Project Dissertation

On

A study of the relationship between spot and future market – A case study of Bharti Airtel Stock Futures

Submitted by:

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CERTIFICATE FROM THE INSTITUTE

This is to certify that the project dissertation report titled “A study of the relationship between spot and future market – A case study of Bharti Airtel Stock Futures” is a bona fide work carried out by Mr. Jyoti Prakash Das of MBA 2015-17 and submitted to Delhi School of Management, Delhi Technological University, Bawana Road, New Delhi-110042 in partial fulfilment of the requirement for the award of the Degree of Masters of Business Administration.

Signature of Guide:	Signature of HOD:
Place:	Place:
Date:	Date:

DECLARATION

I, Jyoti Prakash Das, student of MBA 2015-17 of Delhi School of Management, Delhi Technological University, Bawana Road, Delhi-110042, declare that the project dissertation report on "A study of the relationship between spot and future market – A case study of Bharti Airtel Stock Futures", submitted in partial fulfilment of Degree of Masters of Business Administration is the original work conducted by me.

The information and data given in the report is authentic to the best of my knowledge. This Report is not being submitted to any other University for award of any other Degree, Diploma and Fellowship.

Name of the student:

Place:

Date:

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I would also like to extend my gratitude to the other faculty members of DSM, my family and friends for their support and cooperation during this project.

Jyoti Prakash Das
DSM, 2015-2017

EXECUTIVE SUMMARY

The report titled “A study of the relationship between spot and future market – A case study of Bharti Airtel Stock Futures” is a report based on the case study carried out by me of the futures market in India with respect to stock futures traded in NSE. It is a part of the course work of 4th semester, to be submitted as a requirement of the MBA program of Delhi School of Management, Delhi Technological University. The objectives of the report are to understand the relationship between spot and futures price of stock futures and to know the market efficiency of stock futures market by finding out the lead lag relationship between the spot and future prices in the market. It is a case study of the stock futures of Bharti Airtel, traded in NSE.

This Report is divided into six chapters. The first chapter of this study deals with introduction that presents the financial markets in general and Indian stock futures market in particular. It talks about the various derivative products that are traded in NSE. Futures are discussed in detail with emphasis on its functions and importance. The second chapter of the report presents the literature review. This talks about the various studies that have been conducted in the past with respect to futures trading. Few papers are based on the Indian scenario and helps in understanding how emerging market like India are doing with respect to futures trading. Literature also tells us about the various econometrics techniques to be followed in order to test the objectives of the study. The third chapter is about the research methodology. The fourth chapter gives the test results and their analysis. Augmented Dickey Fuller test is used to check the stationarity of both the spot and future time series. After checking the presence of cointegration between the two series, VECM is applied to know about the lead-lag relationship between the two series. Granger causality test is performed to see the short run causality between both the time series. The fifth chapter summarizes the findings and concludes the discussion. The report is winded up with the sixth chapter on bibliography.

The results of ADF tests showed that the data is non stationarity as desired. Cointegration test between the future and spot prices showed that the prices do exhibit long run relationship. However, the Granger causality test showed that the market is not efficient and there is no existence of causal relationship in the short run. Vector error correction estimation was also done to see the degree of lead lag relationship between the spot and future prices. The coefficients gave us the idea about adjustment to equilibrium takes place each period. Bharti Airtel stock futures market also reacted to the announcement of JIO 4G services by Reliance. The causality between the spot and future prices before and after September 1, 2016, the day when JIO was announced has also been checked. Interestingly, Before the announcement of JIO services, the market was not showing any sort of causal relationship between the spot and the future prices in the short run. However, after the announcement of JIO, we can see a bidirectional causal relationship between the spot and future market which means, the telecom stock future market is currently efficient in strong form and reflects the market information as well as the public information promptly. Impulse response test established that both the cash and futures market destabilizes with the introduction of shocks and takes few lags to come back to stable form.

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CHAPTER 1

INTRODUCTION

1.1 Financial Markets

Financial markets are provisions that facilitates for buying and selling of financial products and services. The enterprises, financial establishments, people and governments trade in financial products in these markets either straightforwardly or through dealers or brokers on stock markets. The stock markets or organized exchanges are primarily involved in attracting new investible resources into the corporate sector and their allocation among alternative uses and users. The securities exchanges by empowering the transforming of proprietorships in the product market into financial assets, to be specific shares, uniting buyers with sellers of partial holding of companies. It empowers organizations to raise long term financing essential for business by issuing securities.

The primary functions of the financial market are enabling companies to raise essential long term financing by issuing securities, and providing a market in which these securities can be valued and easily traded. Thus the financial markets are playing a very important role as far as the determination of the equilibrium price is concerned. Since both undervaluation and overvaluation of securities are financially and economically undesirable, the discovery of the right price has been given a significant place in finance literature. The precondition for right price discovery is the existence of an efficient market. A market is said to be efficient if the current prices fully and instantaneously reflects all available information and leads to right price discovery. If the market is not efficient, excess profit opportunities would arise making the market volatile. Since market volatility seriously handicaps the efficient price discovery process, market participants have long been worked and their efforts came into lime light in the form of the introduction of innovative financial instruments, commonly well known as derivatives. The derivatives help to reduce risk associated with the price volatility of underlying securities.

According to Weber (2008), the concept of derivative securities can be traced back to the Mesopotamia to Hellenistic Egypt and the Roman world civilization. Derivatives were based on commodities only during the earlier years, but the scope of derivatives trading has broadened now-a-days. NSE and BSE started off trading in equity derivatives in India in the year 2000. Index futures was the financial derivative instruments to be introduced in the Indian capital markets. Subsequently index options

were launched in June 2001. Options in individual stocks were introduced in July 2001 whereas single stock derivative futures are the latest ones, introduced in November 2001. Equity derivatives instruments have evolved a long way since then. New and innovative products have continuously come to the market with continuously expanding list of eligible traders. Trade volumes have also increased. India's involvement with the derivatives market has been to a great degree positive. The derivatives turnover of F&O segment on the NSE has already crossed the market turnover of equity. The total turnover of F&O segment on the NSE has increased from Rs. 23,654 Cr. in 2000-01 to Rs. 9168326.74 Cr. in 2017-18. Whereas, the average daily turnover in the F&O segment of the market has risen from mere Rs. 11 Cr. during 2000-01 to an astounding figure of Rs. 539313.34 Cr. in 2010-11.

1.2 Derivatives

Derivatives are contracts between two parties whose price is dependent upon the price of one or more underlying assets. Common underlying assets are stocks, commodities, currency, interest rates and bonds etc. Derivatives are the instruments used for hedging of systematic risk

A derivative can be:

- A security derived from a secured or unsecured loan, share, debt instrument or any other form of security.
- A contract whose value is derived from index of prices or prices of underlying securities.

Example: Farmer growing wheat can sell his crop before harvesting at a negotiated price on a future date so that the risk of price changes by that date can be eliminated. The physical delivery of wheat and exchange of cash will take place on the due date of the contract but the price has been determined in advance. Here the underlying asset is the crop of wheat, the current price of which will govern the price for the future.

One of the prominent characteristic of an efficient market is that the data accessible in the market is instantly reflected in the spot and futures prices. As a result, there will be perfect positive co-movement between the prices of future & spot markets. In other

words, there won't be any systematic lead lag response and arbitrage opportunity in the market. In efficient market, smart investors have no advantage because every bit of superior information has already been captured in actual asset prices. In perfectly efficient future and spot market, informed investors are indifferent in respect of trading in futures and spot market.

1.3 Derivative Products

Many derivatives products are available in the market. According to Ekta (2016), the most common derivatives products are forward, future, option and swap. A concise explanation of these products is given below.

