PERFORMANCE OF COMMODITY FUTURES MARKET IN INDIA — A STUDY OF SELECT VARIABLES

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By

Syeda Rukhsana Khalid

REG. NO: 11MBPH06

Under the Supervision of

Prof. V. MARY JESSICA

SCHOOL OF MANAGEMENT STUDIES

UNIVERSITY OF HYDERABAD

HYDERABAD-500046

TELANGANA STATE

INDIA

DECLARATION

I, SYEDA RUKHSANA KHALID hereby declare that the thesis, ‘’Performance of Commodity Futures Market in India – A Study of Select Variables”, submitted by me under the guidance and research supervision of Prof. V. Mary Jessica is a bonafide research work which is also free from plagiarism. I also declare that it has not been submitted previously in part or in full to this University or any other Institution for the award of any degree or diploma. I hereby agree that my thesis can be deposited in Shodganga / INFLIBNET.

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This is to certify that the thesis entitled ‘‘Performance of Commodity Futures Market in India – A Study of Select Variables”, submitted by Syeda Rukhsana Khalid, bearing registration number 11MBPH06 in partial fulfillment of the requirement for award of Doctor of Philosophy in the School of Management Studies is a bonafide work carried out by her under my supervision and guidance.

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Further, the student has the following Publication(s) before submission of the thesis/monograph for adjudication and has produced evidence for the same in the form of acceptance letter or the reprint in the relevant area of his research: (Note: at least one publication in referred journal is required)

1. Published paper titled “Commodity Futures Market in India – An Overview” in EPRA *International Journal of Research and Development (IJRD)*, ISSN (online)-2455 7838, paper index 201702-02-0000985, Volume 2, Issue 3, March, 2017.

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2. Presented a paper titled "Sustainability growth: Making Commodity Futures Market Inclusive" in *National Conference on "Paradigm for Sustainable Business: People, Planet and Profit",* 2013, Organized by the Department of Management Studies, IIT Roorkee.
3. Presented a paper titled "Basis Risk in Commodity Futures Market", in *National Conference on "Risk Management in Banking, Insurance and Financial Services"* organized by Institute of Public Enterprise, 2013, Hyderabad.

Further, the student has passed the following courses towards fulfillment of coursework requirement for Ph.D:

Course Name	Credits	Pass/Fail
1. Quantitative Methods	3	Pass
2. Research Methodology	3	Pass
3. Financial Management and Strategic Finance	3	Pass
4. Financial Services and SAPM	3	Pass

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ABSTRACT

The present study was conducted to assess whether the CFM in India has reached the end users or not. Despite it's meteoric rise, CFM in India has still not percolated to the grassroot level i.e., the farmers who actually are the target beneficiaries of the CFM and what could be the reasons for their non participation. A sample of farmers from Warangal, Nizamabad and Adilabad districts of Telangana who majorly produce Chilli, Turmeric and Cotton were distributed questionnaires based on convenience/purposive sampling. The results identified the factors that were impeding farmers' participation and none of the farmers were found to be participating. The other end users of CFM are traders and investors. Interviews with traders were conducted who had been participating in CFM and the factors fostering and impeding their participation into CFM were identified. The effectiveness of 'Transaction Hedge' was discussed with the traders. Similarly, the questionnaires were distributed to the investors (who are also important stakeholders of CFM) of Telangana and Andhra Pradesh through brokerage houses in Hyderabad. The effectiveness of 'hedge' for the investors who were participating as hedgers was made known and the investors' factors fostering or impeding their participation in CFM were identified. Factor Analysis was done to reduce the variables/factors using Principal Component Analysis and varimax as rotation method.

Rubber industry is one of the efficient industry in India and also famous for high 'Farm Gate' price. This inspired the researcher to study the rubber industry in detail. Rubber growers of Kerala are majorly small growers like farmers of Telangana. A comparative study was made between small rubber growers and farmers of Telangana. Majority of the factors that were impeding for farmers participation in CFM were also present in the small growers, in contrast the farmers of Telangana did not have the support of Government Bodies working on the lines of

the Rubber Board of Kerala. The Rubber Board took the initiatives of forming co-operative societies called as 'Rubber Producer Societies' who acted as 'aggregators' and also formed 'Rubber Producer Companies' and 'Rubber Trading Companies' with 51% stake of Rubber Board and 49% stake of Rubber Producer Societies. Some of the Rubber Trading Companies also participated in CFM on behalf of the small growers. Suggestions were made by this comparative study which can be fruitful to the welfare and up-liftment of the farmers, more than anything stable income is the priority for the small farmers.

The study also collected secondary data from the websites of NCDEX, RBI. Daily spot and future prices of the select commodities chilli, turmeric, cotton and rubber were collected and using ARDL Bound Test, the co-integration relationship was checked between the two series and using Granger Causality, short and long causation were also found. Except chilli, all the commodities were found to be co-integrated and were having causality in both long and short run. Speed of adjustment for the commodities was also found. The Hedge Ratios in short run and long run were 1.03 and 1 for turmeric, 0.99 and 1 for cotton, 1 and 1 for Rubber (MM), 0.99 and 1 for Rubber (NM), 0.99 and 0.99 for Rubber (DM) and 24.86%, 65.06%, 99.04%, 97.5%, 55.99% as Hedging Effectiveness for the respective commodities.

The study also modeled the volatility of the commodities using ARIMA models. The selected ARIMA models were ARIMA (2,0,2), ARIMA(2,1,1), ARIMA(1,0,0), ARIMA(1,0,0), ARIMA(1,0,0) and ARIMA(2,1,2) respectively for the commodities Turmeric, Chilli, Cotton, Rubber (NM), Rubber (MM), Rubber (DM). The causal relationship between Dhaanya (NCDEX Index) and WPI was investigated and was found that 'Dhaanya is causing WPI'. This study had revealed how effective these markets were in carrying out 'Price Discovery' and 'Risk Management' functions.

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LIST OF ABBREVIATIONS

ACE……….. ACE Derivatives and Commodity Exchange

ACF………... Auto Correlation Function

ADF………. Augmented Dickey Fuller Test

AGFI………. Adjusted Goodness-of-Fit Index

AIC ………... Akaike Information Criterion

AIRIA …….. All India Rubber Industries Association

AON ………. All or None

APMC……....Agriculture Produce Market Committee

APSWC……..Andhra Pradesh State Warehousing Corporation

ARCHLM ….Autoregressive Conditional Heteroskedasticity Lagrainge Multiplier

ARDL ………Auto Regressive Distributed Lag

ARFIMA Autoregressive Fractionally Integrated Moving Average

ARIMA …….Auto Regressive Moving Average

ATMA …….. Automotive Tyre Manufacturers' Association

CA…………Commission Agent

CEI …………Certainty Equivalent Income

CFA ……….. Confirmatory Factor Analysis

CFI …………Comparative Fit Index

CFM……….. Commodity Futures Market

CFTC ……… Commodity Futures Trading Commission

Cointeq ……. Cointegration Equation

CPI…………Consumer Price Index

CTA………... Commodity Trading Advisors

CUSUM…….Cumulative Sum of Recursive Residuals

CWC…………Central Warehousing Corporation

DEA…………Data Envelopment Analysis

Demat……… Dematerialisation

DF ………….Dickey Fuller Test

DM………….Distant Month

ECM ………. Error Correction Model

EFA ……….. Exploratory Factor Analysis

EGARCH….. E-Generalized Auto Regressive Conditional Heteroscedasticity

FMC………...Forward Markets Commision

FP………….. Future Price

FRCA…....... Forward Contract Regulation Act (1952)

GARCH …… Generalized Auto Regressive Conditional Heteroscedasticity

GDP ………..Gross Domestic Product

GFI …………Goodness-of-Fit index

GTC ………. Good Till Cancelled

GTD ………..Good Till Date

ICEX ……….Indian Commodity Exchange Ltd., Mumbai

IFI …………. Incremental Fit Index

IOC ………... Immediate or Cancel

ISIN ……….. International Securities Identification Number

KPSS ……… Kwiatkowski–Phillips–Schmidt–Shin

Log …………Logarithm

LPG ……….. Liberalisation, Privatisation and Globalisation

MAPE ……... Mean Absolute Percentage Error

MCX ………. Multi Commodity Exchange of India Ltd

MM………….Maturity Month

MGARCH ….Mean Generalized Auto Regressive Conditional Heteroscedasticity

MGNREGS... Mahatma Gandhi National Rural Employment Guarantee Scheme

MSP………... Minimum Support Price

MT…………..Metric Ton

MTM ……….Marking-to-Market

NABARD …. National Bank for Agriculture & Rural Development

NCDEX........ National Commodity and Derivatives Exchange of India Ltd.

NFI …………Normed Fit Index

NM………….Near Month

NMCE…. …. National Multi Commodity Exchange of India Ltd.

NR ………….Natural Rubber

NSDC ……... National Skill Development Corporation

OECD……… Organization for Economic Cooperation and Development

OLS ……….. Ordinary Least Squares

PACF ……… Partial Auto Correlation Function

PP …………. Phillips Perron Test

PSF ………... Price Stabilisation Fund

RMSEA…… Root Mean Square Error of Approximation

RMT…………Risk Management Technique

RPS ………...Rubber Producers' Societies

RSDC ………Rubber Skill Development Council

SEBI……….. Securities Exchange Board of India

SHG ……….. Self Help Groups

SP………….. Spot Price

TISP ………..Tappers' Intensive Skill-Developed Programme

TSS …………Tapping Skill-Developed Schools

TV………….. Television

UCX ………. Universal Commodity Exchange Ltd, Navi Mumbai

UNCTAD…... United Nations Conference on Trade and Development

VAR ………..Value at Risk

VECM ……...Vector Error Correction Model

WPI………... Whole Price Index

WTO……….. World Trade Organisation

LIST OF SYMBOLS

∑ …………... Sigma

Π ………… Pi

t …………… Time Period

p …………... Probability

β …………… Beta

α …………… Alpha

μ …………… Mu

λ …………… Lambda

∞ …………... Infinity

ρ …………… Rho

σ …………… Sigma (Standard Deviation)

σ2 ………….. Sigma Square (Variance)

Ψ …………… Psi

γ …………… Gama

δ …………… Delta

χ^2 ………….. Chi Square

df …………... Degrees of Freedom

R……………Correlation Coefficient

R^2 …………..Coefficient of Determination

FP …………. Future Price

SP …………. Spot Price

Log(FP)…….Logarithm of Future Price Series

Log(SP)…….Logarithm of Spot Series

RMSEA……. Root Mean Square Error of Approximation

AR ………… Auto Regressive Term

MA …………Moving Average Term

SigmaSq ……Sigma Square (Variance)

F_t ………….. Future Price at time ‘t’

S_t …………... Spot Price at time ‘t

CHAPTER ONE

AN INTRODUCTION TO COMMIDITY FUTURES MARKET IN INDIA

1.1 Introduction

Commodities are marketable raw materials or agricultural products that are produced or manufactured to satisfy the needs of consumers. Commodities are fungible i.e. individual units of commodities can be mutually substituted. The characteristic of fungibility, render commodities the ability to be traded on exchanges like equity shares or funds. Commodities can be ‘soft’ or ‘hard’; soft commodities are the agricultural products like wheat, jowar, turmeric etc., whereas hard commodities are usually extracted from mines like oil, metals etc.

Commodity Markets are basically of two types, they are Spot Markets (Regular Mandi or Wholesale Market) and Derivative Markets. The spot markets or the wholesale market is the meeting place for buyers and sellers of commodities. The commodities are bought and sold with immediate delivery and after visual inspection of the specific commodity.

Agricultural Markets are examples of spot markets and are established in most parts of India, they are regulated under the “State Agricultural Produce Market Committee (APMC) Acts”. Market Committees constituted by the State Governments manages the markets within the market area of a state. Wholesale marketing activities cannot be carried out by either any person or agency in a specific area if it is proclaimed as a “market area” and falls under the purview of the Market Committee. “Agricultural Produce Market Committee (APMC) is a statutory market committee constituted by a State Government in respect of trade in certain notified agricultural or horticultural or livestock products, under the Agricultural Produce Market Committee Act issued by that state government".

APMCs are responsible for:

- Ensuring transparency in transactions and in "pricing system taking place in market area;
- Benefitting farmers as they provide "market-led extension" services to them;
- Payment to farmers for agricultural produce sold by them is ensured on the same day etc.

On the other hand, Commodity Futures Market, are financial in nature and deal with 'Futures' which are derivative instruments on an underlying physical commodity.

'Derivatives' are financial instruments which "derive their value from an underlying asset". There are many types of derivatives such as, forwards, futures, options, swaps etc. The derivative markets are financial markets where financial instruments like futures or options contracts are traded. These financial instruments are called as derivative instruments because they derived their "value from the underlying asset"; here the underlying asset is 'Commodity' hence they are termed as commodity derivatives. Again, these commodity derivatives require the existence of regulated commodity exchanges where they can be bought and sold. This mechanism gives commodity derivative trading an edge over regular wholesale markets as they require standardized contracts and are traded over regulated exchanges, without any hassle of visual inspection. It is a sort of virtual market where trading of soft or hard commodities takes place. The delivery of the commodity is not immediate but in some certain future time. There are only two types of commodity derivatives in India, they are forwards and futures. Futures markets came into existence to overcome the problems that existed in forward markets. Future Contracts are very similar to forward contracts but unlike forwards, futures are standardized contracts and are traded on regulated commodity exchanges giving them the advantage of mitigating the counterparty risk.

1.2 Chequered History of CFM

In India, commodities market had a prolonged history of derivatives trading. (Vashishtha and Kumar, 2010). It is still in its nascency in India, when compared to other global commodity exchanges. According to, (Ramaswami and Singh, 2007) CFM in India predominantly remains underdeveloped. The Indian CFM has a chequered history; derivative trading in India started with establishment of "Bombay Cotton Trade Association in 1875". This was just after a decade of inception of commodity trading in Chicago. Over time the derivative trading started in different parts of India. It started in oilseeds in Mumbai (1900), in Kolkata (1912) for jute goods and raw jute, in Hapur (1913) for wheat, in 1920 it started in Mumbai for bullion. There was an increased growth in futures trading in India between the First and Second World War.

Dormant Period in India: In 1939, Government of Bombay banned the derivative trading in Cotton because of the increased speculative activities. Later in due course, forward trading was prohibited in oil seeds, sugar, vegetable oils, spices, food grains etc. After the Second World War, there was shortage in supply of many commodities, and in the back drop of war, the derivative trading was prohibited under the "Defence Act of India". The commodity trading again started and was flourishing in early years of 1950 and 1960. But the future trading in commodities was banned in mid 1960's in India except in minor commodities like turmeric and pepper. This was because many blamed derivative trading for unnecessary speculation in essential commodities and also considered it deleterious to the normal and healthy functioning of markets. The CFM remained dormant for about forty years until the beginning of twenty first century.

Forward Contract Regulation Act (FCRA (1952)) and set up of "Forward Market Commission (FMC)"

FCRA (1952) was enacted in Dec', 1952. This was an act to provide for the "regulation of certain matters relating to forward contracts, the prohibition of options in goods and for matters connected therewith". Commodities are divided into three categories according to FCRA (1952) with extent of regulation, viz.

- "Commodities in which futures trading can be organized under the aegis of recognized association.
- Commodities in which futures trading is prohibited.
- Commodities which are neither regulated nor prohibited for being traded. These are referred as 'Free Commodities'".

Forward Markets Commission

It is a "statutory body set up under Forward Contracts (Regulation) Act 1952. The Central Government may, by notification in the official Gazette, establish a Commission to be called the Forward Markets Commission for the purpose of exercising such functions and discharging such duties as may be assigned to the Commission by or under this Act."

Mumbai is the headquarters for FMC. It is a regulatory authority for CFM in India. The Commission had functioned under the aegis of "Ministry of Consumer Affairs, Food & Public Distribution, Department of Consumer Affairs, Government of India" till 5th

September, 2013. Thereafter, the Commission has been functioning under the “Ministry of Finance, Department of Economic Affairs, Government of India”.

The objectives of regulation of CFM are to ensure that markets efficiently and effectively accomplish the twin functions of “Price Discovery and Price Risk Management”, to maintain financial integrity (Capital Adequacy and Payment of Margins) and market integrity (Audit, Surveillance and Monitoring) across the Exchanges, the market and the intermediaries (brokers, assayers, warehouses etc.), to ensure alignment of spot and future prices, Investor Protection and Transparency, Fairness in trading, Clearing and Settlement process.

1.3 Renaissance of Commodity Futures Trading in India

The “Khusro Committee” was constituted in June, 1980. This committee recommended the revival of futures trading. Accordingly, it was started in commodity “Potato” in a few markets during late eighties Punjab in U.P.

Table 1.1

Value of Trading in Commodity Markets in India

Years	Value in Billion (Rupees)
1996-1997	314
1997-1998	315
1998-1999	327
1999-2000	229*
2000-2001	274

Source: http://www.sebi.gov.in/cms/sebi_data/commodities/Report6.pdf[1]

* “The drastic decline in value of trading in 1999-2000 is mainly on account of the reduced trading t the Jute Exchange at Calcutta (from Rs 5022 to Rs 1234) and stor seed exchange at Ahmedabad (from Rs 6854 to Rs 5220 mn)”

In 1990, there was the Liberalization, Privatisation and Globalization of Indian economy in trade and industry. This resulted in major policy shifts in India. The summary position of values and volumes of trading in few of the exchanges (during late nineties) is displayed in the table 1.1 above.

The Government of India established a committee under the chairmanship of Prof. K.N. Kabra in 1993 to examine the role of futures trading over the past years, and then began to encourage commodity markets on the recommendations of Kabra committee submitted in 1994. It strongly recommended the opening of futures trading in select commodities.

Department of Agriculture and Co-operation in Dec', 2000 formed an "Expert Committee" on recommendations of "National Agricultural Policy 2000"; submitted a report in 2001 recommending reforms in agricultural marketing, it recommended "More commodities should be permitted for forward and futures trading to facilitate competitive and free marketing system. Govt. has to continue its efforts to strengthen the commodity exchanges and to instill confidence and awareness among market players". As proposed, in "National Agricultural Policy 2000" more agricultural commodities were recognized and recommended for futures trading. Finally, in the year "2003" three national exchanges were established "National Commodity and Derivatives Exchange of India Ltd. (NCDEX), Multi Commodity Exchange of India Ltd (MCX) and National Multi Commodity Exchange of India Ltd. (NMCE) with on-line trading and professional management".

Since the advent of 1990, the scope of the trading in futures was expanded by the collaborated efforts government of India. The efforts by the Government, recommendations of Khusro and Kabra Committees, recommendations of National Agricultural policy, strengthening of regulatory framework, establishment of National Commodity Exchanges actually have made ways for the commodity futures market to witness phenomenal growth in due time.

The CFM witnessed a spectacular growth till the first ban was imposed on "tur" and "urad" in 2007, and subsequently there was a ban on "wheat" and "rice". In 2008, FMC, as a cautionary step, suspended trading of futures in commodities like "Potato, Chana, Rubber and Soya". Trading in these commodities was resumed in 2008 with the ease of inflationary pressures. In 2009, future trading in "wheat" was re-started. The bans on futures trading in commodities shattered the confidence of CFM's participants.

The commodity trading in India has become very popular among the traders and retail investors in the recent times. The commodity derivatives constitute an important part of the commodity futures trading in the Indian financial market. The commodity derivatives are preferred for the reason that they provide the investors with a better opportunity of diversifying their portfolios in addition to what the bonds, shares, and real estates' offer.

Table 1.2

Commodity Futures Trading Value since 2002-03

Commodity Futures "Trading Value" (Rs in crore) since 2002-03							
Year	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2010-2011
Value	66,531	1,29,362	5,71,758	21,55,121	36,76,925	40,65,988	11948941

1.4 Futures Contract

Futures Contract is “specie of forward contract”. These are “exchange - traded contracts to buy or sell standardized financial instruments or physical commodities for delivery on a specified future date at an agreed price. Futures contracts are used generally for shielding against risk of unfavorable price fluctuation (hedging)”.

The exchange specifies certain standard features to facilitate liquidity in the futures contracts. Before maturity a futures contract can be “offset or square off” before maturity by taking an opposite and equal position.

The standardized items in a CFM contract are:

- “Quantity of the underlying commodity
- Quality of the underlying commodity
- Delivery center
- Delivery date and the month and
- Minimum price change and the units of price quotation.”

1.5 Suitability of Commodities for Futures Trading

For the commodities to be suitable for trading in CFM, it must have:

i. Supply and demand conditions.

ii. Volatility in prices to “necessitate hedging through futures price risk”.

iii. No restrictions on distribution, supply and prices.

iv. Homogenity in specifications, to be eligible for the “standardized contracts”.

v. Storability as “arbitrage” would not be possible.

1.6 Terminology Used in Futures Market

Futures Price: “The price at which the futures contract trades in the futures market”.

Spot Price: “The price at which a commodity trades in the spot market”.

Contract cycle: “The period over which a contract trades. The futures contracts may be for one month, two months, three months etc., but for not more than a year”.

Expiry cycles: “The agri commodities futures contracts (Agri commodity) expire on the 20th day of the delivery month. Thus, a March expiration contract expires on the 20th of March. If 20th happens to be a holiday, (the expiry date shall be the immediately preceding trading day of the Exchange, other than a Saturday). New contracts for agri commodities are launched usually on the 10th of the month”.

Expiry date: “It is the last day on which the contract will be traded, and is specified in the futures contract after which the contract will cease to exist”.

Delivery unit: **“**The amount of commodity that has to be delivered for one contract”.

Basis: Basis is the difference between the “spot price and the futures price. There will be a different basis for each delivery month for each contract. Spot price exceed Future price in a normal market”.

Cost of carry: This measures the “Storage cost plus the interest that is paid to finance the asset”.

Initial margin: “The amount that must be put in the margin account before entering into a futures contract is called as initial margin”.

Maintenance Margin: It is lower than the initial margin. It ensures that the "balance in the margin account never becomes negative. If the balance in the margin account reduces below the maintenance margin, a margin call is issued to the investor and he is expected to top up the amount in margin account back to the initial margin level before the trading commences on the next day".

Marking-to-market (MTM): MTM is the adjustment of the margin account to reflect the investor's loss or gain at the end of the each day depending upon the closing price.

1.6.1 Basic Payoffs

"A payoff is the likely profit/ loss that would accrue to a market participant with change in the price of the underlying asset". Here, the asset could be a commodity like chilli or gold.

"Payoff" for Buyer and Seller of Futures: (Long Futures and Short Futures)

The payoff for a person who buys and sells futures contract is similar to the payoff for a person who holds an asset. They have potentially unlimited upside as well as a potentially unlimited downside.

1.7 Mechanics of Futures Contracts

Futures are standardized contracts and both the parties to the futures contracts are protected against the default risk by a body called the "Clearing Corporation". The Clearing Corporation provides this guarantee to ensure that the seller or the buyer of a futures contract should not suffer from the counter party defaulting on its obligation. Clearing House guarantees the fulfillment of the obligations under the future contracts holds an amount as a security from both the parties, and this amount is called as the "Margin Money". Since the futures contracts are traded on the stock exchanges, the parties have the option to close their contract by squaring off their positions in the market. The following diagram clearly portrays the working of CFM.

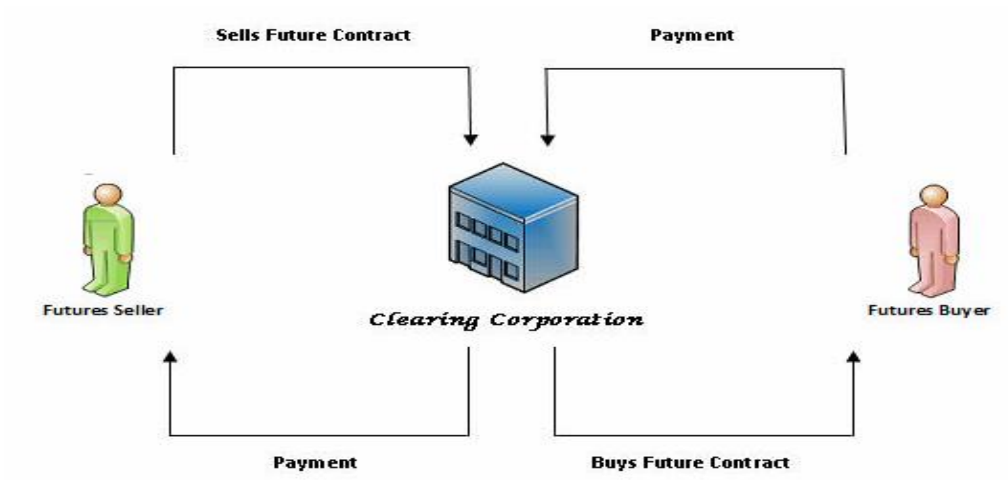


Figure 1.1 Working of a Commodity Futures Market

Client Account

Client Account is an account which is separated from the member's or broker's or principal's own business account, maintained for any client being serviced by a broker for a commission.

Clearing House

It carries out functions which are "post traded" like estimating losses and gains, confirming trades made by the participants, collecting from the members who have incurred losses and paying out to other who has made gains. Each commodity futures exchange has its own clearing house. At end of each trading session, all members of a commodity futures exchange are required to clear their trades and to deposit with the clearing house a sum of money sufficient to cover the member's debit balance.

Role of "Exchange in Futures Trading"

It designs a standardized contract, which cannot be modified by the participants; and provides platform for trading to happen, where the "offers" and "bids" are made. It provides a competitive environment and also provides facilities for "clearing, settlement and arbitration" for smooth trading and also provide financially "secure" environment by putting in suitable margining system and ensuring performance of contract through the "Process of Novation".

The exchange interposes itself between each seller and buyer thereby becoming a "buyer to every seller and a seller to every buyer". All losses and profits of the day are either paid out or paid in through the mechanism of 'Mark to Market'. This reduces the chances of default and it helps in "ensuring exchange interest exposed to only one day of price movement".

M to M

Collection of Mark-to-Market margin daily "reduces the possibility of accumulation of loss, specifically when futures price moves only in one direction", resulting in lessening of the counter party risk.

1.8 Economic Functions of the Futures Market

1. Price Discovery

Demand and supply are never in perfect consonance and therefore commodity futures markets can become the perfect system and place for sellers and buyers to help them in using all the available information to determine the market price at that moment. Futures market "do not set prices and are free markets which provide platform for trading, and where the forces (supply and demand) that influence the prices are brought together in open auction". Futures market "assimilates new information throughout the day, it translates this information into a single benchmark price-that is agreed upon by both the buyer and the seller". The futures are considered as the leading indicator because of this. CFM helps in

- Improved price formation i.e information asymmetry across the spot markets is removed.
- It empowers producers and integrates spot markets across future and present times.

2. Price Risk Management

It is also one of the very important functions of the CFM provided through process of "Hedging – it is the practice of offsetting the price risk inherent in the cash market position by taking an equal and opposite position in the futures market to protect from adverse price changes that could negatively impact the profitability of the business.", It is advantageous to farmers, traders, producers, exporters or importers and processors etc). "Cost of Carry" determines relationship between prices of spot and futures. Both spot and futures prices move in tandem allowing participants of spot market to mitigate the inherent "price risk by taking equal and opposite position in the futures market".

a. Reduces Price Volatility and Risk:

The market mechanism of commodity futures markets also helps to reduce price volatility as it acts like a see-saw and this continual adjustment to the current market situation helps in re-balancing and thus avoid boom and bust cycles.

b. Balancing Production and Consumption

It also helps in balancing production and consumption as price adjustments are constantly being made in the market based on supply and demand. Consumers and producers decide alike how much to consume or produce based on the market prices.

3. CFM is an alternate market for the traders and investors to diversify their investment and it gives improved market access, risk free trading, liquidity and reduced transaction costs.

4. CFM Helps in improving the efficiency of economy as infrastructure and logistics improves, quality of product and efficiency of the contracts improves, because the futures contracts are standardized.

1.9 Economic Benefits to the Stakeholders

It is beneficial to both the participants and non – participants as non participants like farmers can benefit from price discovery; the price signals from futures market can help them in choosing the crop to be sown, the time to sell the produce and processors also can decide when to buy. Market participants like traders, exporters, processors or even farmers if they are participating can hedge their risks and investors can diversify their investment.

1.10 Participants in the CFM

Participants in CFM could be hedgers, speculators, day-traders or scalpers, and arbitrageurs.

Hedgers could be producers, farmers who have an "underlying interest in the commodity and are using futures commodity market to insure or protect themselves against adverse price fluctuations".

Arbitrageurs "make simultaneous sale and purchase in two markets so as to take benefit of price imperfections. In the process they help, remove the price imperfections in different markets, For example, the arbitrageurs help in bringing the prices of contracts of different months in a commodity in alignment".

Day-Traders take "positions in futures contracts and liquidate them prior to the close of the same trading day".

Speculator takes position in the futures market "without having exposure in the physical spot market"; a speculator intention to enter CFM is to make profit, they are always on look out for fluctuations in prices which could be beneficial. Speculators undertake the risks of hedgers for future profits and provide depth and liquidity to the market, and are therefore an important participant of CFM.

Market Maker is a trader, who throughout the day quotes "bid and offer price" at the same time for the "same commodity". Exchange gives privileges to certain market players called as 'Market Makers' to bring the liquidity in the market of particular commodity. Market makers normally belong to the class of speculators.

