India

The start of futures trading in June 2000 was the most significant event in the history of the Indian stock market. In accordance with the stock exchanges' rules/bye-laws and regulations, the SEBI permitted derivatives trading based on futures contracts at the National Stock Exchange (NSE) and Bombay Stock Exchange (BSE). To begin with, the SEBI allowed stock index futures, which are equity derivatives. The BSE launched BSX stock index futures on June 9, 2000, based on the sensitive Index (also known as SENSEX, which consists of 30 scripts), while the NSE launched N FUTIDX NIFTY stock index futures on June 12, 2000, based on its index S&P CNX NIFTY (which consists of 50 scripts). This was followed by approval for option index trading, which began in June 2001, and trading in individual security options, began in July 2001. Individual stock futures contracts were first offered in November 2001. On more than 200 equities, futures and options contracts on individual securities are offered. Trading and settlement of derivative contracts are governed by the rules, bylaws, and regulations of the respective exchanges and clearing houses/ corporations, which have been approved by SEBI and published in the official gazette.

1.6 Types of Derivative Contracts

Forwards, Futures, Options, and Swaps are the four primary contracts that make up derivatives. Several exotic contracts have arisen over the last few decades, but they are mostly modifications of these basic contracts. Let's have a look at some of the contracts in more detail.

a. **Forwards Contracts:** It is an agreement between buyer and seller that promises to deliver an asset at a pre- determined date in Futures at a predetermined price. A forward contract is a customised contract traded on OTC (Over the Counter) directly between the two parties. These are not standardised contracts and hence each contract is designed according to the need of investors, they are unique in nature. Since there is no regulatory mechanism, there are high chances of counterparty risk i.e. the risk that one

of the parties to the contract may not fulfil his or her obligation. Forwards are highly popular on currencies and interest rates

b. **Futures contract**: It is a contract between two parties to buy or sell assets at a specific price at a specific future date. These are standardised contracts traded on stock exchange. settlement of futures is done through mark to market settlement. The exchange stands guarantee to all transactions and counterparty risk is largely eliminated. The buyers of Futures contracts are considered having a long position whereas the sellers are considered to be having a short position. These contracts are highly liquid in nature due to large number of buyers and sellers. They also involve low transaction cost and high transparency. In order to trade, investors need to follow the certain standardise norms framed by exchange. Margins are required to enter futures contract. Futures contracts are available on variety of commodities, currencies, interest rates, stocks and other tradable assets. They are highly popular on stock indices, interest rates and foreign exchange.

c. **Options Contracts:** It is an agreement between two parties which gives right to the buyer of the option to buy/sell the underlying asset but not the obligation is called options contracts. In options contract there are two parties involved, buyer and seller. Buyer is called holder of the option while seller is called the writer of the option. Holder enjoys the only right with no obligation. Whereas writer of the option has obligation to fulfil the contract. In order to forgo his right, option writer receives option premium (option price) from holder of the option. There two types of options- call and put option. Calls give the buyer the right but not the obligation to buy a given quantity of the underlying asset, at a given price on or before a given Futures date. Puts give the buyer the right, but not the obligation to sell a given quantity of the underlying asset at a given price on or before a given date. One can buy and sell each of the contracts. It's worth noting that in the first two types of derivative contracts (forwards and futures), both parties (buyer and seller) are obligated; that is, the buyer must pay for the asset and the seller must deliver the product to the buyer on the settlement date. In case of options, one party enjoys the right whereas other party have an obligation to fulfil. Only the seller (also called option writer) is under an obligation and not the buyer (also called option purchaser). The buyer has right whether to exercise the option or not. An option

that can be exercised at the expiry of the contract period is known as European option. An option that can be exercised at any time before the expiry of contract is called American option contract.

d. Swaps: A swap is the exchange of two cash flow sources. Swaps are private agreements between two parties to exchange futures cash flows in a predetermined manner. Portfolios of forward contracts can be used to describe them. The two most common swaps are

- *Interest rate swaps*: It involves the exchange of interest payments. It usually occurs when a person or a firm needs fixed rate funds but is able to get floating rate funds. It finds another party who needs floating rate loan but is able to get fixed rate funds. The two, known as the counterparty, exchange the interest payments & feel as if they are using the loans according to their own choices.
- *Currency swaps:* It involves in exchange of interest flows, in one currency for interest flows in another currency. In other words, it requires exchange of cash flows in two currencies.

1.7 Participants in Derivatives Market

There are three major participants in the derivatives market

Hedger: Asset price change adversely and thus generate risk among the traders. To minimise or eradicate the risk which is related to the potential movement of the market variable Hedgers use derivatives market. A transaction in which an investor seeks to protect a position or anticipated position in the spot market by using an opposite position in derivatives market is known as a 'hedge', a person who hedges is called hedger. Hedgers basically trade in derivatives market to reduce their risk caused by unfavourable movement in the underlying asset.

Speculators: A person who buys and sells a contract in the hope of profiting from subsequent price movements is known as a speculator. These people voluntarily accept what hedgers want to avoid. A speculator does not have any risk to hedge. They take a view whether prices would rise or fall in Futures and accordingly buy or sell Futures and options in order to make a profit from the Futures price movements of the underlying asset.

Arbitrageurs: Arbitrage means obtaining risk – free profits by simultaneously buying and selling identical or similar instruments in different markets. Sometimes in comparison to the prices in the derivatives market, the price of the stock in the cash market is lower or higher. They take the advantage of the difference in the prices of more or less the same assets or competing assets in different markets i.e. they buy in the market where prices are low and sell in the market where prices are high. Arbitrageurs exploit these inadequacies to their advantage. They also play a significant role in making the market more fluid by increasing liquidity.

1.8 Regulatory Mechanism

The regulatory framework in India is centred on the L.C. Gupta Committee Report, and the J.R. Varma Committee Report. It is frequently persistent with the ideologies of IOSCO (International Organization of Securities Commission) and addresses the universal anxieties of investor protection, market efficiency and reliability and financial integrity.

The L.C. Gupta Committee Report serves a perception on division of regulatory responsibility between the exchange and the SEBI. It recommends that SEBI‟s role should be limited to approving rules, bye laws and regulations of a derivatives exchange, and moreover approving the proposed derivatives contracts before instigation of their trading. It highlights the supervisory and advisory role of SEBI through sanctioning desirable flexibility, expanding regulatory effectiveness and reducing regulatory cost. Regulatory prerequisites for authorization of derivatives traders/brokers include relating to capital adequacy, net worth, certification condition and pioneer registration with SEBI. Moreover, it advises enactment of a distinct clearing corporation, extreme exposure limits, mark to market margins, margin accumulation from clients and separation of client's funds, supervision of sales practice and accounting and disclosure prepossession for derivatives trading. The J.R. Varma committee proposes a procedure for risk control measures for index based Futures and options, stock options and single stock Futures. The risk control measures comprise of calculation of margins, position limits, exposure limits and reporting and disclosure.

1.9 Stock Market Volatility

Introduced in 2000, financial derivatives market in India has shown a remarkable growth both in terms of volumes and numbers of contracts traded. National Stock Exchange (NSE) alone accounts for 99 percent of the derivatives trading in Indian markets. The introduction of derivatives has been well received by stock market players. Trading in derivatives gained popularity soon after its introduction. Despite the encouraging growth and developments, financial analysts feel that the derivatives market in India has not yet realized its full potential in terms of growth and trading. The reason might be the relatively high level of volatility. The introduction of derivative products may increase volatility in underlying stocks. This is because the spot and future markets are linked through risk transfer(hedging) and price discovery.

After the introduction of stock derivatives in the Indian stock market, the ability of stock futures to affect market volatility, as well as the impact of stock derivatives on underlying market volatility, has gotten a lot of attention in recent years. Examining the influence of stock derivatives trading on spot market volatility in a way that takes into account asymmetric reaction to news not only provides useful information, but also sheds light on why asymmetries exist in the stock market. If asymmetries are caused by market dynamics, structural innovation, such as the introduction of stock derivatives trading, may be able to influence not just the quantity of volatility in the underlying market, but also the structure and characteristics of volatility.

CHAPTER 2

LITERATURE REVIEW & RESEARCH METHODOLOGY

Chapter 2: includes literature review, need and scope of the study along with objectives and methodology of study. Various techniques used in the study are also discussed in this chapter

2.1 Review of Literature

H. Baklaci & H. Tutek (2006) examined the impact of future trading on spot volatility with reference to Istanbul Stock Exchange 30 (ISE 30) Index future contracts which represents the most frequently traded future contracts in Turkish derivatives market. The objective of the study was to find out whether the existence of future markets in Turkey has improved the rate at which new information is impounded into spot prices and have any persistence effect. The sample period was taken from 2004 to February 2006. By applying GARCH model Authors concluded that the existence of futures market has significantly improved the rate at which new information is impounded into spot prices and has reduced the persistence of information and volatility in underlying spot market resulting in improved efficiency.

By employing Johansen cointegration test and VECM model, **Kailash Chandra Pradhan and Dr. K. Sham Bhat (2006)** investigated the causal relationship between the spot and futures prices on individual securities. The sample included 25 stocks from S&P CNX Nifty index for a period of November 9, 2001 to September 29, 2005. Test revealed that there is long-run equilibrium between spot and futures prices. VECM results revealed that the futures lead the spot in case of 9 individual securities and spot leads the futures in case of 7 individual securities. Whereas in 9 securities feedback relation took place. Thus, a temporal causality exists between spot and futures prices.

T. Mallikarjunappa and Afsal E. M (2008) had put an emphasises to examine volatility implications of the introduction of derivatives on stock market volatility using the S&P CNX Nifty Index. Research was done with the objective of analysing the impact of derivatives on spot market volatility. Variables selected for study was the Spot Nifty Index, Nifty Index Futures, Nifty Junior Index and the spot S&P500 Index from 1995 to 2006. With the use of

GARCH model paper concluded that introduction of derivatives has not led to decline in volatility of spot market and stated that there can other factors that affect volatility in stock market such as better information dissemination and more transparency.

Dr S. V. Ramana Rao Dr A. Kanagaraj and Dr. Naliniprava Tripathy (2008) intends to study the volatility of spot market. By using GARCH and ARCH model for a period of seven years from June 1999 to July 2006, authors aim to determine the impact of individual stock futures on the underlying stock market volatility. Daily closing prices data of S&P CNX Nifty, S & P CNX 500 and individual stock (of 10 companies) have been collected for the research. The study concluded that stock future derivatives are not responsible for increase or decrease in spot market volatility and the introduction of stock futures derivative lead to increase in the market efficiency. All company's stock futures have an impact on the company's scrip volatility to large extend.