- Forwards: A forward contract is a tailor made agreement unique in terms of asset size, date, price and quantity drawn between two parties, where the date of settlement and the price is agreed upon in advance. It is the simplest form of derivative among all derivatives products. Forward contract is basically a buy or deal exchange in which the cost and different terms have been settled upon but the delivery and payments are postponed to a later date. Forward contracts are negotiated between two parties outside the framework of any stock exchange and without any standard structuring. Forward markets have disadvantages such as absence of centralization of trading, poor liquidity and Counter party risk.
- Futures: A significant advantage of futures contracts is that they are free from the disadvantages of forward contracts as they are traded on exchange and are suited to individuals and small entities. Futures contract is a contract between two involved parties to buy or sell an asset at a specific time later on and at a specific price. Key characteristics of futures contract are that they are standardized in terms of quantity, delivery venues and dates, quality of the product, price and these specifications are controlled by the exchange. Another feature of futures contracts is that futures contract provides greater liquidity and can be reversed with any member of the exchange. If the position has not been reversed, then it is settled by payment of difference or delivery of underlying assets on the maturity date.

- Options: Options are contracts for delivery in future like forwards and futures, where one party is obligated to perform the contract on the enforcement of the second party. Thus option is a right without an obligation to buy or sell an asset at a predetermined price within a specified time interval. The buyer of the option pays a premium to exercise this right. Options are of two types- call option and put option. The put option gives the buyer the right to sell the underlying asset whereas the call option gives the buyer the right to purchase the underlying asset. The main theoretical advantage of options contracts over futures contracts is that in option contracts the maximum risk of loss to the contract buyer is limited to the premium.
- Swaps: Swap is a contract between two parties to exchange cash flows where one of the flows is a fluctuating quantity such as currency, floating interest and the other is a fixed cash flow. It is done according to prearranged formula that depends on the value of one or more underlying assets. In other words, swaps may be regarded as portfolios of forward contracts. Presently numerous swaps are available in the market among them Interest rate swaps and Currency swaps are mostly traded in the market for managing interest rate risk and exchange rate risk respectively.

1.4 Functions of Futures Market

Ekta (2016) discusses that the importance of futures markets arises from their ability to forecast cash prices at a specified future date. This provides traders with a means of managing the risk associated with the trading in underlying asset. Burns (1983) stated that futures market provide both direct and indirect economic benefits. Direct benefits imply lower hedging costs, expansion of output, functional specialization and economies of scale which come from futures market ability to execute transactions more efficiently. While indirect benefits are related to improvement in information about cash prices and improvement in the efficiency and integration of related markets which come from the publically available information about futures prices.

The main functions of the futures market are given below:

- Price Discovery: Active and timely participation by large number of sellers and buyers ensure fair price. Futures market increase the competitiveness of

the market as it encourages large number of participants with objectives of hedging, speculation and arbitraging. As a result, futures market facilitates price discovery due to increased participants, increased volumes, increased sensitivity of participants to react to smallest price change and smooth dissemination of information among different participants.

- Risk Management: A buyer is always willing to obtain at the lowest possible price while the seller is interested in the highest price. But prices in a free market move freely up and down according to changes in the supply and demand of the underlying asset. In free market information about the future trend of the prices do not exist and this may be both favourable and unfavourable to buyer and seller. This creates price risk for both buyer and seller. Futures market enables to manage this risk through hedging. Hedging involves taking a position in the futures market opposite to an exposure in the cash market. It reduces the exposure of risk by shifting that risk to others with opposite risk profile or to investors who will acknowledge the risks in lieu of profit opportunities.
- Provide Leveraging: Futures market involves only fractional outlay of capital as compared to the spot market. An investor just needs a small amount of the price to trade or buy in the derivatives market than he would need for trading in the same stock in the cash market. Therefore, leveraged positions are potentially more profitable, but at the same time are extensively risky. In the event that leveraged positions do fail to meet expectations, a lot of cash would be wiped out. But on the contrary, if these positions work in favour, a lot of money can be made. Thus futures market helps in increasing volumes of trade which further enhance the price discovery efficiency of futures market.
- Transactional Efficiency: Futures market attempts to further down transaction costs and bring in liquidity. This market's reduced costs of trading and liquidity enhances their transactional efficiency, risk management and price discovery functions.

1.5 Futures Pricing

According to Kolb and Overdahl (2003), futures prices is dependent on the cash price of the commodity and the expected cost of storing commodity from the current time to the delivery date of the futures contract. This Cost-of-Carry Model is based on the concept of arbitrage, and the model outlines the relationship between the spot price of a commodity and the expected futures price that prevent arbitrage.

1.6 The Cost-Of-Carry Model

Carrying charges are basically of four types that includes financing costs, storage costs, transportation costs and insurance costs. The carrying charges include only the charges involved in carrying the commodity from a place to another or from one time to other and excludes the price of the commodity itself.

1.7 Spot and Futures Pricing Relationships

According to Kolb and Overdahl (2003), the carrying charges as described above are important because they play an important role in determining pricing relationships between spot and futures prices. It also helps in understanding the relationships among prices of various futures contracts having unalike maturities. A trader can borrow funds from the debt market, buy a commodity with the borrowed funds in the spot market, sell the futures contract, and carry the commodity forward so as to deliver against the futures contract. These transactions would generate a certain profit without investment, or an arbitrage profit. The cash-and-carry arbitrage opportunity arises because the spot price is too low relative to the futures price. If the spot price is too low in comparison to the futures price, an arbitrage opportunity arises. The spot price might also be too high in comparison to the futures price. If that is the case, it is said to have a reverse cash-and-carry arbitrage opportunity.

In case of perfect markets, which do not have transaction costs and no restrictions on the use of proceeds from short sales, the futures price is given by:

$$\mathbf{F_{0,\,t} = S_0\,(1 + C)}$$

Where,

$F_{0,\,t}$ = the futures price at $t = 0$ for delivery at time = t

S_0 = the spot price at $t = 0$

C = the expected cost of carry, expressed as a fraction of thespot price, necessary to carry the good forward from the

present to the delivery date on the futures

Theoretically The futures instrument moves in sync with its underlying. If the underlying price falls, so would the futures price and vice versa. However, the underlying price and the futures price differs and they are not really the same. In the figure above, the underlying value is 342.00 while the 1-month future with expiry date of 27th April 2017 is trading at price 343. This difference in price between the futures price and the spot price is called the "basis or spread". In case of BHARTIARTL, this spread is 1 point

The difference in price is because of the 'Spot – Future Parity'. The difference between the spot and futures price arises due to variables such as interest rates, dividends, time to expiry etc. This is also known as the futures pricing formula.

Futures Price = Spot price *(1+ r_f – d)

Where,

r_f = Risk free rate

d = Dividend

'r_f' is the risk free rate that you can earn for the entire year (365 days); considering the expiry is at 1, 2, and 3 months one may want to scale it proportionately for time periods other than the exact 365 days. Therefore, a more generic formula would be –

Futures Price = Spot price * [1+ r_f*(x/365) – d]

Where,

x = number of days to expiry.

The RBI's 91-day Treasury bill can be used as a measure for the short term risk free rate.

1.8 Convergence of Spot and Future Price

The figure below shows the convergence of spot and future prices of stock future. At the start of the series, we can see a high spread between the spot and futures prices. This is because the number of days to expiry is high hence the x/365 factor in the futures pricing formula is also high. The futures remained at premium to the spot throughout the series. At the end of the series, the futures and the spot have converged. Irrespective of whether the future is at a premium or a discount, on the day of the expiry, the futures and spot always converges. If we have a futures position and if we

fail to square off the position by expiry, then the exchange will square off the position automatically and it will be settled at the spot price as both futures and spot converges on the day of the expiry.