1.11 Orders in CFM

In CFM, the orders that are placed could be various. They are displayed in the table 1.3:

Table 1.3

Order Types based on Time and Price conditions

Order Types Based on Time Conditions	**Order Types Based on Price Conditions**
1. Day Order –"automatically expires if not executed on the day the order is placed".	1. Market Order - Sell or Buy immediately at the available best counter price.
2. GTC (Good Till Cancelled) – Any order to sell or buy, which lasts until the order is cancelled or completed by the user.	2. Limit order – Only at a specific price.
3. GTD (Good Till Date) – These orders are cancelled on the specified day (expiration day) at the close of the market.	3. Stop Order - "will remain unelected (without entering the order book) until the stop price is reached. Once elected, it will be treated similar to a regular market order".
4. IOC (Immediate or Cancel) - An order requiring that all or part of the order be executed immediately after it has been brought to the market. Any portions not executed immediately are cancelled.	4. Stop Limit Order - "limit order that will remain unelected (without entering the order book) until the stop price is reached. Once elected, a stop limit order will be treated similar to a regular limit order".
5. AON (All or None) - The AON order works to "safeguard your purchase by providing the guarantee that you either receive full quantity that you requested or none at all. If full quantity is not available, the order gets expired".	

1.12 Advantages of Futures Market

1. Individual Participants Can go short (sell) or go long (buy) commodity futures contract. If one expects that the price of the commodity will decrease or increase in future they can sell or buy respectively the contract and buy or sell it back later hopefully for a profit.

2. Leverage

One of the important benefits that CFM provides to it's participants is 'Leverage' i.e. it is possible to trade without paying the full value of a contract. One can trade in CFM by paying only 3 to 5% of the contract size.

3. Profits

Volatility in some commodity markets offers potential for quick profits. Speculators usually make use of high variability in prices and make speculative profits.

4. Commission Costs

It is a lot cheaper to sell or buy one futures contract than to sell or buy the underlying instrument.

5. Liquidity

Because of low transaction cost and leverage, the number of participants in the market is more, making the market liquid.

6. Futures Market Benefit Farmers Indirectly

If the CFM is an efficient market i.e., the price is discovered in the CFM then farmers takes benefit "of the price signals emanating" from CFM. These signals help farmers to decide about the pattern of crops to be sown, storage and the investment requirement for the cultivation of crop. They also take advantage by the dissemination of the futures prices of exchange traded commodities as it improves their bargaining capacity.

1.13 Disadvantages of Futures Market

1. There is no assurance of the amount invested in CFM

2. Leverage: In CFM, leverage can be a 'double edged sword', it can add more risk to the participant as huge losses results in "margin calls", if the CFM moves in the opposite direction of the "assumed position".

3. Volatility in Prices of CFM: Prices of commodity futures are volatile in nature and sometimes the CFM moves in opposite direction of the assumed position and because of fluctuations in prices a "margin call" occurs to maintain the account.

1.14 Commodity Futures Market in India: An Overview

1.14.1 Indian Commodity Exchanges

In India, at present there are twelve recognised future exchanges, of which there are six national exchanges and six regional exchanges.

Table 1.4 below displays the list of exchanges in India.

Table 1.4

List of Commodity Exchanges

Sr. No.	Name of the Commodity Futures Exchanges
I.	**National Commodity Exchanges**
1	"Multi Commodity Exchange of India Ltd."
2	"National Commodity & Derivatives Exchange Ltd."
3	"ACE Derivatives and Commodity Exchange."
4	"National Multi Commodity Exchange of India Ltd.
5	"Indian Commodity Exchange Ltd."
6	"Universal Commodity Exchange Ltd."
II.	**Commodity Specific Regional Exchanges**
7	"The Chamber of Commerce", Hapur
8	"Rajkot Commodity Exchange Ltd.", Rajkot
9	"India Pepper & Spice Trade Association", Kochi
10	"Bombay Commodity Exchange Ltd", Mumbai
11	"Spices & Oilseeds Exchange Ltd", Sangli
12	"Cotton Association of India", Mumbai

(**Source:** FMC Bulletin, April 2015 – June 2015)

1.14.2 Distinguishing Characteristics of "National and Regional Exchanges"

The following are the distinguishing features of the commodity futures exchanges:

Table 1.5

Distinguishing Features of "National and Regional Exchanges"

National Commodity Exchanges	Regional Commodity Exchanges
Online trading is mandatory	It is not mandatory
National Exchanges are de-mutualised	De-mutualisation is not mandatory
National Exchanges are recognised on permanent basis.	Recognition is temporary and can be revoked.
National exchanges trade in "Multi commodity".	Regional exchanges trade in "single commodity". They have to take permission for trading in more than one commodity.
Large and expanding "volumes".	Low volumes

As already stated, the national exchanges can deal in multiple commodities, whereas the regional exchanges can trade in one or more commodities.

1.14.3 National Commodity & Derivatives Exchange Limited (NCDEX)

NCDEX is located in Mumbai and is incorporated on April 23, 2003 as a public limited company "under the Companies Act, 1956" and had started it's operations on 15th of Dec', 2003. It is a professionally managed 'online multi commodity exchange'. It majorly trades agri-commodities. The size of the trading unit is significant as this have an impact on the non-participation or participation of the target players. It is often felt that the trading units in the Indian commodity exchanges are unreasonable by the very nature of their size.

They avert small but genuine players from entering the futures market even for the purpose of hedging. The following table 1.6 displays the commodities traded on NCDEX and their respective "trading unit, quotation and maximum order size".

Table 1.6

NCDEX Commodities' Trading Unit, Quotation & Max.Order Size

Commodity Name	Unit of Trading	Quotations	Max. "Order Size"
AGRI PRODUCTS			
CEREALS			
Chana.	10 MT	100 kg	500 Metric Ton
Barley.	10 MT	Rs / Quintal	500 Metric Ton
Wheat.	10 MT	100 kg	500 Metric Ton
Maize-Feed/Industrial Grade	10 MT	Rs. per quintal	50 Metric Ton
FIBER			
V 797 Kapas	1 lot(4 MT)	Rs. per 20 kg	50 lots i.e.200 MT
Shankar Kapas	1 lot(4 MT)	Rs. per 20 kg	50 lots i.e.200 MT
GUAR COMPLEX			
Guar Seed	1 MT	Rs. per quintal	500 MT
Guar Gum	1 MT	Rs. per quintal	250 MT
PLANTATION PRODUCTS			
Rubber	1 MT	Rs. per quintal	50 MT
OTHERS			
Potato	15 MT	Rs. per quintal	750 MT
OIL & OIL SEEDS			
Castor Seed	10 Metric Ton	10 Metric Ton	500 Metric Ton
Cotton seed Oil cake	10 Metric Ton	10 Metric Ton	500 Metric Ton
Soy Bean	10 Metric Ton	10 Metric Ton	500 Metric Ton
Refined soy oil	10 Metric Ton	Rs/10 kg	500 Metric Ton
Mustard seed	10 Metric Ton	Rs. per quintal	500 Metric Ton
RBD Palmolein	1 Metric Ton	Rs. per 10 kg.	50 MT
Soy bean meal	10 Metric Ton	Rs. per MT	500 MT
SOFT			
Sugar	10 MT	Rs 1 quintal	500 Metric Ton
Gur	10 MT	Rs per 40 kg	" "
Spices			
Pepper	1000 kilograms	Rs. per quintal	50 Metric Ton
Turmeric	5 MT	Rs. per quintal	250 MT
Jeera	3 MT	Rs. per quintal	150 MT
Chilli	5 MT	Rs. per quintal	250 MT

Coriander	10 MT	Rs. per quintal	500 MT
NON-AGRI PRODUCTS			
Metals			
Copper	1 MT	Rupees. per Kg	50 MT
Steel	10 MT	Rs per MT	500 MT
Energy			
Crude Oil	100 Barrels	Rupees. per Barrel	50,000 barrel
Precious Metals			
Gold	1 kilogram	Rupees. per 10 gram "of gold with 995 fineness"	50 kilograms
Silver	30 kg	" "	1500 kilograms
Others			
Polyvinyl Chloride	5 MT	Rupees per MT	250 MT

Source: NCDEX Website

'Dhaanya' is the agri-commodities' index of NCDEX. It consists of ten most liquid agri-commodity futures contract traded on the NCDEX platform. The commodities are selected based on their economic significance and liquidity. It is a reliable benchmark for the agri-commodities traded in India.

According to the data released by FMC on 9th of Jan', 2012: "the turnover of the commodity exchanges in India increased by 66% to Rs 137.22 lakh crore till December 2011 in the fiscal 2011-12. The turnover of these exchanges had stood at Rs 82.70 lakh crore in December 2010.

The maximum trade was seen in gold, silver, guar seed, crude oil, soya oil and chana. According to FMC data, the turnover in the bullion segment rose more than two-fold to Rs 80.36 lakh crore during the April to December period of the 2011-12 fiscal from Rs 37.54 lakh crore in the corresponding period in 2010.

The maximum turnover of Rs.12,40,500 crore was posted by MCX in December 2011 followed by NCDEX (Rs 179490 crore), NMCE (Rs 27826 crore), ICEX (Rs 23,655 crore) and ACE (. 12,713 crore)".

Table 1.7

Major Group of Commodities Traded During the Year-2013-14.

Major Group of Commodities Traded During the Year-2013-14.	
Energy	24.72%
Bullion	43.09%
Metals other than Bullion	17.61%
Agricultural Commodities	16.02%

Table 1.8

Trading in NCDEX

Year	**Value (Crores)**	**Quantity(Tons)**
Jan 2012	17242923	40797082
2011	181434752	803183503
2010	112714555	564790948
2009	80384037	442849318
2008	62806323	336883508
2007	85169673	554896683
2006	119071071	636010714
2005	87660125	556909932
2004	15176990	167519848

Source: NCDEX website Archives.

Table 1.9

Trading Volume and Value in various exchanges

Name of Exchange	Volume of Trade	Value	% Share
	Lakh Tons	Crores	(In value terms)
Multi Commodity Exchange of India Ltd.	1758.37	1357877.22	80.55
National Commodity & Derivatives Exchange Ltd.	632.051	316099.21	18.74
National Multi Commodity Exchange Ltd.	19.42	8906.08	0.53
ACE Derivatives & Commodity Exchange Ltd.	0.28	261.80	0.02
Total of National Exchanges	2410.13	1683144.32	99.84
Regional Exchanges	6.43	2656.27	0.16
Grand total	2416.57	1685800.60	100

(**Source:** FMC Bulletin, April 2015 – June 2015)

1.15 Conclusion

The two most important functions of these markets are price discovery i.e. the information is reflected first in futures market and risk mitigation through hedging i.e. offsetting the risk by taking an “equal and opposite position”. CFM, besides providing hedging, also provides for efficient portfolio management because it acts as portfolio diversifier. Diversification benefits help investors in improved returns. For smooth and efficient functioning of the commodity futures market, it requires certain prerequisites like, good liquidity in the market, future and spot price should move in tandem, strengthened regulatory framework, well developed commodity exchanges etc., for the functions to be most effective, the markets should reach to all the target groups. It should be advantageous to all the segments of the economy.

It was established primarily for the farmers of India, so that they can manage the price risk through hedging. But unfortunately farmers are not participating; the possible reasons could be lack of awareness, infrastructure inadequacies, literacy and so on. Therefore, there is a need to identify the factors fostering or impeding their participation, to check the performance of these markets by evaluating the twin functions of “price discovery and risk management”.

With the meteoric rise in the growth of CFM in India, the question that arises is whether this growth is inclusive or not?

“Inclusive when it creates economic opportunities along with ensuring equal access to them.” **(K. C. Chakrabarty, 2009)** “*The concept ‘Inclusion’ should be seen as a process of including the excluded as agents whose participation is essential in the very design of the development process, and not simply as welfare targets of development programmes” (Planning Commission, 2007*[2].

[2] “TOWARDS INCLUSIVE GROWTH: THE GENDER DIMENSION, Planning Commission, November 15, 2007”.

CHAPTER TWO

REVIEW OF LITERATURE

2.1 Review of Literature

In the 1970's, the inception of trading in financial derivatives like futures and options took place, since then the impact of the type of trading on the underlying spot market have attracted researchers, policy makers and academicians. The commodity trading in India is still in nascency and has gained popularity among the retail investors and traders in the recent times only. The commodity derivatives are preferred as they form a different asset class and help investors in diversifying their portfolio. In the proceeding paragraphs the literature which was reviewed for the primary analysis is presented and the literature reviewed for the secondary analysis is presented within the respective chapters.

Jean-Paul Chavas, Rulon D. Pope and Robert S. Kao (1983) have presented a consolidated investigation of the "cash price, the futures price, and government programs in the context of acreage-supply response for soybeans and corn". It generated evidence on how farmers formulated expectations about prices of products. In particular, in the acreage decision it had refined the role of different sources of price information.

It was felt that policy variables have played a major role in the production of corn decision, and reflected the strong influence of the "government corn support price program" in the preceding decades. Policy Variables have played a role even in the soybean acreage decision, but only indirectly through the formulation of the 'expected corn price'. The results also indicated that "futures prices were not good proxies for expected future cash prices in the presence of government programs". It was admitted that it remained unclear whether the futures prices in the absence of government intervention were informationally efficient for the formulation of price expectation or not.

In this study, **Gopal Naik and Sudhir Kumar Jain (2002)** examined the performance of CFM based on the “membership pattern over time, extent of liquidity, price volatility, basis risk, and pattern”. The authors have also examined co-integration between futures and cash markets, efficiency, and lack of bias to reflect their performance in discovering prices was also examined.

The performance of Indian commodity futures markets varies across commodities, exchanges and contracts. However, it revealed that the potential for performing the “functions of price discovery and risk management”, barring a few, they are still not congenial markets for ‘hedgers’. The markets are deficient in several aspects such as logistics management, infrastructure, and linkages with financial institutions, integrity and reliability, dominance of speculators, and efficient information system, which discourage market players from trading in these markets. With the expected increase in price risk in the coming years it would be essential to address these issues to make futures markets for commodities useful mechanisms of risk management and price discovery.

Kalyan Raipuria (2003) suggested that “farmers growing agricultural commodities have suffered due to fluctuations of price but all risk in production management is not exogenous. Imperfection in information systems and analysis methods also share part of the blame”. Traditional subsidies and stabilisation funds are “distortionary” and he felt mitigating risk using futures is an efficient mechanis if there is wide participation by stakeholders. Given the “noisy nature of Indian retail and wholesale markets" specifically in major commodities, symmetry in dissemination of real time future and spot prices would benefit consumers.

Pavaskar(2005) felt that what is good for the stock exchange is necessarily not so for a commodity exchange and that the present level of the Indian agricultural marketing sector, and the development of the commodity exchanges which are still in nascent stage, and the demat delivery system posed a real danger not only to the "economic utility of the commodity futures markets, but also to the very survival of the commodity exchanges themselves". The reasons cited by him were inadequate number of warehouses, fear of commodities sellers of their commodities being downgraded, and frequent retesting. The cost of designated warehouses might also be a problem in the future. He felt that since only specified varieties are deliverable at specific centre, these contracts would be too narrow for either price discovery or price risk management. It was also felt that there would be a spate of needless litigations owing to not only the various legal barriers, but also the possible quality' disputes, as most farm produce and their products do not have very precise quality specification standards yet.

Gorton, G., & Rouwenhorst, K. (2006), constructed an "equally weighted index of monthly returns of the commodity futures" for the period from Jul', 1959 to Dec', 2004. Their main findings were that "fully collateralized" CFM have offered historically equal sharp ratio and return as of equities of United States of America, though "risk premium on commodity futures was same as that on equities" for their study period, CFM returns were found to be negatively correlated with returns on equity and returns on bond, the last important finding was that futures of commodities were positively correlated with changes in "expected inflation" and changes in "unexpected inflation".

L. Ahuja (2006), discussed in his descriptive paper about regulation, development and future prospects in CFM in India. He started with the chequered history of Indian CFM and discussed that it started in year 1875. But it was felt that derivatives fuelled unnecessary speculation, as a result, after independence, they were banned in 1952. In 1960s the conditions deteriorated as there were draughts for long years and farmers defaulted on forward contracts (some committed suicides), as a result the forward trading was discontinued. He further explained that the commodities derivative markets in India "dismantled and remained dormant" for about forty years. Government started encouraging the commodity derivatives market only after major shift in policy. CFM started in 2002, experienced boom in terms of number of commodities allowed for futures trading and the number of modern exchanges. However, he suggested that there are many obstacles and issues to be tackled for the sustainable development of CFM.

Bhattacharya (2007), in his paper traced the evolution and development of CFM in India. He outlined it's infrastructure and regulation, pointed out the significant risk returns features. He further elaborated, that the diversification potential of CFM had made "commodities popular as an 'asset class' and these markets have improved significantly well in recent years and would result in fundamental changes in the existing isolated local markets specifically in case of agricultural commodities".

Berg (2007), this is a "Report of the UNCTAD Study on 'Emerging Commodity Exchanges". It was observed that though the Indian Government allowed futures trading in the year 2003, by establishing three national futures exchanges and despite exponential growth in volumes in these commodity exchanges, participation from farmers in CFM had been very, very less. It was felt that there had been a few efforts to augment the awareness about these markets, though there have been "pilot field experiments involving trading in these markets by farmers". Hedging involves transactions costs due to margin costs, aggregation, and brokerage costs. The produce or output of an individual farmer in most of the cases may not be comparable to the contract sizes mentioned in the futures contracts. So it was felt that there is a need to "aggregate the produce through formal means like 'marketing cooperatives' or informally in order to hedge in commodity futures markets".

Sahadevan (2007), had four-fold objectives in his study. First, In UP, he examined the "physical supply and market chain of Mentha and Potato. Secondly, he evaluates the advantages of futures in terms of mitigating the market risk of various players in entire supply chain and of improving realization. Thirdly, he also analyses the potentials of mentha and potato as candidates for introducing futures. Finally, he examines the advantages of on- line trading in terms of access, reach, transparency and price discovery. The data and observations are obtained through administering a schedule on a set of samples .The study has utilized and also published data of various governmental and private sector agencies. Farrukhabad, Moradabad and Lucknow for potato and Moradabad, Rampur and Barabanki for mentha have been chosen for sample collection". The important findings of the study were that "potato and mentha were economically significant not only for their contribution to the livelihood of thousands of farmers" but also were potential candidates for futures trading. However, their small size was the major stumbling block which inhibits the farmers from benefiting the futures markets. Therefore, he felt that the *"important question to be addressed is how to make farmers participate in the futures markets"* and elaborated that Indian commodity futures market are predominantly occupied by "small players" and are highly unorganized. CFM are characterised by price instability and price seasonality. Potato and Mentha oil markets improved in “price realization after the introduction of futures” and therefore, farmers indirectly benefitted. He suggested that farmers’ organizations can improve the “supply chain” and help farmers who are small in participating CFM indirectly. He also suggested development of a formal financing like crop collateral, building institutional capacity for warehouses and institutional credit flow in agriculture.

Golaka C. Nath and Tulsi Lingareddy (2008), attempted to explore the effect of futures trading on spot prices of pulses. Their results indicated that “volatility in urad as well as pulses prices was higher during the period of futures trading than in the period prior to its introduction as well as after the ban of futures contracts”.

It was noted a clear increase in rates of “urad” during the introduction of futures trading. The increased rates of “urad” had increased the rates of other pulses also. It was observed by them that “the spurt in spot prices was observed in the post-futures trading period even in the case of gram though less distinct compared to urad”. However, the authors admitted they did not know if the observed increase in urad and gram prices was precisely due to the introduction of futures contracts or not. Granger causality results indicated that “future's volumes had a significant causal impact on spot prices” and not vice versa.

A multi-stakeholder pilot project organised by “associations among a number of institutional entities namely Sajjata Sangh, Aga Khan Rural Support Programme India [AKRSP (I)], MCX, NABARD, Cardinal Edge Management Services and a Farmer’s Federation from Chotila taluka of Surendranagar” studies the efficiency of CFM for hedging by farmers, in “Surendranagar” involving sixty seven growers of cotton. “The larger goal of this pilot project was to arrive at a working model for farmer participation in commodity derivatives trading”. The key findings of the project evaluation which involves pre-post, with-without analysis among focus group and control group survey are given below:

Farmers of “focus group” realised: 3.1% more than the average price realization of “control group farmers”. Another important benefit achieved by the “focus group farmers” was their better “bargaining power with traders due to higher awareness of futures prices and cotton market developments”.

Srinivasan (2008), in her study tried to examine the rationale behind the ban on four agricultural commodities chick pea, potato, rubber and soy oil and studied how logical the decision to impose the ban was? She argued that only “price of potato” was decreased after the ban that to because of bumper crop. She also analysed “spot and futures prices of the four banned commodities” and found out a positive correlation in the prices of the two markets. She found that banning futures was an illogical solution and suggested that in the short run, higher food aid to the poor was important to minimize the effect of the food crisis and in future, “the government must invest in developing agriculture and providing better infrastructure” in terms of storage and transportation, and the organization of spot markets rather than adopting misguided schemes like the ‘farm loan waiver’.

Bose Sushmita (2008), made use of NCDEX and MCX indices values to comment on the efficiency in price. The study is primarily an empirical one. The study period was from June 2005 to September 2007 and the sample data consisted of the MCX spot and future indices, the NCDEX spot and future indices and global indices maintained by Dow Jones and Reuters. The correlation analysis revealed a very high correlation between the future and cash prices. She found the indices to be co-integrated and for MCX indices there was a clear bi-directional Granger causality indicating that both markets contribute to price discovery. The agri indices were not integrated but futures prices lead the spot prices when the higher lags of seven to twelve days of futures prices were included as regressors in the causality test but the reverse was not true.

Sen (2008), in his "Report of the Expert Committee (which was formed to study the impact of futures trading on prices of agricultural commodity)" examined whether the CFM were efficient or not, using secondary data. Primary data was used to find out how futures trading were helping major stakeholders in the value chain. The commodities like Gram, Sugar, Wheat, Gaurseed, Urad and tur were chosen for study in which futures trading had attained reasonable volume.

The first conclusion of the study was that all these commodities except sugar, witnessed higher increase in prices in the post-exchange period when compared to the pre-exchange period. The study noted that sugarcane prices were to a large extent controlled by government and sugar prices played little role in determination of the sugarcane prices, though they affected the prices to be offered for the next year and payment capacity of sugarcane mills. Guar grown mainly in the arid regions of Rajasthan, a normal monsoon gives a production that would meet the demand of guar seed. In the year 2005-06 "increased in price followed low carry-over stocks and hence increased export demand. In case of wheat, after 2005, the high increase in prices followed low production and hence low stock availability with the government. Tur also showed a sharp increase in prices during 2006 following low production and stocks. Urad too, showed continuous decline in production from 2004 onwards and a rise in the prices. Changes in fundamentals i.e (mainly from the supply side) were thus found important in causing the higher post-futures increase in prices and found that the government policies also contributing, and therefore, he concluded that the role of futures trading remains unclear".

The **IIMB (2008)**, study found that price volatility in spot markets increased after introduction of futures in case of "wheat and urad". There was no change found in the volatility of prices of gram, except an unusual increase in year 2006-2007, or for "tur and sugar". Price volatility was found to be lower for guar seed. In the case of "chana, sugar, wheat and tur" there was improvement found in correlation between weekly price changes in different wholesale and retail markets in the Post Exchange period. Apart from a reduction in the price volatility of spot market in case of "guar seed", this was the only important observation (positive) that the study had made after the introduction of futures markets.

Another finding was that many of the contracts traded on Indian CFM did not satisfy the minimum requirement for them to be suitable for "hedging" In all the contracts of tur, basis risk was found to be less than the price risk, while in case of wheat, sugar, and urad, basis risk was higher than price risk

One positive development found by the study was that the growth of commodity futures exchanges have appeared to had helped in "integrating geographically separated markets and this may be due to the fact that they might be playing the role of reference markets".

Easwaran R., Ramasundaram P. (2008), have investigated the agricultural commodity futures market. They conducted an econometric “analysis of the relationship between price volume, return, market depth and volatility”. They concluded that market depth and volume were not significantly influenced by the volatility and return of futures as well as spot markets.

Mishra, D. K. (2008), investigated “present status, growth constraints and developmental policy alternatives” for the Indian CFM. He also examined benefits of downside risk reduction through adding commodities to the equity portfolio and diversification. The first observation was that the “risk adjusted return of a portfolio was enhanced by adding commodity futures” to a portfolio of equities and it also gave a significant downside protection and enhanced kurtosis, skewness of the return distribution.

Pavabutr, P., & Chaihetphon, P. (2008), have examined the “price discovery” for the contracts of gold traded on the Multi Commodity Exchange from the year 2003 to year 2007.They had used VECM and found that “futures prices of both standard and mini contracts lead spot price”. It was also found out that “mini contracts have” contributed thirty percent of “price discovery of gold futures trade”, though they are accounted only for two percent of the value of trading value on Multi Commodity Exchange. The results from their study suggested that “trades initiated in mini contracts were much more informative than what size of their volume of market share suggested”.

Ghosh N. (2009), explored the “concerns” of Indian CFM. He suggested “ it requires a trans-disciplinary research framework as such concerns cannot merely be addressed in a reductionist framework of financial economics only, but entail deep thinking in institutional economics, social anthropology, quantitative methods, as also information systems and data mining”. He further elaborated that even from the policymakers’ perspective, there were lesser attempt to encourage research on market microstructure in CFM, and economists scarcely attempted to comprehend “commodity market microstructure”. Thus, he felt that a coordinated effort was required.

Kapil & Kapil (2010), in his conceptual paper discussed the importance of Commodity Trading Advisors (CTAs) and their effect on the “development of the global commodity market”. Highlight of the paper was the policy and developmental issues related to commodity futures market in India. Further, the possibility of having commodity trading advisors in India, their probable role in Indian economy had been explained. He further elaborated that CTAs can be (used as benchmarks) and can be evaluated using data DEA without using traditional market indices. It was also suggested in the study that the Indian commodity futures market must allow the CTAs as their efficiency measuring scales had already been developed and hence CTA’s can play advisory role in Indian market. The authors concluded that the Indian commodity futures market with CTAs would see a rise in its efficiency, depth and volume which at this point is much required.

Shiv S. Shrivastav (2010), in his descriptive paper discussed the importance of commodity market and that it is destined to play a significant role in managing price risk and discovering price, and help agriculture and other sectors in the development. He also suggested that for new issues and problems, Govt. regulators and other shareholders will need to be “proactive and quick in their response to new developments”. Regime of World Trade Organisation made urgent to develop the futures markets to develop the economy, specifically agriculture, as the focus is now “Manage price change rather than change prices; the commodity markets will play a key role for the same.”

Markel (2012), suggested that during inflationary times, many investors took to asset classes like real estates, commodities and return bonds to "protect the purchasing power of their capital. By adding these diverse asset classes to their portfolios, investors seek to provide multiple degrees of upside potential and downside protection". He further elaborated that the "unique negative correlation" that commodities have to bonds and stocks made them a good addition to every investment portfolio almost.

There are some studies that provided empirical results which are in support of the popular opinion that "trading in futures can destabilize the spot market". For example, **Figlewski (1980)** investigated the Treasury Bills' futures contract and had provided evidence that futures market activity augments the volatility of cash prices. But, there are also some studies that negated this opinion.

Brunetti,C. & Buyuksahin,B. (2009), tested the hypothesis that "speculative trading is destabilizing", and for that they employed a unique dataset on individual positions of speculators from the U.S CFTC. For the first known time they tested whether speculators had cause, in a forecasting sense, volatility and price movements in futures markets and, therefore, destabilized the markets. Their findings have provided evidence that the speculative trading in the futures markets is not destabilizing, speculative trading activity in particular, reduces volatility levels.

Imai.K. Gaiha.R., & Thapa, G. (2008), studied speculation in commodity markets and they wrote that speculation had influenced "food prices" in two important ways: the first one was the "huge influx of capital from hedge funds, commodity index funds and pension funds" in the CFM or options. It was also suggested that expiry prices in

CFM were considerably more than spot or cash prices, meaning that these markets were not helping in discovering prices. The second one was hoarding or "purchase of commodities on the assumption that their prices would continue to rise". They had analysed using "rational distributed lag model of the global stocks of rice, wheat and maize and their prices over the period 1986 to 2008, and confirmed a positive long-run effect of increasing prices on stocks." For rice, the effect was strong. Different suggestions of the study included the imperative of a "virtual grain reserve to be established to help calm markets through the futures market". It was felt there was a need for an improved carrying out of "trading system in particular, for trade liberalization in agriculture and also to build trust in global food markets and stock management".

T. Ranganathan and Ananthakumar (2014), have analysed potential benefits of CFM for "soybean farmers in the Dewas district of Madhya Pradesh state in India. He estimated the optimal hedge ratios in futures markets for farmers in different scenarios characterised by varying levels of different parameters relevant to the farmers". He estimated then the benefits from hedging for these ratios defined as the "change in certainty equivalent income (CEI) due to hedging". The findings suggested that the certainty equivalent income gained due to hedging was "positively related to the risk aversion" of farmers and "inversely related to price expectations of farmers and transaction costs".

The certainty equivalent income gain was positively related to the "natural hedge" when the "risk aversion" was high. Therefore hedging acted as a substitute to the natural hedge for farmers with high risk aversion.

Dey and Maitra (2016), examined whether commodity futures markets in India helped rationalize farmers' price expectation or not. "It has become an ongoing debate whether Indian commodity futures markets can accommodate farmers. The study starts with questions on the efficiency and other roles of commodity futures markets." They studied efficiency, causality and divergence/convergence of futures markets of pepper, coffee, and natural rubber (NR) by employing error correction, co-integrations, and causality models. Their analysis showed that pepper futures market is efficient in price discovery, while NR and coffee spot markets did the process faster. Coffee and pepper spot and futures prices exhibit the convergence; NR showed sign of divergence. Unidirectional causality was observed in pepper futures to spot while, bidirectional causality was observed in coffee and rubber.

As seen in the preceding paragraphs there were questions raised by researchers on the possibility or inability of Indian farmers to participate in CFM but there is very little written on the opinions or experiences of traders participating in CFM or the factors that could be impeding their participation.

Patnaik (2007) had explained how dominant traders in local regional mandis exercised notable control on prices of the "physical crop in regional-level futures exchanges". Markets for a given commodity are restricted to the region in which it is grown and traded. The author had felt that this had made the trade more susceptible to traders for local price manipulation as they remained the main participants in the commodity exchanges. He further writes that such a "futures market is a powerful tool to break the market power of (local trading) families".