Sathya Swaroop Debasish (2009) has aimed to examine whether index futures trading in India has a significant change in spot price volatility of the underlying stocks and how introduction of index futures trading has affected the trading efficiency of the selected stocks. Author attempts to study the volatility of spot prices before and after introduction of stock index futures. The period of study was taken from 1995 to May 2009. The paper concluded that the introduction of Nifty index futures trading in India has led to reduction in spot price volatility and reduced trading efficiency in the underlying stock market. The results of this study suggest that there is a trade-off between gains and costs associated with the introduction of derivatives trading in the short-term period. Market would be stabilized by paying a certain price in the form of losing market efficiency

Rajesh Pathak (2009) by applying the Granger causality test attempted to examine the relationship between futures volume and returns of stocks in Indian. The aim of this project was to find out if past movement in volumes in future market helps to improves the return of stocks in spot market. Sample was selected based on highly traded stocks having significant share in nifty 50 index and it represented different sectors, have been selected for the study. Research was conducted for a period of 3 months in year 2009 using ADF and granger causality test statistical tools. The results revealed that there was a weak evidence of causal relationship between future volume and spot returns and concluded that future volume is not the cause of price movement in spot market and hence affecting the returns in equity market.

Ravi Agarwal, Shiva Kumar, Wasif Mukhtar and Hemanth Abar (2009) studied whether the Indian stock markets has shown some significant change in the volatility after the introduction of derivatives trading in India. Data selected included Closing prices of Nifty 50, Nifty Futures VIX (Volatility Index), index Nifty Junior and NIFTY Volumes. The Authors used auto-regressive Variances model to study the volatility between Nifty and Nifty futures and second statistical tool used was Regression Analysis. The paper revealed that Futures derivatives contribute towards stabilizing stock market by do not contributing to the variances in stock market and suggested that futures trading has led to contribute towards stabilizing the market.

Dr. Gurcharan Singh and Salony Kansal (2010) made an attempt to study the impact of introduction of financial derivatives trading on the volatility of Indian stock market. The author has chosen NSE S& P CNX Nifty index as the market representative and various derivative instruments. The study period is divided into pre-and post-introduction of F&O segment and it ranges from 1995-1996 to 2008-09 on the financial year basis. The paper concluded that derivative trading has reduced the stock market volatility. This may be due to increase in the trading volume by new set of traders in F&O segment which has led to greater liquidity reflecting to more stable market.

Prof. Anilkumar Garag and Dr. B Ramesh (2011) has made an attempt to study a relation between the change in the prices of futures contracts of specific stocks and the change in Open Interest. Sixteen liquid stocks were selected on a random basis for the period of 2002 to 2006. The researcher employed correlation analysis to study the change in open interest in stock futures with the change in the futures prices and also to study the change in the price of NIFTY led to the change in Open Interest in NIFTY Futures contract. Authors concluded with analysis that change in open interest will not lead to a change in futures price in any direction. The open interest is a measure of liquidity in the futures contract and cannot be used to find out price direction of the futures contract.

Dr. Y. Nagaraju, Suman Reddy S (2015) intended to find out the relation between Spot and Futures Markets and if there is any causal effect of Futures price on Spot market. The data used for the study consist of 5 indices (Nifty, Nifty Mid Cap 50, Bank Nifty, CNX IT, CNX Infra) for the period from 1st January 2012 to 30th September 2014. By employing ADF and Granger causality test, researchers found that one-way causality from spot markets to futures

market is not seen significantly among 5 indices which was analysed and also there was no two-way causality relationship was observed between spot and futures market. Therefore, we can conclude that investors can take their investment decision without considering interdependency of market from this analysis

Kerkar Puja Paresh and Dr. P. Sriram (2016) has made an attempt to study the causal relationship between future closing prices, open interest and trading volume for Nifty Index near month, next month and far month contracts. By using Granger Causality test for the period of June 2000 to December 2015, Researcher's result revealed that the relationship between future closing prices, trading volume and open interest have a causal relationship for three futures contracts traded on Nifty Stock Index Futures. Paper concluded that the future closing prices can be used to predict the trading volume and open interest & Open interest information can be helpful to predict the trading volume in futures contracts as the results showed a causal relation between open interest, trading volume and closing price.

Dr. P. Sri Ram (2017) attempts to investigate the impact of volatility on various market participants. The objective of the study is to analysed the co-integration and Causal relationship between Spot and Futures prices of stocks and index & to study the impact of Spot market on Futures market. The author also analysed the volatility of Indian Stock Market represented by S&P CNX Nifty Index with reference to energy sector stocks. Research was conducted for a period of five years from 2010-2015 using ADF test, Johansen's co-integration test, VECM, Granger Causality, OLS model, GARCH model. The study revealed that there exists short run co-integration between the Spot and Futures prices Spot prices of all variables have significant impact on their respective Futures prices. The causal relationship between Spot and Futures returns Granger causality test showed that there is bidirectional relationship between Spot and Futures for one stock and majority of stocks had unidirectional relationship i.e. Futures market has effect on the Spot market.

Dr. P.Sri Ram(2017) studied the relationship between spot prices and futures prices with reference to Bank Nifty NSE Index. The objectives of the paper included to Study the causal relationship between the Spot prices and Futures prices and to examine the Spot prices and its impact on the Futures prices of Nifty Bank Index. Various statistical tools used were Johansen Co-integration, VECM, Granger Causality Test, OLS Model, Impulse Response Function and FEVD. The period study covered from 2007 to 2016 including Near Month, Next Month and Far Month derivative contracts. The Author concluded that in all three Futures Contracts there

exist a long run association and in Short-run Unidirectional relationship which are only in the case of Next and Far month. The result of impact provided that for all Near, Next and Far Month Contract, the Spot market do have an impact on the Futures market.

Kerkar Puja Paresh and Dr. P. Sriram (2017) investigates whether there exists a relationship between spot and stock future prices and index futures of NIFTY 50 on NSE in India. A sample of Nifty 50 Index & 25 select stocks on NIFTY 50 Index traded on NSE India for a period from April 2005 to December 2015 was taken. The authors applied descriptive statistics, unit root test, granger causality, co-integration, vector error correction model came up with the results that there is bidirectional relationship between spot and futures markets. The study also provided the evidence of there exist long-run equilibrium relationship between the spot index market price and its futures price. This implies that either of these two historical prices will help to forecast the other price.

Dr. P. Sri Ram (2017) examines the relationship and impact of Spot prices on Futures prices of NSE Index Futures contracts and also investigates the optimal hedge ratio and hedging effectiveness of the contracts traded on CNX NIFTY INDEX in India. Period of study covered from January 2006 to December 2015 and test employed were ADF, Johansen's Co-integration Test, VECM, Granger Causality, Impulse Response, OLS and GARCH model. The findings are as follows: VECM stated that apart from having a long run relationship, the prices of Futures are influenced by the prices of Spot in short run. Granger Causality test showed that there is unidirectional Granger Causality running from Futures prices to the Spot prices for all contracts and OLS provided Futures is impacted by the Spot prices in all the contracts. In order to estimate hedge ratios and hedging effectiveness three models were used i.e. OLS, VAR and VECM. The hedge ratios for all the contracts are higher in the VECM model, but the hedging effectiveness is very high from the OLS Model.

By using Granger Causality, GARCH Analysis and VAR Model, **Parizad Phiroze Dungore and Sarosh Hosi Patel (2021)** made an attempt to study causal relationship that exists between volatility volume and open interest for Nifty Index futures traded on the NSE. For the study two liquid variables has been selected i.e. trading volume and open interest and its effect on volatility for the period of 1 January 2014 to 31 December 2019. Authors concluded that the volatility, volume and open interest data were left skewed which implies that most futures trades are done for the purpose of hedging. The results show that the GARCH (1,1) model was

the best fit for all categories except public and private firms. It was found that the impact of volume is stronger than open interest on volatility using VAR model. Granger causality suggests noise trading, as there are only two cases having a unidirectional causality. No bidirectional causal relationships are seen between the three pairs of variables.

2.2 Research Gap

To study the causal relationship between spot and future prices, most of the studies were done pertaining to a particular sector. This dissertation attempts to study the causal relationship of stocks included in Nifty 50 since inception. Most of the previous studies were done for the longer period (10 years). This dissertation attempts to study causal relation for a period of 5 years.

2.3 Need of the study

Derivatives market is one of the emerging market of capital market. It provides investor with some opportunities to participate in trade with less investment (margins), provision to transfer their risk from risk averse to risk takers and exploit arbitrage opportunities. Therefore, it becomes essential to understand and study derivatives market properly in order to exploit such opportunities. Also, it is significant to understand the relationship between spot and futures prices. This knowledge will help investors to take inform investment decisions. This dissertation makes an attempt to study stock futures derivatives market and how it impacts Indian stock market. This will provide the investors with better understanding of derivatives market before they start investing. The study on stock market volatility is important to policy makers, financial market participants and academics for several reasons. Forecasting of financial market volatility is essential to economic agents as it helps to measure risk present in their investments. Stock market volatility is a cause of great concern for policymakers because it generates uncertainty and has a negative impact on growth expectations. When markets are seen to be extremely volatile, it has an impact on investors' investing decisions. The study of stock market volatility is vital due to rising worldwide economic crises and increased investor participation, particularly in India. This dissertation has made an attempt to study the impact of volatility of selected stock on selected stocks futures.

2.4 Scope of the Study

This research analyses causal relationship between the Spot prices and Futures prices in stock market and also study the relationship between Nifty 50 index and Nifty 50 Futures Index. It also studies the impact of Spot prices on Futures prices of selected stocks from Nifty 50 Index based on the age of stocks listed on Nifty 50 index. It also studies the volatility of spot prices on Future prices of selected stocks and index. NSE accounts more percent of the total trading volume in the derivatives segment; therefore, using Nifty 50 Index for our study.

2.6 Research Question

1. Is there any causal relationship between Nifty 50 Index and Nifty 50 futures Index?
2. Is there any causal relationship between Stock prices and Stock Futures Prices included in Nifty 50 index?
3. Does spot prices impact futures prices?
4. Is there any impact of futures trading on volatility of spot market?

2.5 Objective of the study

1. To examine the causal relationship
   a) Between stock and stock futures prices included in Nifty 50 Index of NSE
   b) Between Nifty 50 index and Nifty 50 futures index of NSE.
2. To study the impact of
   a. Stock prices on Stock Futures prices included in Nifty 50 Index of NSE.
   b. Nifty 50 Index prices on Nifty 50 Futures Index prices of NSE
3. To study the impact of
   a. Stock futures prices on volatility of stock included in Nifty 50 Index of NSE.
   b. Nifty 50 futures Index on volatility of Nifty 50 index.

2.7 Limitation of the study

The present study is conducted only for a period of 5 years but as per the literature review most of the studies were conducted for a period of 10 years. Also, present dissertation only

concentrates on stock futures and one Index Futures (Nifty 50) and do not study options trading which is also a part of derivatives market in India.