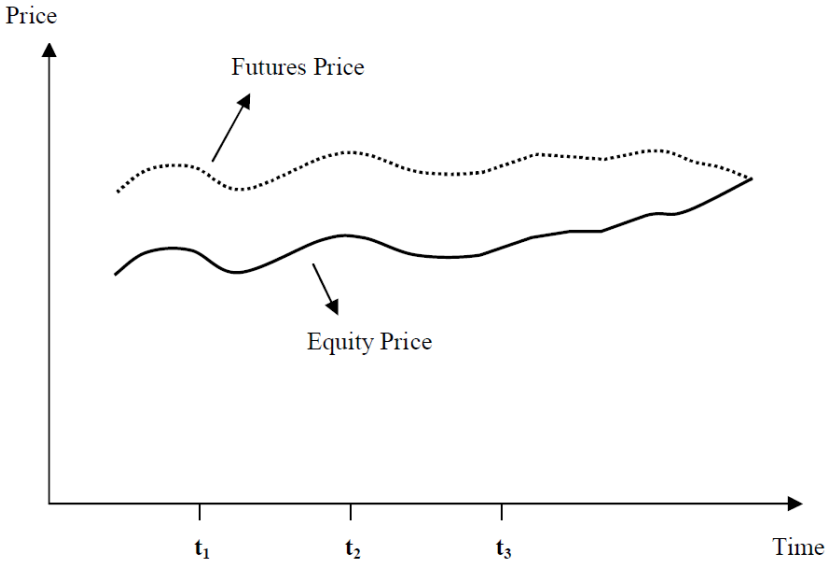

Figure 1: Price convergence of spot and future market

Here the Future is trading at a price higher than the Spot. If the future is trading higher than the spot, then the futures market is said to be at 'premium'. This is also known as "Contango". There could be instances – mainly owing to short term demand and supply imbalances where the futures would trade cheaper than its corresponding spot. This situation is when the futures is said to be trading at a discount to the spot, also referred to as the "Backwardation".

1.9 Importance of Futures

Primarily, there are three reasons for using futures contract –

- Hedging against a price risk
- Speculating in the changing price
- To take arbitrage opportunities

A hedger is one who wishes to reduce risk associated with the ownership of an inventory of a commodity. Hedgers buys or deals exclusively with the end goal of setting up a known value level ahead of time for something they later expect to purchase or sell in the spot market. They do this by taking an equivalent and inverse position in the future market than they have in the spot market. As the cost of the

commodity changes, the hedger is ensured in light of the fact that gain in one market are counterbalanced by misfortunes in the other market, paying little mind to which direction the price moves. Hedgers enthusiastically surrender the chance to profit by favourable price changes keeping in mind the end goal to accomplish assurance against unfavourable price changes.

Speculators, on the other hand, accepts the risk relinquished by the hedger. Speculators take stands on their desires of future price movement frequently with no expectation of making or taking delivery of the commodity. They purchase when they envision rising costs and sell when they expect declining prices. Without the speculator, the market would not be liquid and it would be a costly affair of price protection sought by the hedger.

Arbitrageurs are those traders who exploit price disparities between spot and future markets by entering into trades in two or more markets. When the opportunity emerges, an arbitrageur tries to exploit it by purchasing in one market at a specific 'cost and at the same time offering in the other market at a higher cost. Be that as it may, these value disparities must be transitory since they can without much of a stretch be disposed of by the arbitrage procedure itself. This is done, in light of the fact that the buy in one market will drive costs up for that market, while the deal in the other will drive costs down. Consequently, arbitrage is vital for keeping future and cash market prices in line.

1.10 Motivation for the study

The motivation for studying the spot and futures contracts with respect to stock futures can be summarized as:

- Stock futures are highly liquid instruments widely used for short term trading and portfolio adjustments
- The usefulness of these contracts for minimizing risk and price discovery depends on the effectiveness with which pricing is done relative to the underlying stock.

- To identify the existence of degree of Cointegration and Causal relation between stock futures market and spot market especially in an emerging market economy like India.

CHAPTER 2

LITERATURE REVIEW

Derivative market in its form today, has emerged from the fact that the risk averse market participants are willing to protect themselves from the fluctuations and uncertainties of the associated prices of market. Derivatives are tools that provide the market participants the opportunities to hedge the associate risks, speculate the price movement and take arbitrage opportunities. It also provides high leverage to the investors who can take large position with less capital. Since world markets for trade and finance have turned out to be more incorporated, derivatives have given strength to the interoperability and linkages between worldwide markets, which in turn have increased the efficiency and market liquidity, and have encouraged the flow of trade and finance.

David M. Modest and Mahadevan Sundaresan (1983) showed that at the point when transaction costs are perceived, the futures price can vary inside a limited interim without offering ascend to any arbitrage benefits. They demonstrated that in an arbitrage-free economy, the index futures might sell at a reduced rate relative to the spot index at equilibrium. When dividends were introduced to the analysis, it showed greater wedge between the futures and spot price.

Mohammed Alzahrani, Mansur Masih, Omar Al-Titi (2014) did extensive work on the bidirectional causality between spot and future prices in the oil market under different time scales. The linear and nonlinear causal relationship between daily spot and futures prices for one, two, three and four months of maturities of West Texas Intermediate crude oil were investigated by Bekiros and Diks (2008) to see the lead lag relationship. They also extensively researched on the efficiency of price discovery mechanism and the role played by futures markets in providing it. Several studies can be found in literature which have dealt with the lead-lag relationships between spot and futures prices of commodities, primarily focussed on investigating the issue of market efficiency.

According to A. R. Chowdhury (1991), a futures market is efficient with respect to an information set where only new and unforeseen information leads to a price change. Raghavendra RH et. al (2016) reveals that both the spot and future markets price of Indian agricultural commodities plays the leading role in the price discovery process.

Indian commodity future market is informationally efficient and reacts quickly to each other in context of Indian agricultural future market.

Raghavendra RH et. al (2016) tested market efficiency using cointegration analysis. Tarun Kumar Soni (2015) also applied cointegration to test the efficiency hypothesis and arbitrage condition for Indian agricultural future contracts. Soni (2015) showed that the results of cointegration tests between futures and spot prices of the selected agricultural commodities indicated a long term relationship do exist in three out of four futures contracts. However, the Wald tests results on the cointegrating vectors indicate markets as inefficient and biased. Further, analysis of short-term relationship using alternate tests of causality do not give consistent results for same commodity series indicating that results may vary due to alternate measures and specifications.

Priya Gupta and Archana Singh (2016) used standard Granger Causality Test to find the existence of short run causality between FDI and GDP in China. Causality between the spot and future market can also be studied under the Granger test to see whether there exists causality between the two markets.

VECM gives the speed of adjustment coefficient (α) for the spot and future prices (Mantu Kumar Mahalik et al. 2014). The element of the vectors indicates that following a price discrepancy, each market adjusts to the new equilibrium price, which can give the dominance results for the future market possesses over the spot market or vice versa and show the efficiency of price discovery in both the spot and future market.

From the empirical literature cited above, it is clear that most of the studies published till date in Indian context provide evidence of markets to be playing an efficient role in price discovery and risk management. The majority of the studies have used traditional tools to show the relationship between spot and future market. However as per my findings, most work has been done on commodities market and its futures. There are very few works on stock futures. The present study is based on stock futures of a telecom giant Bharti Airtel listed on NSE. The study also tried to explore the efficiency of the market during two time periods. Airtel stocks were constantly trading at a lower price since the announcement of the disruptive force in the market –

Reliance JIO. We try to explore the causality of the market before and after announcement of 4G services by Reliance on September 1, 2016.