As different participants sell and buy a commodity, they bring “information and expectations about the market they may possess to the price”. With more such transactions taking place, more information would be reflected in the market price. Economists argued that this makes the market price a “better reflecting indicator of actual conditions in the market rather than a figure set by the power of anyone local group or person”. Technology is expected to help create electronic exchange which are transparent and have nationwide access which aggregates or gathers market information across mandis in the country, and thus, disperses power to many more people.

Kumar, R. (2010), conducted ethnographic interviews with traders of soybean in a market yard or mandi of Madhya Pradesh, she explored the “online commodity futures market created by the new technology with the physical market of commodities, intermediaries, and life in the mandi.” called as "dabba" in vernacular, she also observed that the online CFM was vilified by the traders who define these markets as "nothing but speculation". The study also argued that the “criticisms made by the traders need to be taken gravely because this group forms the backbone of the agricultural marketing system in India and their lack of participation takes away from the credibility and completeness of information on the online futures market”.

2.2 Research Methodology

Research is nothing but search for knowledge; it can be defined as scientific and systematic investigation for pertinent information on a specific topic. According to **Goddard &**

Melville (2004), "Research is exploring which does not exist and answering the unanswered questions". Research is a "systematized effort" to acquire new knowledge (**Redmen & Mory, 2009).** Research Methodology is a way to systematically solve the research problem. In it, the various steps are adopted by the study in solving the specific research problem. In a nutshell research adds the original contribution to the existing body of literature making new advancements and research methodology maps out the various steps in a scientific and systematic manner to solve the problem and reach the conclusion.

2.2.1 Significance of the Study

According to the famous Hudson maxim "All progress is born of inquiry. Doubt is often better than overconfidence, for it leads to inquiry, and inquiry leads to invention", this explains the significance of research.

Despite an exponential growth and development in the commodity markets in terms of technology, number of commodities traded, the values and volumes of trades, the market is not totally free from problems. It is one of the fundamental purpose of setting up of CFM in India is to enable farmers, food processors and traders to participate and mitigate their risk through hedging their aggregate of the commodity.

CFM in India had been in limelight for the allegations viz., firstly, it is the reason behind the increase in prices of commodities i.e., directly or indirectly it is causing inflation of prices.

Secondly, the prices are believed to be highly volatile especially for agri-commodities. As it is a young market in India it has all the attention from the researchers and financial analysts whether the twin "functions of price discovery and risk management" through hedging had been achieved or not.

2.2.2 Research Problem

Despite eleven years of existence after revival in 2002, Commodity derivatives market in India is at its nascent stage, and the question is, whether the primary purpose of its very existence has been achieved or not?

Ghosh (2009) had rightly said "it requires a trans-disciplinary research framework as the concerns involved cannot be merely addressed in a reductionist framework of financial economics only, but entail deep thinking in institutional economics, social anthropology, quantitative methods, as also information systems and data mining". Therefore, a collaborative effort is needed to develop the research.

Research Gap / Questions

As, CFM in India is still in its nascency, coupled with the lack of data and less literature availability, it is still not clear as to:

- Whether CFM has reached the producers, end-users, at the grass root level.
- What could be the reasons or factors encouraging or discouraging the participation of farmers, traders and investors?
- Whether the Indian market is really capable for the dematerialization of CFM.
- Whether the two functions of price discovery and risk mitigation have been achieved or not.
- Whether the CFM is causing inflation or not

The present study principally aims to evaluate and examine the performance of the commodity futures market in India in terms of the original mandate, as mentioned under the Forward Regulations Act, 1952. The study also focuses on the general functions which are expected of CFM.

2.2.3 Variables Identified From The Existing Literature:

1. Average Land Holding
2. Quantity Produce
3. Storage
4. Seek Spot Information
5. Popular Information Sources on Prices
6. Motivation for Selling
7. Minimum Support Price
8. Source of Finance
9. Ownership of Land
10. Awareness about Futures Trading

(IIM B Study, 2008) (Sahadevan, 2008) (Cardinal Edge Management Services (P) ltd, 2008)

2.2.4 Objectives of the Study

1. To study the awareness of Commodity Futures Markets among the farmers of Telangana.

2. To identify the factors responsible for fostering or impeding the percolation of Commodities Futures Market to the end users (Farmers, Traders and Investors)

3. To study the functioning of Rubber Market of Kerala and carry out a comparative study between the Planters of Kerala and Farmers of Telangana.

4. To model the volatility of the select commodities.

5. To study the Price Discovery and Risk Management functions of Commodity Futures Market:

   i. To study whether future lead spot or not.

   ii. To study the effectiveness of Commodity Futures Market in providing 'Transaction hedge' to market participants in select commodities.

   iii. To study the effectiveness of Commodity Futures Market in providing an 'Investment hedge' to potential investors.

6. To study the Causal relationship between inflation and Dhaanya.

2.2.5 Type of Study

The present study is descriptive and analytical in nature. It is descriptive as it includes surveys and fact finding enquiries of different kinds and describes the present status of Commodity Futures Market. It is also analytical in nature as it has made use of available information like future and spot prices of select commodities contracts to analyse and make critical evaluations about risk management, price discovery and volatility of Commodity Futures Market and have also tried to find if there is causation between CFM and inflation.

2.2.6 Research Hypotheses:

H1: There is effectiveness in hedging for the select commodities contracts.

H2: The Future prices of the select commodities lead (causes) the spot prices.

H3: There is significant long run relationship between future values and spot values.

H4: There is causal relationship between WPI and Dhaanya.

2.2.7 Scope of the Study

The study is limited to three major commodities traded on NCDEX. The target participants are farmers, investors and the traders participating in CFM. The Telangana state was chosen for the study to meet the farmers and traders of the commodities for which the state is one of the leading producers. The data is collected from the investors of Andhra Pradesh and Telangana and for the comparative study, commodity 'Rubber' is chosen for which Kerala is the largest producer in India.

2.2.8 Sources of Data

Primary Data

The study depends on both primary and secondary sources of data. The primary data was collected through questionnaires administered to farmers and investors of Commodity Futures Market, and through interviewing the traders participating in Commodity Futures Market and also excerpts from the discussion and interview of officials from the Rubber Board.

Secondary Data

The secondary data was collected from websites of NCDEX, RBI and other related websites. Figure 2.1 gives a pictorial representation of the various sources of data from where the data had been collected.

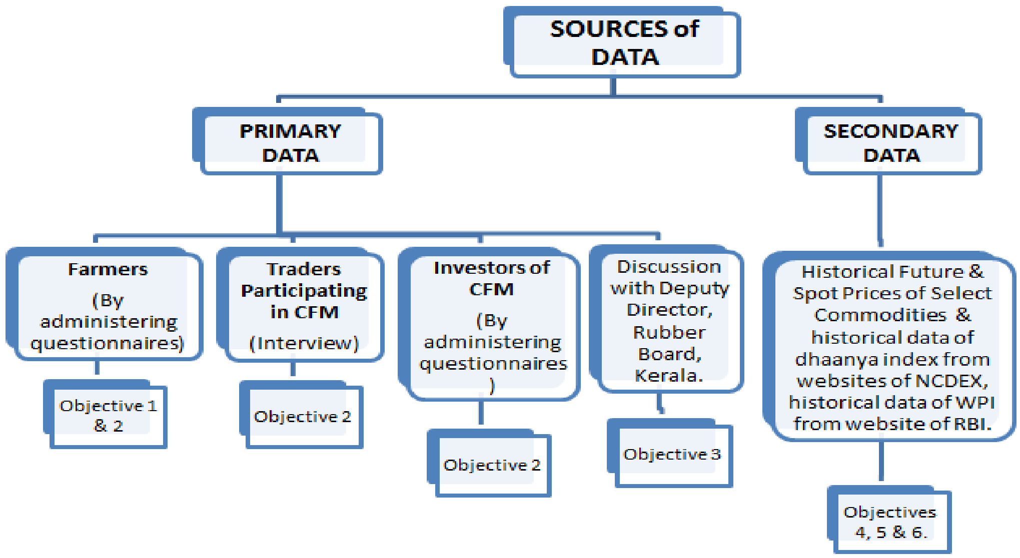


Figure 2.1 ***Sources of Data***

2.2.9 Sampling and Sample Size

As the present study has objectives to study the awareness about commodity futures market among the farmers of Telangana state and also to identify the factors fostering or impeding the participation, therefore only agricultural commodities were chosen for the study and hence NCDEX was selected out of the three national commodity exchanges as it majorly trades in agricultural commodities. NCDEX trades in approximately thirty six commodities. The commodities for which Telangana state is the largest or one of the largest producers have been chosen. Chilli, Turmeric and Cotton have been chosen for the study. Warangal is the largest producer of chilli, Nizamabad is largest producing district for turmeric, Adilabad and Warangal are the largest producers for cotton. Farmers of the aforementioned districts were chosen for the study.

The commodity Rubber was chosen for a comparative study between the Rubber planters and the farmers of three commercial crops because rubber market is one of the efficient markets in India. The planters of Kerala were chosen as it is the largest producer of Rubber in India. The traders of chilli, cotton and turmeric who are participating had been interviewed and investors of Commodity Futures Market from Telangana and Andhra Pradesh had been administered questionnaires.

Type of Sampling

Convenience sampling was chosen for the collection of data from farmers and investors. Snow ball sampling was chosen for the collection of data from traders.

Sample Size for Administration of Questionnaires

Approximately thousand questionnaires were distributed but only five hundred and eighty four were used for analysis. Group of traders of the select commodities participating in commodity futures market were interviewed. Two hundred and fifty questionnaires were distributed to investors of Commodity Futures Market belonging to Telangana and Andhra States. Hundred questionnaires were used for analysis.

The table 2.1 given below displays the type of sample, sample size and type of sampling used for the present study. Figure 2.2 and Figure 2.3 pictorially describe the tools used for primary and secondary analysis respectively.

Table 2.1

Sample Size and Type of Sampling

NCDEX	Chilli, Cotton Turmeric	Farmers	Traders	Investors
• NCDEX was selected out of the **three** national commodity exchanges as it majorly trades in agricultural commodities	• NCDEX trades in approximately 36 commodities. The three commodities for which Telangana state is the largest or one of the largest producers are chosen.	• Sample Size • Turmeric→Nizamabad→188 • Cotton→Adilabad →207 • Chilli→Warangal →189 • Convenience/Purposive Sampling	• Size: 8 • Snowball Sampling	• Sample Size: 100 • States: Telangana & AP • Type: Convenience Sampling • Brokerage Houses: Anand Rathi, Motilal Oswall, Angel Broking, PCS Securities ltd.

2.2.10 Tools of Analysis

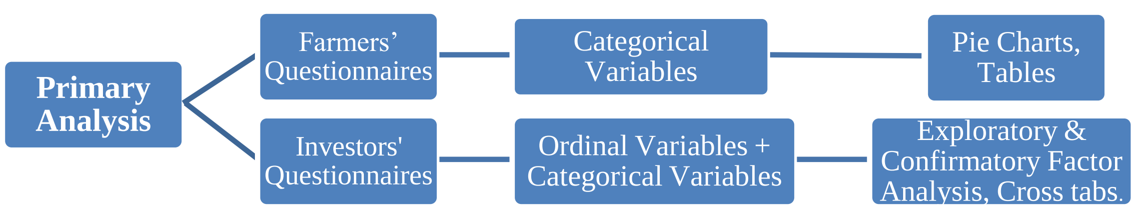


Figure 2.2 ***Tools of Analysis – Primary Analysis***

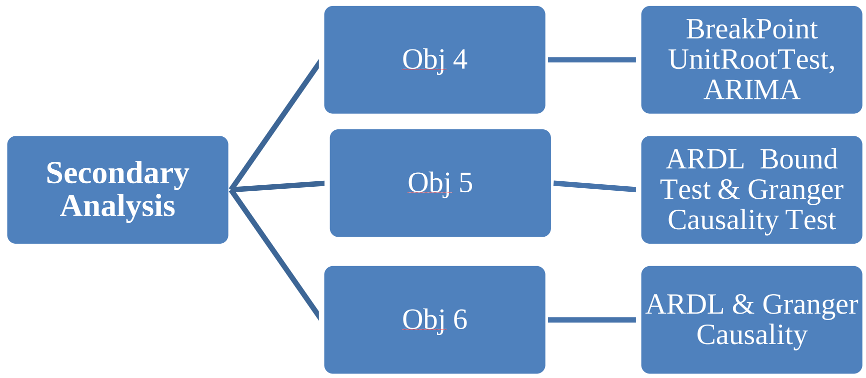


Figure 2.3 ***Tools of Analysis – Secondary Analysis***

2.2.11 Chapterisation of the Thesis

The thesis is presented in eleven chapters. The first chapter presents the introduction and overview of CFM, Review of Literature and Research Methodology has been presented in the second chapter. The third chapter deals with the awareness among the farmers of Telangana and the factors impeding their participation in CFM, the fourth chapter discusses the excerpts of the interviews with the traders; the factors fostering and impeding the traders' participation and also the effectiveness of 'Transaction Hedge' are discussed. The fifth chapter had used factor analysis to identify the factors fostering or impeding the investors' participation and has discussed the effectiveness of 'Investment Hedge'.

The chapter six is dedicated to study the Rubber Market in Kerala and make a comparison between the Small Growers of Rubber and Farmers of commercial crops in Telangana. For this, a discussion was made with the officials of Rubber Board and the literature about the Rubber Market was also obtained from the office of ‘Rubber Board’.

Discussion and findings of secondary data analysis has begun from the seventh chapter. The seventh chapter discusses the sample size of the select commodities, descriptive statistics and stationarity of the data, the eighth chapter models the volatility of the select models using ARIMA. The ninth chapter explores the causal relationship and co-integration between the future and spot prices and the hedge ratios and hedge effectiveness of the select commodities using ARDL and Granger Causality. The tenth chapter investigates the causal relationship between the ‘Dhaanya’ and ‘WPI’ using ARDL and Granger Causality and chapter eleven summarises the findings of the study and present suggestions and recommendations to the Government, apart from suggesting scope of further study in the area.

CHAPTER THREE

PERCOLATION OF COMMODITY FUTURES MARKET TO FARMERS OF TELANGANA: FACTORS FOSTERING OR IMPEDING PERCOLATION OF CFM

3.1 Introduction

Agriculture is an important sector of Indian economy. It contributes to the tune of 14% towards GDP of India and is one of the largest contributions to India's GDP along with Forestry and Fisheries. India was an agrarian economy, historically India has classified its GDP and economy into three sectors namely Agriculture, Industry and Services. In farm output, India ranks second in the world. India is the "largest producer, consumer and Exporter of spices and spice products". Export from agriculture constitutes ten percent of the country's export.

During the first five-year plan (1950-51) there was shortage of food grain and India used to import it from other countries. But abolition of zamindari system, ceiling on Land Holding, Green Revolution and usage of hybrid crops transformed the traditional agriculture to capital intensive. This resulted in bumper crop in the market, and hence the prices came down sharply. The 'Agricultural Price Policy' was later formulated and Government gave farmers the assurity that if the prices steadily drop down, then government would take the farmer's produce at a minimum price and support them, this price is termed as 'Minimum Support Price' (MSP), which is announced before sowing of the crop. Based on cost of cultivation, statistics profit is added to the cost to form MSP. In case of inflation, MSP would not be viable.

Therefore, after harvest the inflation factors are added to the MSP and then it is known as “Procurement Price”. Procurement Price is never less than MSP. In 1969, fourteen private banks achieved nationalized status i.e., government took over these banks and started disbursing loans to farmers as a special promotional drive to boost agriculture. There are approximately twenty such banks as on date.

However, the Marketing System was not efficient and traders were duping farmers. Government introduced the concept of ‘APMC’, Agriculture Produce Market Committee with licensed middlemen, standard weights, fixed prices for ‘hammalis’, activities were regulated and prices left for market demand and supply forces. But, regulations did became a bottle neck. So, APMC Act was made more congenial with some amendments in the Act.

Most of the Indian population still lives in villages, 70% of the household in villages depends on agriculture as a principal means of livelihood. The farmers (operational holders) are involved in cultivation and generally have very low income.

Operational holding is defined as “All land used wholly or partly for agricultural production and operated as one technical unit by one person or others, without regard to the title, legal form, size or location”.

Table 3.1

Number of Holdings and Operated Area

Year	Number of Holdings (in Million)	Area operated (in Million Hectares)	Average area per holding (in Hectares)
1970-1971	71.01	162.15	2.281
1976-1977	81.5	163.33	2.01
1980-1981	88.7	163.87	1.843
1985-1986	97.1	164.67	1.691
1990-1991	106.61	165.57	1.557
1995-1996	115.67	163.42	1.411
2000-2001	119.97	159.47	1.333

Source: Agricultural Census Portal

Table 3.2

Distribution of Number of Holdings and Area Operated in India, 2000-01

Size of Group (Hectares)	No. of Holding (in Million)	Area operated (in Million Hectares)	Average Area per Holding	% of Holdings to Total Holdings	% of Area Operated to Total Area
Marginal (Below 1.)	75.412	29.811	0.401	62.882	18.701
Small (1.0 – 2.0)	22.691	32.141	1.421	18.921	20.161
Semi-medium (2.0 – 4.0.)	14.022	38.191	2.722	11.691	23.961
Medium (4 – 10.)	6.581	38.222	5.811	5.481	23.971
Large (10 & Above)	1.231	21.071	17.121	1.032	13.221
All holdings	**119.937**	**159.446**	**1.336**	**100.00**	**100.00**

Source: Agricultural Census Portal

As displayed in the table 3.2; it is clearly evident that maximum number of holdings belongs to marginal farmers whose holdings are less than one hectare and then belong to small farmers whose land holdings are between 1-2 hectares. In year 2012-13, India produced crops worth Rs 9.23 lakh crore. Only a small fraction of this is currently being traded in the commodity futures market.

3.2 Sample

In the present chapter, the study tried to analyse the awareness of Commodity Futures Market among the Telangana farmers and also tried to identify the factors fostering or impeding their participation in Commodity Futures Market. From the state of Telangana, Cotton growing farmers from Adilabad district, Turmeric growing farmers from Nizamabad district and Chilli growing farmers from Warangal district were chosen as the sample. Approx. thousand questionnaires were distributed, but only 584 were considered for analysis as some were returned either completely empty or were mostly empty. In the proceeding few paragraphs a small description of the aforementioned select commodities is given.

Turmeric

India is the largest "Producer, Consumer and Exporter" of turmeric. Due to high curcumin content in Indian turmeric, it is considered as of best quality. It is finding rising acceptance in the global markets as it is a naturally occurring product, therefore exports of turmeric have escalated in near past. A healthy local demand of turmeric exists as majority of the produced turmeric is consumed locally. Turmeric takes 7-9 months to be ready for harvesting. Sowing starts from end of "May and last till August whereas arrivals start from

December and last up to March and also from the month of February and extend up to May”.

India produces nearly 80-85% (approx 6.0 lakh MT to 7.0 lakh MT) per year of world's total production of turmeric and is the world's largest producer. Major producing states in India are “Telangana, Tamil Nadu, Orissa, West Bengal, Karnataka and Maharashtra’. Major trading centres in India are “Nizamabad, Duggirala, Sangli, Salem, Erode, Dharmapuri”.

In April 2004, futures contract of turmeric was launched on NCDEX platform. Producers can lessen their price risk, exporters can hedge themselves against price risk. Turmeric stocks present good arbitrage opportunities to different market participants. As, it is a “highly liquid contract” the speculators can enter or exit the market easily. Therefore, the futures contract of Turmeric provides room for any type of participant.

Figure 3.1: Supply Chain of Turmeric

Source: NCDEX Website

Chilli

Production of chilli globally stands approx twenty lakh MT to twenty five lakh MT per annum. India contributes about ten lakh MT to twelve lakh MT yearly and is the major producer followed by “China, Nigeria, Peru, Bangladesh and Hungary”. Domestically, “Andhra contributes 49 % of total production followed by Karnataka (14 %), Orissa (7 %), Maharashtra (5 %), West Bengal (5 %), Rajasthan (5 %) and Tamil Nadu (4 %)”.

Two crops of chilli are produced in a year in each wet and dry season of the country and duration of the crop is three to four months. In dry season, the seedlings or the seeds are planted in April and are harvested in the month of August. In wet season, the crop is planted as and when the rainfall occurs starting from the month of August and harvesting takes place in the month of December and in months of February and March, chillies start reaching the major markets.

Globally, Indian chillies are of higher quality which makes India the largest exporter of chillies. Domestic demand for chilli is good and the spice processing industry is developing at a very fast rate and is generating extra demand for the commodity.

Chilli Futures contract was launched on 11th of March, 2005 on NCDEX platform and since then the contract has observed “good participation from various supply chain participants”. Using futures platform producers can hedge the price risk. The chilli contract provides space for every investor category (producer, exporter etc).

Figure 3.2: Supply Chain of Chilli

Source: NCDEX Website

Cotton

Cotton refers to the “ginned fibrous substance extracted from the cotton plant (cotton ball), which covers the underlying seed”. 29 mm refers to the staple length, which is considered to be a long staple, fine grade variety of cotton, with a micronaire of 3.5 to 4.9. Total annual production of cotton in India, is approx 330 lakh bales of 170 Kgs each, out of which long staple varieties constitute 78%.

Cotton is majorly used for export purpose and for manufacturing of yarn. In India, long staple varieties form the maximum produced staple length of cotton, and demand of which is rising year on year within the textile industry and cotton importers from India.

In India, 29 mm Cotton is majorly grown in Gujarat, followed by Maharashtra, Telangana, Madhya Pradesh and Karnataka. It is a four month long crop with a two month sowing window, around June to July. The arrival of the crop is thus typically seen during month of October. Typically raw cotton contains 35% Fiber and 65% seed by weight. The seed extracted is crushed to extract oil and the by product which is left after crushing is “Cotton Seed Oil Cake” generally used as cattle feed. Adilabad district of Telangana is one of the largest cotton growers in the nation.

In Adilabad district, the cotton yield is around 5-6 quintal per acre. In tribal areas, the yield may touch low level of one to two quintals as the farmers in the regions are illiterate, uneducated and not able to protect their crops using advanced methods.

Cotton has significant price volatility and the export demand has augmented between years, and therefore, exchange traded cotton futures are suitable for price risk management needs of the Ginners, Spinners, Brokers, Exporters, & Agents. Directional view on cotton future prices can be taken by speculators and accordingly they take positions in 29 mm cotton futures.

Figure 3.3: **Supply Chain of Cotton**

Source: NCDEX Website

3.3 Analysis of Data

3.3.1 Cotton

Table 3.3

Land Holding of the Farmers (Cotton)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	9	4.3	4.6	4.6
	2.00	42	20.3	21.3	25.9
	2.50	2	1.0	1.0	26.9
	3.00	28	13.5	14.2	41.1
	4.00	33	15.9	16.8	57.9
	4.50	2	1.0	1.0	58.9
	5.00	28	13.5	14.2	73.1
	6.00	14	6.8	7.1	80.2

	7.00	4	1.9	2.0	82.2
	8.00	9	4.3	4.6	86.8
	9.00	1	.5	.5	87.3
	10.00	19	9.2	9.6	97.0
	12.00	1	.5	.5	97.5
	13.00	1	.5	.5	98.0
	14.00	1	.5	.5	98.5
	16.00	1	.5	.5	99.0
	21.00	2	1.0	1.0	100.0
	Total	197	95.2	100.0	
Missing	System	10	4.8		
Total		207	100.0		

Note: The unit taken for land holdings is Acres.

Table 3.4

Statistics: Landholdings

(Cotton)

N	Valid	197
	Missing	10
Mean		4.7868
Mode		2.00
Std. Deviation		3.27330
Minimum		1.00
Maximum		21.00

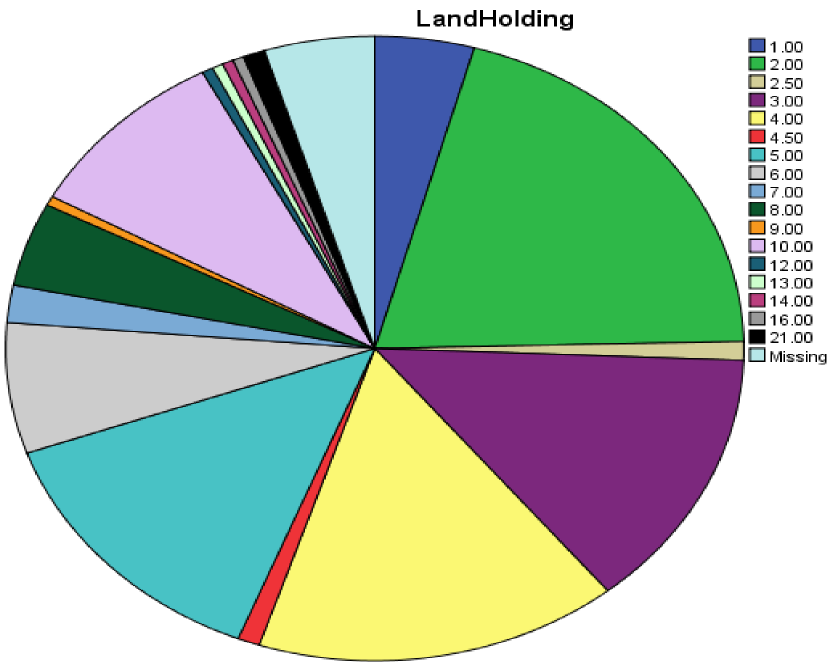


Figure 3.4: **Pie Chart –'Land Holding' (Cotton)**

From table 3.3 and table 3.4, it is evident that 97% of cotton farmers possess 10 acres of land and less. Maximum numbers of farmers in the sample possess 2 acres of land (21.3%). This is also evident from table 3.4, i.e the mode of the data is 2 acres. The average land possessed by the farmers is 4.78 acres. The land holding for the sample of cotton farmers ranges from one acre to twenty one acres.

Table 3.5

Ownership of Land (Cotton)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		3	1.4	1.4	1.4
	3	2	1.0	1.0	2.4
	2	11	5.3	5.3	7.7
	1	191	92.3	92.3	100.0
	Total	207	100.0	100.0	

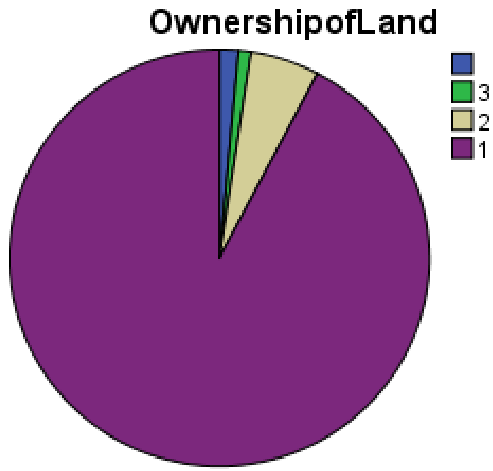


Figure 3.5: ***Pie Chart – 'Ownership of Land' (Cotton)***

Note:

'1' → Owned the Whole Land
'2' →Whole Land on Lease
'3'→ Part of Land on Lease and Part of Land Owned

As displayed, from the table 3.5, 92.3% of the cotton farmers own the land and 5.3% of them have taken the land wholly on lease, and meager 1% of them have taken some part of their land on lease.

Table 3.6

Average Output (Cotton)

Output (in Quintals)		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4	2	1.0	1.0	1.0
	5	2	1.0	1.0	1.9
	6	11	5.3	5.3	7.2
	7	12	5.8	5.8	13.0
	8	26	12.6	12.6	25.6
	9	19	9.2	9.2	34.8
	10	14	6.8	6.8	41.5
	11	4	1.9	1.9	43.5
	12	4	1.9	1.9	45.4

	13	3	1.4	1.4	46.9
	14	4	1.9	1.9	48.8
	15	2	1.0	1.0	49.8
	16	1	.5	.5	50.2
	17	6	2.9	2.9	53.1
	18	2	1.0	1.0	54.1
	19	3	1.4	1.4	55.6
	20	4	1.9	1.9	57.5
	21	5	2.4	2.4	59.9
	22	13	6.3	6.3	66.2
	23	9	4.3	4.3	70.5
	24	3	1.4	1.4	72.0
	25	8	3.9	3.9	75.8
	26	5	2.4	2.4	78.3
	27	7	3.4	3.4	81.6
	28	2	1.0	1.0	82.6
	29	2	1.0	1.0	83.6
	30	2	1.0	1.0	84.5
	32	2	1.0	1.0	85.5
	33	3	1.4	1.4	87.0
	35	1	.5	.5	87.4
	36	2	1.0	1.0	88.4
	37	1	.5	.5	88.9
	39	2	1.0	1.0	89.9
	40	3	1.4	1.4	91.3
	41	2	1.0	1.0	92.3
	42	1	.5	.5	92.8
	43	1	.5	.5	93.2
	45	1	.5	.5	93.7
	46	1	.5	.5	94.2
	48	1	.5	.5	94.7
	50	4	1.9	1.9	96.6
	57	1	.5	.5	97.1
	81	1	.5	.5	97.6
	83	2	1.0	1.0	98.6
	87	1	.5	.5	99.0
	92	1	.5	.5	99.5
	99	1	.5	.5	100.0
	Total	207	100.0	100.0	

Table 3.7

Statistics (Cotton)

N	Valid	207
	Missing	0
Mean		20.05
Mode		8
Std. Deviation		16.378
Minimum		4
Maximum		99

The cotton farmers were asked to give the information relating to their output or produce of cotton for the last three years, in quintals.

Then, the average of the three years output was calculated. For some years they don't have proper output because of the natural calamities like heavy rainfall. From table 3.6 and table 3.7, it can be clearly seen that the output of cotton ranges from four to ninety nine quintals.