2.8 Hypotheses

To study the significant relationship between variables, following hypotheses are framed:

H_0: There is presence of unit root in the series.

H_0: Spot price does not granger cause Futures price.

H_0: Futures price does not granger cause Spot price.

H_0: There is no significant impact of Spot prices on Futures prices of variables.

$H_{0:}$ Futures prices does not significantly impact volatility of spot prices.

2.9 Research Methodology

2.9.1 Data collection

The data collected for the purpose of this study is based on secondary data i.e. the Spot and Futures closing prices of 13 selected stocks listed on NIFTY 50 Index since inception and NIFTY 50 Index. Data is collected from the historical data available on the NSE website for a period of 5 years from 1st April 20017 to 31st March 2022. For present study only near month futures contracts closing price is taken into consideration, as these contacts are more liquid and significant comparison can be made with spot market prices. Other reason for choosing near month contracts is the volume of trade for near month contract is more compared to next and far month contracts.

2.9.2 Sample

Sample of data includes daily closing prices of Spot and Futures return of 13 selected stocks listed on NIFTY 50 Index that includes DRREDDY, GRASIM, HDFC BANK, HDFC, HERO MOTOCO, HINDALCO, HINDUNILVR, ITC, LT, RELIANCE, SBIN, TATA MOTORS, TATA STEEL and NIFTY 50 Index. These 13 stocks are selected based on the criteria that it was list on Nifty 50 since inception and it is assumed that longer the age of stock more is the reliability. The sample size consists of 1236 observations.

2.9.3 Period of study

The study is undertaken for the period of 5 years from 1st April 2017 to 31st March 2022.

2.9.4 Variables

Spot prices are considered as an explanatory variable i.e. independent variable, whereas Future prices are considered as a dependent variable, to explain the impact between Spot and Futures. In a study, an independent variable is a variable that is changed to see what influence it has on a dependent variable. The dependent variable is a variable that is reliant on the independent variable.

2.9.5 Research design

Daily returns of both the variables for Spot and Futures prices are calculated as log returns by using the following equations:

$R_{S_1 t} = \ln[\frac{S_t}{S_{t-1}}]$ $R_{F_1 t} = \ln[\frac{F_t}{F_{t-1}}]$

R_s – Daily Spot returns

R_f – Daily Futures returns

S_t – Closing price of stock for Spot

F_t – Closing price of stock for Futures

t – Corresponding day

The ADF test is used to check the stationarity data in the study. The presence of a long-term equilibrium link between the Spot and Futures prices of stocks and index is tested using Johansen's co-integration test. The Vector Error Correcting Model is used to investigate the error correction mechanisms that result in a state of disequilibrium. To assess the causal relationship between Spot and Futures prices of variables, the Granger Causality test is performed. The OLS model is used to see if Spot prices have a significant impact on Futures pricing. The GARCH model is used to examine the volatility of the stock market on futures market.

2.9.6 Statistical Tools and Techniques

2.9.6.1 Unit root test

The stationarity properties of the variables should be tested effectively using a unit root test before performing any econometric test. The most commonly employed methods of testing the Stationarity properties of the variables are the Augmented Dickey-Fuller (ADF) Test and the Phillips-Perron (PP) Test. The Stationarity is checked using only the Augmented Dickey-Fuller Test in this study. The presence of a unit root in autoregressive time series models violates the assumptions of classical linear regressions. The observed time series is not stationary if it has a unit root. When non-stationary time series are employed in a regression model, irrelevant variables can appear to have substantial correlations. This is referred to as false regression. As a result, the ADF test is used to determine whether time series data is stationary or not, as non-stationary data can lead to inaccurate conclusions.

2.9.6.2 Johansen Cointegration Test

Co-integration is a technique for determining whether or not there is a long-run equilibrium relationship between time series data. Granger (1981) was the first to present the concept of co integration, which was further improved upon by Engle and Granger (1987) and finally by Johansen (1995). The co-integration test is useful for determining whether non-stationary variables of the same order have a stationary linear combination. When such a combination is discovered, the variables are considered to be in equilibrium. In research, the Johanson's co-integration test is used to investigate the long run relationship between Spot and Futures prices of the variables.

2.9.6.3 Vector Error Correction Model (VECM)

The VECM Model is used to examine the short-run relationship among variables. Since Because it is employed for non-stationary time series that are co-integrated, or non-stationary time series with a long run equilibrium relationship, the Vector Error Correction Model is also known as the Restricted Vector Autoregressive Model. The coefficient of the equilibrium error term, which should always be negative and significant, is used to determine the rate of adjustment. If the error term's coefficient is negative and significant, it indicates that the variables are in an equilibrium relationship. However, if the error correction term's coefficient

is positive and not significant, it suggests that there is no Short run equilibrium relationship between the variables.

2.9.6.4 Granger Causality

To analyse the lead and lag relationship between the Spot and Futures prices of the variables, the Granger causality test has been employed. The Granger causality test is a statistical method for determining if one-time series may be used to forecast another. Simple pair-wise granger causality tests are used to determine bivariate causality between the variables of Spot and Futures prices.

2.9.6.5 Ordinary Least Squares (OLS) Model

Ordinary least-squares (OLS) regression is a type of generalised linear modelling technique that can be used to describe a single response variable on at least an interval scale. The method can be used with single or multiple explanatory variables, as well as categorical explanatory variables that have been coded correctly. In this research, OLS is used to estimate the impact of Spot prices on Futures prices of variables involved, where Spot prices are the independent variable and Futures prices are the dependent variable.

2.9.6.6 GARCH Model

The Generalized Auto Regressive Conditional Heteroscedasticity (GARCH) model is used to estimate stock price volatility. The model is mostly used to examine financial data. Volatility is defined statistically as a high level of autocorrelation in squared returns, which can be found using Heteroscedasticity tests. GARCH is a generalised version of ARCH that aids in determining volatility. The tendency for estimating time series data for volatility clustering is captured by GARCH. The model aids in understanding the behaviour of returns, with the dependent variables' behaviour assumed to be a result of the dependent and independent variables' previous values (Engle, 2002). It allows to comprehend the relationship between information and volatility.

CHAPTER 3

DATA ANALYSIS AND FINDINGS

Chapter 3: deals with Data Analysis and Finding of various techniques used in study such as Descriptive statistics, Unit root test, Johansen's co-integration test, Vector Error Correction Model, Granger Causality test, OLS Model and GARCH Model.

3.1 Descriptive Statistics

To investigate the cause and effect relationship between future close price and spot close price, we calculated daily log returns of the NIFTY Index and 13 stocks based on their daily future close price and spot close price from 1st April 2017 to 31st March 2022. The descriptive analysis of spot close price is used to determine the distribution pattern and the performance of the stocks. The descriptive statistics of spot close prices are summarised in table 3.1 in terms of mean, median, standard deviation, Skewness and Kurtosis, for the Nifty 50 Index and select 13 stocks from 1st April 2017 to 31st March 2022

Table 3.1: Descriptive statistics of Spot and Futures prices of variables

Variables		Mean	Median	Std. dev.	Skewness	Kurtosis
DRREDDY	**Spot**	0.036244	-0.021492	1.824405	0.399555	9.506895
	Futures	0.036224	-0.037796	1.787923	0.440312	9.506895
GRASIM	**Spot**	0.037206	0.000000	2.241516	-1.116212	17.81571
	Futures	0.036919	0.029511	2.234952	-1.182931	18.20615
HDFC BANK	**Spot**	0.002443	0.050611	2.532607	-16.22311	440.0938
	Futures	0.001966	0.073921	2.517485	-16.55083	453.5265
HDFC	**Spot**	0.035907	0.030866	1.9465	-0.46593	7.4463
	Futures	0.035845	0.057110	1.9104	-0.48090	7.6111
HERO MOTOCO	**Spot**	-0.026979	-0.038158	1.942743	0.116164	8.591793
	Futures	-0.027115	-0.027916	1.925777	0.106895	9.364388

HINDALCO	**Spot**	0.087295	0.063324	2.592870	-0.252876	7.552050
	Futures	0.086907	0.051217	2.570802	-0.326123	7.870701
HINDUNILVR	**Spot**	0.064713	0.019208	1.484766	0.934957	12.57960
	Futures	0.064402	0.035084	1.431920	1.008936	14.01559
ITC	**Spot**	-0.009406	-0.072176	1.729344	-0.683046	12.72169
	Futures	-0.009674	-0.066858	1.700916	-0.791237	13.83734
LT	**Spot**	0.005035	-0.020042	2.098954	-5.532536	106.3276
	Futures	0.004912	-0.003845	2.094885	-5.745625	108.9064
RELIANCE	**Spot**	0.052637	0.106237	2.792894	-12.66762	321.3094
	Futures	0.052639	0.075721	2.769824	-12.82799	326.6884
SBIN	**Spot**	0.042147	0.019918	2.353159	0.756640	15.77655
	Futures	0.041827	0.000000	2.351671	0.678951	15.42812
TATA MOTORS	**Spot**	-0.006563	0.000000	3.074540	0.275220	9.383108
	Futures	-0.006647	0.000000	3.049331	0.206165	9.329730
TATA STEEL	**Spot**	0.080076	0.071447	2.472796	-0.126677	5.282700
	Futures	0.079814	0.084385	2.497023	-0.140012	5.435555
NIFTY INDEX	**Spot**	0.051878	0.098719	1.183591	-1.724866	26.88589
	Futures	0.051315	0.090858	1.212984	-1.571966	26.65146

Source: Compiled from E-views Output

The above table 3.1 shows the descriptive statistics of daily return for stocks and stock futures listed on Nifty 50 index. It also includes daily returns of Nifty 50 and Nifty 50 Index futures prices. Descriptive statistics will help to understand the nature and behaviour of time series data selected for the study.

Mean gives the average value ranging from 0.087295 to -0.027115 of which highest is constituted by HINDALCO Spot returns and lowest by HDFC BANK futures return. The table shows positive mean returns for NIFTY 50 Index, DRREEDY, GRASIM, HDFC BANK, HDFC, HINDALCO, HINDUNILVR, LT, RELIANCE, SBIN and TATA STEEL indicating

that the close prices of these stocks performed superior whereas negative mean returns were observed for HERO MOTOCO, ITC, TATA MOTORS signifying lower performance. It can be noticed that the rate of return as given by the mean is greater for the Spot markets than compared with Futures market except for RELIANCE.