The study takes historical data of last 2 years from NSE website to determine the cointegration relationship i.e. the existence of long run relationship between the spot and future price which determines the market efficiency using BHARTIAIRTEL futures, trading in NSE. Short run relationship is determined using Granger causality test to see if futures Granger-causes spot and vice versa. VECM is estimated to see if each market adjusts to new equilibrium price and at what rate, following a price discrepancy.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Need and Significance of the Study

- To understand the concept of futures in stock market.
- To understand the relationship between spot and futures price of stock futures.
- To perform ADF test and determine the cointegration among the spot and future market price of BHARTI AIRTEL stock.
- To estimate the coefficients of vector error correction model for the spot and future price of BHARTI AIRTEL.
- To study market efficiency of stock futures market.
- To understand the causality in stock futures market.
- To study the effect of efficient market on causality.

3.2 Scope of the Study

The study brings out the pattern of pricing of stock futures in the stock market for BHARTI AIRTEL stock. It covers the study of futures, their spot pricing and their future pricing. To analyse the efficiency of futures market in the telecom domain in Indian scenario, we focus on a 24-month data of Airtel's stock future which is listed on NSE and is one of the 50 determining stock of NIFTY. The historical data is retrieved from NSE's website. In the first step, Augmented Dickey-Fuller test have been used to examine the stationarity of all futures and spot price series. Once stationarity is confirmed, Johansen's cointegration test is performed to test whether the futures price is an unbiased predictor of spot at contract maturity. VECM is applied to the data series to analyse the price discovery of spot to future and vice versa. Granger causality test is also performed on the data to see how the causality between spot and future price is effected due to external news and shocks.

3.3 Data Collection

The research work is based on analytical research design. The research deals with the spot and future prices of BHARTIAIRTEL stock futures over a period of 24 months from 12th March 2015 to 10th March 2017.

3.3.1 Primary Data:

- Discussions with supervisor for better understanding of the concepts and working.

3.3.2 Secondary Data:

- Historical data from NSE website
- Review of Previous research papers related to study
- Textbook references for interpretation and understanding
- Internet Resources

3.4 Tools for Analysis

- Johansen's Cointegration Test parameters
- Granger Causality Test parameters
- VECM estimate coefficients
- Charts
- Graphs
- Statistical measures

3.5 Limitations

- Historical data of up to two years is only available.
- Gap between theoretical and practical pricing of stocks and its futures depending on the market efficiency.
- The study is limited to the scope of data provided publically.
- The interpretation has been made according to my limited knowledge and experience.

CHAPTER 4

ANALYSIS AND DISCUSSION

4.1 Market efficiency test of stock futures market

The efficiency of stock futures market with respect to Bharti Airtel stocks listed on NSE is being tested over the period from March 2015 to March 2017. For analysing the efficiency of of futures market,it is essential to have the time series of the spot (S) prices and Futures(F) prices. To solve the purpose, data on daily closing price of BHARTIARTL future contracts and spot price of BHARTIARTL have been downloaded from the NSE India Ltd. Website. The spot and future price time series are then transformed to their logarithmic values to avoid the common econometrics related problems. Market efficiency of stock futures market is then examined by testing the cointegration relationship between the spot price and the futures price. Johansen's cointegration test has been applied to solve this purpose. Cointegration of two price series representing the spot and futures market is a primary condition to establish market efficiency because the market efficiency hypothesis implies that the future spot price can be predicted by the futures price in an unprejudiced way. If the two series are cointegrated, the spot and the future prices move together and will not tend to deviate from each other with time and we can say that the futures price can predict the future spot price in an unbiased manner.

4.2 Data Series

Last 24 months' data (from 12/03/2015 to 10/03/2017) of Futures of BHARTIARTL (Bharti Airtel) is downloaded from the NSE website. The data series consist of the following columns

- Symbol
- Date
- Expiry
- Open
- High
- Low
- Close
- LTP
- Settle Price
- No. of Contracts
- Turnover in Lacs

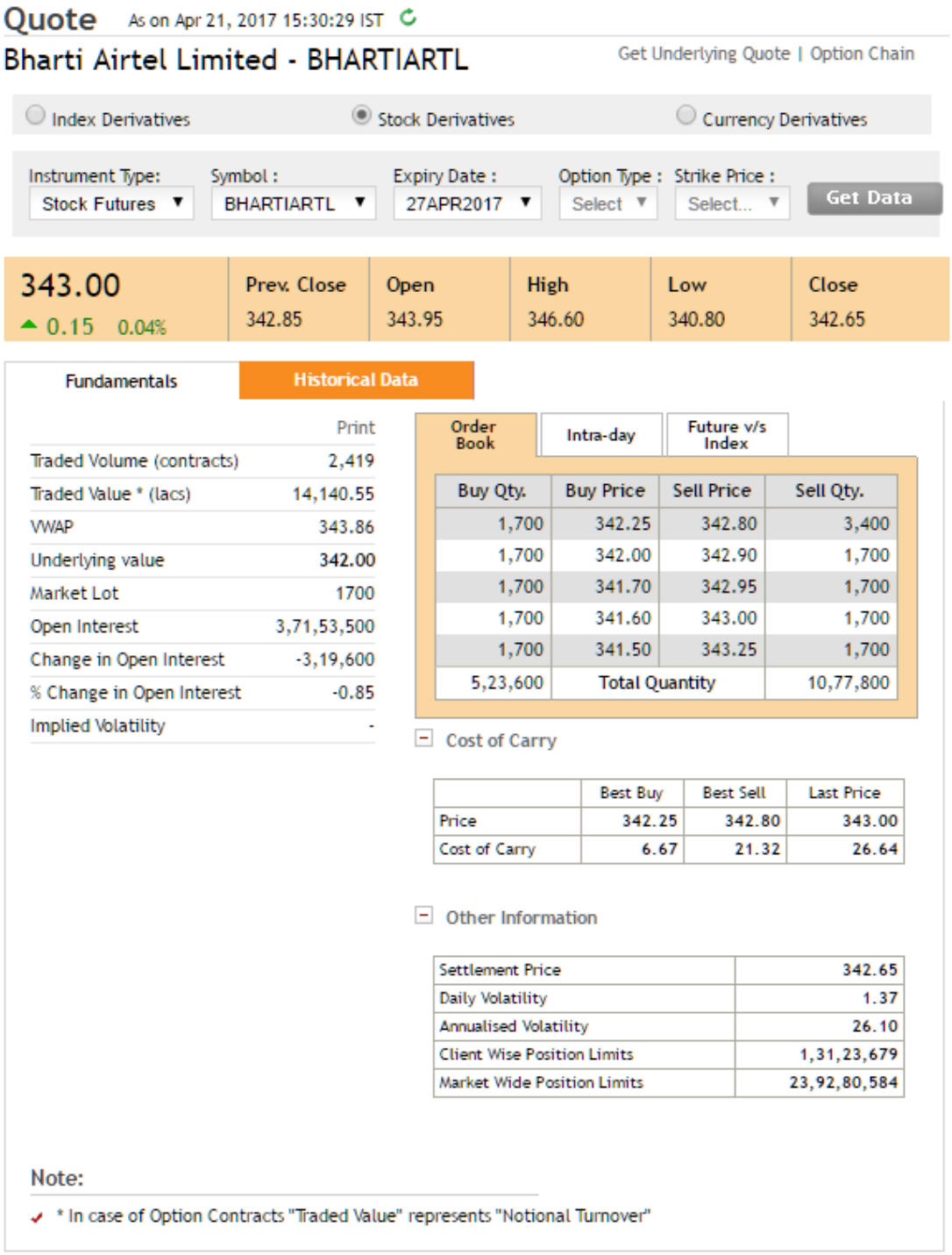

Figure 2: NSE page showing various details of BHARTIARTL stock futures

- Open Interest
- Change in Open Interest
- Underlying Value

For the co-integration test, we will be using the Underlying Value and the Close Price of the Futures. The UNDERLYING VALUE denotes the spot price of the BHARTIARTL Stock while CLOSE denotes the future price.