The average output of cotton for the sample of farmers is found to be 20.05 quintals. The mode of the data is eight; this indicates that maximum number (12.6%) of farmers in the sample produced eight quintals of cotton. 97.1% of total cotton farmers produced 57 quintals of cotton and less.

Table 3.8
Source of Finance (Cotton)

		Frequency	Percent	Valid Percent
Valid		2	1.0	1.0
	6	5	2.4	2.4
	5	3	1.4	1.4
	1	111	53.6	53.6
	2	60	29.0	29.0
	3	26	12.6	12.6
	Total	207	100.0	100.0

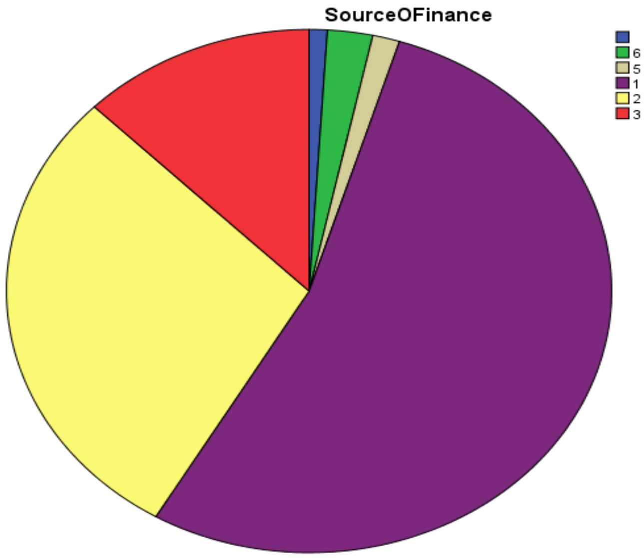


Figure 3.6: **Pie Chart –'Source of Finance' (Cotton)**

Note: '1'→ Banks, '2'→Money Lenders '3'→Self,
'4'→Others, '5'→Bank+Money Lenders+Self,
'6'→Bank+Self, '7' →Bank+MoneyLenders

As clearly evident from table 3.8, 53.6% of cotton farmers made use of banks to finance the cultivation of their land, 29% took finance from local money lenders and only 12.6% of farmers did not take any financial help i.e., they self-financed their cultivation. 2.4% of farmers used their own finances as well as took finance from bank. 1.4% of farmers used their own finances and also took from banks and money lenders.

Table 3.9

Criterion for Area of Cultivation (Cotton)

		Frequency	Percent	Valid Percent
		1	.5	.5
	3	3	1.4	1.4
	0	126	60.9	60.9
Valid	1	44	21.3	21.3
	4	6	2.9	2.9
	2	27	13.0	13.0
	Total	207	100.0	100.0

Note: '0'→None, '1'→Output, '2'→Spot Price, '3'→Future Price, '4'→Price+Output

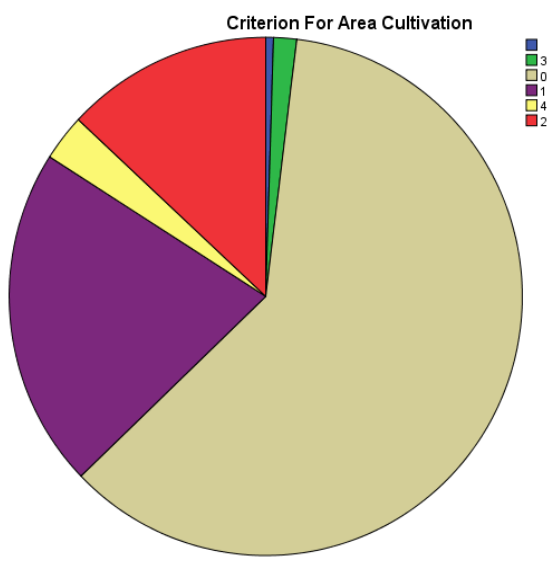


Figure 3.7: **Pie Chart – 'Criterion for Cultivation' (Cotton)**

When the cotton farmers were asked about the criterion they took into consideration before cultivating their land for cotton, 60.9% of them said that they did not consider anything, 21.3% of them told they considered the output before cultivation, 13% told they checked the prevailing market or spot price and 1.4% told they cultivated based on the expected future price of the cotton whereas 2.9% told they considered both output and price before cultivation.

Table 3.10

Risk Management Techniques Known (Cotton)

		Frequency	Percent	Valid Percent
Valid		11	5.3	5.3
	2	62	30.0	30.0
	4	30	14.5	14.5
	3	26	12.6	12.6
	0	78	37.7	37.7
	Total	207	100.0	100.0

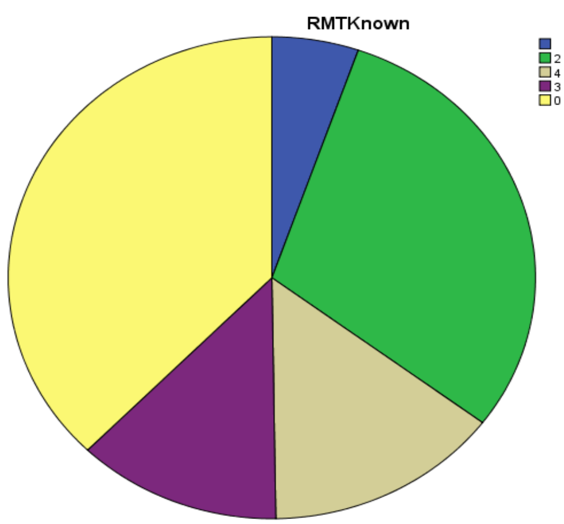


Figure 3.8: **Pie Chart – 'RMT Known'**

Note: '0'→None, '1'→Hedging, '2'→Crop Insurance, '3'→MSP, '4'→Crop Insurance and MSP

As evident from table 3.10, when the farmers were asked about the risk management techniques they knew, 37.7% replied that they knew none, 30% told they knew about crop insurance, 12.6% of them know about Minimum Support Price (MSP) and 14.5% of them knew about both crop insurance and MSP. Zero percent or none of them knew about hedging.

As evident from table 3.11 below, when the farmers were asked how they collected information about the price of cotton, 38.6% told they have collected the information from mandi, 30% of them told they took it from newspaper and tv. 14% of them told they keep themselves updated only from television.

Table 3.11

Price Information (Cotton)

		Frequency	Percent	Valid Percent
Valid	7	3	1.4	1.4
	4	11	5.3	5.3
	3	80	38.6	38.6
	5	10	4.8	4.8
	10	1	.5	.5
	11	1	.5	.5
	8	62	30.0	30.0
	1	7	3.4	3.4
	9	3	1.4	1.4
	2	29	14.0	14.0
	Total	207	100.0	100.0

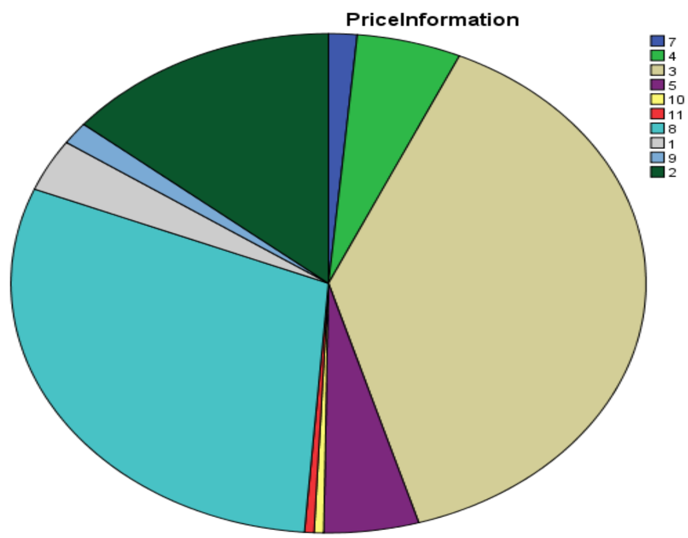


***Figure 3.9* – Pie Chart -'Price Information' (Cotton)**

Note: '1'→Newspapers, '2'→TV, '3'→Mandi, '4'→Friends, '5'MSP→, '6'→FuturePrice, '7'→ Traders, '8'→Newspaper+TV, '9'→Newspaper+Tv+Friends '10'→Newspaper+Friend, '11'→Newspaper+TV+mandi

5.3% of them told they took help of their friends. 4.8% told they have used MSP, 3.4% told they read newspaper and kept themselves updated only through it. 1.4% told they had called traders and took the price information. Further, 1.4% told they had used news papers, tv and friends to gather price information. Only One farmer (0.5%) told he used newspaper and friends and another told he used newspaper, tv and mandi. Majority of the farmers used Mandi or market, newspaper and tv to collect information relating to the price of cotton. Not a single farmer had told that he used future price as the criterion to decide the spot price of cotton.

Table 3.12

Motivation Behind Selling (Cotton)

		Frequency	Percent	Valid Percent
Valid	4	155	74.9	74.9
	2	6	2.9	2.9
	3	19	9.2	9.2
	5	6	2.9	2.9
	1	21	10.1	10.1
	Total	207	100.0	100.0

Note: '1'→Target Attained, '2'→Get Back What Invested+ Store for Consumption, '3'→MaximumProfit, '4'→Cash Urgency, '5'→Others

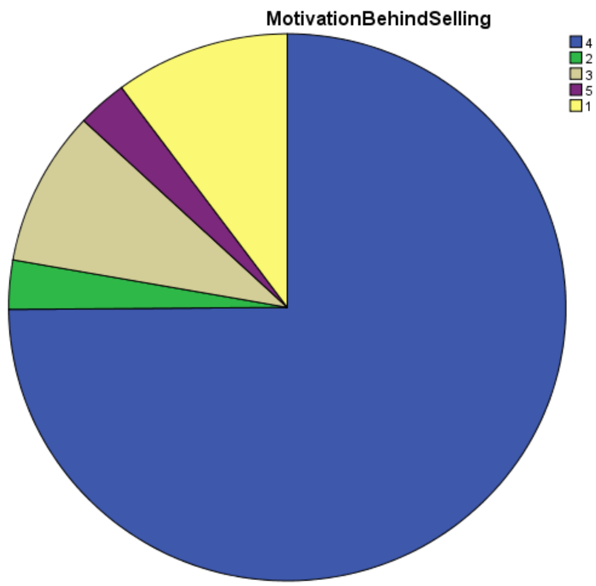


Figure 3.10: **Pie Chart –'Motivation Behind Selling' (Cotton)**

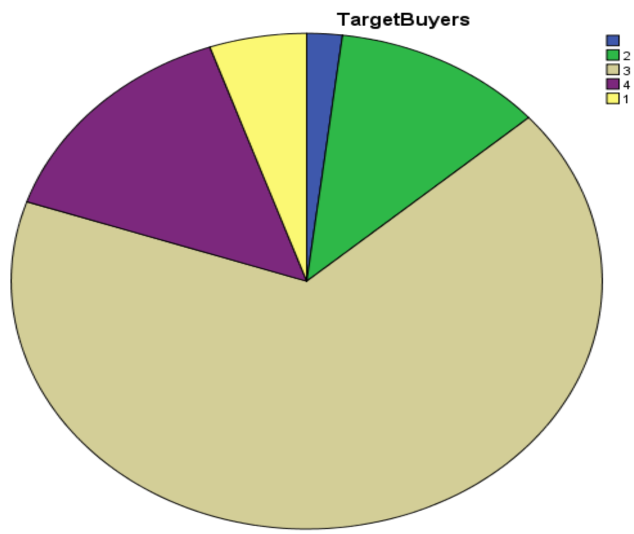
As evident from table 3.12 above; when the cotton farmers were asked about the motivation behind selling their cotton produce; maximum number of farmers (74.9%) told it is the cash urgency that forced them to sell their produce at whatever price. 10.1% of them told they waited to sell their produce till their target is achieved i.e, till they got decent profit. 9.2% of them told they wait and store their cotton produce till they got maximum profit. Only Six farmers (2.9%), of them told they waited till they got back what they have invested and stored the rest of the produce for their personal consumption, six more farmers told they have other reasons behind to sell their produce.

As evident from table 3.13 below, when the farmers were asked about the buyers of their produce, 78.3% of the farmers told it's either commission agents or brokers to whom they sold their produce of cotton. Only 5.3% of farmers sold their produce directly to traders and 14.5% of them sold it at rythu bazaars.

Table 3.13

Target Buyers (Cotton)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		4	1.9	1.9	1.9
	2	24	11.6	11.6	13.5
	3	138	66.7	66.7	80.2
	4	30	14.5	14.5	94.7
	1	11	5.3	5.3	100.0
	Total	207	100.0	100.0	



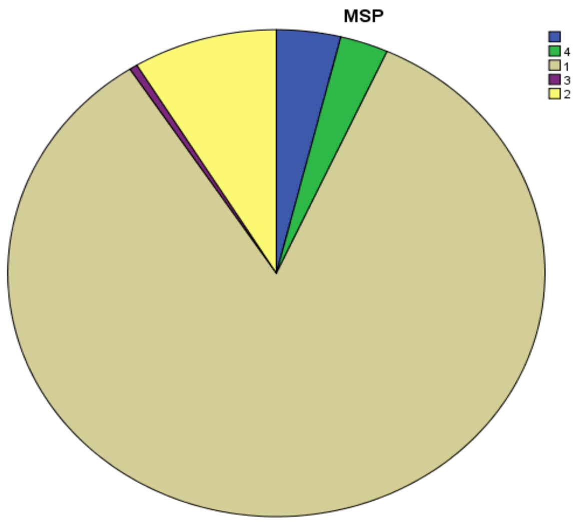
Note: '1'→Traders, '2'→ Brokers, '3'→Commission Agents, '4'→Rythu Bazars

Figure 3.11: **Pie Chart –'Target Buyers' (Cotton)**

Table 3.14

MSP (Cotton)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		8	3.9	3.9	3.9
	4	6	2.9	2.9	6.8
	1	174	84.1	84.1	90.8
	3	1	.5	.5	91.3
	2	18	8.7	8.7	100.0
	Total	207	100.0	100.0	



Note: '1'→Never, '2'→Sometimes, '3'→Often, '4'→Always

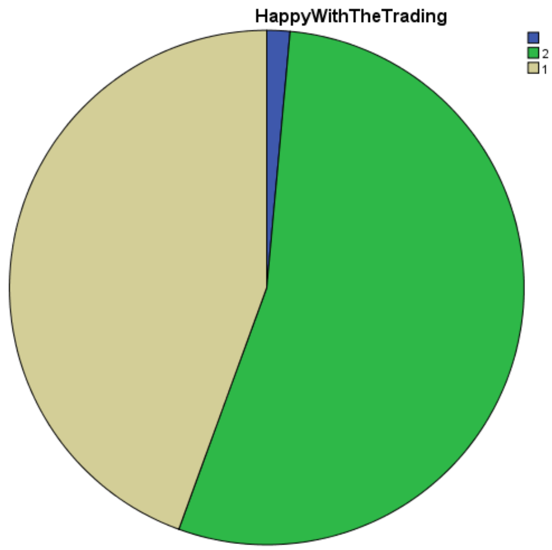
Figure 3.12 – ***Pie Chart –'MSP' (Cotton)***

As evident from table 3.14, when the farmers were asked whether they have taken the benefit of Minimum Support Price (MSP) and sold their cotton produce at the AMC, 84.1% of them told that they have never sold, 8.7% of them told they have sold their produce only sometimes at MSP, 2.9% of the farmers told they have sold their produce always at MSP, only one (0.5%) farmer told that he often sold his cotton produce at MSP.

Table 3.15

Happy With The Trading (Cotton)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		3	1.4	1.4	1.4
	2	112	54.1	54.1	55.6
	1	92	44.4	44.4	100.0
	Total	207	100.0	100.0	



Note: '1'→Yes, '2'→No

Figure 3.13: **Pie Chart –'Happy with the Trading' (Cotton)**

As evident from table 3.15, when the farmers were asked whether they were happy with the trading of cotton, 92 out of 207 farmers (44.4%) told "YES" whereas the rest of the farmers i.e 112 out of 207 (54.1%) told "NO". When asked about the reasons of unhappiness to these farmers, some of them mentioned the following reasons.

Table 3.16

Reasons For Unhappiness (Cotton)

	Frequency	Percent
	144	69.6
Brokers quote less price	3	1.4
Forced to sell at lower rates	6	2.9
Govt. should have direct interaction with farmers.	1	.5
High fluctuation of rates	1	.5
Labour price also could not be recovered	1	.5

Low market rates	6	2.9
Low Rates	3	1.4
Market rates are low	1	.5
More expenditure than profit	1	.5
No other alternative	11	5.3
Not able to get the expected price	13	6.3
Not satisfied with the market rates	1	.5
Price and yield both are also les	1	.5
Remove commission agents	13	6.3
There is no other option	1	.5
Total	207	100.0

As evident from table 3.16, most of the farmers were unhappy with the rates that they get from selling their cotton produce in the market, some of the farmers mentioned that they were not even able to get what they have invested in cultivating the crop, and most of them also suggested removal of commission agents and brokers as they quote very less price for their produce and suggested there should be a platform where government can interact directly with the farmers. Some of them had said there is no other option or alternative available to them to be able to sell their produce at a good rate.

Table 3.17

Awareness About CFM (Cotton)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		13	6.3	6.3	6.3
	2	194	93.7	93.7	100.0
	Total	207	100.0	100.0	

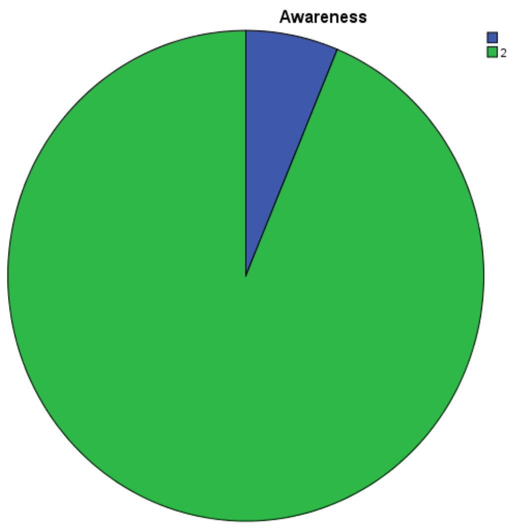


Figure 3.14: **Pie Chart –'Awareness' (Cotton)**

Note: '1'→Yes, '2'→No

As evident from table 3.17, when the cotton farmers were asked whether they were aware of commodity futures market, the farmers answered in "NO" i.e., none of them were aware.

Table 3.18

Given Training (Cotton)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		15	7.2	7.2	7.2
	2	1	.5	.5	7.7
	1	191	92.3	92.3	100.0
	Total	207	100.0	100.0	

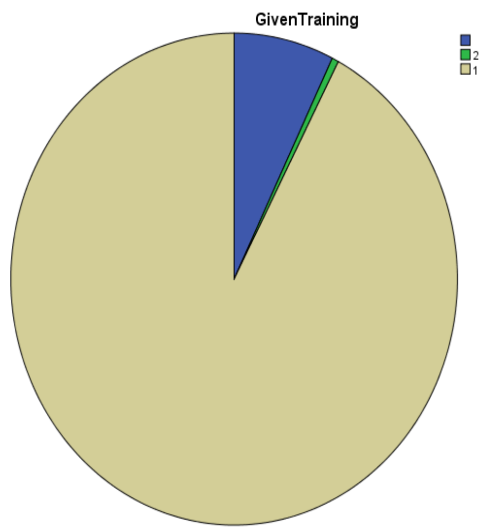


Figure 3.15: **Pie Chart –'Given Training' (Cotton)**

Note: '1'→Yes, '2'→No

As evident from table 3.18, when the farmers were asked whether they would participate in Commodity Futures Market if given training, all the farmers except one agreed.

3.3.2 Chilli

Table 3.19

Land Holding (Chilli)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.50	1	.5	.6	.6
	1.00	11	5.8	6.1	6.7
	1.50	1	.5	.6	7.3
	2.00	32	16.9	17.9	25.1
	2.50	3	1.6	1.7	26.8
	3.00	25	13.2	14.0	40.8

	4.00	25	13.2	14.0	54.7
	4.50	1	.5	.6	55.3
	5.00	26	13.8	14.5	69.8
	6.00	16	8.5	8.9	78.8
	7.00	4	2.1	2.2	81.0
	8.00	9	4.8	5.0	86.0
	10.00	17	9.0	9.5	95.5
	12.00	1	.5	.6	96.1
	13.00	2	1.1	1.1	97.2
	21.00	3	1.6	1.7	98.9
	30.00	1	.5	.6	99.4
	50.00	1	.5	.6	100.0
	Total	179	94.7	100.0	
Missing	System	10	5.3		
Total		189	100.0		

Note: The unit taken for land holdings is Acres.

Table 3.20

Statistics – Land Holding (Chilli)

N	Valid	179
	Missing	10
Mean		5.2570
Mode		2.00
Std. Deviation		5.17214
Minimum		.50
Maximum		50.00

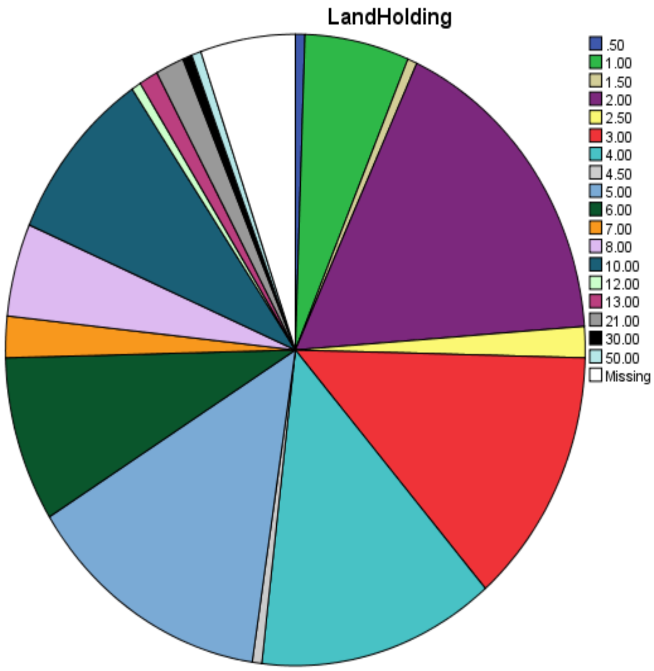


Figure 3.16: **Pie Chart –'Land Holding'** ***(Chilli)***

From table 3.19 and table 3.20, it is evident that 97.2% of chilli farmers possess 13 acres of land and less. Maximum number of farmers in the sample possesses two acres of land (17.9%). This is also evident from table 3.2, i.e the mode of the data is two acres. The average land possessed by the farmers is 5.25 acres. The land holding for the sample of chilli farmers ranges from half acre to fifty acres.

Table 3.21

Ownership of Land (Chilli)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		2	1.1	1.1	1.1
	3	5	2.6	2.6	3.7
	2	24	12.7	12.7	16.4
	1	158	83.6	83.6	100.0
	Total	189	100.0	100.0	

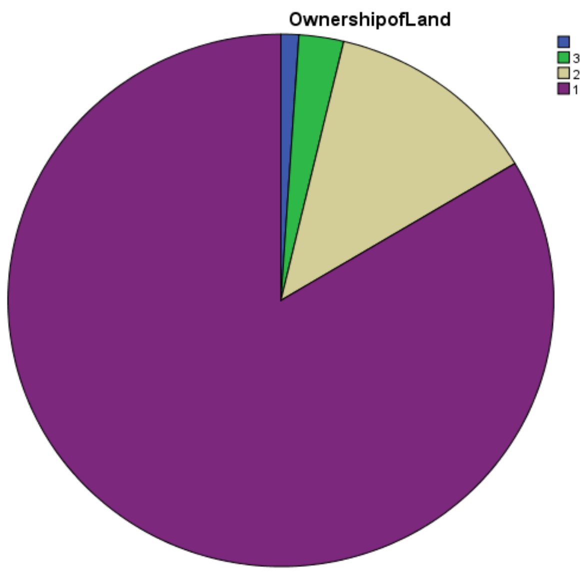


Figure 3.17: **Pie Chart –'Ownership of Land'** ***(Chilli)***

Note:

'1' → Owned the Whole Land

'2' →Whole Land on Lease

'3'→ Part of Land on Lease and Part of Land Owned

As displayed, from the table 3.21, 83.6% of the chilli farmers owned their land and 12.7% of them had taken the land wholly on lease, and meager 3.7% of them had taken some part of their land on lease.

Table 3.22

Average Output (Chilli)

In Quintals		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4.00	1	.5	.5	.5
	6.33	3	1.6	1.6	2.1
	7.67	2	1.1	1.1	3.2
	8.00	2	1.1	1.1	4.2
	8.67	1	.5	.5	4.8
	9.00	4	2.1	2.1	6.9
	9.83	1	.5	.5	7.4
	10.0	3	1.6	1.6	9.0
	10.25	2	1.1	1.1	10.1
	11.33	2	1.1	1.1	11.1
	11.67	3	1.6	1.6	12.7
	12.33	5	2.6	2.6	15.3
	12.67	5	2.6	2.6	18.0
	13.50	1	.5	.5	18.5
	13.67	3	1.6	1.6	20.1
	14.67	1	.5	.5	20.6
	15.00	9	4.8	4.8	25.4
	16.00	2	1.1	1.1	26.5
	16.67	2	1.1	1.1	27.5
	17.67	2	1.1	1.1	28.6
	18.00	4	21	2.1	30.7
	18.33	6	3.2	3.2	33.9
	19.00	5	2.6	2.6	36.5
	20.00	9	4.8	4.8	41.3
	21.00	4	2.1	2.1	43.4
	21.33	2	1.1	1.1	44.4

21.50	2	1.1	1.1	45.5
21.67	7	3.7	3.7	49.2
22.00	3	1.6	1.6	50.8
22.33	2	1.1	1.1	51.9
22.50	2	1.1	1.1	52.9
22.67	3	1.6	1.6	54.5
23.00	4	2.1	2.1	56.6
23.33	7	3.7	3.7	60.3
24.00	3	1.6	1.6	61.9
24.33	3	1.6	1.6	63.5
24.67	1	.5	.5	64.0
25.00	17	9.0	9.0	73.0
25.67	2	1.1	1.1	74.1
26.67	4	2.1	2.1	76.2
27.00	1	.5	.5	76.7
27.67	1	.5	.5	77.2
28.00	1	.5	.5	77.8
28.33	2	1.1	1.1	78.8
29.00	1	.5	.5	79.4
30.00	8	4.2	4.2	83.6
31.00	4	2.1	2.1	85.7
31.67	2	1.1	1.1	86.8
32.00	2	1.1	1.1	87.8
32.33	2	1.1	1.1	88.9
33.33	2	1.1	1.1	89.9
34.00	2	1.1	1.1	91.0
35.00	4	2.1	2.1	93.1
35.33	2	1.1	1.1	94.2
36.67	2	1.1	1.1	95.2
43.33	2	1.1	1.1	96.3
45.00	2	1.1	1.1	97.4
50.00	3	1.6	1.6	98.9
54.67	2	1.1	1.1	100.0
Total	189	100.0	100.0	

Table 3.23

Statistics - Average Output (Chilli)

N	Valid	189
	Missing	0
Mean		22.4118
Mode		25.00
Std. Deviation		9.39846
Minimum		4.00
Maximum		54.67

The chilli farmers were asked to give the information relating to their output or produce of chilli for the last three years, in quintals. Then, the average of the output for three years was calculated. For some years they didn't have proper output because of the natural calamities like heavy rainfall and also due to the damage caused by the virus.

From table 3.22 and table 3.23, it can be clearly seen that the output of chilli ranges from four to fifty five quintals. The average output of chilli for the sample of farmers is found to be 22.41 quintals. The mode of the data is twenty five.

This indicated that maximum number (9%) of farmers in the sample produce eight quintals of cotton. 95.2% of total chilli farmers produces 36.7 quintals of chilli and less.

Table 3.24

Source of Finance (Chilli)

		Frequency	Percent	Valid Percent
Valid		6	3.2	3.2
	7	1	.5	.5
	6	12	6.3	6.3
	1	44	23.3	23.3
	8	3	1.6	1.6
	2	70	37.0	37.0
	4	4	2.1	2.1
	3	49	25.9	25.9
	Total	189	100.0	100.0

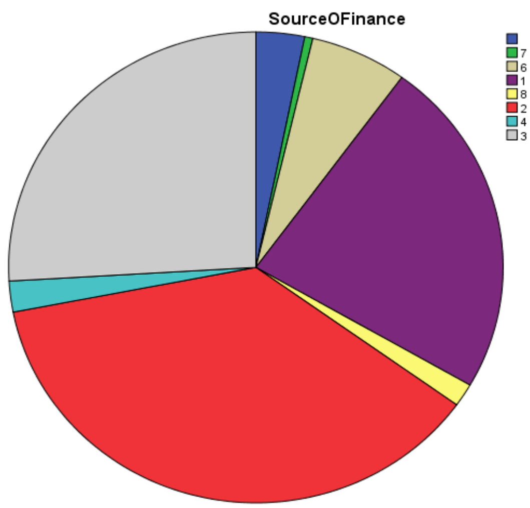


Figure 3.18: **Pie Chart –Source of Finance (Chilli)**

As clearly evident from table 3.24, 23.3% of chilli farmers made use of banks to finance the cultivation of their land, 37% took finance from local money lenders and this is the highest percentage for the sample of chilli farmers, and only 12.6% of farmers did not take any financial help i.e they self financed their cultivation. 25.9% of farmers used their own finance as well as took finance from bank. 6.3% of farmers used their finance and also took help from banks. 1.6% of farmers used their own finance and also sourced some from money lenders. Only one farmer (0.5%) sourced his finance from banks as well as money lenders. 2.1% of farmers said they made use of other sources of finance.