Standard deviation values in the table indicates the volatility in the Spot and Futures stock prices. The volatility in spot market is higher than compared with Futures market except NIFTY 50 Index of which futures is more volatile than compared with spot market. From the sample TATA MOTORS stocks are highly volatile having standard derivation of 3.074540 in Spot and 3.049331 in futures, followed by RELIANCE with standard deviation of 2.792894 in spot and 2.769824 in futures market. NIFTY 50 Index possess lowest volatility with standard deviation of 1.183591 in spot market and 1.212984 in futures market, followed by Stocks of HINDUNILVR with Standard deviation of 1.484766 in spot and 1.431920 in futures market.

The measure of skewness indicates that the data points of variables both Spot and Futures prices are moderately symmetric i.e. the data points lie within +/- 1 except HDFC BANK, LT, GRASIM, RELIANCE and NIFTY Index where in the data points do not lie within +/-1. In the table, 9 stocks returns are negatively skewed and rest are positively skewed.

The kurtosis data points for all data series are more than three, indicating leptokurtic behaviour with sharper peaks, longer tails, and fatter tails on both ends that implies the unconditional return distributions are not normal.

3.2 Unit root test

A unit root test helps to find out Stationarity in time series data variable is present or not. Stationarity of Series is tested using Augmented Dickey–Fuller test. The hypothesis for testing stationarity of series using ADF test is:

H_0- There is presence of unit root in the series.

H_1- There is no unit root in the series.

TABLE: 3.2 Augmented Dickey- Fuller test

Variables	Critical Value at 1% Significance level	t- Statistics	Prob.*
DR REDDY	-3.435432	-33.96539	0.00
GRASIM	-3.435432	-36.74291	0.00
HDFC BANK	-3.435432	-37.00844	0.00
HDFC	-3.435453	-16.48608	0.00
HERO MOTOCO	-3.435432	-36.72064	0.00
HINDALCO	-3.435432	-36.8293	0.00
HUL	-3.435432	-37.53781	0.00
ITC	-3.435432	-35.19259	0.00
L&T	-3.435432	-33.81997	0.00
RELIANCE	-3.435432	-35.59531	0.00
SBIN	-3.435432	-35.43836	0.00
TATA MOTORS	-3.435432	-34.35746	0.00
TATA STEEL	-3.435432	-36.01654	0.00
NIFTY FUT1	-3.435458	-12.04759	0.00
DR REDDY FUT1	-3.435432	-33.68297	0.00
GRASIM FUT1	-3.435432	-36.69853	0.00
HDFC BANK FUT1	-3.435432	-37.21533	0.00
HDFC FUT1	-3.435453	-16.37556	0.00
HERO MOTOCO FUT1	-3.435432	-37.18874	0.00
HINDALCO FUT1	-3.435432	-36.69846	0.00
HUL FUT1	-3.435432	-37.38250	0.00
ITC FUT1	-3.435432	-35.08445	0.00
L&T FUT1	-3.435432	-34.18285	0.00
RELIANCE FUT1	-3.435432	-35.63161	0.00
SBIN FUT1	-3.435432	-35.50677	0.00
TATA MOTORS FUT1	-3.435432	-34.69893	0.00
TATA STEEL FUT1	-3.435432	-36.63831	0.00
NIFTY 50 INDEX	-3.435488	-13.59263	0.00

Source: Compiled from E-views Output

From the table 3.2 it has been seen that Null hypothesis for spot and futures return i.e. presence of unit root has been rejected, as the p value is less than 0.01 in all cases. Similarly, it can be observed that for all stock and future returns t – Statistics is higher than critical value at 1% significance level, therefore we reject null hypothesis at 1% significance level and say that the data is free from the unit root and hence it is Stationery at level. Since the data is stationary at level, we can proceed with further analysis and interpretations.

3.3 Johansen test for Co-integration

The Johansen test for co-integration seeks to determine whether there is a co-integrating relationship between Spot and Futures prices. The primary goal of this test is to determine whether there is a long-term relationship between variables. The test results are listed in table.

The hypothesis to test the long-term relationship between variables using Johansen integration test is

None

H_0: There is no long run relationship between variables.

H_1: There is long run relationship between variables.

At most 1

H_0: There is no at least one significant long run cointegration between variables

H_1: There is at least one significant long run relationship between variables.

Reject H_0 if $p < 0.05$

Table: 3.3 Johansen test for co integration (Spot and Futures)

Variables	Hypothesized No. of CE(s)	Eigen value	Trace Statistic	Critical Value	Probability*
DRREDDY	None *	0.073392	94.95441	15.49471	0.0000
	At most 1	0.000849	1.046251	3.841466	0.3064
GRASIM	None *	0.084638	109.1430	15.49471	0.0001
	At most 1	0.000227	0.278982	3.841466	0.5974
HDFC BANK	None *	0.063586	83.49469	15.49471	0.0000
	At most 1	0.002017	2.489476	3.841466	0.1146
HDFC	None *	0.061892	82.20640	15.49471	0.0000
	At most 1	0.002994	3.685668	3.841466	0.0549
HERO MOTOCO	None *	0.053972	70.54344	15.49471	0.0000
	At most 1	0.001682	2.077132	3.841466	0.1495
HINDALCO	None *	0.078109	101.4756	15.49471	0.0001
	At most 1	0.001238	1.522597	3.841466	0.2172
HINDUNILVR	None *	0.049170	66.76804	15.49471	0.0000
	At most 1*	0.003943	4.851709	3.841466	0.0276
ITC	None *	0.060199	79.84228	15.49471	0.0000
	At most 1	0.002612	3.227351	3.841466	0.0724
LT	None *	0.064446	85.14046	15.49471	0.0000
	At most 1	0.002432	3.002442	3.841466	0.0831
RELIANCE	None *	0.109933	143.9399	15.49471	0.0001
	At most 1	0.000186	0.229953	3.841466	0.6316
SBIN	None *	0.088555	114.0507	14.26460	0.0001
	At most 1	0.000749	0.921622	3.841466	0.3370

TATA MOTORS	None *	0.119994	159.2351	15.49471	0.0001
	At most 1	0.001317	1.625073	3.841466	0.2024
TATA STEEL	None *	0.058658	74.31187	15.49471	0.0000
	At most 1	1.64E-05	0.020138	3.841466	0.8871
NIFTY 50	None *	0.047442	59.85500	15.49471	0.0000
	At most 1	9.76E-05	0.119933	3.841466	0.7291

Source: Compiled from E-views Output

From the above table 3.3, the p-values of none (r=0) is less than 0.05. So, at 5% significance level, the null hypothesis that there is no long run relationship between variables is rejected and alternate hypothesis that there is long run relation between variables is accepted. This shows that Spot prices and Futures prices of respective variables are co-integrated i.e. there exists long run relationship between the data series. But p-value of at most 1($r \leq 1$) is more than 0.05. therefore, the null hypothesis that there is no at least one significant long run cointegration between variable is fail to reject and accept null hypothesis. This shows that spot prices and futures prices there is no at least one significant long run relationship except for HINDUNILVR that is significant at both levels.

3.4 Vector Error Correction Model

The Johansen Co-integration test aids in determining the association as well as long-term trends between the variables. The VECM method is used to find stability and investigate the dynamic interaction between the variables. The vector error correction model also assists in the investigation of short-term causality between the two markets. It describes the direction and relevance of long and short run causality between markets.

To study the following objective VECM test is used:

1. **To examine the long run causal relationship**
   a) **Between stock and stock futures prices included in Nifty 50 Index of NSE**
   b) **Between Nifty 50 index and Nifty 50 futures index of NSE.**

The null hypotheses to test VECM are as follows

H_1: Spot price does not cause Futures price.

H_2: Futures price does not cause Spot price.

Reject H_0 if $p < 0.05$

Table: 3.4 Vector Error Correction model for long run relation

Variables	Direction	Coefficient	Std. Error	t-Statistic	Prob.
DRREDDY	Spot to Future	-0.221905	0.203433	-1.090802	0.2756
	Future to spot	-0.511254	0.267917	-1.908252	0.0566
GRASIM	Spot to Future	-0.933991	0.255538	-3.655004	0.0003*
	Future to spot	-1.408482	0.255887	-5.504303	0.0000*
HDFC BANK	Spot to Future	0.305876	0.215282	1.420814	0.1556
	Future to spot	-0.036422	0.216550	-0.168194	0.8665
HDFC	Spot to Future	0.171183	0.199945	0.856147	0.3921
	Future to spot	-0.136248	0.203700	-0.668866	0.5037
HERO MOTOCO	Spot to Future	0.083597	0.094459	0.885009	0.3763
	Future to spot	-0.086948	0.095486	-0.910587	0.3627
HINDALCO	Spot to Future	-0.574901	0.284447	-2.021115	0.0435*
	Future to spot	-1.043046	0.287398	-3.629274	0.0003*
HINDUNILVR	Spot to Future	-0.096937	0.146828	-0.660206	0.5092
	Future to spot	-0.393789	0.151420	-2.600633	0.0094*
ITC	Spot to Future	0.078290	0.097285	0.804750	0.4211
	Future to spot	-0.110172	0.099325	-1.109198	0.2676

LT	Spot to Future	0.999878	0.000567	1762.813	0.0000*
	Future to spot	0.999878	0.000567	1762.813	0.0000*
RELIANCE	Spot to Future	0.063397	0.296521	0.213801	0.8307
	Future to spot	-0.344804	0.298997	-1.153202	0.2491
SBIN	Spot to Future	-0.062437	0.277278	-0.225178	0.8219
	Future to spot	-0.500117	0.278212	-1.797608	0.0725
TATA MOTORS	Spot to Future	-0.412650	0.329336	-1.252979	0.2105
	Future to spot	-0.889262	0.326696	-2.721990	0.0066*
TATA STEEL	Spot to Future	0.024269	0.154771	0.156809	0.8754
	Future to spot	-0.165980	0.154021	-1.077645	0.2814
NIFTY 50	Spot to Future	-0.055794	0.191971	-0.290638	0.7714
	Future to spot	-0.387344	0.189081	-2.048564	0.0407*

Source: Compiled from E-views Output

Since the variables have long run cointegration we can use VECM to check long run causality relationship between spot and futures prices of selected stocks. The table 3.4 gives the results of VECM for only long run causality effect (C1). From the results, it can be seen that only two stocks (HINDUNILVR and TATA MOTORS) and NIFTY 50 index shows causal relation from future to spot prices. p- value is less than 0.05, therefore, reject the null hypothesis that there is no long run causal relation from futures to spot. This indicates that change is spot prices of above stocks is due to change is future prices. GRASIM, LT and HINDALCO show two-way cause and effect relationship between spot and futures prices i.e. Futures prices and Spot prices has the effect on each other during price discovery process. Rest all variables do not show long run relationship between spot and futures prices. Short run causality relation is checked by using Granger Causality Test in further study therefore, it is not analysed using VECM.