4.3 Data transformation

As per the theories of econometrics, the data needs to transformed to logarithmic form. We generate a series of natural logarithm of both the data series.

The transformation is $lx = \log_e(x)$

The two data series in our case are:

- lclose = $\log_e$(Close)
- lunder = $\log_e$(Underlying_Value)

The transformation is done by taking the natural logarithm which limits the overall trends of exponential growth, as seen in many time series data.

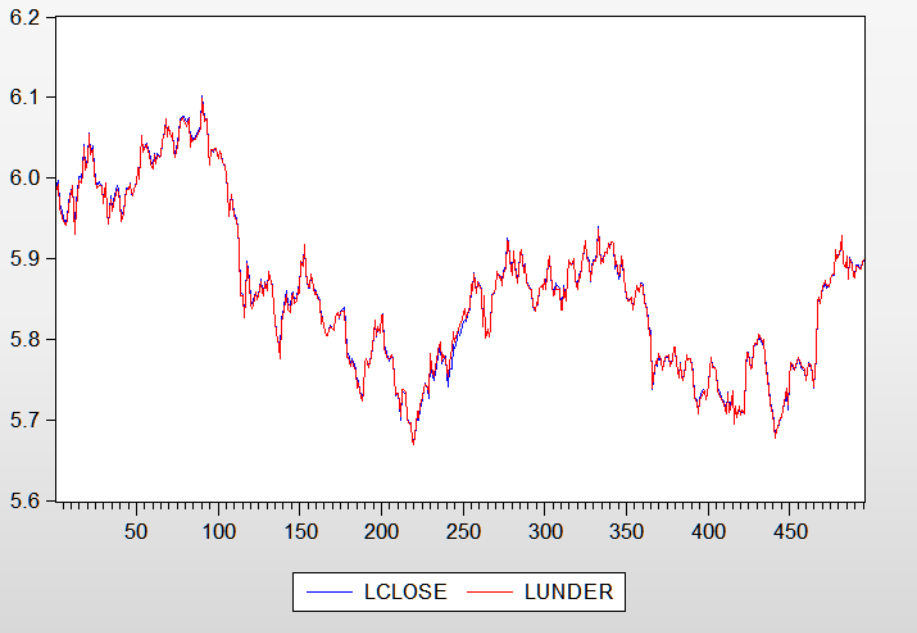

Figure 3: Log transformed data series

4.4 Test for Stationarity

A stationary time-series is one whose statistical properties such as variance, mean, autocorrelation, etc. are all constant over time. If a series has unit root, and its first difference is stationary then it is said to be non-stationary of order 1. Unit root test is a test commonly used in the literature to test the efficient market hypothesis in its weak form. It essentially is a random walk test for the futures price of the BHARTIARTL stock futures traded in NSE market in India.

In our study we have applied Augmented Dickey – Fuller (ADF) unit root test. The basic objective of Dickey and Fuller test (Dickey and Fuller 1979, Fuller 1976) is to test the null hypothesis that $\varepsilon = 1$ in:

$y_t = \varepsilon y_{t-1} + u_t$

against the one-sided alternative $\varepsilon < 1$.

Thus, our null hypothesis is H0: series contains a unit root vs. the alternate hypothesis H1: series is stationary.

We use the regression:

$\Delta y_t = \mu y_{t-1} + u_t$, so that a test of $\varepsilon = 1$ is equivalent to a test of $\mu = 0$ (since $\varepsilon - 1 = \mu$).

4.4.1 Stationarity Test of lclose:

Null Hypothesis: LCLOSE has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=17)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.074750	0.2552
Test critical values:	1% level	-3.443361	
	5% level	-2.867171	
	10% level	-2.569831	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LCLOSE)
Method: Least Squares
Date: 04/27/17 Time: 16:08
Sample (adjusted): 2 495
Included observations: 494 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LCLOSE(-1)	-0.015664	0.007550	-2.074750	0.0385
C	0.091609	0.044250	2.070232	0.0390

R-squared	0.008673	Mean dependent var	-0.000186
Adjusted R-squared	0.006658	S.D. dependent var	0.017139
S.E. of regression	0.017082	Akaike info criterion	-5.297588
Sum squared resid	0.143557	Schwarz criterion	-5.280573
Log likelihood	1310.504	Hannan-Quinn criter.	-5.290908
F-statistic	4.304586	Durbin-Watson stat	2.169339
Prob(F-statistic)	0.038529		

Figure 4: ADF test result of lclose – level

Interpretation:

The probability value is 25.52%, which means that the hypothesis that lclose has a unit root cannot be rejected.

Null Hypothesis: D(LCLOSE) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=17)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-24.31294	0.0000
Test critical values:	1% level	-3.443388	
	5% level	-2.867183	
	10% level	-2.569837	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LCLOSE,2)
Method: Least Squares
Date: 04/27/17 Time: 16:10
Sample (adjusted): 3 495
Included observations: 493 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LCLOSE(-1))	-1.092699	0.044943	-24.31294	0.0000
C	-0.000217	0.000770	-0.281143	0.7787

R-squared	0.546261	Mean dependent var	7.03E-06
Adjusted R-squared	0.545337	S.D. dependent var	0.025357
S.E. of regression	0.017098	Akaike info criterion	-5.295684
Sum squared resid	0.143537	Schwarz criterion	-5.278643
Log likelihood	1307.386	Hannan-Quinn criter.	-5.288993
F-statistic	591.1191	Durbin-Watson stat	1.988571
Prob(F-statistic)	0.000000		

Figure 5: ADF test result of lclose – first difference

Interpretation:

The probability value is 0, which means that the hypothesis that D(lclose) has a unit root can be rejected.

Thus, the variable lclose is stationary and integrated of same order, i.e., I(1).

4.4.2 Stationarity Test of lunder:

Null Hypothesis: LUNDER has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=17)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.104503	0.2431
Test critical values:	1% level	-3.443415	
	5% level	-2.867195	
	10% level	-2.569844	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LUNDER)
Method: Least Squares
Date: 04/27/17 Time: 16:38
Sample (adjusted): 2 495
Included observations: 492 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LUNDER(-1)	-0.016421	0.007803	-2.104503	0.0358
C	0.096047	0.045732	2.100228	0.0362

R-squared	0.008958	Mean dependent var	-0.000181
Adjusted R-squared	0.006935	S.D. dependent var	0.017506
S.E. of regression	0.017445	Akaike info criterion	-5.255459
Sum squared resid	0.149122	Schwarz criterion	-5.238392
Log likelihood	1294.843	Hannan-Quinn criter.	-5.248758
F-statistic	4.428932	Durbin-Watson stat	2.169367
Prob(F-statistic)	0.035843		

Figure 6: ADF test result of lunder – level

Interpretation:

The probability value is 24.31%, which means that the hypothesis that lclose has a unit root cannot be rejected.