Table 3.25

Criterion For Area Cultivation (Chilli)

		Frequency	Percent	Valid Percent
Valid		3	1.6	1.6
	0	53	28.0	28.0
	1	64	33.9	33.9
	4	26	13.8	13.8
	2	43	22.8	22.8
	Total	189	100.0	100.0

Note: '0'→None,'1'→Output, '2'→Spot Price, '3'→Future Price,

'4'→Price+Output

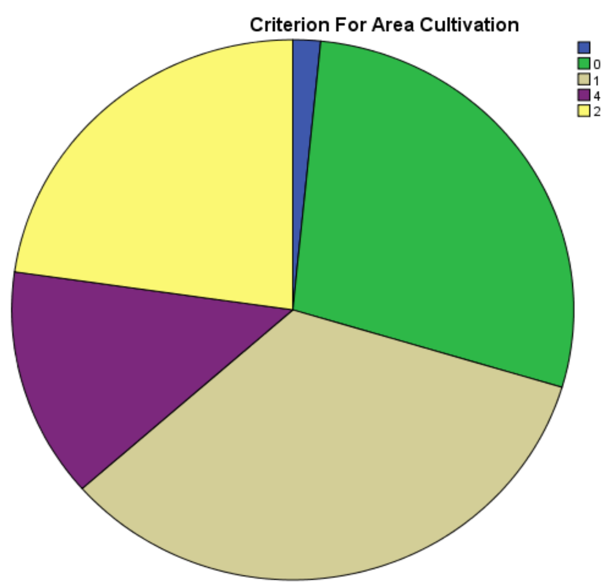


Figure 3.19: **Pie Chart -'Criterion for Area Cultivation' (Chilli)**

As evident from table 3.25, when the chilli farmers were asked about the criterion they took into consideration before cultivating their land for chilli, 28% of them said that they did not consider anything, 33.9% of them told they considered the output before cultivation, 22.8% told they checked the prevailing market or spot price, whereas 13.8% told they considered both output and price before cultivation.

Table 3.26

Risk Management Techniques Known (Chilli)

		Frequency	Percent	Valid Percent
Valid		8	4.2	4.2
	2	22	11.6	11.6
	4	49	25.9	25.9
	3	96	50.8	50.8
	0	14	7.4	7.4
	Total	189	100.0	100.0

Note: '0'→None, '1'→Hedging, '2'→Crop Insurance, '3'→MSP, '4'→Crop Insurance and MSP

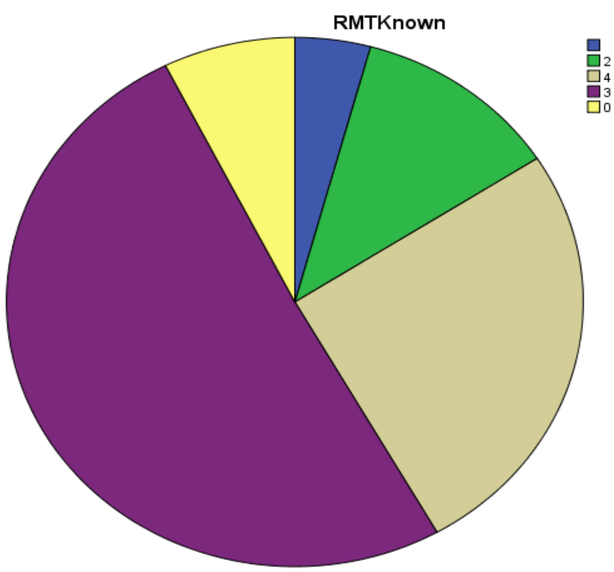


Figure 3.20: **Pie Chart –'RMT Known' (Chilli)**

As evident from table 3.26, when the farmers were asked about the risk management techniques they knew, 7.4% replied that they knew none, 11.6% told they knew only about crop insurance, 50.8% of them knew about MSP and 25% of them knew about both crop insurance and MSP. Zero percent or none of them knew about hedging.

Table 3.27

Price Information (Chilli)

		Frequency	Percent	Valid Percent
	[illegible]	3	1.6	1.6
	7	3	1.6	1.6
	4	28	14.8	14.8
	13	2	1.1	1.1
	3	44	23.3	23.3
Valid	5	12	6.3	6.3
	8	49	25.9	25.9
	1	26	13.8	13.8
	2	19	10.1	10.1
	12	3	1.6	1.6
	Total	189	100.0	100.0

As evident, from table 3.27, when the farmers were asked how they collected information about the price of chilli, 23.3% told they collected the information from mandi, 25.9% of them told they kept themselves updated from newspaper and tv. 19% of them told they kept themselves updated only from TV. 14.8% of them told they took help of their friends. 6.3% told they used MSP, 13.8% told they read newspapers and kept themselves updated only through it.

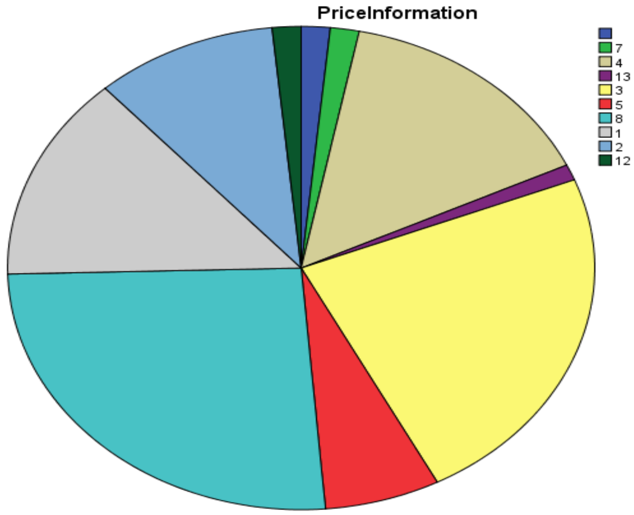


Figure 3.21: **Pie Chart –'Price Information' (Chilli)**

Note: '1'→Newspapers, '2'→TV, '3'→Mandi, '4'→Friends, '5'MSP→, '6'→FuturePrice, '7'→ Traders, '8'→Newspaper+TV, '10'→Newspaper+TV+mandi '12'→TV+Friends, '13'→Friends+Mandi

1.6% told they had enquired traders and took the price information, only one farmer (0.5%) said he used newspaper and friends and another said he used newspaper, tv and mandi. Only two farmers told they enquired from friends and mandi.

Majority of the farmers used Newspaper and TV and Market or Mandi to collect information relating to the price of chilli. Not a single farmer told that they used future price as the criteria to decide the spot price of chilli.

Table 3.28

Motivation behind Selling (Chilli)

		Frequency	Percent	Valid Percent
Valid		4	2.1	2.1
	4	111	58.7	58.7
	2	18	9.5	9.5
	3	14	7.4	7.4
	5	4	2.1	2.1
	1	38	20.1	20.1
	Total	189	100.0	100.0

Note: '1'→Target Attained, Get Back What Invested + Store for Consumption, '3'→MaximumProfit, '4'→CashUrgency, '5'→Others

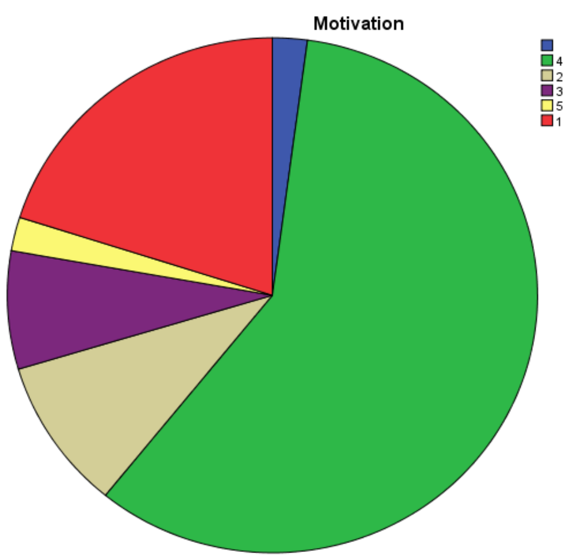


Figure 3.22: **Pie Chart –'Motivation' (Chilli)**

As evident from table 3.28, when the chilli farmers were asked about the motivation behind selling their chilli produce, maximum number of farmers (58.7%) told it's the cash urgency that forced them to sell their produce at whatever price. 20.1% of them saidd they waited to sell their produce till their target is achieved i.e, till they got decent profit .

7.4% of them to said they waited and stored their chilli produce till they got maximum profit. 9.5% of them told they waited till they got back what they have invested and stored the rest of the produce for their personal consumption, four farmers (2.1%) told they have other reasons behind to sell their produce.

Table 3.29

Target Buyers (Chilli)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		3	1.6	1.6	1.6
	2	26	13.8	13.8	15.3
	3	142	75.1	75.1	90.5
	1	15	7.9	7.9	98.4
	4	3	1.6	1.6	100.0
	Total	189	100.0	100.0	

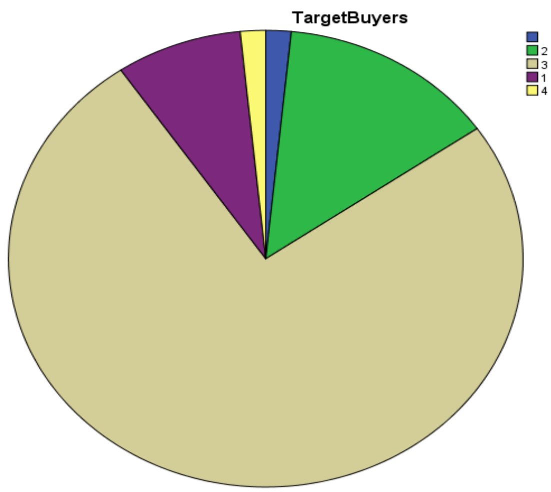


Figure 3.23: **Pie Chart-'Target Buyers' (Chilli)**

Note: '1'→Traders, '2'→ Brokers, '3'→CommissionAgents, '4'→Traders+CommissionAgents

As evident from table 3.29, when the farmers were asked about the buyers of their produce, 90.5% of the farmers told it's either commission agents or brokers to whom they sold their produce of chilli. Only 7.9% of farmers sold their produce directly to traders and three farmers (1.6%) sold their produce either to traders or commission agents.

Table 3.30

MSP (Chilli)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		10	5.3	5.3	5.3
	4	23	12.2	12.2	17.5
	1	118	62.4	62.4	79.9
	3	15	7.9	7.9	87.8
	2	23	12.2	12.2	100.0
	Total	189	100.0	100.0	

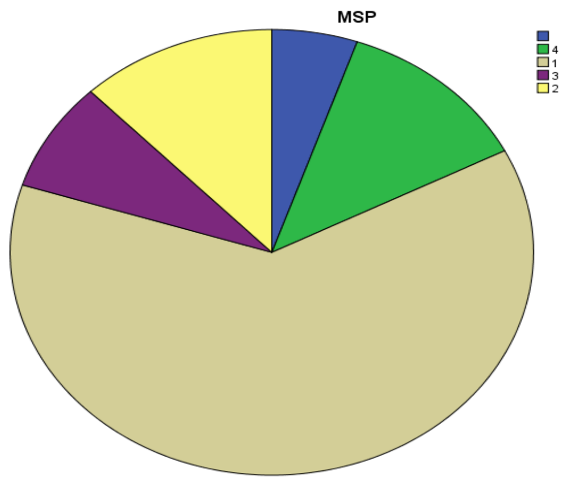


Figure 3.24: **Pie Chart – 'MSP' (Chilli)**

Note: '1'→Never, '2'→Sometimes, '3'→Often, '4'→Always

As evident from table 3.30, when the farmers were asked whether they have taken the benefit of MSP and sold their chilli produce at the AMC, 62.4% of them told that they have never sold, 12.2% of them told they have sold their produce only sometimes at MSP, 12.2% of the farmers told they have sold their produce always at MSP, 7.9% farmers told that they often sold their chilli produce at MSP.

Table 3.31

Happy with the Trading (Chilli)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		9	4.8	4.8	4.8
	2	107	56.6	56.6	61.4
	1	73	38.6	38.6	100.0
	Total	189	100.0	100.0	

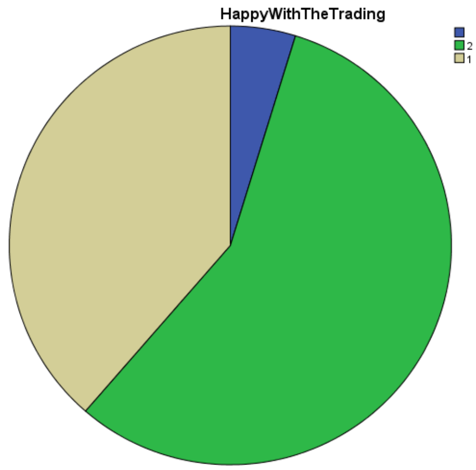


***Figure 3.25:* Pie Chart –'Happy with the Trading' (Chilli)**

Note: '1'→Yes, '2'→No

As evident from table 3.31, when the farmers were asked whether they were happy with the trading of chilli, 73 out of 189 farmers (38.6%) told "YES" whereas the rest of the farmers i.e 107 out of 189 (56.6%) told "NO". When asked about the reasons of unhappiness to these farmers, some of them mentioned the following reasons.

Table 3.32

Reasons For Unhappiness (Chilli)

	Frequency	Percent
		58.2
At least the price we get for the crop should be able to fulfill the basic household needs.	1	.5
Because of market conditions	1	.5
Brokers quote less price	3	1.6
Commission is more	1	.5
Commission Agents take lot of commission	5	2.6
Forced to sell at low market rates	1	.5
Govt. should have direct interaction	1	.5
In the market they do not give money on the spot.	1	.5
Low Rates	32	16.9

Many Problems exist in the market.	2	1.1
Market is not good	1	.5
Market rates are low	1	.5
Mkt is not good	1	.5
No other alternative	3	1.6
Not able to get the expected price	1	.5
Not satisfied with the market	1	.5
Price	5	2.6
Price and Yield both are less	1	.5
Price and Yield both are less	1	.5
Price and Yield is also less	1	.5
Rates are fluctuating.	3	1.6
Remove CA	3	1.6
There is no other option	1	.5
Traders are exploiting and the prices are not good	8	4.2
Total	189	100.0

As evident from table 3.32, most of the farmers were unhappy with the rates that they got from selling their chilli produce in the market, some of the farmers mentioned that they were not even able to get what they have invested in cultivating the crop, even one of them told that they didn't get paid instantly in the market, and most of them also suggested removal of commission agents and brokers as they quoted very less price for their produce and suggested there should be a platform where government could interact directly with the farmers. Some of them said there is no other option or alternative available to them to be able to sell their produce at a good rate. Few farmers were even not happy with the yield of the crop, some blamed the fluctuating rates of chilli, and few felt they were being exploited at the hands of the traders.

Table 3.33

Awareness (Chilli)

		Frequency	Percent	Valid Percent	Cumulative Percent
		2	1.1	1.1	1.1
Valid	2	187	98.9	98.9	100.0
	Total	189	100.0	100.0	

Note: '1'→Yes, '2'→No

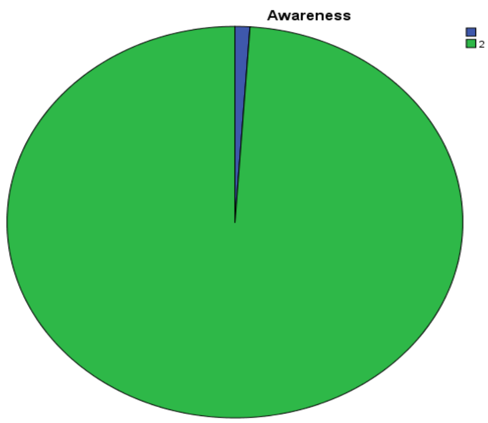


Figure 3.26: ***Pie Chart –'Awareness'(Chilli)***

As evident from table 3.33, when the chilli farmers were asked whether they were aware of commodity futures market, the farmers answered in "NO" i.e., none of them were aware.

Table 3.34

Given Training (Chilli)

		Frequency	Percent	Valid Percent	Cumulative Percent
		2	1.1	1.1	1.1
Valid	2	3	1.6	1.6	2.6
	1	184	97.4	97.4	100.0
	Total	189	100.0	100.0	

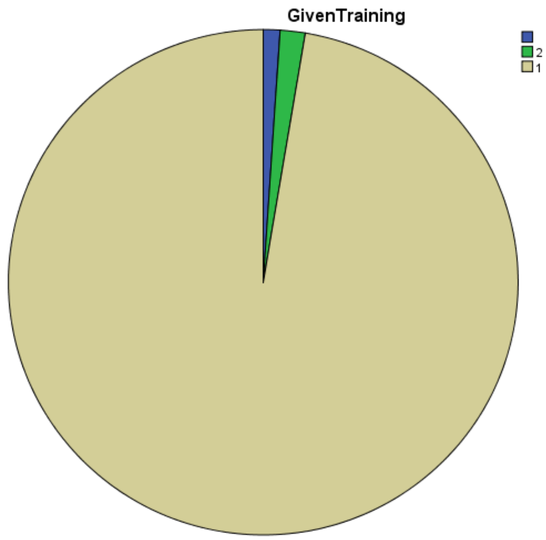


Figure 3.27: ***Pie Chart –'Given Training' (Chilli)***

Note: '1'→Yes, '2'→No

As evident from table 3.34, when the farmers were asked whether they will participate in Commodity Futures Market if given training, all the farmers except three, agreed.

3.3.3 Turmeric

Table 3.35

Land Holding (Turmeric)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.50	6	3.2	3.3	3.3
	1.00	40	21.3	21.9	25.1
	1.10	1	.5	.5	25.7
	1.30	4	2.1	2.2	27.9
	1.40	3	1.6	1.6	29.5
	1.60	3	1.6	1.6	31.1
	1.80	6	3.2	3.3	34.4

	1.90	1	.5	.5	35.0
	2.00	31	16.5	16.9	51.9
	2.20	3	1.6	1.6	53.6
	2.30	1	.5	.5	54.1
	2.40	2	1.1	1.1	55.2
	2.60	1	.5	.5	55.7
	3.00	9	4.8	4.9	60.7
	3.30	3	1.6	1.6	62.3
	4.00	13	6.9	7.1	69.4
	4.40	1	.5	.5	69.9
	5.00	21	11.2	11.5	81.4
	5.30	1	.5	.5	82.0
	6.00	5	2.7	2.7	84.7
	7.00	5	2.7	2.7	87.4
	8.00	11	5.9	6.0	93.4
	9.00	2	1.1	1.1	94.5
	9.30	1	.5	.5	95.1
	10.00	7	3.7	3.8	98.9
	10.30	1	.5	.5	99.5
	15.50	1	.5	.5	100.0
	Total	183	97.3	100.0	
Missing	System	5	2.7		
Total		188	100.0		

Note: The unit taken for land holdings is ACRES.

Table 3.36

Statistics Land Holding (Turmeric)

N	Valid	183
	Missing	5
Mean		3.4372
Mode		1.00
Std. Deviation		2.77761
Minimum		.50
Maximum		15.50

From table 3.35 and table 3.36, it is evident that 93.4% of turmeric farmers possess 8 acres of land and less. Maximum number of farmers in the sample possess one acre of land (21.9%). This is also evident from table 3.36, i.e the mode of the data is one acre. The average land possessed by the turmeric farmers is 3.43 acres. The land holding for the sample of turmeric farmers ranges from half acre to 15.50 acres.

As displayed, from the table 3.37 below, 84.6% of the farmers own the land and 7.4% of them have taken the land wholly on lease, and 8% of them have taken some part of their land on lease.

Table 3.37

Ownership of Land (Turmeric)

		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	3	15	8.0	8.0	8.0
	2	14	7.4	7.4	15.4
	1	159	84.6	84.6	100.0
	Total	188	100.0	100.0	

Note:

‘1’ → Owned the Whole Land

‘2’ →Whole Land on Lease

‘3’→ Part of Land on Lease and Part of Land Owned

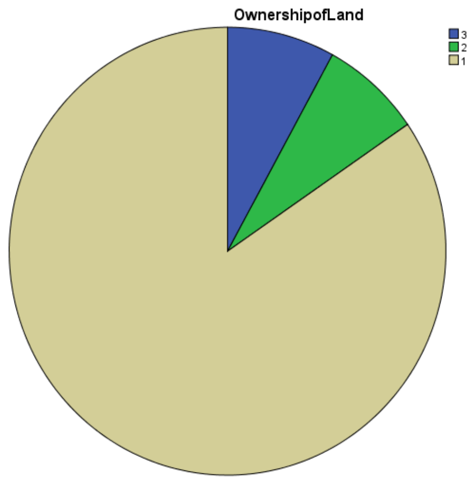


Figure 3.28: **Pie Chart –'Ownership of Land' (Turmeric)**

Table 3.38
Average Output (Turmeric)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.17	3	1.6	1.6	1.6
	1.20	3	1.6	1.6	3.2
	2.67	1	.5	.5	3.7
	3.67	7	3.7	3.7	7.4
	4.00	3	1.6	1.6	9.0
	4.33	4	2.1	2.1	11.2
	4.67	4	2.1	2.1	13.3
	5.00	3	1.6	1.6	14.9
	5.33	2	1.1	1.1	16.0
	5.77	2	1.1	1.1	17.0
	6.00	12	6.4	6.4	23.4
	6.33	6	3.2	3.2	26.6
	6.67	4	2.1	2.1	28.7
	7.00	14	7.4	7.4	36.2
	7.13	2	1.1	1.1	37.2
	7.33	8	4.3	4.3	41.5
	7.67	11	5.9	5.9	47.3
	8.00	34	18.1	18.1	65.4
	8.33	5	2.7	2.7	68.1
	8.67	10	5.3	5.3	73.4
	9.00	4	2.1	2.1	75.5
	9.33	3	1.6	1.6	77.1
	10.00	3	1.6	1.6	78.7

11.00	3	1.6	1.6	80.3
12.00	1	.5	.5	80.9
14.67	2	1.1	1.1	81.9
15.67	6	3.2	3.2	85.1
16.00	20	10.6	10.6	95.7
16.67	2	1.1	1.1	96.8
18.00	1	.5	.5	97.3
19.33	2	1.1	1.1	98.4
22.00	1	.5	.5	98.9
33.33	2	1.1	1.1	100.0
Total	188	100.0	100.0	

Note: The Produce/Output is in Quintals

Table 3.39

Statistics
AverageOutput (Turmeric)

N	Valid	188
	Missing	0
Mean		8.9037
Mode		8.00
Std. Deviation		4.82428
Minimum		1.17
Maximum		33.33

The turmeric farmers were asked to give the information relating to their output or produce of turmeric for the last three years, in quintals. Then, the average of the three years output was calculated. From table 3.38 and table 3.39, it can be clearly seen that the output of turmeric ranges from 1.17 quintals to 33.33 quintals.

The average output of turmeric for the sample of farmers is found to be 8.9 quintals. The mode of the data is eight. This indicates that maximum number (18.1%) of farmers in the sample produce eight quintals of cotton. 97.3% of total turmeric farmers produces 18 quintals of turmeric and less.

Table 3.40

Source of Finance (Turmeric)

		Frequency	Percent	Valid Percent
		4	2.1	2.1
	5	10	5.3	5.3
Valid	1	173	92.0	92.0
	2	1	.5	.5
	Total	188	100.0	100.0

Note: '1'→ Banks, '2'→Money Lenders '3'→Self, '4'→Others, '5'→Bank+Money Lenders.

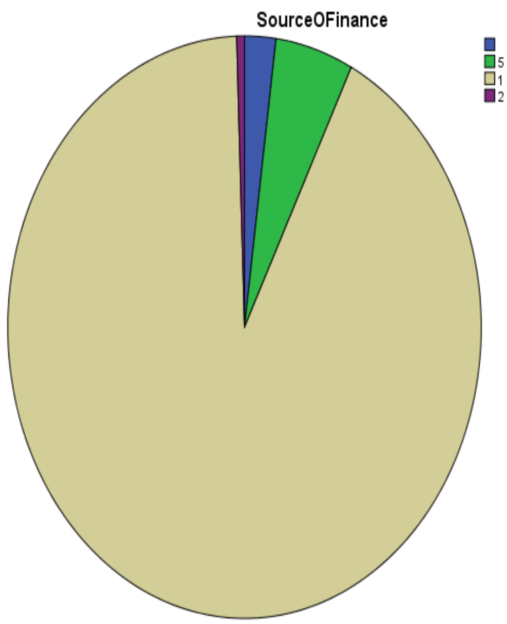


Figure 3.29: Pie Chart –'Source of Finance'

As clearly evident from table 3.40, majority (92%) of turmeric farmers made use of banks to finance the cultivation of their land, only one farmer took finance from local money lenders and 5.3% of farmers sourced their finance from banks and money lenders.

Table 3.41

Criterion For Area Cultivation(Turmeric)

		Frequency	Percent	Valid Percent
Valid	0	164	87.2	87.2
	1	18	9.6	9.6
	2	6	3.2	3.2
	Total	188	100.0	100.0

Note: '0'→None,'1'→Output, '2'→Spot Price, '3'→Future Price, '4'→Price+Output

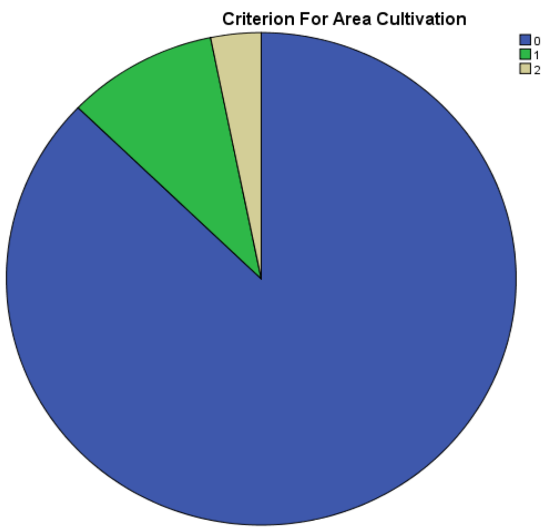


Figure 3.30: **Pie Chart-'Criterion For Area Cultivation' (Turmeric)**

When the turmeric farmers were asked about the criterion they take into consideration before cultivating their land for turmeric, 87.2% of them said that they do not consider anything, 9.6% of them told they consider the output before cultivation, 3.2% told they checked the prevailing market or spot price.

Table 3.42

RMT Known (Turmeric)

		Frequency	Percent	Valid Percent
Valid		5	2.7	2.7
	2	18	9.6	9.6
	4	23	12.2	12.2
	3	27	14.4	14.4
	0	115	61.2	61.2
	Total	188	100.0	100.0

Note: ‘0’→None, ‘1’→Hedging, ‘2’→Crop Insurance, ‘3’→MSP, ‘4’→Crop Insurance and MSP

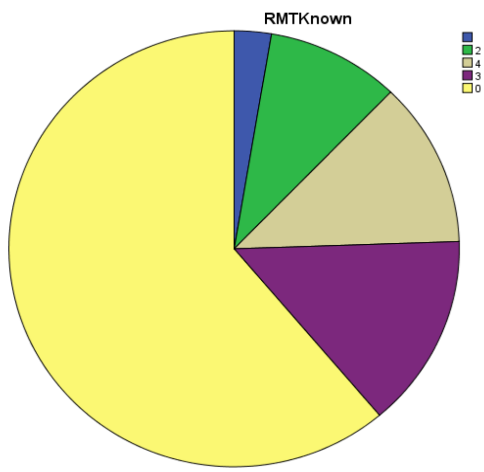


Figure 3.31: **Pie Chart –‘RMT Known’ (Turmeric)**

As evident from table 3.42, when the farmers were asked about the risk management techniques they knew, 61.2% replied that they knew none, 9.6% told they knew about crop insurance, 14.4% of them knew about MSP and 12.2% of them knew about both crop insurance and MSP. Zero percent or none of them knew about hedging.

Table 3.43

Price Information (Turmeric)

		Frequency	Percent	Valid Percent
Valid	4	6	3.2	3.2
	3	158	84.0	84.0
	7	1	.5	.5
	2	6	3.2	3.2
	5	17	9.0	9.0
	Total	188	100.0	100.0

Note: '1'→Newspapers, '2'→TV, '3'→Mandi, '4'→Friends, '5'→Traders, '6'→Others, '7'→ Mandi+TV.

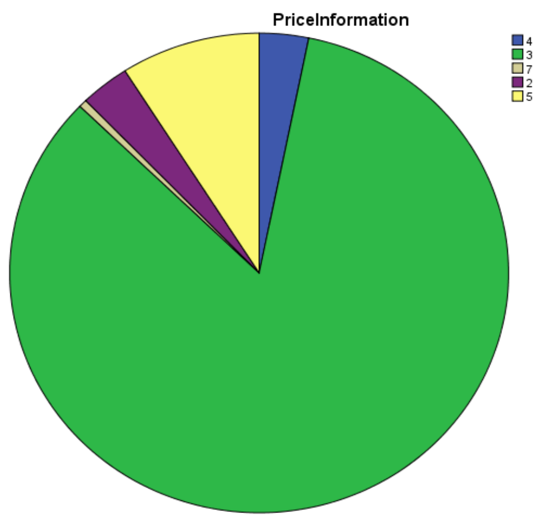


Figure 3.32: **Pie Chart: 'Price Information' (Turmeric)**

As evident from table 3.43, when the farmers were asked how did they collect information about the price of turmeric, majority of them (84%) told they collected the information from mandi, 3.2% of them told they watch tv and keep themselves updated only from tv. 3.2% of them told they take help of their friend, 9% told they call traders and take the price information. Only one farmer told he take the price information from tv and mandi. Majority of the turmeric farmers uses Mandi or market to collect the price information, not a single farmer told that they use future price as the criteria to decide the spot price of turmeric.