From the result it can be seen that most of stocks do not exhibit long run causal relation between spot and future prices. This is because most of the futures contract are short term contract for maximum three months. Therefore, getting a long relationship between variables is inappropriate. This test was run to check whether there is long run causal relation between spot and futures prices and result proved that there is no long run causal relation between the variables for most of the stocks.

3.5 Granger Causality

The Granger causality test is a statistical test to find out cause and effect relationship between two data series. It is used to determine if future prices impact spot prices or spot prices influence future prices. The null hypotheses to test the granger causality are as follows.

H_1: Spot price does not granger cause Futures price.

H_2: Futures price does not granger cause Spot price.

Reject H_0 if $p < 0.05$

Simple pair-wise granger causality tests are run to examine bivariate causal between the variables with the following objective:

1. **To examine the short run causal relationship**
   a. **Between stock and stock futures prices included in Nifty 50 Index of NSE**
   b. **Between Nifty 50 index and Nifty 50 futures index of NSE.**

Table 3.5.1: Granger Causality for Stocks

Null Hypothesis	F-statistic	Prob.	Remark
DR__REDDY_FUTURES does not Granger Cause DR__REDDY	2.79306	0.0616	NO
DR__REDDY does not Granger Cause DR__REDDY_FUTURES	0.57964	0.5603	
GRASIM_FUTURES does not Granger Cause GRASIM	16.3710	0.0000*	Bidirectional
GRASIM does not Granger Cause GRASIM_FUTURES	9.58088	0.0005*	
HDFC_FUTURES does not Granger Cause HDFC	1.29314	0.2748	NO
HDFC does not Granger Cause HDFC_FUTURES	2.54618	0.0788	
HDFC_BANK_FUTURES does not Granger Cause HDFC_BANK	4.68737	0.0001*	Unidirectional
HDFC_BANK does not Granger Cause HDFC_BANK_FUTURES	0.05716	0.9993	
HERO_MOTOCO_FUTURES does not Granger Cause HERO_MOTOCO	0.09171	0.9124	NO
HERO_MOTOCO does not Granger Cause HERO_MOTOCO_FUTURES	1.08403	0.3386	
HINDALCO_FUTURES does not Granger Cause HINDALCO	6.65691	0.0013*	Bidirectional
HINDALCO does not Granger Cause HINDALCO_FUTURES	3.67810	0.0255*	
HINDUNILVR_FUTURES does not Granger Cause HINDUNILVR	3.08895	0.0459*	Bidirectional

HINDUNILVR does not Granger Cause HINDUNILVR _FUTURES	3.75023	0.0238*	
ITC_FUTURES does not Granger Cause ITC	0.46779	0.6265	NO
ITC does not Granger Cause ITC_FUTURES	0.41137	0.6628	
LT_FUTURES does not Granger Cause LT	4.02842	0.0180*	Unidirectional
LT does not Granger Cause LT_FUTURES	2.59708	0.0749	
RELIANCE_FUTURES does not Granger Cause RELIANCE	0.97469	0.3776	NO
RELIANCE does not Granger Cause RELIANCE_FUTURES	0.98470	0.3738	
SBIN_FUTURES does not Granger Cause SBIN	1.09944	0.3334	NO
SBIN does not Granger Cause SBIN_FUTURES	0.19431	0.8234	
TATA_MOTORS_FUTURES does not Granger Cause TATA_MOTORS	7.21987	0.0008*	Bidirectional
TATA_MOTORS does not Granger Cause TATA_MOTORS_FUTURES	3.61778	0.0271*	
TATA_STEEL_FUTURES does not Granger Cause TATA_STEEL	1.08957	0.3367	NO
TATA_STEEL does not Granger Cause TATA_STEEL_FUTURES	1.31155	0.2698	

Source: Compiled from E-views Output

Table 3.5.1, represents the results of Granger Causality test between stock and stock futures closing prices return, wherein it is witnessed that there exists a bi-directional causality from spot to future close price returns for GRASIM, HINDALCO, HINDUNILVR and TATA MOTORS stocks. There exists unidirectional causality from futures to spot for HDFC BANK and LT. No causality was found between spot and futures for DRREDDY, HDFC, HERO MOTOCO, ITC, RELIANCE, SBIN and TATA STEEL indicates that spot price is not causing change in the future price and also the future price is not causing change in the spot price for the given study period.

The result shows that HDFC BANK has unidirectional Granger causality i.e. Futures prices of HDFC BANK has effect on Spot prices of HDFC BANK as null hypothesis is rejected at 5 percent significance whereas Spot prices has very less effect on Futures prices as null hypothesis is accepted at 5 percent significance during price discovery process. In case of LT, there is also unidirectional causality with respect to Spot and Futures prices of LT. The Spot prices of LT do not have effect on Futures prices but Futures prices cause a change in spot prices.

The results of GRASIM, HINDALCO, HINDUNILVR and TATA MOTORS stocks revealed that there exists Bidirectional causality relationship between stop and futures prices i.e. spot price cause change in future price as the probability value is less than 0.05 hence it is significant at 5% of significance and we reject the Null hypothesis. Similarly, futures prices cause a change in spot price as in this case also the probability value is less than 0.05. therefore, we reject the Null hypothesis and accept the alternative hypothesis i.e. stock futures granger cause spot prices.

Table 3.5.2: Granger Causality for NIFTY 50 Index

Null Hypothesis	F-statistic	Prob.	Remark
NIFTY_FUTURES does not Granger Cause NIFTY	3.81243	0.0224*	Unidirectional
NIFTY does not Granger Cause NIFTY_FUTURES	0.95558	0.3849	

Source: Compiled from E-views Output

Granger Causality test shows whether Change in one Variable is the Cause of Change in another variable. Above table 3.5.2, shows the results of Granger Causality Test of NIFTY 50 index and NIFTY 50 futures index. The results revealed that there exists a unidirectional causal relationship between Nifty spot and future prices i.e. NIFTY futures index cause change in NIFTY spot index as the probability is less than 0.05, we reject the Null hypothesis (NIFTY_FUTURES does not Granger Cause NIFTY) but NIFTY spot Index does not cause change in NIFTY futures Index as the probability value is more than 0.05. in this case we fail to reject the Null hypothesis and conclude that NIFTY Futures Index has Unidirectional causal relationship with NIFTY spot Index.

3.6 OLS Model

To study the second objective, OLS model is used

2. **To study the impact of**
    a. **Stock prices on Stock Futures prices included in Nifty 50 Index of NSE.**
    b. **Nifty 50 Index prices on Nifty 50 Futures Index prices of NSE**

The ordinary least square (OLS) model is used to determine if Spot prices have an impact on Futures prices, with Futures prices being the dependent variable and Spot prices being the independent variable. It is used to find out if a coefficient of independent variables is significant. The hypothesis for using the OLS model to examine the impact of spot on futures prices is.

H_0: There is no significant impact of Spot prices on Futures prices of variables.

H_1: There is significant impact of Spot prices on Futures prices of variables.

Reject H_0 if $p < 0.01$

If the probability of the independent variable i.e. Spot prices is significant at 1% significance, it can be concluded that Spot prices have an impact on Futures prices. The OLS test results are summarised in the table 3.7.

Table 3.6: Result of OLS test for variables

Variables	Coefficient	Prob.	Adjusted R-squared
DRREDDY	0.972867	0.0000	0.985479
GRASIM	0.991466	0.0000	0.988779
HDFC BANK	0.960478	0.0000	0.933581
HDFC	0.975770	0.0000	0.988390
HERO MOTOCO	0.978402	0.0000	0.974191
HINDALCO	0.986710	0.0000	0.990375
HINDUNILVR	0.953941	0.0000	0.978394
ITC	0.969404	0.0000	0.971395
LT	0.990045	0.0000	0.983987

RELIANCE	0.989088	0.0000	0.994655
SBIN	0.994950	0.0000	0.991172
TATA MOTORS	1.005134	0.0000	0.993790
TATA STEEL	1.000577	0.0000	0.981806
NIFTY 50	1.007879	0.0000	0.985727

Source: Compiled from E-views Output

The table 3.6, explain the result of OLS model with the Futures prices as dependant variable and the Spot prices as explanatory variable. It studies the impact of Spot prices on the Futures prices. The table shows that the probability value is less than 0.01 which means that the null hypothesis is rejected and the alternative hypothesis i.e. H1: There is an impact of Spot prices on the Futures prices, is accepted. This means that Spot prices do have an impact on the Futures prices of selected stocks.

DRREDDY result shows that there is 0.972867% change in Futures prices because of 1% change in Spot prices of DRREDDY. It can be also seen about 98% change in Futures prices are explained by its Spot price as per Adjusted R-squared.

The result of GRASIM shows that 1% change in its Spot prices changes Futures prices by 0.991466%. The Adjusted R-squared is 0.988779 which tells that 98% variations in Futures prices are explained by Spot prices.

HDFC BANK result shows that there is 0.960478% change in Futures prices because of 1% change in its Spot prices. It can be also seen about 93% variations in Futures prices are explained by its Spot price as per Adjusted R-squared.

The result of HDFC shows that if there is 1% change in Spot price then Futures prices will change by 0.975770%. The Adjusted R-squared is 0.988390 which tells that 98% variations in Futures prices are explained by its Spot prices.

HERO MOTOCO result shows that there is 0.978402% change in Futures prices because of 1% change in its Spot prices. It can be also seen about 97% variations in Futures prices are explained by its Spot price as per Adjusted R-squared.

The result of HINDALCO shows that there 0.986710% change in Futures prices because of 1% change in Spot prices of HINDALCO. About 99% variations in Futures prices are explained by its Spot price as per Adjusted R-squared.

HINDUNILVR result shows that if there is 1% change in Spot price then Futures prices will change by 0.953941%. The Adjusted R-squared is 0.99 which tells that 99% variations in Futures prices are explained by its Spot prices.

ITC result shows that about 97% variations in Futures prices are explained by its Spot prices as per Adjusted R-square. The coefficient of ITC spot is 0.969404 which shows that 1% changes in ITC's Spot prices changes its Futures price by 0.969404%.

The result of LT shows that if there is 1% change in Spot price then Futures prices will change by 0.990045%. The Adjusted R-squared is 0.983987 which tells that 98% variations in Futures prices are explained by Spot prices.

RELIANCE result shows that there is 0.989088% change in Futures prices because of 1% change in Spot prices of RELIANCE. It can be also seen about 99% variations in Futures prices are explained by its Spot price as per Adjusted R-squared.

The result of SBIN shows that 1% change in its Spot prices changes Futures prices by 0.994950%. The Adjusted R-squared is 0.991172 which tells that 99% variations in Futures prices are explained by Spot prices.