Null Hypothesis: D(LUNDER) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=17)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-24.20793	0.0000
Test critical values:	1% level	-3.443469	
	5% level	-2.867219	
	10% level	-2.569857	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LUNDER,2)
Method: Least Squares
Date: 04/27/17 Time: 16:38
Sample (adjusted): 3 495
Included observations: 490 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LUNDER(-1))	-1.092615	0.045135	-24.20793	0.0000
C	-0.000200	0.000790	-0.252640	0.8007

R-squared	0.545634	Mean dependent var	-1.07E-05
Adjusted R-squared	0.544703	S.D. dependent var	0.025906
S.E. of regression	0.017480	Akaike info criterion	-5.251393
Sum squared resid	0.149116	Schwarz criterion	-5.234273
Log likelihood	1288.591	Hannan-Quinn criter.	-5.244669
F-statistic	586.0237	Durbin-Watson stat	1.987654
Prob(F-statistic)	0.000000		

Figure 7: ADF test result of lunder – first difference

Interpretation:

The probability value is 0, which means that the hypothesis that D(lunder) has a unit root can be rejected.

Thus, the variable lunder is stationary and integrated of same order, i.e., I(1).

4.5 Cointegration Test

The variables lclose (log of closing price) and lunder (log of underlying price) are both I(1). The Johansen's test of cointegration is performed so as to check whether a linear function of lclose and lunder is I(0).

Sensitivity of the Johansen's test is dependent on the selection of lag length. Before doing Cointegration, we need to determine the number of lag intervals to be provided between the cointegrating variables. An unrestricted VAR model is taken to determine the no of lags that need to be introduced for determining Cointegration between the two variable series.

VAR Lag Order Selection Criteria
Endogenous variables: LCLOSE LUNDER
Exogenous variables: C
Date: 04/27/17 Time: 16:46
Sample: 1 2000
Included observations: 478

Lag	LogL	LR	FPE	AIC	SC	HQ
0	2463.466	NA	1.15e-07	-10.29902	-10.28158	-10.29216
1	3426.434	1913.849	2.09e-09	-14.31144	-14.25910	-14.29086
2	3455.835	58.18596	1.88e-09	-14.41772	-14.33049*	-14.38342*
3	3461.288	10.74575	1.87e-09	-14.42380	-14.30167	-14.37579
4	3466.124	9.491504	1.86e-09	-14.42730	-14.27028	-14.36557
5	3471.835	11.15934*	1.85e-09*	-14.43446*	-14.24255	-14.35901
6	3472.562	1.412555	1.87e-09	-14.42076	-14.19396	-14.33159
7	3473.281	1.392935	1.90e-09	-14.40703	-14.14534	-14.30415
8	3474.637	2.616310	1.92e-09	-14.39597	-14.09939	-14.27937

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Figure 8: Lag length Selection Criteria

Going by the Schwarz Information criteria in our case, and taking a lag of 2, the Cointegration test is performed.

Date: 04/09/17 Time: 13:04
Sample (adjusted): 4 495
Included observations: 488 after adjustments
Trend assumption: Linear deterministic trend
Series: LCLOSE LUNDER
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.078136	43.27465	15.49471	0.0000
At most 1	0.007293	3.571899	3.841466	0.0588

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.078136	39.70275	14.26460	0.0000
At most 1	0.007293	3.571899	3.841466	0.0588

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

LCLOSE	LUNDER
-352.1653	356.5366
31.12458	-21.48179

Unrestricted Adjustment Coefficients (alpha):

D(LCLOSE)	0.000560	-0.001444
D(LUNDER)	-0.000140	-0.001485

1 Cointegrating Equation(s): Log likelihood 3537.859

Normalized cointegrating coefficients (standard error in parentheses)

LCLOSE	LUNDER
1.000000	-1.012413
	(0.00444)

Adjustment coefficients (standard error in parentheses)

D(LCLOSE)	-0.197263
	(0.27295)
D(LUNDER)	0.049369
	(0.27900)

Figure 9: Cointegration Test Result

Test results show that there exist a cointegration equation among the variables at 0.05 level. From this we can say that the spot and future prices co-move with each other and they have a long run relationship. The implication of cointegration is that both the spot and futures markets do not respond proportionately to the pricing information in the short run, however in the long run they converge to equilibrium under the

condition that both the spot and futures markets are efficient. But evidence of cointegration does not tell anything about the speed of price discovery in either of the markets; rather it conveys very significant information regarding the strength of the basis (Futures Price – Spot Price) (Booth et al., (1999)). On date of the maturity of the contract, price series in two markets converges and it implies that cost-of-carry model holds good. The following figure shows the convergence.

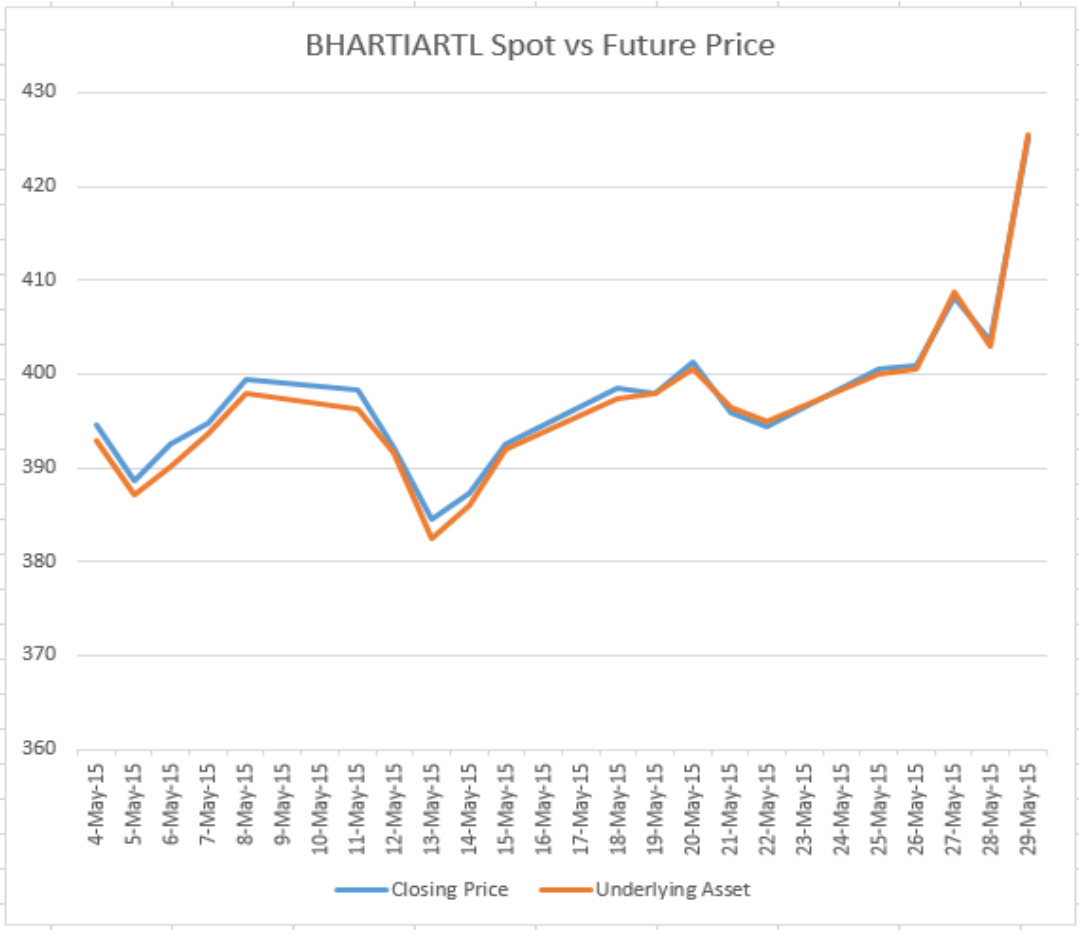

Figure 10: Spot vs Future Price - Convergence

In order to determine which is the best model to use in the testing of Cointegration, we summarise all 5 sets of assumptions