Table 3.44

Motivation (Turmeric)

		Frequency	Percent	Valid Percent
Valid	2	140	74.5	74.5
	4	12	6.4	6.4
	3	3	1.6	1.6
	1	33	17.6	17.6
	Total	188	100.0	100.0

Note: '1'→Target Attained, '2'→Cash Urgency, '3'→Maximum Profit, '4'→Others

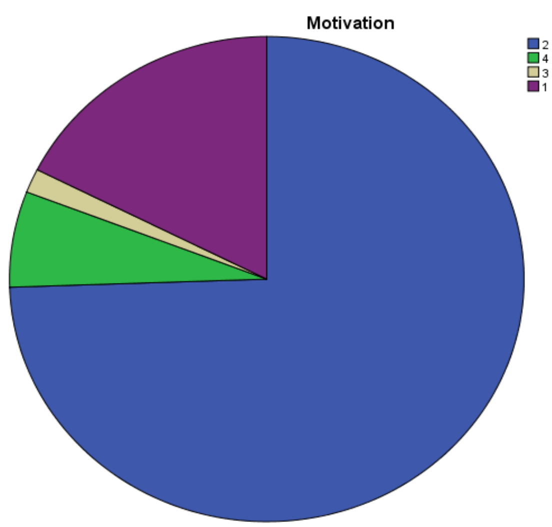


Figure 3.33: **Pie Chart -'Motivation behind Selling' (Turmeric)**

As evident from table 3.44, when the turmeric farmers were asked about the motivation behind selling their produce maximum number of farmers (74.5%) told it is the cash urgency that force them to sell their produce at whatever price. 17.6% of them told they wait to sell their produce till their target is achieved i.e, till they get decent profit. Only 1.6% of them told they wait and store their cotton produce till they get maximum profit, another 6.4% of farmers told they have other reasons behind to sell their produce.

Table 3.45

Target Buyers (Turmeric)

		Frequency	Percent	Valid Percent
Valid	3	144	76.6	76.6
	4	44	23.4	23.4
	Total	188	100.0	100.0

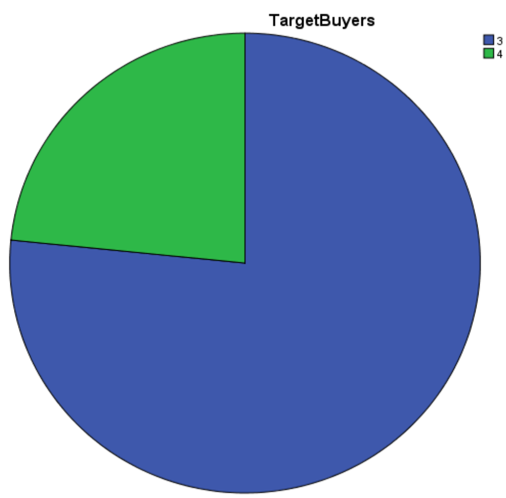


***Figure 3.34:* Pie Chart –'Target Buyers' (Turmeric)**

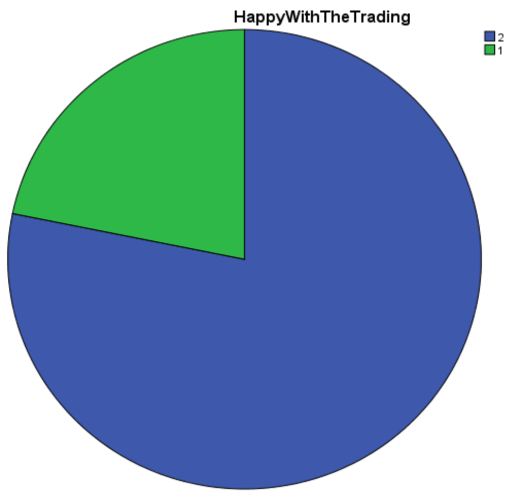
Note: '1'→Traders, '2'→ Brokers, '3'→Commission Agents, '4'→Rythu Bazaars

As evident from table 3.45, when the turmeric farmers were asked about the buyers of their produce, 76.6% of the farmers told its either commission agents or brokers to whom they sell their produce of turmeric, and 23.4% of them sell it at rythu bazaars.

Table 3.46

Happy with the Trading (Turmeric)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	147	78.2	78.2	78.2
	1	41	21.8	21.8	100.0
	Total	188	100.0	100.0	



Note: '1'→Yes, '2'→No

***Figure 3.35:* Pie Chart –'Happy With the Trading' (Turmeric)**

As evident from table 3.46, when the farmers were asked whether they are happy with the trading of turmeric, 41 out of 188 farmers (21.8%) told "YES" where as the rest of the farmers i.e 147 out of 189 (78.2%) told "NO". When asked about the reasons of unhappiness to these farmers, some of them mentioned the following reasons.

Table 3.47

Reasons for Unhappiness (Turmeric)

		Frequency	Percent
Valid		105	55.9
	CA should be removed	5	2.7
	Low Rates	23	12.2
	There is no MSP available	30	16.0
	Traders are exploiting	3	1.6
	Traders are exploiting	24	12.8
	Turmeric Yield is Low	1	.5
	Total	188	100.0

As evident from table 3.47, most of the turmeric farmers are unhappy with the rates that they get from selling their produce in the market and also with the government for not listing turmeric in the MSP list, and some of them also suggested removal of commission agents and brokers as they quote very less price for their produce and suggested there should be a platform where government can interact directly with the farmers.

Few farmers were even not happy with the yield of the crop, some blame the fluctuating rates of turmeric and few felt they are being exploited at the hands of traders.

Table 3.48

Awareness (Turmeric)

		Frequency	Percent	Valid Percent	Cumulative Percent
		15	8.0	8.0	8.0
Valid	2	173	92.0	92.0	100.0
	Total	188	100.0	100.0	

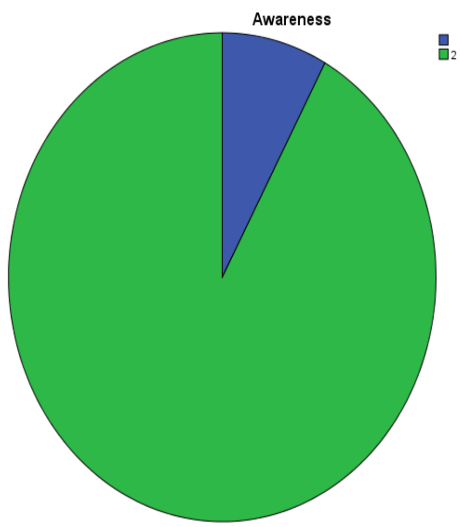


Figure 3.36: **Pie Chart –'Awareness' (Turmeric)**

Note: '1'→Yes, '2'→No

As evident from table 3.48 above, when the turmeric farmers were asked whether they are aware of commodity futures market, the farmers answered in "NO" i.e., none of them were aware.

Table 3.49

Given Training (Turmeric)

		Frequency	Percent	Valid Percent	Cumulative Percent
		66	35.1	35.1	35.1
Valid	1	122	64.9	64.9	100.0
	Total	188	100.0	100.0	

Note: '1'→Yes, '2'→No

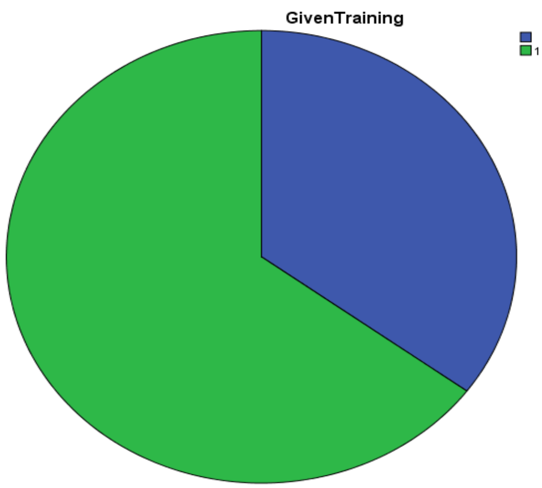


Figure 3.37: **Pie Chart –'Given Training' (Turmeric)**

As evident from table 3.49, when the farmers were asked whether they will participate in Commodity Futures Market if given training, all the farmers agreed. Sixty six of them did not respond.

3.4 Excerpts from the Questionnaires

i. The average land holding of cotton farmers is 4.87 acres, whereas for chilli farmers it is 5.25 acres and for turmeric farmers it is 3.43 acres.

ii. From the sample of cotton farmers, 92.3% of the farmers wholly owned their land, and for chilli farmers, 83.6% wholly owned their land, and for turmeric farmers 84.6% owned their land.

iii. The average output of cotton for the sample of farmers is found to be 20.05 quintals, and 97.1% of total cotton farmers produced 57 quintals of cotton and less. The average output of chilli for the sample of farmers is found to be 22.41 quintals. 95.2% of total chilli farmers produce 36.7 quintals of chilli and less. The average output of turmeric for the sample of farmers is found to be 8.9 quintals. 97.3% of total turmeric farmers produce 18 quintals of turmeric and less.

iv. The major source of finance for the sample of cotton farmers is bank and then money lenders, for chilli farmers they sourced their finance mostly from money lenders and then from bank, and for sample of turmeric farmers, bank is the major source of finance.

v. When the cotton farmers were asked about the criterion they took into consideration before cultivating their land for cotton, 60.9% of them said that they did not consider anything, 21.3% of them told they considered the output before cultivation, in the sample of chilli farmers, 28% of them said that they did not consider anything, 33.9% of them told they considered the output before cultivation, 22.8% told they checked the prevailing market or spot price, whereas 13.8% told they considered both output and price before cultivation, where as in the sample of turmeric farmers 87.2% of them said that they did not consider anything, 9.6% of them told they considered the output before cultivation, 3.2% told they checked the prevailing market or spot price.

vi. In the sample of cotton farmers 37.7% of them knew nothing about the risk management techniques, remaining of them knew either about crop insurance or MSP or both, in the sample of chilli farmers, 7.4% replied that they knew none, 11.6% told they knew only about crop insurance, 50.8% of them knew about MSP and 25.% of them knew about both crop insurance and MSP, and in the sample of turmeric farmers 61.2% replied that they knew none, 9.6% told they knew about crop insurance, 14.4% of them knew about MSP and 12.2% of them knew about both crop insurance and MSP.

vii. In the sample of cotton farmers, 38.6% told they collected the information pertaining to cotton prices from mandi/market, and the next most used source is newspaper and tv, in the sample of chilli farmers, 23.3% told they collected the information from mandi, 25.9% of them told they took it from newspaper and tv. 19% of them told they keep updated themselves only from tv. 14.8% of them told they took help of their friends. 6.3% told they used MSP, in the sample of turmeric farmers, majority of them (84%) told they collected the information from mandi, 3.2% of them told they keep updated themselves only from tv. 3.2% of them told they took help of their friend, 9% told they enquired traders and took the price information.

viii. In the sample of cotton farmers, 74.9% of them told it's the cash urgency that forced them to sell their produce at whatever price, in the sample of chilli farmers, maximum number of farmers (58.7%) told it is the cash urgency that forced them to sell their produce at whatever price. 20.1% of them told they waited to sell their produce till their target is achieved i.e, till they got decent profit . 7.4% of them told they waited and stored their chilli produce till they got maximum profit. 9.5% of them told they waited till they got back what they have invested and stored the rest of the produce for their personal consumption, whereas in the sample of turmeric farmers, maximum number of farmers (74.5%) told it's the cash urgency that forced them to sell their produce at whatever price. 17.6% of them told they waited to sell their produce till their target is achieved i.e, till they got decent profit . Only 1.6% of them told they waited and store their produce till they got maximum profit, another 6.4% of farmers told they have other reasons behind to sell their produce.

ix. In the sample of cotton farmers, 78.3% of the farmers told its either commission agents or brokers to whom they sell their produce of cotton. In the sample of chilli farmers, 90.5% of the farmers told it is either commission agents or brokers to whom they sell their produce of chilli, and in the sample of turmeric farmers, 76.6% of the farmers told its either commission agents or brokers to whom they sell their produce of turmeric, and 23.4% of them sell it at rythu bazaars.

x. In the sample of cotton farmers, 84.1% of them told that they have never sold their cotton produce at MSP, where as in chilli farmers 62.4% of them told that they have never sold.

xi. In the sample of cotton farmers, 112 out of 207 i.e., 54.1% told they are not happy with trading of cotton as they did not get the expected price, brokers give less rate, no alternate market hence forced to sale at a lower rate. In the sample of chilli farmers, 107 out of 189 (56.6%) to they were not happy with the chilli trading as rate fluctuates, no other alternate market is there for them to sell their produce, forced to sell at very low prices, commission is more for commission agents and they quote very low prices etc. In the sample of turmeric farmers, 147 out of 189 (78.2%) told they were not happy with the turmeric trading and cited reasons like there is no MSP for turmeric, Commission agents should be removed etc.

xii. In the sample of cotton, chilli and turmeric farmers, none of them were aware about Commodity Futures Trading.

xiii. In the sample of cotton, chilli and turmeric farmers, almost all were ready to participate in Commodity Futures Trading, if given training.

3.5 Discussions with Officials and Farmers' Leaders

During the course of the study, several people and officials were interviewed, and there were discussions relating to performance of CFM in India and the percolation of it to the grass root level. The following people were instrumental for the present study:

The Secretary General of the 'Consortium of Indian Farmers Association', Farmer Leaders belonging to different village, Sarpanches of the village, Retd. Joint Director of Agriculture Department, Faculty from Agriculture University, Officials from NCDEX office, Hyderabad, Additional Director in Commissioner Office of Agricultural Marketing Department, Hyderabad, Secretaries APMC of Warangal and Nizamabad etc., inputs a training program organized by FMC at Agricultural University, Hyderabad.

EXTRACT:

i. Officials from NCDEX confirmed that there is no direct involvement of farmers in CFM trading. Only a handful of farmers are there from Telangana and Andhra who directly participate, and these farmers are highly educated and some are even based in USA.

ii. Mostly farmers in India are marginal and have to sell their produce just after twenty four or forty eight hours of harvest as there is no provision for ginning or warehousing.

iii. Traders cheat gullible farmers; farmers were charged three to four percent commission wheras only two percent had to be takenas commission according to government rules.

iv. According to Secretary AMC, there is a scheme called as **"Rythu Bandhu Pathakam"**, which help farmers who do not get remunerative price for their produce i.e. equal or above MSP, 70% of amount is given as loan to the farmers for ninety days i.e., for three months no interest is charged, and a nominal interest of one percent is charged after ninety days. This is a good scheme for the farmers as they can store the produce for some more time till they get the desired price and with the help of the loan can satisfy his requirements.

v. APMC had provided APSWC and CWC five acres of land each in their premises and had also provided cold storage facility to private people on lease basis.

vi. Again, there are government godowns provided by AMC to farmers free of cost.

vii. Banks give loans only up to a lakh of rupees, and insurance amount is deducted mandatorily from the loan amount, many farmers were not even aware for the insurance facility with the loan.

viii. When the farmers' crops got damaged, due to weather extremes etc., it was difficult for the farmers to claim insurance as the insurance companies considered damage over a large area (mandal wise), and moreover the insurance amount is only ten thousand rupees.

ix. The farmer leaders claimed that it is only 10% of the whole produce brought at APMC that is purchased at MSP. Hence, it is not easy for every farmer to avail MSP.

x. The farmers could avail only upto a lakh of loan from banks, where as a single trader could avail many times over.

xi. It was claimed that there was no proper maintenance of warehouses in APMC and there were infested with pests, hence farmers were apprehensive to keep their produce in godowns, because any damages would have to be borne by them.

xii. The private godowns are costly proposition and require a lot of formalities resulting in delay for the deposit of the crop.

xiii. Farmers from remote villages and distant from the market cannot even afford the transportation costs.

xiv. Some farmers are willing to take loan for warehousing from banks but there are many stringent conditions and also collateral is required which cannot be fulfilled by the farmers.

xv. Farmers also faced problems like lack of electricity for long hours, no finance available etc. Only electricity was provided in the night time for few hours and it was very difficult for the farmers to irrigate acres of land in such short duration which affected the yield of the crop despite there were modern agricultural and irrigation facilities available with them.

xvi. Farmers in Adilabad are mostly uneducated and poor. They typically use bullocks for farming activities unlike other farmers who use tractors for cultivation. Cotton farming is conducted by many tribals who do not have any technical updates about farming. Hence, the cotton yield in tribal areas is very low.

xvii. There are villages without banks as they were blasted by naxalites.

xviii. The major problem for farmers is to decide where to sell the produce and at what price. There is no alternate market available to them; they also suggested that the government should give remunerative prices and not MSP.

xix. Farmers are compelled to sell their produce only to a handful of traders and have no other viable options.

xx. The study also found that regrettably one lakh bags of cotton i.e., approximately 50,000 quintals were destroyed by rains in the APMC yard. Farmers were not even remunerated for this huge loss.

xxi. Traders and Commission Agents were found to be afraid of Comprehensive Electronic Bidding System and computerization as this requires graded crops.

xxii. MSP only for certain varieties of crops is offered by the Government.

xxiii. The study also found the need for construction of scientific godowns in APMC.

xxiv. Alternate trading system should be provided by the Government specifically at the village level; this will help in saving the transportation cost of farmers.

3.6 Conclusion

The information collected from the farmers through administration of questionnaires, interviews of traders who were participating in Commodity Futures Market (see chapter five), field visits, discussion with officials, and other concerned indicated that there is lack of awareness among farmers of Telangana. The first objective of the study is "To study the awareness of Commodity Futures Markets among the Telangana farmers". From the study's findings it is clearly evident that there is no awareness with the sample of farmers cultivating chilli, cotton and turmeric of Warangal, Adilabad and Nizamabad districts of Telangana. The second objective of the study is "To identify the factors responsible for fostering or impeding the percolation of Commodity Futures Market". This study has find out certain factors impeding the percolation of CFM to farmers. They are as follows:

Factors Impeding the Percolation of CFM to the Farmers:

i. **Average Land Holding:**

The sample of farmers of chilli, turmeric and cotton belonging to Warangal, Nizamabad and Adilabad possess on average of a land holding of 3.43 acres to 5.25 acres, indicating that they were small and semi medium farmers.

ii. **Average Output:**

The average output of the farmers was found to be meager in order to cater the minimum requirement of contract size of NCDEX i.e. 5 MT whereas, the cotton farmers average output was 2MT, chilli farmers average output was 3.7 MT and for turmeric farmers' average output was almost 1 MT.

iii. **Source of Finance:**

Source of finance was another problem as mostly the sample of farmers relied on banks and money lenders. Banks provide them only a maximum of one lakh of rupees, irrespective of the landholding and this was not sufficient to cultivate the whole land, they could not take much finance from money lenders as they had higher rate of interests. Thus, due to a lack of finances farmers even with large land holdings could not completely cultivate their lands.

iv. **Risk Management Techniques**

Risk Management techniques were also not known by the majority of the sample of farmers. Crop Insurance and MSP were the two techniques known by many of them but they were unable to adopt them,

i. Crop insurance was mandatory for availing bank loans by farmers but some farmers did not know about it and paid the insurance premium which was deducted from the loan, further reducing the utilizable amount in the loan, other farmers who were aware about the insurance coverage said that they could not claim damages. As, the insurance company checked for damages on a mandal wise basis and hence many times the farmer was unable to claim the amount though his crop got damaged and despite paying the insurance premium, interest on it, this added further to the woes of the farmers. Thus, crop insurance was not a great technique with this sample of farmers to protect their crop from damages and the yield is also affected, thus reducing the output.

ii. Minimum Support Price was another option for the farmers who did not get buyers for a reasonable price and can sell at MSP declared by the government. According to the farmers, APMC gave MSP only for 10% of the total produce brought to the APMC. Even more, there was no MSP declared for many varieties of crop like turmeric. Turmeric farmers continuously demanded MSP for their produce.

All these left farmers without any risk mitigation technique, hence low yield, less profits and urgency of cash to recover the damage and basic needs were prevalent among the sample of farmers. Hedging was known by them due to lack of awareness.

v. Lack of storage places like warehouses:

The farmers were “forced to sell their crop at whatever price” they were offered

because they could not store the produce for a remunerative price. There were no warehouses or ginning mill available to the farmers.

i. The farmers whose villages were located far away from APMC could not afford the transportation cost of taking the produce to the godowns of APMC which were free of cost provided by the government. The farmers who could take their produce to the godowns or warehouses of APMC thought twice before depositing their produce as the maintenance was not good and there was high possibility of pest and rodent infestation.

ii. The farmers who wanted to take finance for warehousing from banks could not avail it because of the stringent conditions.

Thus, it was found that though the farmers had good output and could think of selling to an alternate market like NCDEX but due to want of proper storage space they were forced to sell their produce to the traders.

vi. Cash Urgency:

Mostly the sample of farmers were small and semi-medium they were usually in need of cash as soon as the harvest was done, this cash urgency also made them sell to those who could provide cash on hand though less.

vii. Lack of Basic Education:

It was also observed, during the course of the study that these sample of farmers lacked basic education and literacy which was required to participate in Commodity Futures Market.

viii. The yield or the produce of this sample of farmers had become less sometimes because of certain problems like electricity shortage as a result they were unable to irrigate their complete land at a time and thus could not cultivate the whole land which they were capable of.

CHAPTER FOUR

FACTORS FOSTERING OR IMPEDING PERCOLATION OF CFM AND EFFECTIVENESS OF TRANSACTION HEDGE: TRADERS' PERSPECTIVE

4.1 Introduction and Methodology

"Traders form the backbone of the agricultural marketing system in India and lack of their participation takes away the credibility and completeness of information on the online futures market" **(Kumar, R., 2010)**. It was also argued by her that the "criticisms made by the traders" should be taken seriously. "Traders bring information and expectations about the market they may possess to the price", **(Patnaik, 2007)**. The purpose of this chapter is to identify factors fostering/impeding the participation in CFM from the perspective of traders. One of the important functions of CFM is to manage risk through hedging. It is expected that traders participate in CFM to hedge their transactions. However, in previous studies it is found most traders use it as an asset class or hedge against investments in stock market. Only few traders use it as hedge against price risk of underlying commodity **(Mary Jessica, 2012).** Therefore, it is also one of the objectives of this study to discuss the effectiveness of 'Transaction hedge' carried out by traders. The findings in this chapter help improve trading practices in NCDEX as traders form important group of participants in CFM.

In this context the traders of the select commodities from Warangal, Nizamabad and Adilabad districts who are participating in NCDEX were interviewed. The NCDEX office in Begumpet was approached during the study and the manager head for spices was requested to provide with the details of traders participating in NCDEX from the state of

Telangana. The information was provided by the NCDEX office, but on calling or mailing the traders, it was found that the traders only got registered with NCDEX in awareness programs conducted by NCDEX, but actually never participated. In fact only one or two traders who were actually participating did not divulge the information.

Further, during the course of the study, the Secretary of Warangal APMC and Secretary of Nizamabad APMC were also approached and were requested to provide the information of the traders who are participating in NCDEX. It was found that there were only a handful of traders who were found to be participating in NCDEX, while at the same time it was difficult to identify them. The secretaries of AMC arranged a meeting with some of the traders. A questionnaire was prepared for the interview; the excerpts and important findings from the interview are furnished in the following paragraphs.

4.2 Excerpts from the Interview

The traders principally traded in Maize, turmeric, chilli and cotton. All the traders purchased the crop/commodity from commission agents ‘only’ and not directly from farmers as is popularly known. The quantity purchased from the commission agents ranges from 500 MT to 3000 MT which equaled to have purchased 50 to 100 Lorries of the crop. When asked about the source of finance, they told that they had sourced it from banks (in the form of ‘pledge loan’).

When asked how they came to know about the commodity futures market, they told it was through awareness programme conducted by NCDEX. Some traders told the reason for their participation is purely hedging and some mentioned it was for speculation or profit making. They take both the positions long or short i.e. they sometimes purchase the commodity or sell the commodity as the case may be.

When asked about the significance of computer knowledge in the participation of CFM, some were neutral about the statement and some felt computer knowledge was not required for participation.

Further, when they were asked whether they felt minimum contract size for a commodity is large; again few were neutral and some strongly agreed that contract size was large.

When asked whether they faced lot of formalities before the participation in NCDEX. One of them disagreed with the statement but another agreed with the statement and told there were a lot of formalities and also difficulties in taking delivery of the commodity i.e. if the position is not cash settled.

When the traders were asked about the fluctuation of commodity prices, they all told that the prices were highly volatile. When asked about liquifying the specific position, i.e. how fast they can cash settle the position, they all told that it was easy to liquify the position.

The traders who used CFM for hedging were asked whether the transaction hedge is successful they all strongly agreed and when they were further asked about the efficiency of the CFM in carrying out Price Risk Management through hedging, they all felt NCDEX was efficient enough.

When asked the traders whether they have any time, gained profit by selling or buying the commodity in NCDEX & vice versa in another market. On or two told they have done very often but others told they did it rarely.

When asked whether inflation in prices of commodity is due to bad crop or due to import and export, they all disagreed to it but when asked whether the inflation in prices of the commodities is due to functioning of CFM, to this also they disagreed. When traders were asked how they feel about trading in NCDEX, one or two told it is easy to trade; some told it is slightly difficult to trade.

When asked whether they are happy with the trading in NCDEX, they all told they were happy. One of the major traders in chilli from Warangal and renowned exporter of chilli narrated one of his experiences with NCDEX. According to the trader who purchased chilli from an online auction hosted by NCDEX, and selected a sample of good variety of chilli as listed on the online auction, which he agreed to purchase and paid the money, but on delivery he got 'white chilli' which is regarded as a poor variety of chilli. On demanding the refund for his money, he was able to get a refund of only 75% of the total amount; this prevented him from further participating in NCDEX.

Hence, the lack of trust among the traders against NCDEX, itself brings out the ground reality and factual position brought out by this study.

4.3 Summary, Findings and Conclusion

From the discussions and interview with the traders participating in NCDEX and secretaries of AMC the following are the findings.

1) There exist a single main broker like globe commodities which trade directly with NCDEX and the other traders are small time brokers or sub-brokers of the main broker.

2) Sub brokers collect 0.04% as brokerage fee from different brokers out of which they have to pay 50% to the main broker. Most of the traders have come to know about NCDEX through awareness programmes.

3) There are formalities which the traders felt are somewhat difficult like contract size, formalities to obtain license, deposits etc.

4) Only licensed brokers can trade in NCDEX, and to obtain a license there are many conditions.

5) Traders are able to purchase the crop from commission agents only. Traders take pledge loan from the banks after depositing their crop in the warehouses. The traders get an ISIN number which can be shown to the bank and pledge loan can be taken.

6) They felt minimum contract size for NCDEX is too large, sometimes it becomes difficult for small traders to aggregate such huge quantity and hence unfortunately ensuring that participation is by only a single major broker and small time brokers lose on the opportunity of trading directly on NCDEX.

7) They felt computer knowledge is not much required for participation but basic education and literacy is required, and also mentioned it is one of the reason why it is difficult for farmers to participate at all in the first instance.

8) However, the traders were satisfied that they had NCDEX as an alternate market and a prospective game changer in trading practices.

9) The traders who were hedgers were satisfied that they were able to hedge their transactions efficiently, and transaction hedging was a major advantage to them.

10) Even the traders who speculate had made big profits, but sometimes they made huge losses alike i.e. in 2006, due to addiction and speculation with a hope for future profits', trading was continued but sometimes this resulted in further losses as well.

11) The traders were even happy with cash settlement, or liquidating their position, they told it is very easy to liquidate the specific position and they like this about NCDEX. The cash requirement can be met at any time. This study brought out the major and strategic advantage of trading through NCDEX.

12) They also consider NCDEX to be efficient in price risk management.

13) The traders observed high volatility i.e. fluctuations in prices of commodities and were not happy with this part of trading on the NCDEX platform.

14) Traders were not happy with delivery and warehousing facilities provided by the NCDEX as well, which proved to be a major disadvantage and drawback of trading.

15) The warehouses were located far from the trader's godowns and were very few. The transportation and labour costs incurred were significant as well. Further, even after the commodity was transported to the ware house it has to be selected through grading, after grading, the crop was selected. It had to be deposited and otherwise it would be sent back and the losses to be borne by the trader. This also was a major deterrent/disadvantage.

16) The traders have also observed and felt that the grading system is not good enough and they do not trust it anymore. Hence, again trust factor played a major role in the events of traders participating CFM over the NCDEX platform.

17) They also complained about the high rent of warehouses. According to them NCDEX charges approx 16% of the price whereas other warehouses charges somewhere around 8%.

18) Even if there is any loss to the deposited commodity in warehouses it will not be borne by NCDEX which makes the traders insecure.

19) Traders strongly recommended that the delivery mechanism, number of warehouses and standard and maintenance of warehouses should be improved.

20) Traders also recommended strong rules for the grading system. They are not at all happy with grading system and they also recommend there should be rules pertaining to losses of warehouses.

21) Some traders suggested that they should be given pledge loan against the deposited stock in warehouses with a lower interest rate to promote trading further.

23) Over all the traders were satisfied with the trading in NCDEX with some reservations i.e., trust factor, formalities and rules in appropriated grading system, warehouse facilities etc but definitely considered NCDEX as an alternate platform for trading and hedging and also recommended that it should be efficiently and effectively utilised for transaction hedge for which it was meant for, rather than making profits only.

4.4 Factors Impeding and Fostering for Traders who are participating in NCDEX

The study had tried to identify the factors impeding and fostering traders' participation in CFM from the interview conducted with the traders. The factors are listed below:

Factors Impeding:

1. Contract size is large for small traders.
2. Warehouses provided by the NCDEX are very few.

3. Transportation cost has to be borne by the traders to transport the crop from their godowns to NCDEX warehouses.
4. There are no clear rules for grading the crop.
5. Maintenance of the warehouses was not even par with the global standards.
6. Any losses in warehouse, to be borne by the traders with no risk coverage.
7. Traders dissatisfied with the high fluctuating prices of commodity i.e., volatility of prices.
8. Traders do not trust the quality of the commodity traded through NCDEX; Lack of trust.