TATA MOTORS result shows that there is 1.005134% change in Futures prices because of 1% change in its Spot prices. It can be also seen about 99% variations in Futures prices are explained by its Spot price as per Adjusted R-squared

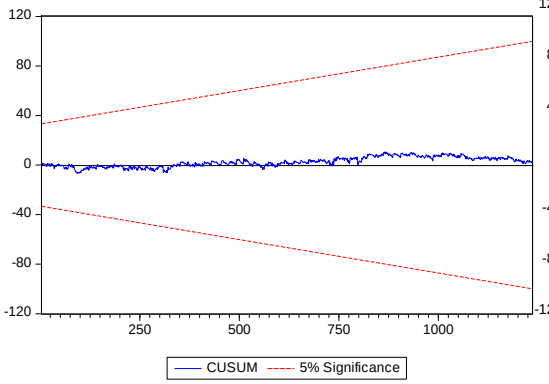
TATA STEEL result shows that about 98% variations in Futures prices are explained by its Spot prices as per Adjusted R-square. The coefficient of TATA STEEL Spot is 1.000577 shows that 1% changes in TATA STEEL's Spot prices changes its Futures price by 1.000577%.

The result of NIFTY 50 Index shows that if there is 1% change in Spot price then Futures prices will change by 1.007879%. The Adjusted R-squared is 0.985727 which tells that 98% variations in Futures prices are explained by Spot prices.

From the Ordinary Least Square test we can concluded that there is significant impact of spot prices on futures prices of selected set of variables. Variations in Futures prices are caused by its Spot prices by more than 90% in all the variables.

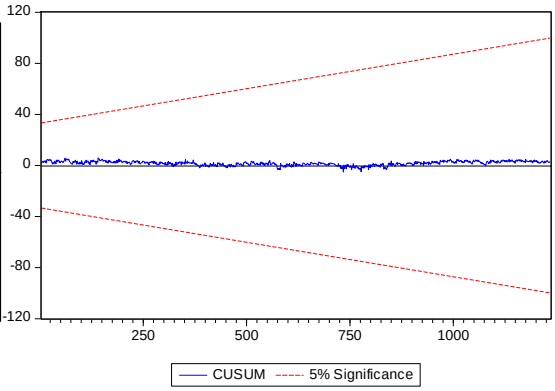
3.6.1 Cusum Test for Stability

Fig 3.6.1.1: DRREDDY



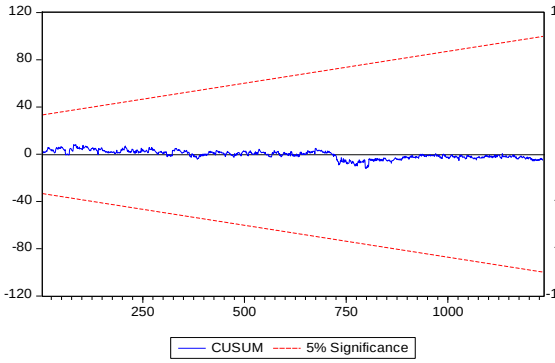
Source: E-views Output

Fig 3.6.1.2: GRASIM



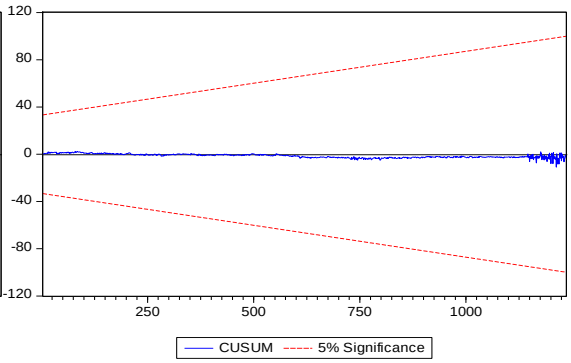
Source: E-views Output

Fig 3.6.1.3: HDFC



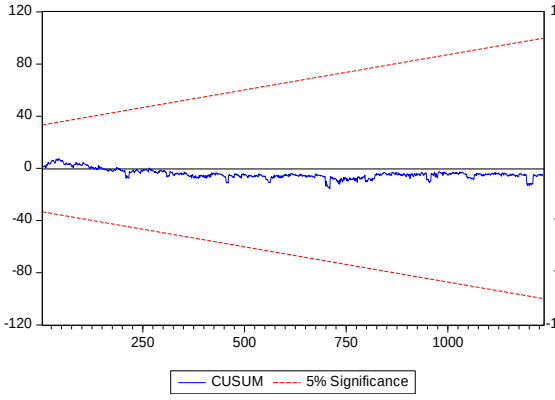
Source: E-views Output

Fig 3.6.1.4: HDFC BANK



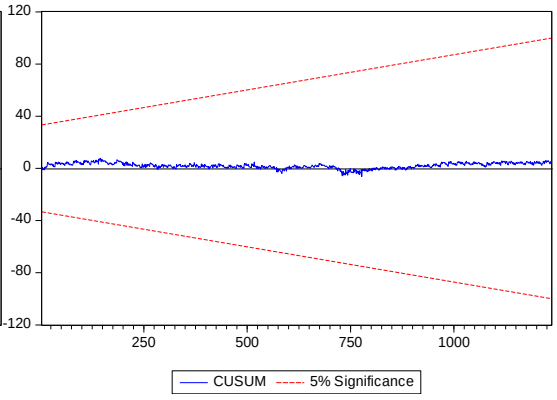
Source: E-views Output

Fig 3.6.1.5: HERO MOTOCO



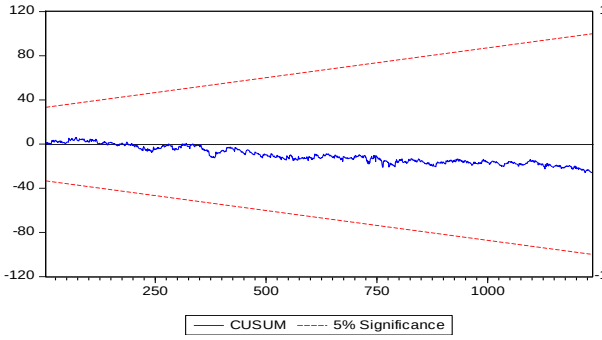
Source: E-views Output

Fig 3.6.1.6: HINDALCO



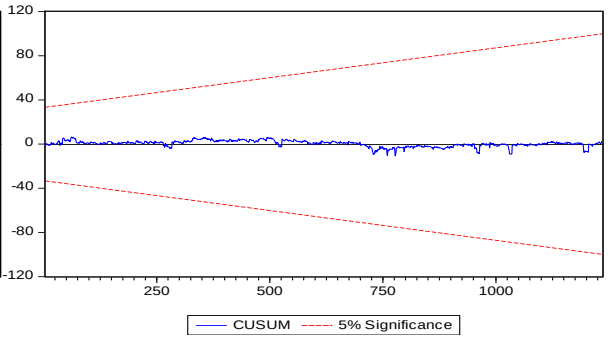
Source: E-views Output

Fig 3.6.1.7: HINDUNILVR



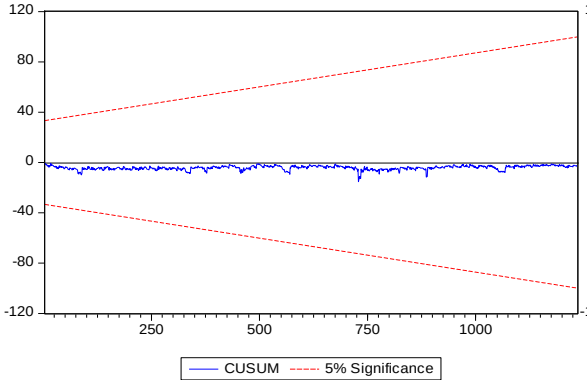
Source: E-views Output

Fig 3.6.1.8: ITC



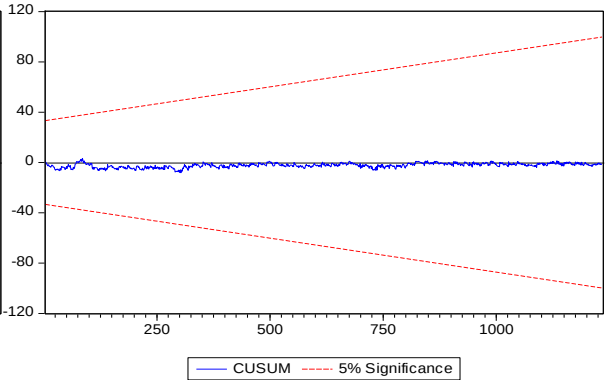
Source: E-views Output

Fig 3.6.1.9: LT



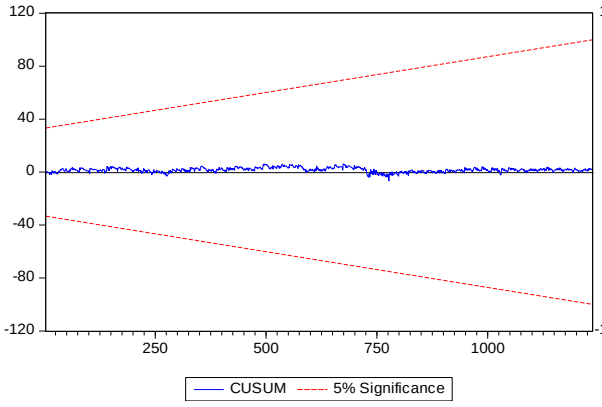
Source: E-views Output

Fig 3.6.1.10: RELIANCE



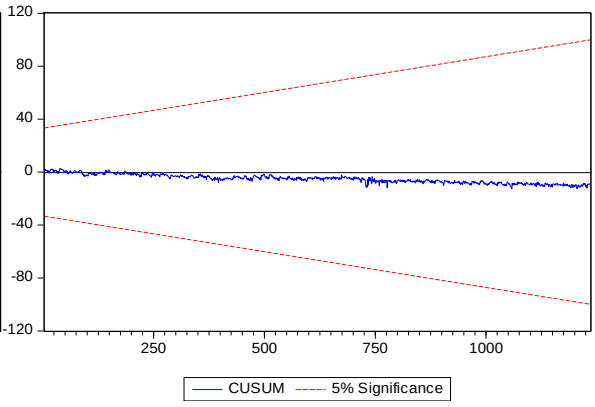
Source: E-views Output

Fig 3.6.1.11: SBIN



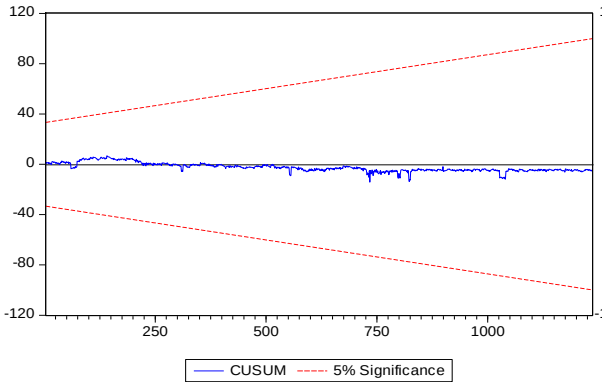
Source: E-views Output

Fig 3.6.1.12: TATA MOTORS



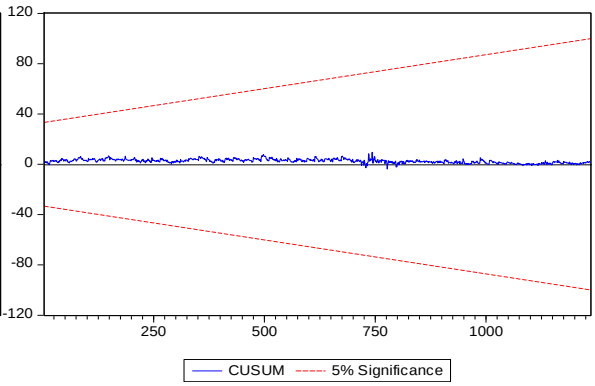
Source: E-views Output

Fig 3.6.1.13: TATA STEEL



Source: E-views Output

Fig 3.6.1.14: NIFTY 50 Index



Source: E-views Output

Interpretation

The above charts depict the stability criteria for OLS test. In order to check the reliability of results got from OLS test, Cusum test is run to satisfy stability feature in the results. From the above charts the variance (blue line) lies between red boundaries which states that results got from OLS test is reliable and stable and it can be used for further estimations.