Date: 04/10/17 Time: 20:58
Sample: 1 2000
Included observations: 488
Series: LCLOSE LUNDER
Lags interval: 1 to 2

Selected (0.05 level*) Number of Cointegrating Relations by Model

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	1	1	1	1	1
Max-Eig	1	1	1	1	1

*Critical values based on MacKinnon-Haug-Michelis (1999)

Information Criteria by Rank and Model

Data Trend:	None	None	Linear	Linear	Quadratic
Rank or No. of CEs	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
	Log Likelihood by Rank (rows) and Model (columns)				
0	3517.958	3517.958	3518.008	3518.008	3518.277
1	3534.708	3537.836	3537.859	3537.861	3538.088
2	3534.732	3539.645	3539.645	3539.892	3539.892
	Akaike Information Criteria by Rank (rows) and Model (columns)				
0	-14.38507	-14.38507	-14.37708	-14.37708	-14.36999
1	-14.43733	-14.44605*	-14.44205	-14.43796	-14.43479
2	-14.42103	-14.43297	-14.43297	-14.42579	-14.42579
	Schwarz Criteria by Rank (rows) and Model (columns)				
0	-14.31638	-14.31638	-14.29121	-14.29121	-14.26695
1	-14.33429	-14.33442*	-14.32183	-14.30916	-14.29740
2	-14.28364	-14.27841	-14.27841	-14.25405	-14.25405

Figure 11: Modelling cointegration relation

From this, we conclude that model 2 (i.e. None, intercept, no trend) is the best model in case of our data variable (1 cointegrating relation).

4.6 Testing the lead-lag relationship in stock futures

The analysis of lead-lag relationships between stock spot prices and stock futures prices is based on the observation that indicates –

- The degree of integration between the markets
- How rapidly the entry of new and relevant information in the market is reflected in the market.

The lag and lead coefficients on the futures and spot prices shows the significance of the lag-lead relationship. Significant lags in spot prices and zero leads will make the futures lead the spot. If the reverse is true, then the spot leads the futures. If statistically non-zero coefficients are seen, then a feedback relationship exists between the spot and future prices.

4.7 Estimation of VECM

Error correction method provides a means to rectify a proportion of disequilibrium in the next period. The error correction coefficient (α) is very important in this error correction estimation as it tells us how much of the equilibrium error is corrected in each period or how much the adjustment to equilibrium takes place each period. Asteriou (2007) explained the coefficients in the following ways:

- If $\alpha \sim 1$, the adjustment is very fast and 100% of adjustment takes place within the period
- If $\alpha \sim 0.5$, about 50% of the adjustment happens within the period.
- If $\alpha \sim 0$, no adjustment seems to happen.

In order to estimate the VECM, cointegration needs to be established first. We see from the above analysis that the spot and future prices are cointegrated. The optimum lag length is selected as 2, as determined in the previous steps.

Vector Error Correction Estimates
Date: 04/11/17 Time: 23:44
Sample (adjusted): 4 495
Included observations: 488 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LCLOSE(-1)	1.000000
LUNDER(-1)	-1.012401 (0.00443) [-228.354]
C	0.072096 (0.02598) [2.77457]

Error Correction:	D(LCLOSE)	D(LUNDER)
CointEq1	-0.199673 (0.27250) [-0.73274]	0.046900 (0.27854) [0.16838]
D(LCLOSE(-1))	-0.165854 (0.34467) [-0.48119]	0.243801 (0.35231) [0.69201]
D(LCLOSE(-2))	-0.225034 (0.31295) [-0.71907]	-0.083858 (0.31988) [-0.26215]
D(LUNDER(-1))	0.073415 (0.34281) [0.21415]	-0.322346 (0.35041) [-0.91992]
D(LUNDER(-2))	0.235336 (0.30894) [0.76175]	0.093159 (0.31578) [0.29501]
R-squared	0.011226	0.010990
Adj. R-squared	0.003037	0.002799
Sum sq. resids	0.141313	0.147644
S.E. equation	0.017105	0.017484
F-statistic	1.370916	1.341759
Log likelihood	1295.449	1284.756
Akaike AIC	-5.288724	-5.244901
Schwarz SC	-5.245790	-5.201967
Mean dependent	-0.000171	-0.000153
S.D. dependent	0.017131	0.017508

Determinant resid covariance (dof adj.)	1.77E-09
Determinant resid covariance	1.73E-09
Log likelihood	3537.836
Akaike information criterion	-14.44605
Schwarz criterion	-14.33442

Figure 12: VECM Estimates

Interpretation: From the above information table, it is found that –

- Only about 20% of disequilibrium is corrected in 2 years by changes in closing price lclose
- Only about 5% of disequilibrium is corrected in 2 years by changes in underlying asset price lunder

The inference which can be drawn in the case of stock futures is that futures market is able to uncover all the latest data through the channels and then spill overs some of the information to the spot market. The analysis reveals a relationship between spot and futures markets of bidirectional nature.

4.8 Test of Causality

There may exist a causal relationship between the spot and future price series as there exist a long run relationship. If both the price series contribute to same nature of information, then we can say that causality exist. For this purpose, Granger Causality test has been applied. The Granger causality test tells us how much of the past value of one variable can explain the present values of other variable. It further tries to improve the explanation by adding lagged values of the prior variable. (Jabir Ali and Kriti Bardhan Gupta, 2011).

Pairwise Granger Causality Tests
Date: 04/27/17 Time: 21:28
Sample: 1 495
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LCLOSE does not Granger Cause LUNDER	493	0.63497	0.5304
LUNDER does not Granger Cause LCLOSE		0.80300	0.4486

Figure 13: Granger Causality Test Results

Interpretation: From the above test results, at a probability value of 53.04% and 44.86%, we can infer that the neither the spot price Granger causes future price nor the future price Granger cause spot price. Although there exists a long run relationship between the future and spot prices, but in the short run no causality is seen. This might be due to the fact that the stock future market is weak form efficient in case of BHARTIARTL futures in the short run as information flow from spot to future market (and vice versa) seems inefficient.

An interesting result is seen when we divide the time period in our study to two sub groups. One subgroup denotes the prices before September 1, 2016 and the other subgroup is after September 1, 2016. We do this analysis, because Reliance had announced JIO services on September 1, 2016. Because of the disruptive pricing

strategies in the telecom market, Bharti Airtel lost Rs. 8,454.49 crores in market value on that day. Bharti Airtel fell as much as 9%, in intraday trading, its steepest fall since 15 February 2010, to Rs.302.

Pairwise Granger Causality Tests
Date: 04/27/17 Time: 21:22
Sample: 1 130
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LUNDER does not Granger Cause LCLOSE	128	4.29932	0.0157
LCLOSE does not Granger Cause LUNDER		5.59113	0.0047

Figure 14: Granger Causality Test of prices after announcement of JIO

Pairwise Granger Causality Tests
Date: 04/27/17 Time: 22:41
Sample: 1 365
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LUNDER does not Granger Cause LCLOSE	363	0.31182	0.7323
LCLOSE does not Granger Cause LUNDER		0.22037	0.8023

Figure 15: Granger Causality Test of prices after announcement of JIO

Interpretation: From the above two test results of two different subgroups of prices, it is clear that before the announcement of the 4G services by Reliance, there was no causality between the spot and future prices. The information flow from the spot to future market was inefficient, because of which there could have been the possibility of arbitrage opportunities. On the other hand, if we see the results after the announcement of JIO, it is very obvious that there exists a bidirectional relationship between the spot and future market which implies that both futures and spot market contributes to the price movement in other series. Hence we can say that the futures market for telecom stocks is currently in semi-strong efficient or strong efficient form as it absorbs and reflects the market information as well as the public information

With the efficient price discovery mechanism in both the markets, it will help the traders in taking hedging position with minimum risk exposure. This will also reduce volatility in the spot market.