Factors Fostering Traders Participation in CFM:

1. Transaction Hedge is one of the reasons why traders prefer CFM. CFM is a platform where risk management can be done through hedging.
2. Traders also participate to earn profits through speculative activities.
3. Traders find NCDEX as an alternate market.
4. Traders find it easy to liquidate the position.
5. Traders are also happy with squaring off their position at any time with the provision of cash settlement.

CHAPTER FIVE

FACTORS FOSTERING OR IMPEDING PERCOLATION OF CFM AND EFFECTIVENESS OF INVESTMENT HEDGE: INVESTOR'S PERSPECTIVE

5.1 Introduction

Not long ago, Indian markets have opened a new avenue called as commodity futures for traders and retail investors. The investors who are willing to "diversify their portfolios" beyond real estates, bonds and shares, CFM has emerged as the best option. Commodities actually offer immense prospects to become a separate asset class for retail investors, speculators and arbitrageurs and commodities futures is an unfathomable market. Investors should understand the advantages and risks of trading in CFM before making any huge investments.

The size of the commodities markets in India is also quite significant. Of the country's GDP of "Rs 13, 20730 crore, commodities related and dependent industries constitute about 58 per cent. Currently, the various commodities across India clock an annual turnover of Rs 140000 crore". With the introduction of futures trading, the size of the commodities market grew at a faster pace. However, with the setting up of three national commodity exchanges in India in 2003, retail investors can now trade in the CFM without having physical stocks.

Like any other market, CFM plays an important role in "information pooling and risk sharing". The market mediates between buyers and sellers of the commodities, and facilitates decisions related to consumption and storage of commodities. In this process, futures market makes underlying market more liquid.

5.2 Investors of CFM

Investors are one of the participants of Commodity Futures Markets like farmers and traders. This study also tried to identify the factors fostering or impeding their participation into Commodity Futures Markets. To this regard, the questionnaires were administered to the investors of Commodity Futures Markets. The questionnaire consists of questions of ordinal and categorical type. The five point "Likert scale" is used where "1" represents "Strongly Disagree", "2" represents "Disagree", "3" represents "Neutral", "4" represents "Agree" and "5" represents "Strongly Agree". Questions related to the factors that could be fostering or impeding investors' participation, about the functions of Commodity Futures Markets, about the effectiveness of investment hedge, price discovery, arbitrage and speculation etc were included in the questionnaire.

5.3 Methodology

Type of sampling: convenience sampling

Participants: Investors who are participating in Commodity Futures Markets belonging to Telangana and Andhra Pradesh states were administered the questionnaires.

Sample selection and size: The investors of Commodity Futures Markets are very meager as in comparison to stock market in India. Reputed brokerage houses like Motilal Oswal , Karvy, Anand Rathi etc only provide brokerage services for Commodity Futures Markets' investors after they became the members of the exchanges. To collect data from

Commodity Futures Markets' investors; it was a challenging task as there are no walk-ins in the brokerage houses, and according to KYC norms the information like e-mail id's related to investors cannot be revealed. The management of Motilal Oswal, Angel Broking, Anand rathi etc helped in collecting the data from investors of commodity futures. The data was collected by administering the questionnaires to the investors through brokerage houses at Hyderabad, approx. 250 questionnaires were distributed. Some of them were returned almost unanswered, and after the refinement of the data for missing values etc., a total of a hundred questionnaires were considered for the analysis.

5.4 Discussion

The data collected from the investors of Commodity Futures Markets consisted of both ordinal and categorical data. The ordinal data had been validated using factor analysis (Exploratory Factor Analysis and Confirmatory Factor Analysis). Factor analysis had been used in the present study primarily for dimension reduction i.e. to reduce the number of variables. Principal Components as extraction method and VariMax as rotation method had been chosen, and two factors have been identified. The two factors are named as "Factors Fostering or Impeding CFM" and factor 2 as "Functions of CFM"

5.5 Results

5.5.1 Data Screening

The data was screened for missing data and outliers (using List wise deletion). The minimum amount of data required for factor analysis was satisfied, with the final sample size of 100 (Rule of 100 and Rule of 5) Gorsuch (1983) and Kline (1979, p. 40) recommended at least 100, and a ratio of over 7 cases per variable was established. The subjects-to-variables ratio “should be no lower than 5” (Bryant and Yarnold, 1995, in David Garson, 2008)

The Kaiser-merger-olkin measure of sampling adequacy is 0.719, it is clearly above 0.6 and Bartlett’s test of sphercity ($p<0.01$) is significant i.e the null of identity correlation matrix is rejected. These two tests provide a “minimum standard” which should be passed before a formal factor analysis can be conducted.

5.5.2 Factor Analysis

It is a method of data reduction and is done by seeking underlying “latent” or unobservable variables that are reflected in the manifest or observable. There are many different methods that can be used to conduct a factor analysis (such as principal components, principal axis factor, maximum likelihood, unweighted least squares, and generalized least squares.) There are also many different types of rotations methods that can be done after the initial extraction of factors, they are orthogonal rotations, such as equimax or varimax, which impose the restriction that the factors cannot be correlated, and there are oblique rotations, viz., promax, which allow the factors or components to be correlated with one another. One needs to determine the number of factors that has to be extracted. Simple structure and pattern of results are preferred such that each variable loads highly onto one and only one factor.

For the present study, at first, the factorability of the fourteen items was examined. Many well known criteria for the factorability of a correlation were used. Firstly, it was observed that all the fourteen items correlated at least more than .3 with at least one other item, suggesting reasonable factorability (see Appendix A).

Secondly, the Kaiser-Meyer-Olkin measure of sampling adequacy was 0.719, and it is clearly above the commonly recommended value of 0.6, and the result of Bartlett's test of sphericity was also significant ($\chi 2 = 378.021$, $p < .01$).

In anti image correlation matrix (See Appendix A), all the diagonals were also all over 0.5. Finally, the communalities of all items were all above 0.3 (see Table 5.1), further confirming that each item shared some common variance with other items. Communality is "the proportion of variance of each variable that can be explained by the other factors". Considering all the aforementioned indicators, factor analysis was found to be suitable with all fourteen items.

Table 5.1

Communalities of the Variables

	Initial	Extraction
TCosts	1.000	.725
IMargin	1.000	.605
ConSize	1.000	.760
AprhnsNew	1.000	.752
InvstHedge	1.000	.670
PD	1.000	.619
Dvsftn	1.000	.470
Fees	1.000	.662
DifBrkr	1.000	.658
DifFrmlts	1.000	.651
Vltlty	1.000	.526
ComLtrcy	1.000	.368
Arbtrg	1.000	.460
Spec	1.000	.466

Extraction Method: Principal Component Analysis.

Principal components analysis was used because the primary purpose was dimension reduction and to identify and compute composite scores for the factors underlying. Eigen values are the "variances of the factors". As, the factor analysis had been conducted on the "correlation matrix, the variables are standardized, which means that each variable has a variance of 1, and the total variance is equal to the number of variables used in the analysis". Factors with initial eigen values of one or more than one were chosen. Initial eigen values indicated that the first two factors (4.62 and 2.42) explained 23.79% and 20.19%, of the variance respectively. The third factor had eigen value just over one i.e. 1.34 and explained 15.96% of the variance. Solutions for three and two, factors were each examined using varimax rotations of the factor loading matrix. The two factor component solution, which explained 66.56% of the variance (See Table 5.2), was preferred.

Table 5.2

Total Variance Explained

Component	Initial Eigen Values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.555	44.440	44.440	3.555	44.440	44.440	3.319	41.485	41.485
2	1.770	22.124	66.565	1.770	22.124	66.565	2.006	25.080	66.565
3	.706	8.827	75.391						
4	.614	7.670	83.061						
5	.526	6.574	89.635						
6	.349	4.358	93.993						
7	.283	3.536	97.529						
8	.198	2.471	100.000						

Extraction Method: Principal Component Analysis.

a. When components are correlated, "sums of squared loadings cannot be added to obtain a total variance".

The two factor model was chosen because of the insufficient number of primary loadings and cross loadings and difficulty of interpreting the third factor and subsequent factors. A total of six items were eliminated because they did not contribute to a simple factor structure, 'Comp Literacy' was removed because it had communality 0.36 only, items, in subsequent rotations with two factors extracted 'Difficult to find broker', 'Difficult Formalities', 'Arbitrage', 'Volatility' and 'Speculation' because they either loaded simultaneously with the two factors or were having less communality when compared to other items. The factor loading matrix for this final solution is presented in Table 5.3. Internal consistency was examined using Cronbach's alpha. The alpha value is 0.829 for the eight items and the descriptive statistics and individual chronbach alpha is given in Table 5.3. Overall, the analysis indicated that there are two distinct factors that were underlying the investors' responses, and the two factors are named as Factor 1: 'Factors Fostering or Impeding participation in CFM', Factor 2: 'CFM Functions'.

Table 5.3

Factor loadings and communalities based on a principal components analysis with varimax rotation for 9 items (N = 100)

	Loadings of Factor1	**Loadings of Factor2**	**Communalities**
'Transaction Costs are high'	.799		.660
'Initial Margin is low'	.781		.628
'Brokerage Fees is high'	.707		.516
'Contract Size is a hinderance for a contract of choice'	.844		.728
'Apprehensions to adopt new Techniques'	.842	.736	.730
'Investment Hedge is Effective'		.818	.754
'Price is Discovered in CFM'		.803	.678
'Diversification is Possible'		.775	.633

Table 5.4

Item Statistics

	Mean	Mode	Median	Std. Deviation	N
Fees	3.5000	4	4	.94815	100
IMargin	3.1300	4	3	1.30775	100
TCosts	3.1800	5	5	1.35870	100
AprhnsNew	2.9600	2	2	1.34780	100
InvstHedge	2.6800	3	3	.86316	100
PD	2.9300	3	3	1.00760	100
Dvsftn	2.9600	4	3	.95261	100
ConSize	3.3000	4	3	1.08711	100

Table 5.5

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.804	.796	8

A confirmatory factor analyses (CFA) was performed to assess and confirm the factor structure of the investor questionnaire which resulted from Exploratory Factor Analysis.

There are two factors which resulted from the Exploratory Factor Analysis; Factor 1 is named as ‘Factors Fostering/Impeding investors’ participation in CFM’. All four items ‘TCost is high’, ‘IMargin is low’, ConSize is high’, ‘Brokerage Fees is high’ and ‘Apprehension to adopt new techniques’ loaded significantly onto the factor 1 (loadings ranging from 0.50 to 0.89)

The factor 2 is named as ‘CFM Functions’ and all the three variables ‘InvstHedge is Effective’, ‘Price Discovery is achieved’, ‘Gained profits through Diversification’ loaded successfully onto factor 2 and loadings ranging from (0.52 to 0.88), though the two factors are hypothesised as independent, they were allowed to correlate and the subsequent correlation is $r = 0.46$.

Chi-square value for the overall model fit was significant, suggesting a lack of fit between the data and the hypothesized model. However, modification indices suggested freeing the co-variances between few error terms.

A subsequent model (see figure 5.1) resulted in freeing these paths was found to have better fit to the constrained model, $\chi 2 = 20.519$ with 15 degrees of freedom $p<0.153$. Given the significant improvement in overall fit of the model after freeing the error co-variances was considered the better model.

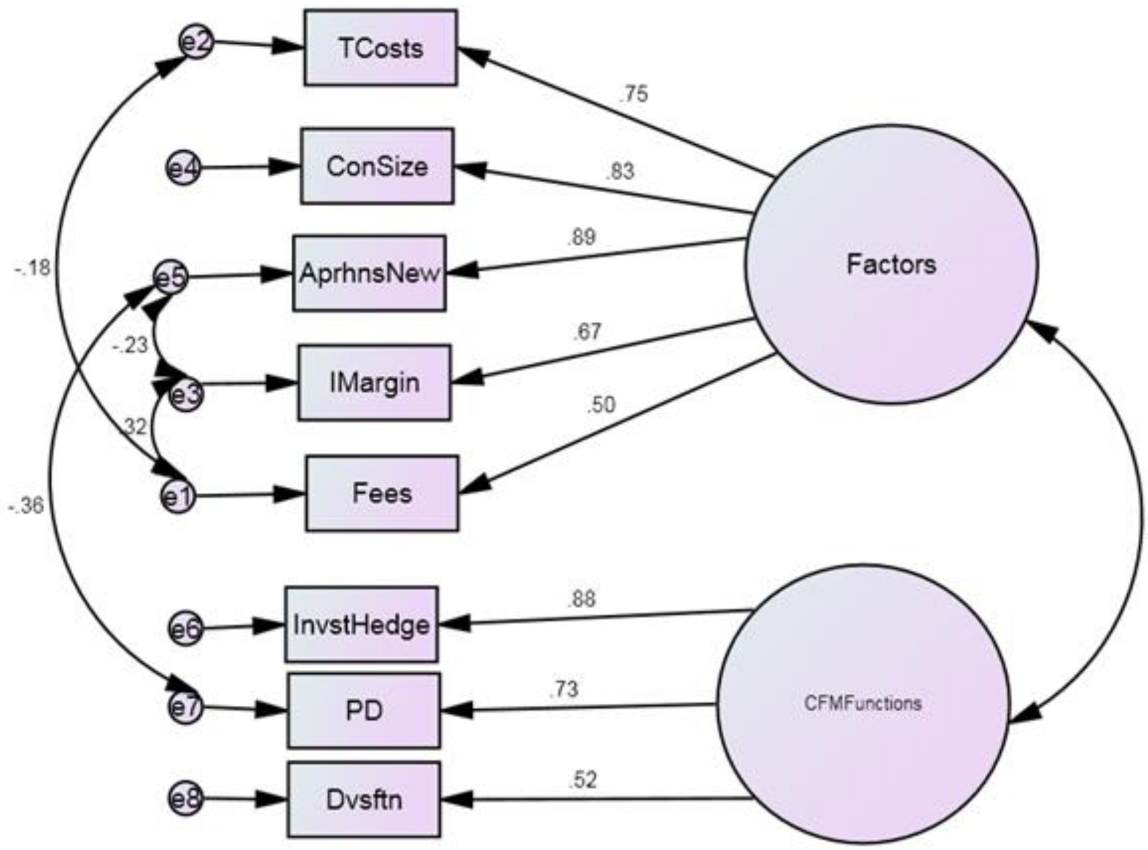


Figure 5.1: ***Evaluation of the Model Fit***

The large $\chi 2$ value and small *p* value means that there is a significant difference between actual and estimated matrices, thus for a good model fit the $\chi\mathbf{2}$ value should be small and non-significant.

In the table 5.6 below, the goodness of fit indicators are clearly displayed, it can be clearly seen that the chi-square value is small and non-significant. The absolute and incremental fit indices represent how much of the variance in the covariance matrix has been accounted for by the model. The present study had used the following absolute and incremental indicators and their values are displayed in the table 5.6:

Normed fit index (NFI=0.94), Incremental fit index (IFI=0.996), Comparative fit index (CFI=0.996), Goodness-of-fit index (GFI=0.956), Adjusted goodness-of-fit index (AGFI=0.911). These indicators range from 0 to 1, with higher values indicating better fit, the general standard for good fit, is that the value should be 0.9 or higher (Tabachnick and Fidell, 2007). All the indicators for the present study have values greater than 0.9. Another measure for goodness of fit is residual indices which represent the "residuals" (discrepancies) between observed and estimated co-variances.

The present study had used RMSEA (Root Mean Square Error of Approximation), it's value ranges from 0 to 1, with lower values indicating better fit. "The value of RMSEA which is acceptable is less than 0.08, but less than 0.05 is very good." Mc Donald and Ho(2002). RMSEA value for the present study is 0.061

Table 5.6

Goodness of fit Indicators

Model	**χ 2**	**df**	**χ 2 /df**	**GFI**	**RMSEA**	**NFI**	**CFI**	**IFI**
Two Factor Model	20.519	15	1.07	.948	.061	.806	.929	.939

* SRMR = Standardized root mean squared residual

* RMSEA = Root mean square error of approximation

* Goodness-of-fit Index

*Normed fit index (NFI)

* Incremental fit index (IFI)

* Comparative fit index (CFI)

5.3.3 Analysis of Categorical Variables

Table 5.7

Speculator Or Hedger

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Did not Reply	8	8.0	8.0	8.0
	Both	83	83.0	83.0	91.0
	Hedger	6	6.0	6.0	97.0
	Speculator	3	3.0	3.0	100.0
	Total	100	100.0	100.0	

Table 5.8

Crosstabulation (Speculator or Hedger * Investment Hedge)

		Investment Hedge					
Count		1.00	2.00	3.00	4.00	5.00	**Total**
Speculator or Hedger	Did not Reply	0	1	7	0	0	8
	Both	4	33	27	19	0	83
	Hedger	2	4	0	0	0	6
	Speculator	0	0	3	0	0	3
Total		6	38	37	19	0	100

As displayed in table 5.7, out of hundred investors; six investors are hedgers, three are speculators, eighty three are both hedger as well as speculator and eight did not answer. From table 5.8, it can be seen that out of six hedgers, two strongly agree that investment hedge is effective and another four agree with the statement that investment hedge is effective. Out of eighty three investors who are both hedger and speculator four strongly agree, thirty three agree, twenty seven remain neutral and nineteen disagree with the statement 'Investment hedge is effective'.

Table 5.9

Leverage

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		27	27.0	27.0	27.0
	No	17	17.0	17.0	44.0
	Yes	56	56.0	56.0	100.0
	Total	100	100.0	100.0	

When the investors of CFM were asked whether the Commodity Futures Market gives them the advantage of starting with a fraction amount of actual contract value(Leverage), to this 56% replied in 'Yes', 17% replied in 'No' and 27% were neutral.

Table 5.10

Ease of Liquidity

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		14	14.0	14.0	14.0
	No	17	17.0	17.0	31.0
	Yes	69	69.0	69.0	100.0
	Total	100	100.0	100.0	

When the question 'Is it easy to liquidate the position?' was asked to investors, 69% of them replied 'Yes' where as 17% of them told 'No' and 14% did not reply

Table 5.11

M to M

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		14	14.0	14.0	14.0
	No	11	11.0	11.0	25.0
	Yes	75	75.0	75.0	100.0
	Total	100	100.0	100.0	

When the investors were asked the question 'Does Mark to Market mechanism is efficient and effective?', 75% of them replied 'Yes', 25% of them replied 'No' and 14% did not reply.

Table 5.12

CFM is Cause of Inflation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		33	33.0	33.0	33.0
	No	22	22.0	22.0	55.0
	Yes	45	45.0	45.0	100.0
	Total	100	100.0	100.0	

When the investors were asked the question 'Do they feel CFM is the cause of increase in inflation?', 45% of them told 'Yes', 22% of them told 'No', and 33% of them did not reply.

Table 5.13

Happy with the Trading in CFM

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		31	31.0	31.0	31.0
	No	5	5.0	5.0	36.0
	Yes	64	64.0	64.0	100.0
	Total	100	100.0	100.0	

When the investors were asked the question 'Are they happy with the functioning of Commodity Futures Trading?', 64% of them told 'Yes', 5% of them told 'No', and 31% of them did not reply.

Table 5.14

What Make Them Invest In CFM

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		51	51.0	51.0	51.0
	Diversification Benefits	10	10.0	10.0	61.0
	PD and Diversification Benefits	2	2.0	2.0	63.0
	Price Discovery	2	2.0	2.0	65.0
	Risk Management through Hedging	31	31.0	31.0	96.0
	Speculation Benefits	4	4.0	4.0	100.0
	Total	100	100.0	100.0	

When the investors were asked 'what made them invest in CFM?', 31% told it's risk management through hedging, 10% told they participate to avail diversification benefits, 2% for Price discovery, 2% for price discovery and for diversification benefits, 4% told for speculation benefits and 51% did not answer to this question.

5.6 Conclusion and Findings

1. With the help of Factor analysis, out of fourteen variables, eight were selected and grouped into two factors namely 'Factors Fostering and impeding investors' Participation' and 'CFM Functions'. Most of the investors considered transaction costs, brokerage fees to be high and agreed that initial margin is low, but disagreed that there are apprehensions to adopt new techniques but agreed that contract size is a hinderance for contract of choice. Most of them remained neutral when asked whether through CFM they are able to hedge their investment effectively and also that price is discovered in the futures market but agreed that diversification is possible with CFM. Out of six hedgers two strongly agreed that investment hedge is effective and another four agreed with the statement. Out of eighty three investors who were both hedger and speculator; four strongly agreed, thirty three agreed, twenty seven remained neutral and nineteen disagreed with the statement. Overall, from eighty nine investors who were hedgers forty two either agreed or strongly agreed that investment hedge is effective, whereas twenty seven were neutral about the statement and nineteen strongly disagreed with the statement.
2. Most of the investors feel it's easy to liquidate their position which means the cash settlement mechanism or squaring off the position is not difficult in CFM and most of them

also agreed that they have been getting leverage, and also the mark to market mechanism or clearing mechanism is effective and efficient.

3. Majority of the investors felt that Commodity Futures Trading is not the cause for inflation in commodity prices and they were happy about the overall functioning of Commodity Futures Trading in India.
4. Majority of the users told it is investment hedge that had made them participate in Commodity Futures Market, another set of investors told they are there because of the diversification benefits, meager 4% told its price discovery and another 4% told it's speculation benefits.
5. Few investors suggested transaction tax should be reduced; lot size should be reduced, and also complained of very low initial margin and very high volatility.

The factors which were found to be fostering and impeding investors' participation in CFM are tabulated below:

Table 5.15

Factors Fostering and Impeding Investors' Participation in CFM

Factors Fostering	Factors Impeding
Leverage	Transaction Cost
Ease of Liquidity	Brokerage Fees
Mark to Market	Contract Size
Investment Hedge	
Diversification	

CHAPTER SIX

A COMPARISON OF TELANGANA FARMERS WITH SMALL RUBBER GROWERS OF KERALA

6.1 Natural Rubber

Natural Rubber (NR) is the multipurpose industrial raw material of plant origin. It is extracted from the rubber tree *Hevea Brasiliensis, which is* native of the Amazon River basin. During the latter part of 19th century, natural rubber was introduced to tropical Africa and Asia by the efforts of the British Government.

The rubber trees grow in a wide range of agro soil and climates conditions, and it requires well distributed rainfall of about 200 cm (received annually). Latex, the economic produce of the tree is harvested by controlled wounding, on the bark of the tree, from which it flows out and is collected in a container; this procedure is termed as tapping. The latex contains up to 40% natural rubber, water and other constituents. Natural Rubber is a multipurpose industrial raw material as it has visco-elastic properties, and it is a polymer high molecular weight.

The main application of natural rubber is in automobiles industry. Nearly 65% of natural rubber is consumed by the automobile industry. It is the main component in heavy duty tyres, bicycle tyres and tubes, conveyor belts, hoses, foam mattresses, footwear, toys, balloons and several other products of daily use. It also has engineering application in shock absorption, road surfacing and vibration.

Rubber Growing Regions in India

Rubber growing tract stretches from Kanyakumari District of Tamil Nadu in the south to whole of Kerala, and Kodagu District of Karnataka in the North and Dakshin

Kannada. This stretch is known as traditional area, whereas the cultivation of rubber has also been extended to less suitable regions called as non- traditional areas including Konkan region of Goa and Maharashtra, North Eastern States, and parts of Madhya Pradesh, Andhra Pradesh, West Bengal and Orissa.

Production and Prices of Natural Rubber in India

"Thailand, Indonesia, Malaysia, India, Vietnam, China, Sri Lanka, Philippine and Cambodia are the world's largest producers of natural rubber". Nearly 48% of the global demand for natural rubber comes from China, India and Malaysia.

Table 6.1

Annual Trends in Area, Production, Consumption, Import, Export and Average Prices of Natural Rubber in India

Year (April to March)	Rubber Area (ha)	Tappable Rubber Area (ha)	Production (tonne)	Average yield (kg/ha)	Consumption (tonne)	Import (tonne)	Export (tonne)	Average price of RSS-4 at Kottayam (Rs/100kg)
2004-2005	584,091	439,721	749,664	1,704	755,40	72,834	46,151	5,570
2005-2006	597,611	447,014	802,624	1,795	801,112	45,284	73,831	6,698
2006-2007	615,201	454,022	852,894	1,878	820,303	89,798	56,544	9,203
2007-2008	635,401	458,832	825,344	1,798	861,453	86,393	60,352	9,084
2008-2009	661,981	463,131	864,501	1,866	871,720	77,761	46,925	10,111
2009-2010	686,514	468,481	831,401	1,774	930,563	177,131	25,091	11,497
2010-2011	711,561	477,231	861,952	1,805	947,713	190,691	29,850	19,002
2011-2012	734,781	490,971	903,701	1,840	964,413	214,432	27,144	20,804
2012-2013	757,521	504,042	913,703	1,812	972,703	262,752	30,593	17,681
2013-2014	778,402	518,102	774,002	1,628	981,520	360,262	5,397	16,601
2014-2015	795,134	533,674	645,001	1,442	1,020,910	442,131	1,001	13,256
2015-2016p	811,001	559,004	562,001	1,436	994,414	458,373	864	11,305

P: provisional

During May 2016, India had produced 46,000 tonnes of natural rubber with a positive growth of “2.2% from the same month a year ago”. During May 2016, consumption of NR increased by 3.6 per cent to 86,775 tonnes from 83,750 tonnes consumed.

According to preliminary estimate, the country has consumed 87,000 tonnes of NR during. During May 2016, India imported 35,445 tonnes of NR making the total volume during the first two months of the current fiscal at 69,995 tonnes, down 5.3% from the same trends in import and export, production and consumption.

Table 6.2

Price of “Natural Rubber” (Rupees per 100 Kg) in India (2015-16)

Month/year		RSS 5	RSS 4	RSS 3	Latex(60% drc)		ISNR 20	SMR 20
		Domestic		International	Domestic	International	Domestic	International
May	2015	12135	12510	11809	17048	13403	11270	9712
June	"	12821	13098	11813	19415	14358	12045	10072
July	"	12346	12537	10622	18302	12403	11326	9180
August	"	11237	11665	9661	14098	11318	10270	8506
September	"	10852	11218	8961	13635	10738	9902	8301
October	"	11179	11410	8628	14443	10433	10264	8198
November	"	10744	10954	8163	13770	9723	9129	7771
December	"	10038	10279	8412	12708	9443	8482	7772
January	2016	9370	9780	8305	13143	9103	8500	7321
February	"	9041	9355	8668	12860	9835	8638	7534
March	"	10590	10812	9776	13108	11398	10275	8651
April	"	12834	13062	11416	17163	13680	12225	9930
May	"	12774	13076	11231	16978	13602	11714	9137
June	"	13010	13375	10556	16485	12392	11500	8558
July	"	13856	14177	11788	15653	12442	11936	8656

Note: Domestic price refers to Kottayam market, international RSS 3 refers to Bangkok market and international price of latex and SMR 20 to Kuala Lumpur market.

6.2 Rubber Board

The cultivation of “natural rubber” was introduced in India during the British regime, as early as in 1873. The efforts were made to cultivate rubber commercially at the “Botanical Gardens, Calcutta but the first commercial *rubber* plantations were established at Thattekadu in 1902". Government realized the significance of production of Natural Rubber during the Second World War, and during this time, maximum rubber required for the use was produced in India by growers of rubber and were motivated by the government. After the war, the Indian growers demanded setting up a "permanent organization" to cater to the developmental needs of the rubber industry. On the recommendations of the "ad-hoc committee" formed in 1945, the government passed the "Rubber (Production and Marketing) Act, 1947, on 18th April 1947", and the "Indian Rubber Board" came into existence, later on "The Rubber Production and Marketing (Amendment) Act, 1954", changed the name of the Board as "The Rubber Board"

Following are the functions of the Rubber Board of India as defined under the Act:

1. "To promote by such measures as it thinks fit the development of the rubber industry.
2. Without prejudice to the generality of the foregoing provision the measures referred to therein may provide for:

a. Undertaking, assisting or encouraging scientific, technological or economic research.
b. Training students in improved methods of planting, cultivation, manuring and spraying.
c. The supply of technical advice to rubber growers
d. Improving the marketing of rubber.
e. The collection of statistics from owners of estates, dealers and manufacturers.
f. Securing better working conditions and the provision and improvement of amenities and incentives to workers.
g. Carrying out any other duties which may be vested with the Board as per rules made under this Act.

3. It shall also be the duty of the Board:

a. To advise the Central Government on all matters relating to the development of the rubber industry, including the import and export of rubber.

b. To advise the Central Government with regard to participation in any international conference or scheme relating to rubber.

c. To submit to the Central Government and such other authorities as may be perscribed, half yearly reports on its activities and the working of this Act, and

d. To prepare and furnish such other reports relating to the rubber industry as may be required by the Central Government from time to time."