3.7 GARCH Model

To study the third objective, GARCH Model has been employed

3. **To study the impact of**
    a. **Stock futures prices on volatility stocks included in Nifty 50 Index of NSE.**
    b. **Nifty 50 futures Index on volatility of Nifty 50 index.**

The volatility of Nifty 50 index and selected stocks is estimated by using Generalized Auto Regressive Conditional Hetroscedasticity (GARCH) model. Here GARCH Model is used to study the impact of futures closing prices on spot volatility. The result of GARCH model is summarized in the table 3.7.1 and 3.7.2

Table 3.7.1: GARCH (1, 1) Model for DRREDDY

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.034705	0.003538	9.808645	0.0000*
RESID(-1)^2	0.311552	0.034846	8.940854	0.0000*
GARCH(-1)	0.006342	0.071639	0.088525	0.9295

Source: Compiled from E-views Output

Table 3.7.1, shows the result of GARCH model on DRREDDY's spot volatility. In table, C is constant of DRREDDY returns with coefficient 0.034705. RESID(-1)^2 is previous period's squared residual i.e. previous day's DRREDDY spot and future information about volatility that is ARCH term(α). GARCH(-1) is conditional variance (β). The coefficient of ARCH is significant, which shows the presence of previous day's information has effect on the DRREDDY Spot returns volatility. The ARCH coefficient (α) is (0.311552) indicates less impact of previous events or news in India. The GARCH coefficient (β) is insignificant as p-value is more than 0.05. Therefore, it can be said that DRREDDY futures return is not the cause for volatility in spot return. There are other factors influencing volatility of spot returns.

Table 3.7.2: GARCH (1, 1) Model for Model for GRASIM

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.040721	0.004352	9.357377	0.0000*
RESID(-1)^2	0.253853	0.039663	6.400225	0.0000*
GARCH(-1)	0.031012	0.078318	0.395970	0.6921

Source: Compiled from E-views Output

Table 3.7.2, shows the result of GARCH model on GRASIM's spot volatility. In table, C is constant of GRASIM returns with coefficient 0.040721. RESID(-1)^2 is previous period's squared residual i.e. previous day's GRASIM spot and future information about volatility that is ARCH term(α). GARCH(-1) is conditional variance (β). The coefficient of ARCH is significant, which shows the presence of previous day's information has effect on the GRASIM Spot returns volatility. The ARCH coefficient (α) is (0.253853) indicates less impact of previous events or news in India. The GARCH coefficient (β) is insignificant as p-value is more than 0.05. Therefore, it can be said that GRASIM futures return is not the cause for volatility in spot return. There are other factors influencing volatility of spot returns.

Table 3.7.3: GARCH (1, 1) Model for HDFC BANK

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.002099	0.000648	3.237206	0.0012*
RESID(-1)^2	0.111115	0.011015	10.08771	0.0000*
GARCH(-1)	0.876099	0.013162	66.56154	0.0000*

Source: Compiled from E-views Output

Table 3.7.3, shows the results of HDFC BANK spot volatility. RESID(-1)^2 is previous period's squared residual i.e. previous day's HDFC BANK information about volatility that is ARCH term(α). GARCH(-1) is conditional variance (β). The coefficient of ARCH and GARCH are significant, which shows the persistence of information has effect on the HDFC BANK returns volatility. In other words, the volatility in HDFC BANK is due to internal shocks i.e. both the last period's squared residual and conditional variance. The ARCH coefficient (α) is low (0.111115) indicates less impact of previous events or news in India. The GARCH coefficient (β) is very high i.e. (0.876099) which shows that the volatility of HDFC BANK is very high due to its previous returns of HDFC BANK futures. C is constant of HDFC BANK returns with coefficient 0.002099 which would remain constant over the period time.

Table 3.7.4: GARCH (1, 1) Model for HDFC

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.000859	0.000478	1.795951	0.0725
RESID(-1)^2	0.017426	0.005279	3.300788	0.0010*
GARCH(-1)	0.962766	0.014536	66.23179	0.0000*

Source: Compiled from E-views Output

In table 3.7.4, the RESID(-1)^2 is previous period's squared residual i.e. previous day's HDFC information about volatility that is ARCH term(α). GARCH(-1) is conditional variance (β).

The coefficient of ARCH and GARCH are significant, which shows the presence of information has effect on the HDFC returns volatility. In other words, the volatility in HDFC spot is due to internal shocks i.e. both the last period's squared residual and conditional variance. The ARCH coefficient (α) is low (0.017426) that implies less impact of previous events or news in India on HDFC spot. The GARCH coefficient (β) is very high i.e. (0.962766) which shows that the volatility of HDFC is very high due to its previous returns of HDFC futures.

Table 3.7.5: GARCH (1, 1) Model for HERO MOTOCO

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.004777	0.000969	4.929159	0.0000*
RESID(-1)^2	0.038568	0.006371	6.054068	0.0000*
GARCH(-1)	0.913294	0.015220	60.00768	0.0000*

Source: Compiled from E-views Output

In table 3.7.5, C is constant of HERO MOTOCO returns with coefficient 0.004777. RESID(-1)^2 is previous period's squared residual i.e. previous day's HERO MOTOCO information about volatility that is ARCH term(α). GARCH(-1) is conditional variance (β). The coefficient of ARCH and GARCH are significant, which shows the Persistence of information has effect on the HERO MOTOCO spot returns volatility. In other words, the volatility in HERO MOTOCO is due to internal shocks i.e. both the last period's squared residual and conditional variance. The ARCH coefficient (α) is low (0.038568) indicates less impact of previous events or news in India. The GARCH coefficient (β) is very high i.e. (0.913294) which shows that the volatility of HERO MOTOCO is very high due to its previous returns of HERO MOTOCO futures.

Table 3.7.6: GARCH (1, 1) Model for HINDALCO

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.004173	0.001372	3.040806	0.0024*
RESID(-1)^2	0.065742	0.014699	4.472450	0.0000*
GARCH(-1)	0.868075	0.032563	26.65867	0.0000*

Source: Compiled from E-views Output

The table 3.7.6, shows volatility of HINDALCO stock. The RESID(-1)^2 is previous period's squared residual i.e. previous day's HINDALCO information about volatility that is ARCH term(α). GARCH(-1) is conditional variance (β). The coefficient of ARCH and GARCH are significant, which shows the presence of information has effect on the HINDALCO returns

volatility. In other words, the volatility in HINDALCO spot is due to internal shocks i.e. both the last period's squared residual and conditional variance. The ARCH coefficient (α) is low (0.065742) that implies less impact of previous events or news in India on HINDALCO spot. The GARCH coefficient (β) is very high i.e. (0.868075) which shows that the volatility of HINDALCO is very high due to its previous returns of HINDALCO futures.

Table 3.7.7: GARCH (1, 1) Model for HINDUNILVR

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.023777	0.002777	8.561633	0.0000*
RESID(-1)^2	0.151538	0.029605	5.118672	0.0000*
GARCH(-1)	0.355668	0.066467	5.351029	0.0000*

Source: Compiled from E-views Output

The table 3.7.7, shows volatility of HINDUNILVR spot market. Term C is constant of HINDUNILVR returns with coefficient 0.023777. RESID(-1)^2 is previous period's squared residual i.e. previous day's HINDUNILVR information about volatility that is ARCH term(α). GARCH(-1) is conditional variance (β). The coefficient of ARCH and GARCH are significant, which shows the presence of information has effect on the HINDUNILVR Spot returns volatility. In other words, the volatility in HINDUNILVR is due to internal shocks i.e. both the last period's squared residual and conditional variance. If we compare ARCH and GARCH coefficient, (α) is low (0.151538) indicates less impact of previous events or news in India whereas GARCH coefficient (β) is higher than ARCH i.e. (0.355668) which shows that previous returns of HINDUNILVR futures has greater impact on volatility of HINDUNILVR spot. If the coefficient of GARCH and ARCH term is added, we get 0.507206 through which it can be said that there are other factors in the market that influences volatility of HINDUNILVR stock.

Table 3.7.8: GARCH (1, 1) Model for ITC

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.003728	0.000303	12.32270	0.0000*
RESID(-1)^2	0.080826	0.006638	12.17636	0.0000*
GARCH(-1)	0.887431	0.006714	132.1798	0.0000*

Source: Compiled from E-views Output

The table 3.7.8, shows volatility of ITC stock. The RESID(-1)^2 is previous period's squared residual i.e. previous day's ITC information about volatility that is ARCH term(α). GARCH(-

1) is conditional variance (β). The coefficient of ARCH and GARCH are significant, which shows the persistence of information has effect on volatility of ITC returns. In other words, the volatility in ITC spot is due to internal shocks i.e. both the last period's squared residual and conditional variance. The ARCH coefficient (α) is low (0.080826) that implies less impact of previous events or news in India on ITC spot. The GARCH coefficient (β) is very high i.e. (0.887431) which shows that the volatility in ITC is very high due to its previous returns of ITC futures.