4.9 Impulse response function

An impulse response test has been performed on the price series to see how the market prices react to the innovations. Figure shows that a unit shock in futures market destabilized the cash market (response of DLUNDER to DLCLOSE) up to 5 lags and thereafter the spot market price curve become stable. Similar observation can be made from a unit shock to price series in the spot market and its effect to the futures market. Interestingly, here the cash market reacted instantaneously from very upward point to a unit shock in the futures market whereas, in case of future market, reverse phenomenon is seen.

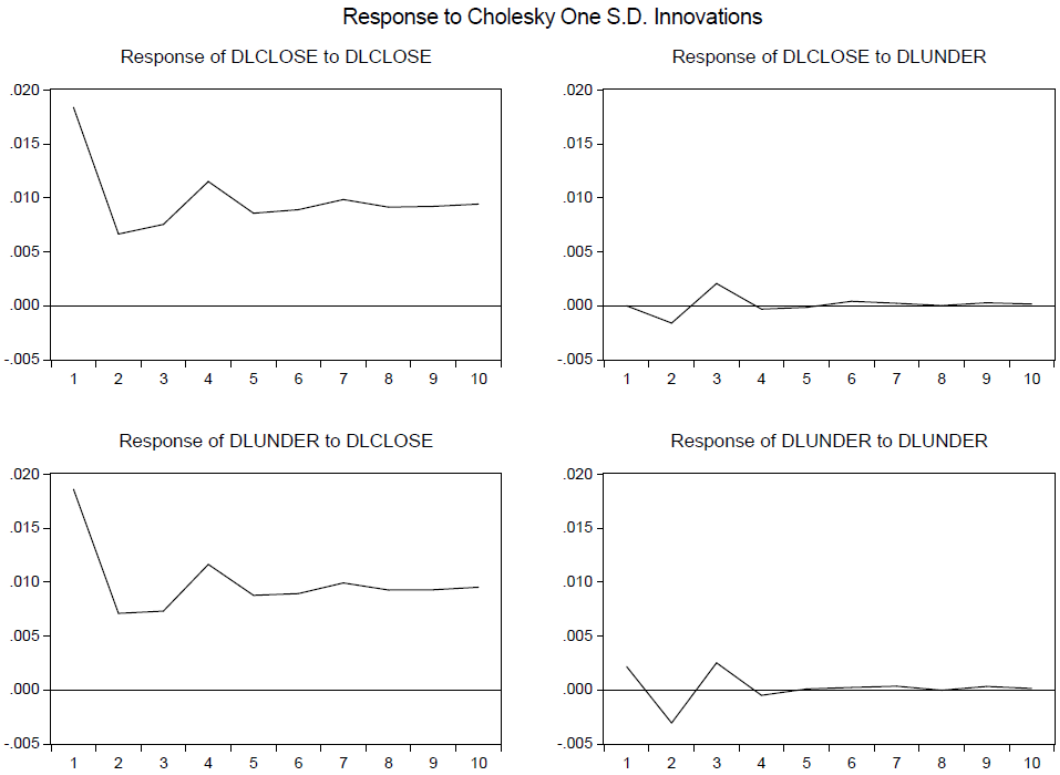

Figure 16: Impulse response curves on daily returns of spot and future markets

CHAPTER 5

CONCLUSION

5.1 Summary

In the present research work, the relationship between the spot and future market in India with respect to stock futures has been the prime objective. For the purpose, the spot and future price series of Bharti Airtel Stock futures which is traded in NSE has been used. The efficiency of the market and its unbiasedness for price discovery has been tested. The causal relationship between the spot and future prices has also been tested. In the study, stock futures having maturities of 1 month has only been considered. The results of ADF tests showed that the data is non stationarity as desired. Only when the data series is non stationary, the test of cointegration can be applied to the series. Cointegration test between the future and spot prices revealed the long run relationship between the prices. However, the Granger causality test showed that the market is not efficient and there is no existence of causal relationship in the short run. Vector error correction estimation was also done to see the degree of lead lag relationship between the spot and future prices. The coefficients tell us how much of the equilibrium error is corrected each period or how much of the adjustment to equilibrium takes place each period. How the Bharti Airtel stock futures market reacted to the announcement of JIO 4G services by Reliance, has also been checked. For this, the causality between the spot and future prices before and after September 1, 2016, the day when JIO was announced has been investigated. Interestingly, Before the announcement of JIO services, the market was not showing any sort of causal relationship between the spot and the future prices in the short run. However, after the announcement of JIO, a bidirectional causal relationship between the spot and future market can be seen, which means, the telecom stock future market is currently efficient in strong form and and reflects the market information as well as the public information promptly. Finally, an impulse response test has been performed on the price series to see how the market prices react to the innovations. It was established that both the cash and futures market destabilizes with the introduction of shocks and takes few lags to come back to stable form.

5.2 Conclusion

With time, as the economies are developing, financial systems too are becoming increasingly sophisticated, which means there is greater need of risk management techniques. Development and innovation of derivatives in risk management have reclassified and revolutionized the scene of financial system and it has earned suitable

place among all the financial products available till date. Derivatives are an excellent choice of risk management tool that help in effective management of risk. They essentially transfer risks from the one who wishes to avoid it to the one who chooses to accept it. The motivation for studying the spot and futures contracts with respect to stock futures came from the fact that firstly stock futures are highly liquid instruments widely used for short term trading and portfolio adjustments. The usefulness of these contracts for managing risk and in price discovery mechanism depends on the efficiency of pricing relative to the underlying stock. Secondly, to identify the existence of degree of Cointegration and Causal relation between stock futures market and spot market especially in an emerging market economy like India. In an efficient market, all available information is reflected in the prices of the securities in the spot market. The futures and spot market prices ought to move all the while immediately. However, for an inefficient market, the transmission of information and its corresponding price change of the securities does not happen, as seen in the current case. The lead-lag relationship between spot prices and its future gives an idea about the swiftness of each market while reacting to market wide information and how well their co-movements can be predicted. If any market responds faster to the information available in the market compared to the other, a lead-lag relationship can be observed in the data.

The results as seen in the analysis assure the traders that in case of any latest development in the market they can depend upon where the futures market is heading. The relationship between the spot and futures market would provide them sufficient intelligence about the prospective move in the spot market. This will help the traders including both the retail as well as the institutional traders to redesign their portfolios so that they can protect themselves from the volatility in the spot market by taking position in the futures market. Moreover, any prospective movement in the spot market will come to the knowledge of the regulators well ahead of time. They can thus take appropriate measures so as to protect the interest of the common investor when they feel that the market is reacting to the information. The expected volatility in the spot market can also be adjudged from the price movements in the futures market.

5.3 Scope for Further Research

A number of areas for further research can be suggested from the analysis of this research work.

- India is an emerging market and volatility in such market is obvious. It may not suffice to just know the lead-lag relationship. A volatility study can be done to examine the volatilities between price movements of stock futures and the underlying spot market.
- The study can be extended to include futures having two and three months' maturity periods to further understand the market behavior.
- Further extension can be done so as to include all the stock futures of telecom companies listed in NSE so as to know the market efficiency.

CHAPTER 6

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ANNEXURE

PLAGIARISM REPORT

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