Table 3.7.9: GARCH (1, 1) Model for LT

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.023889	0.001519	15.72259	0.0000*
RESID(-1)^2	0.523642	0.033341	15.70558	0.0000*
GARCH(-1)	0.286426	0.020819	13.75820	0.0000*

Source: Compiled from E-views Output

In table 3.7.9, C is constant of LT returns with coefficient of 0.023889. RESID(-1)^2 is previous period's squared residual i.e. previous day's LT information about volatility that is ARCH term(α). GARCH(-1) is conditional variance (β). The coefficient of ARCH and GARCH are significant, which shows the presence of information has effect on the LT spot returns volatility. In other words, the volatility in LT is due to internal shocks i.e. both the last period's squared residual and conditional variance. The ARCH coefficient (α) is high (0.523642) indicates greater impact of previous events or news in India on LT spot volatility. The GARCH coefficient (β) is low i.e. (0.286426) which shows that previous returns of LT futures have less impact on the volatility of LT.

Table 3.7.10: GARCH (1, 1) Model for RELIANCE

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.031886	0.009519	3.349823	0.0008*
RESID(-1)^2	0.099301	0.027818	3.569618	0.0004*
GARCH(-1)	0.134994	0.236476	0.570859	0.5681

Source: Compiled from E-views Output

Table 3.7.10, shows the result of GARCH model on RELIANCE's spot volatility. In table, C is constant of RELIANCE returns with coefficient 0.031886. RESID(-1)^2 is previous period's squared residual i.e. previous day's RELIANCE spot and future information about volatility that is ARCH term(α). GARCH(-1) is conditional variance (β). The coefficient of ARCH is significant, which shows the presence of previous day's information has effect on the

RELIANCE Spot returns volatility. The ARCH coefficient (α) is (0.099301) indicates less impact of previous events or news in India. The GARCH coefficient (β) is insignificant as p-value is more than 0.05. Therefore, it can be said that RELIANCE futures return is not the cause for volatility in spot return. There are other factors influencing volatility of spot returns.

Table 3.7.11: GARCH (1, 1) Model for SBIN

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.019110	0.003020	6.326757	0.0000*
RESID(-1)^2	0.219764	0.032178	6.829632	0.0000*
GARCH(-1)	0.394198	0.073567	5.358371	0.0000*

Source: Compiled from E-views Output

The table 3.7.11, shows volatility of SBIN spot market. Term C is constant of SBIN returns with coefficient 0.019110. RESID(-1)^2 is previous period's squared residual i.e. previous day's SBIN information about volatility that is ARCH term(α). GARCH(-1) is conditional variance (β). The coefficient of ARCH and GARCH are significant, which shows the presence of information has effect on the SBIN Spot returns volatility. It can be said that the volatility in SBIN is due to internal shocks i.e. both the last period's squared residual and conditional variance. If we compare ARCH and GARCH coefficient, (α) is low (0.219764) indicates less impact of previous events or news in India whereas GARCH coefficient (β) is higher than ARCH i.e. (0.394198) which shows that previous returns of SBIN futures has greater impact on volatility of SBIN spot. If the coefficient of GARCH and ARCH term is added, we get 0.613962 through which it can be said that there are other factors in the market that influences volatility of SBIN stock.

Table 3.7.12: GARCH (1, 1) Model for TATA MOTORS

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.023775	0.003336	7.127562	0.0000*
RESID(-1)^2	0.303344	0.040804	7.434207	0.0000*
GARCH(-1)	0.298554	0.072881	4.096455	0.0000*

Source: Compiled from E-views Output

In table 3.7.12, C is constant of TATA MOTORS returns with coefficient of 0.023775. RESID(-1)^2 is previous period's squared residual i.e. previous day's TATA MOTORS information about volatility that is ARCH term(α). GARCH(-1) is conditional variance (β). The coefficient of ARCH and GARCH are significant, which shows the presence of information has effect on the TATA MOTORS spot returns volatility. In other words, the

volatility in TATA MOTORS is due to internal shocks i.e. both the last period's squared residual and conditional variance. The ARCH coefficient (α) is high (0.303344) indicates greater impact of previous events or news in India on TATA MOTORS spot volatility. The GARCH coefficient (β) is low i.e. (0.298554) which shows that previous returns of TATA MOTORS futures have slightly less impact on the volatility of TATA MOTORS.

Table 3.7.13: GARCH (1, 1) Model for TATA STEEL

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.021431	0.001504	14.25290	0.0000*
RESID(-1)^2	0.227271	0.019509	11.64943	0.0000*
GARCH(-1)	0.589477	0.023643	24.93275	0.0000*

Source: Compiled from E-views Output

In table3.7.13, C is constant of TATA STEEL returns with coefficient of 0.021431. RESID(-1)^2 is previous period's squared residual i.e. previous day's TATA STEEL information about volatility that is ARCH term(α). GARCH(-1) is conditional variance (β). The coefficient of ARCH and GARCH are significant, which shows the persistence of information has effect on the TATA STEEL Spot returns volatility. It can be said that the volatility in TATA STEEL is due to internal shocks i.e. both the last period's squared residual and conditional variance. The ARCH coefficient (α) is low (0.227271) indicates less impact of previous events or news in India. The GARCH coefficient (β) is high i.e. (0.589477) which shows that the volatility of TATA STEEL is very high due to its previous returns of TATA STEEL futures.

Table 3.7.14: GARCH (1, 1) Model for NIFTY 50 INDEX

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.000360	8.460005	4.261967	0.0000*
RESID(-1)^2	0.035859	0.004811	7.454067	0.0000*
GARCH(-1)	0.945125	0.007367	128.2927	0.0000*

Source: Compiled from E-views Output

In table 3.7.14, C is constant of Nifty 50 index returns with coefficient 0.000360. RESID(-1)^2 is previous period's squared residual i.e. previous day's Nifty 50 information about volatility that is ARCH term(α). GARCH(-1) is conditional variance (β). The coefficient of ARCH and GARCH are significant, which shows the presence of information has effect on the Nifty Spot returns volatility. In other words, the volatility in NIFTY 50 is due to internal shocks i.e. both

the last period's squared residual and conditional variance. The ARCH coefficient (α) is low (0.035859) indicates less impact of previous events or news in India. The GARCH coefficient (β) is very high i.e. (0.945125) which shows that the volatility of nifty 50 is very high due to its previous returns of NIFTY 50 Index futures.

CHAPTER 4

FINDINGS AND CONCLUSION

4.1 FINDINGS

This study has been carried out to study the relationship between Spot and Futures market with reference to selected stocks listed on NIFTY 50 Index NSE. It also analysed the long run co-integration and Causal relationship between Spot and Futures prices of stocks and index. The study also estimated the impact of Spot market on Futures market. The study has been carried out on volatility of spot returns along with influence by stock futures.

The descriptive statistics of the study has shown that the rate of return as given by the mean is greater for the Spot markets than compared with Futures market except RELIANCE whose mean return for futures is greater than spot market return. The volatility in spot market is higher than compared with Futures market except for NIFTY 50 Index. Standard deviation is higher for TATA MOTORS and RELIANCE in both Futures and Spot market which shows that they are highly volatile as compared to other variables. NIFTY 50 Index and HINDUNILVR possess lowest volatility among rest all variables. The measure of skewness indicates that the data points of all variables both Spot and Futures prices are moderately symmetric except for HDFC BANK, GRASIM, LT and RELIANCE where data points do not lie within +/-1. The kurtosis data points for all data series lies above three which indicates leptokurtic behaviour of the data series.

ADF test was performed to analyse the stationary of data and it is found that all the data was stationary at level.

Further Johansen's Co-integration test was carried out to see long term relationship between Spot and Futures market and test revealed that both Futures and Spot prices are correlated to each other. The test also disclosed that there is no at least one significant long run cointegration between variable except for HINDUNILVR.

Vector Error Correction Model was run to check long run causal relationship between spot and futures prices. From the results, it was seen that only two stocks (HINDUNILVR and TATA MOTORS) and NIFTY 50 index showed long causal relation from future to spot prices. This

indicates that change is spot prices of above stocks is due to change is future prices. GRASIM, LT and HINDALCO show two-way cause and effect relationship between spot and futures prices i.e. both markets influence each other.

From the result it can be seen that most of stocks do not exhibit long run relation between spot and future prices. This is because most of the futures contract are short term contract for maximum three months. Therefore, getting a long relationship between variables is inappropriate. This test was run to check whether there is long run causal relation between spot and futures prices and result proved that there is no long run causal relation between the variables for most of the stocks.

To analyse short run causal relationship between Spot and Futures returns Granger causality test was used and the result showed that there is bidirectional relationship between Spot and Futures for GRASIM, HINDALCO, HINDUNILVR and TATA MOTORS stocks. This implies that for these stocks there is a cause and effect relationship between spot and future prices i.e. change in future prices is caused by change in spot prices and vice versa. In case of HDFC BANK, LT and NIFTY, there is unidirectional relationship i.e. Futures market has effect on Spot market. There were seven stocks that showed no causal relationship between spot and future prices which states that spot and futures prices are not dependent on each other.

OLS Model was used to estimate the impact of Spot market on Futures market and test revealed that Spot prices of all variables have significant impact on their respective Futures prices i.e. Spot market has significant impact on Futures market.

In order to check the reliability of results got from OLS test, Cusum test is run to satisfy stability feature in the results. Test revealed that OLS test is reliable and stable and it can be used for further estimations.

GARCH Model was used to study the impact of futures prices on volatility of spot prices. The test revealed that value of beta is greater than the alpha suggesting past conditional variance (previous return of stock futures) has greater impact on volatility of spot returns then recent news announcement. DRREDDY, GRASIM and RELIANCE did not show GARCH effect which indicates that previous return of these stock futures are not the cause for the volatility of spot returns.

4.2 Conclusion

This study was conducted to examine causal relationship between spot and futures prices based on sample of 13 stocks selected from Nifty 50 Index and Nifty 50 Index. It also studied impact and volatility of futures prices on spot prices. From the study it can be concluded that there exists a relationship between spot and futures market. Futures prices influence spot prices in short run. Whereas long run causal relation between spot and futures prices was not seen except for few stocks. Study revealed that spot prices have significant impact on futures prices. The volatility in spot returns are caused due to changes in futures returns and previous day's market information. However, there are also other factors causing influence on stock returns which has to be studied before venturing into stock market trading.

4.3 Suggestions

4.3.1 Scope for further study

This dissertation focused to study the causal relationship between spot and futures prices, also taking into consideration the impact and causes of volatility in spot market. Since the work is carried only for the period of 5 years and the results got is only for the short term, the conclusion cannot be generalised. To get more valid conclusion it is suggested that one can do work for longer period (10 years). Also, this study is limited to only selected stocks, it would be more meaningful if scope of study is extended to different sectors. This dissertation is only concentrating on impact of spot prices on futures prices, however the stock futures can also be impacted by many other markets like, commodity market, forex market, money market etc. Therefore, integrative study of these markets can be done for better results. Scope for further research can be concluded that if the same study extends in future covering the above points would give more valuable inputs.

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