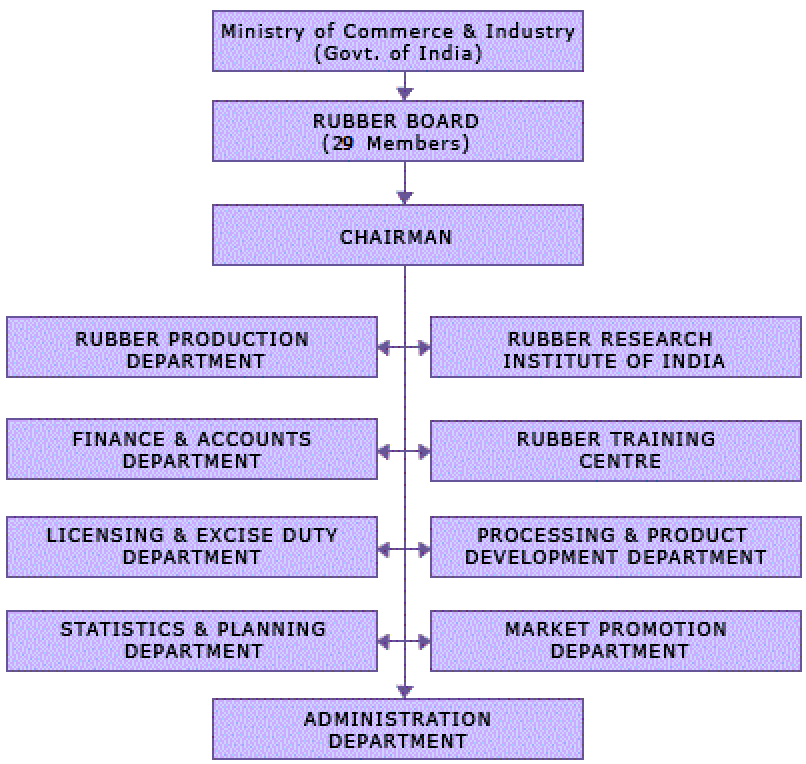


Figure 6.1: Hierarchy of 'Rubber Board'
Source: Rubber Board of India

6.3 Methodology and Discussion

In India, Rubber Market is considered as one of the efficient markets and the Rubber Planter gets the best 'Farm-Gate'[3] price when compared to other agricultural crops. In India, the rubber growers are majorly small and are more than 1.20 million in number. This has attracted the researcher's attention and inquisitiveness towards the Rubber Market, though it is dominated by the small growers similar to the case of farmers in Telangana or the whole India, but the market is considered as efficient and the growers are getting the best Farm Gate price. Therefore, the present chapter is dedicated to study the Rubber Market in Kerala and make a comparison between the small growers of Rubber and Farmers of commercial crops in Telangana. For this, a discussion was made with the officials of Rubber Board and the literature about the Rubber Market was also obtained. Below are some of the facts and information which have made the attempts of Rubber Board to be successful in the development and welfare of the small growers and have also helped them in participation in Commodity Futures Market (indirectly) through aggregating their produce and trading them on their behalf.

6.3.1 Developmental Activities of Rubber Board

The Rubber Board carries out various developmental activities designed to promote modernisation and expansion of the rubber plantation industry. Until 1956, these were confined to extension and advisory services, distribution and procurement of planting materials of improved varieties. Promotion of replanting of uneconomic and old plantations was the first major development scheme to be introduced which started

[3] **-**'The **farm gate** value of a cultivated product in agriculture or aquaculture or plantation is the net value of the product when it leaves the **farm**, after marketing costs have been subtracted'.

operation in 1957. This was followed by a host of other activities and schemes in quick succession encompassing almost all the development requirements of the industry. These broadly cover modernisation of processing, technical services, supplies, replanting, new planting, and exploitation of large byproducts to augment plantation economy, marketing, productivity improvement, promotion of collective self help amongst small holders, labour welfare and training. Planters have had to take into account the agro-climatic and geographical limitations in growing rubber on the one hand and the ever-growing industrial requirements of rubber as the raw material in this large developing country on the other. The problem is further aggravated by the incessant fragmentation of plantations engineered by economical and social factors.

In India, the rubber growers, are majorly small and are more than 1.20 million. For effective transfer of technology, institution buildings of farmer groups and for empowerment of smallholders were undertaken by the Rubber Board. From 1960s, initial attempts made through formation of 'rubber marketing cooperatives' were mostly confined to either taluk headquarters or district, far from the villages in which plantations of rubber were mostly scattered. Majority of the rubber growers were not into their fold to derive benefits. To solve this problem; from 1986, the board actively supported the formation of organizations of rubber growers at village level, known as '*Rubber Producers' Societies (RPS)'*.

6.3.2 Rubber Producers' Societies.

The bylaw for functioning of Rubber Producer Societies was formulated by the Rubber Board. "Rubber producers societies are voluntary self-help association of small growers, registered under the Charitable Societies Act. The RPS were envisaged to function as a nonprofit making institution imparting technical and scientific know how to the members for the general improvement of their plantations and thereby achieving economics and social welfare.”

A group of at least seven small holders can register a RPS by contributing fifty rupees each as entrance fee and ten rupees as annual subscription. Subsequently, after verifying its feasibility, the Board grants approval to the RPS. The Board takes the initiative in identifying the promoters of RPS and also helps them in the formation of it. Membership is open to small growers of rubber who own less than five hectares of rubber plantation and also agree to market the latex and scrap produce in the holdings through the society. The society funds are raised through annual subscription, admission fee, donation, loans and advance from other institutions including Rubber Board, Co-operative societies, Banks, Government etc. The authority of the society vests in its general body and the General Body meeting is held periodically. Board of Directors (BOD) consisting of the president and six members elected from the general body are vested with the responsibility for management of the society. Extension officers to the committee are nominated by the Rubber board to be in charge of the locality. President and vice-president are elected by the executive committee and their services are gratuitous. Only latex agent can be appointed by the society as it is not authorized to appoint any.

6.3.3 Activities of RPS

The Board provides financial assistance to the activities of RPS through various schemes. RPS has made a considerable affect in modernization of the rubber holding sector and the extension strategy proposed by the Board is delegation of the extension functions by involvement of RPS in a gradual manner. The main activities of RPS are:

1. Promoting “group approach for all activities related to rubber development for the advantage of members”.
2. Facilitating transfer of technology
3. Ensuring adoption of “cultural practices essential for productivity".
4. To ensure quality and uniformity, improvement of produce by establishment of common processing facilities.
5. Ranging supply of different farm inputs from the Rubber Board and other sources to rubber growers.
6. To ensure remunerative price, it provides ‘handholding’ support to members in marketing of rubber.
7. Secures financial assistance from Rubber Board and other institutions for implementation of developmental welfare activities.
8. Bringing in convergence with activities of other organizations or departments for inclusive development.

6.3.4 Companies in RPS Sector

Networking, market intervention and connectivity among RPS, processing and professional expertise in marketing, timely debt or equity capital was essential to strengthen the functioning of RPS. Processing of scrap to marketable form also required large investments. Hence, Rubber Board took the lead to form processing and trading companies.

The Rubber Board formed the trading and processing companies with 49% being contribution of RPS and promoter share participation of 51%. These companies have been “instrumental in maintaining the member societies as a cohesive unit with common ideas and goals”. Remunerative price realization and quality of produce were focused. A reverse linkage was also established by the companies with member RPS by providing plantation inputs and quality assured planting materials at competitive rates. These companies’ market intervention could effectively and efficiently improve quality and control the price. On deputation, the Board’s officials manage these companies. At present, in the RPS sector there are twelve trading companies and five processing companies.

Table 6.3

Names of the Processing and Trading Companies

A. Processing Companies	**B. Trading Companies**
Kavanar Latex Ltd at Pala.	1. Adoor Rubbers (P) Ltd. At Pathanamthitta.
Meenachil Rubber Wood Ltd at Kottayam.	2. Ananthapuri Rubbers (P) Ltd at Nedumangad.
Pamba Rubbers Ltd at Pathanamthitta.	3. Bharathapuzha Rubbers (P) Ltd at Palakkad.
Periyar Latex Ltd at Muvattupuzha.	4. Kanhagad Rubbers Ltd at Kasargod District.
Ponmudi Rubbers Ltd at Thiruvanthapuram.	5. Kanjirappally Rubbers (P) Ltd at Puthenangadi.
	6. Kozhikode Rubbers (P) Ltd at Kozhikode
	7. Manimalayar Rubbers (P) Ltd at Kottayam
	8. Sahyadri Rubbers (P) Ltd at punalur.
	9. Thunchatu Ezhuthachan Rubbers (P) Ltd at Malapuram.
	10. Vallathol Rubbers (P) Ltd at Thrissur
	11. Vembanadu Rubbers Pvt. Ltd at Kochi.
	12. Tripura Latex Pvt. Ltd at Tripura.

These companies process and trade the aggregated produce of the small growers, and distribute the profit according to the share of their respective produce. In discussion, with the Rubber Board officials, the researcher came to know that few among these trading companies have also participated in Commodity Futures Market to hedge their price risk. Thus, Rubber Board has indirectly helped the small rubber growers to indirectly participate in Commodity Futures Market and reap the benefits.

6.3.5 Technology Transfer Centers

The board has supported thirty five Rubber Producer Societies to effectively function as Model RPSs with facilities for technology transfer. These are equipped with the most modern environment friendly, fuel efficient, and pollution free, processing centers. Now, these centers function as a common platform for capacity building programs and farm- related activities, for stakeholders etc.

6.3.5 By-Products and Ancillary Sources of Income

Rubber board helps and supports the small growers of rubber to commercially exploit the by-products from rubber plantations as it is important in the backdrop of escalation in uncertainty in prices, diminution of relative profit margins and cost of cultivation. Rubber honey, rubber seed and rubber wood can form the major sources of auxiliary income in the mature phase of rubber plantations.

6.3.6 Cluster Development

For the cluster development of marginal and small farmers, the board has been encouraging cluster-based implementation of the extension and development activities through Self Help Groups and RPS Companies in RPS sector. The activities proposed are formation groups, marketing of produce and community development, women empowerment and capacity building, setting up demonstration plots, input supply and entrepreneurship development etc.

6.3.7 Rubber Swasraya Sangham (Self Help Group)

Scarcity of skilled human resource is one of the major limitations experienced in rubber plantation sector. As, this scarcity of skilled labour can be overcome by utilizing group potential; therefore Rubber board has, promoted formation of self- help groups, under the RPS as "activity groups of marginal and poor farmers for community participation and more inclusive development".

6.3.8 Award for the Best RPS and Grower

Once in two years the Board renders the best performing Rubber Producers' Society with '*Suvarnasangham Award'*. The objective of the award is to give proper motivation and incentive to the RPS, which "perform well and serve the growers to the desired extent in transfer of technology and enhancement of production and productivity". As, an encouragement to small growers, who have contributed in a large extent for the growth of rubber plantation industry in India, the Rubber Board has instituted *'K.M. Chandy Memorial Award'*, for the 'Best Grower'.

6.3.9 Women Development

The tribal families who ventured into this rubber plantation needed financial support during the immature phase for livelihood as rubber is a long gestation crop. Hence, to supplement the income, new activities involving women were taken up by forming "Self

Help Groups (SHG) under the World Bank Assisted Rubber Project". In Tripura, approx 8000 families were assisted through this. Activities emphasis also was given to health, hygiene, education and savings etc, besides income generation. Women small growers of rubber or spouses of small growers and women workers in the plantation sector are assisted through this.

6.3.10 Insurance Schemes

A provision has been made, since 1988, to bring rubber plantation under insurance coverage provided by 'National Insurance Company Ltd.' through Rubber Board. The *Price Stabilisation Fund (PSF)* [4] scheme was launched in 2003 and was terminated in 2013. Along with crop Insurance, a modified scheme is under consideration by the Government.

6.3.11 Activities in Convergence with other Agencies/ Organisations

Aiming for inclusive development, attempts have been made for convergence of activities of Rubber Board with that of various departments or agencies have been initiated.

6.3.11.1 Management Agency (ATMA)

ATMA functioning at Kottayam, is a scheme sponsored by central government and operated through ministry of Agriculture, Government of Kerala. It extended financial support to RPS for exposure visits, for organizing trainings, and demonstration with technical expertise from the Rubber Board.

[4] **Price Stabilisation Fund** (PSF) refers to "any fund constituted for the purpose of containing extreme volatility in prices of selected commodities".

6.3.11.2 “Mahatma Gandhi National Rural Employment Guarantee Scheme” (MGNREGS)

Rubber Board also got the consent of Government of India for bringing rubber plantation activity under MGNREGS. For the first time, an agricultural activity is taken up under this scheme. During 2013, Pilot project was commenced and the scheme has been extended during 2014 to different rubber growing states.

6.3.11.3 Rubber Skill Development Council (RSDC)

Rubber Skill Development Council (RSDC) is set up by “All India Rubber Industries Association (AIRIA) and Automotive Tyre Manufacturers’ Association (ATMA) in collaboration with National Skill Development Corporation (NSDC)” is focusing on training needs and skill development of the rubber sector.

6.3.11.4 Training in Harvesting

Technically qualified rubber tapping demonstrators are available in the regional offices of the Rubber Board and provide free ‘On-Farm’ training and technical guidance in harvesting of latex. Rubber Board runs fourteen ‘*Tapping Skill-Developed Schools (TSS)*’ at different plantation centers for imparting practical training to small rubber growers and their workers, in tapping, stimulation and rain guarding tapping panel protection and processing of crop into ribbed smoked sheets. Apart from the conventional TSS, Rubber Board also organises short-term intensive ‘*Tappers’ Intensive Skill-Developed Programme (TISP)*’on scientific methods of tapping, rain-guarding and stimulation, processing with importance on practical aspects.

Thus, from the above paragraphs it is evident as to how Rubber Board has worked for the welfare and upliftment of small growers by forming RPS which not only help to aggregate the produce but also process it and trade it, also the Board helped small growers to sustain in the immature phase through ancillary income earned from rubber by-products, have covered them under insurance, helped in cluster and women development and have floated various schemes, training programs and also render 'awards' to encourage and motivate.

6.4 Excerpts from the Discussion with the Deputy Director of Rubber Board

The following are the excerpts and important observations made during discussions with the Deputy Director of Rubber Board, Kottayam, Kerala, and his officials.

i. India is producing 70% of the rubber in the form of rubber sheets where as the other rubber producing countries produce in the form of block rubber.

ii. Indian Rubber price is higher when compared to global rubber prices because the domestic rubber market is strong and supply of natural rubber in India is in shortage when compared to the demand or consumption of the natural rubber.

iii. Other rubber producing countries like Indonesia, Thailand export 80% of their production because rubber manufacturing industry is not well developed where as Indian Rubber Manufacturing industry is very well developed.

iv. Rubber prices are affected by exchange rate fluctuations, oil prices etc.

v. From 1996 to 2003, the rubber prices came down because of devaluation of Asian currencies, this affected the cultivation of rubber trees at that time, and the rubber tree takes seven years to mature and to produce latex. In 2005, the prices of rubber soared because of less production as the planting was very less in the late 90's. The rubber planting increased in 2005 and now the production of rubber is good.

vi. If the planters of Kerala are not getting remunerative price for the latex, they do not harvest or tap the latex as the wages of tappers are also high. Kerala is the state of India with high per capita income and increased standard of living, hence the labour is costly, whereas in other countries like Indonesia and Thailand, the labour is not costly, and so, even if the rubber price is low then also the planters harvest the rubber.

vii. In 2001, the foreign restrictions on import and export of rubber were removed. Now, anyone can import the rubber but he has to pay an import duty of 25%.

viii. There is no Minimum Support Price for rubber like other commercial crops because the economy is open and the trader can import rubber at a lower price.

ix. For the same reason the government cannot procure and store the rubber as the rubber can be imported.

x. In Kerala, rubber producers are majorly small growers and possess land holding not more than half a hectare.

xi. In 1986, the Rubber Board promoted formation of voluntary associations of small rubber growers registered under the Charitable Societies Act called the 'Rubber Producers Societies' (RPS). Mr. PC. Cyriac IAS, the then chairman of the Rubber Board is the one behind the formation of RPS.

xii. In India according to the recent estimates there are about 2000 plus RPS. They function as a self helping group which targets at the social and economic empowerment of growers.

xiii. Eighty percent of the Indian rubber planters are registered under various RPS.

xiv. The RPS was formed after studying AMUL Model in Gujarat, which is a great success among the small producers of milk. On those lines the RPS came into existence.

xv. Each RPS consists of nearly 50 to 100 farmers, sometimes even more than hundred. The societies collect the latex from all the farmers and process it into rubber sheets and then sell them to the traders and subsequently the profit is distributed among the growers.

xvi. Group of RPS have formed trading companies, where 51% stake is of rubber board and 49% of RPS. There are eleven such trading companies. Each trading company comprises of 10-20 RPS. These trading companies trade in rubber on behalf of planters.

xvii. There are few trading companies like Periyar Latex which have participated in CFM and have earned good profits.

xviii. Hence, participation of small growers in CFM is through RPS or trading companies which is really novel idea as the contract size of rubber in CFM can be attained by aggregating their produce.

xix. Rubber planters watch news on television continuously and keep themselves updated with the latest news on rubber prices. Particularly, they follow Tokyo Futures Prices as there is time difference in India and Japan. Tokyo market reflects the information first. The well-informed planters hence, have ability to bargain well and the traders cannot cheat them like they do in other commercial crops.

xx. One more advantage to the rubber planters is that they process the latex into rubber sheets and the shelf life of rubber sheet is six months. Hence, they can store the rubber till they get the remunerative price for their produce.

xxi. In other rubber producing countries, the planters store it in the form of coagulum or rubber blocks, which has very less shelf life; hence these planters cannot wait for a remunerative price like Indian planters.

xxii. Another advantage to 60-70% of Kerala rubber planters is that they do rubber planting as part time and hence can sustain themselves even if they get low prices for rubber.

xxiii. Rubber planters can also have the advantage of culturing bee hives on rubber trees for honey, trading of rubber seed and oil, rubber wood etc.

xxiv. Rubber market is one of the efficient markets in India in terms of Farm Gate Price; farmers/planters are able to realize 95% of the price.

The branch manager of NMCE, Kochi was contacted, he provided with the information that there are major planters (who own estates and also trade in rubber); participates in NMCE, but there is no direct participation from small planters.

6.5 Conclusion

The present study has observed that the factors which were impeding the small or marginal farmers of Chilli, Turmeric and Cotton in Telangana from participation in CFM were even present in the small rubber growers. But, the Rubber Board and the Government have helped these small growers in overcoming many of their problems by forming Rubber Producer Societies and therefore they are able to aggregate their latex produce, even these societies are helping them to further process their produce of latex into rubber sheets which are giving them twin advantage of increased shelf life and ease of grading too. These RPS are further grouped together to form trading companies with 51% stake of Rubber Board and 49% of RPS. Thus these RPS registered under Charitable Act, have made everything favourable and conducive to the small growers of rubber, to participate in CFM not directly but through trading companies. The other factors which distinguished the Telangana's small and marginal farmers are these planters have high literacy rate, more educated, have other source of incomes, keep themselves updated with latest rubber news and rubber price fluctuations, no cash urgency, able to get maximum farm gate price, are given adequate training for cultivation and adoption of new techniques, covered under good insurance schemes, by Rubber Board. Other schemes like Agricultural Technology Management Agency (ATMA), Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS), Rubber Skill Development Council (RSDC), Training in harvesting through Tapping skill-development schools(TSS) and Tappers' Intensive Skill-Improvement Programme (TISP) are also floated to aid the small growers in rubber plantation.

A comparative table indicating the factors, which were impeding the participation of farmers in CFM in Telangana, and how these impeding factors were tackled and made fostering in rubber planters of Kerala had been summarized and displayed below for information:

Table 6.4

Comparative Table between Rubber Growers and Telangana Farmers

The factors identified during the course of study as impeding for the small/marginal farmers' participation in CFM of Chilli, Cotton and Turmeric in Telangana.	**How the same factors are tackled and made conducive their participation in Rubber Planters of Kerala.**	**Suggestions**
Average Land Holding and Average Output.	Major chunk of the rubber planters are small growers possessing land less than half a	On the same line of "AMUL Model" in Gujarat and "RPS" in

	hectare, but the Rubber Board have promoted formation of Rubber Producer Societies for economic and social welfare of the planters, RPS act as aggregators of their produce, and on behalf of them trade the rubber and distribute the profits among the farmers according to their contribution.	Kerala there should be aggregators of the produce at each village level in Telangana.
Risk Management Techniques	Since 1988, Rubber Board had made provisions to bring rubber plantation under insurance coverage by National Insurance Company Ltd, hence they are able claim the damages. Hedging can also be done on behalf of these small growers through trading companies formed by 10-20 group of RPS.	1. Awareness of insurance schemes among the farmers should be made. 2. Insurance amount should be increased according to the severity and quantity of damage, 3. The damage should not be checked at Mandal level but should be checked at village level 4. MSP should be available to all the crops and should be easy to avail. 5. Government should think something similar to PSF.
Storage of the crop	The latex aggregated by the RPS is further processed by them into rubber sheets of uniform quality which increases the shelf life of rubber also ease the grading. Thus, rubber can be stored till they get the remunerative price.	Again there is a need of society or self help groups which help the farmers in transporting their produce to warehouses or construction and maintenance of warehouses at village level.
Lack of Basic	Kerala is the state with highest	Training and awareness

Education.	literacy rate, hence majority of the planters are literate and possess basic education, which is a prerequisite for participation into CFM.	programs should be conducted for the farmers. In kerala, it's the RPS responsibility to train the farmers, the Rubber Board send the trainers to the society and then the society trains all the farmers.
Cash Urgency	There is no cash urgency with rubber planters as 60-70% of them do planting as part time. Rubber planters can also have the advantage of culturing bee hives on rubber trees for honey, trading of rubber seed and oil, rubber wood etc. Rubber market is one of the efficient market in India in terms of Farm Gate Price, farmers/planters are able to realize 95% of the price.	Farmers in Telangana are totally dependent on agriculture for their livelihood, should be trained for and shown other sources of income. 2. Government should also try that farmers get remunerative price not minimum support price.
Rubber Swasraya Sangham(Self Help Group) → Rubber Board promoted Self Help Groups' formation. Under the RPS as 'activity groups' of marginal and resource poor farmers for more inclusive development and community participation. Companies in RPS Sector→The initiative was taken by Rubber Board to form trading and processing companies with the promoter share participation of 51% and the remaining 49% being contribution of RPS. Agricultural Technology Management Agency(ATMA) Mahatma Gandhi National Rural Employment Guarantee Scheme(MGNREGS)		

CHAPTER SEVEN

DESCRIPTIVE STATISTICS AND STATIONARITY OF THE DATA

7.1 Introduction

The present chapter is divided into two sections; they are ‘Descriptive Statistics’ and ‘Stationarity’. The purpose of this chapter is to make known the select commodities’ sample size, period of collection of data and the methodology used to construct the pooled series, to estimate descriptive statistics like kurtosis, skewness, standard deviation etc, and to know about the stationarity of the future and spot series of the select commodities.

The secondary data used in this study was collected from the “official website of National Commodities and Derivations Exchange Ltd (NCDEX)”. The daily closing prices of future contracts for selected commodities (rubber, cotton, chilli and turmeric) and their respective spot closing prices were collected. The future contracts have been categorized into Maturity Month Contract (Maturing in the same month), Near Month Contract (Has only one month to maturity), Far Month Contract (Has two months to maturity) and Distant Month Contract (More than two months to maturity). Roll over methodology was used to construct the pooled series of daily data. The first day of a contract was considered as the first day of second month from maturity month and it ends with the last day of the second month. Similarly, the contracts were rolled over to the next contracts. So that, the data did not overlap and methodological problems associated with overlapping of the data were avoided.

The following section deals with the descriptive statistics of the select commodities and along with it, the number of futures and spots contract collected, frequency of the data, the time period for which the data was collected and the number of observations taken for each commodity are discussed.

7.2 Descriptive Statistics

7.2.1 Rubber

The commodity ‘Rubber’ had been chosen from the Plantation category of NCDEX commodities. There are two types of future contracts for commodity ‘rubber’ on NCDEX; they are RSS4 (RBRRS4KTM) and Rubber_New_RBBRS4KOC. RBRRS4KTM contract was active from 2004 to 2007 and RBBRS4KOC was active from 2007 to 2014. RBBRS4KOC had been chosen for the study as presently it is the active contract. The daily closing prices of RBBRS4KOC was collected from Jan’, 2007 to April, 2014 and daily closing prices of spot RBBRS4KOC was also collected for the same period. The data had been downloaded from the official website of NCDEX. The dates for future and spot closing price series were matched and any unmatched dates were deleted from the series. For commodity rubber, four types of contracts have been identified they are:

1) Maturity Month Contracts(Contracts maturing in the same month)
2) Near Month Contracts(Contracts maturing in the next month)
3) Distant Month Contracts(Contracts maturing in more than two months)

In the following section the descriptive statistics and the stationarity of the data (future series and spot series) of the aforementioned contracts have been displayed.

7.2.1.1 Maturity Month Contracts

There are six maturity month contracts for rubber. The data for maturity month contracts ranges from 2nd May, 2009 to 17th April, 2014. There are total ninety four observations of future and spot closing prices for maturity month contract. The descriptive statistics and the stationarity for the pooled series of future and spot prices are illustrated below. The software used for computing descriptive statistics is E-Views 9. Figure 7.1 is the graphical representation of log returns of future and spot prices ranging from year 2009 to 2014.

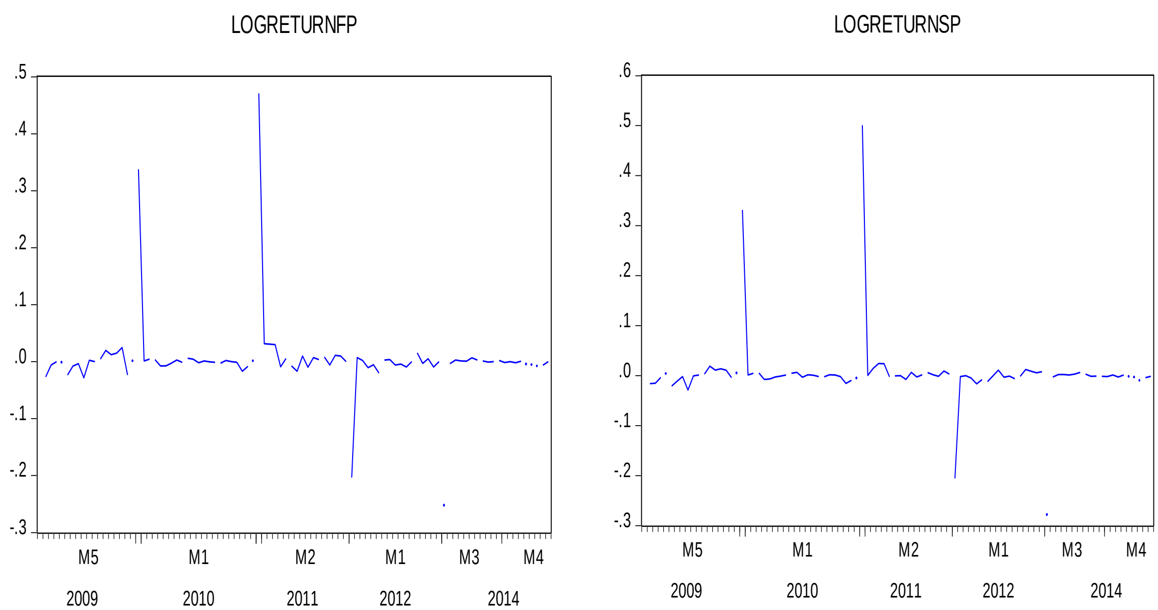


***Figure 7.1*: Graphical representation of log returns of Future and Spot prices**

It is clearly visible from Figure 7.1 that there are two pronounced upward spikes and one downward spike. The two upward spikes are in the year of 2009 and 2011 whereas the downward spike is in the year of 2012.

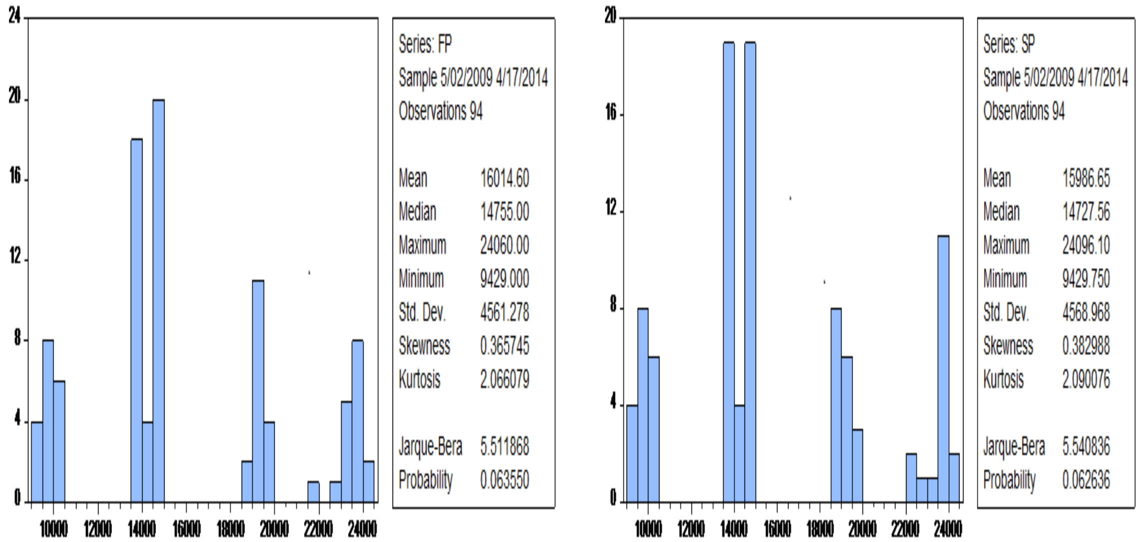


Figure 7.2: **Descriptive Statistics (Rubber MM)**

From figure 7.2, it can be seen that the maximum value of the future closing price is 24060(spot is 24096.10)[5] and minimum is 9429(9429.750). The mean is 16014.60(15986.65) spot is and the standard deviation is 4561.278(spot is 4568.968**)**, the standard deviation is very high for the future series, indicating variability in the prices of the rubber. Both, future and spot series are positively skewed and displays excessive negative kurtosis, therefore are platykurtic. "Jarque-Bera test null for normality" can be rejected at 10% level of significance.

7.2.1.2 Near Month Contracts

There are thirteen near month contracts for rubber. The data of near month contracts ranges from 1st Dec, 2007 to 30th Nov, 2013. There are total two hundred and thirty six observations of future and spot closing prices for near month contracts.

[5] The value within the parentheses indicates Spot Values.

Figure 7.3 is the graphical representation of log returns of future and spot prices ranging from year 2007 to 2013.

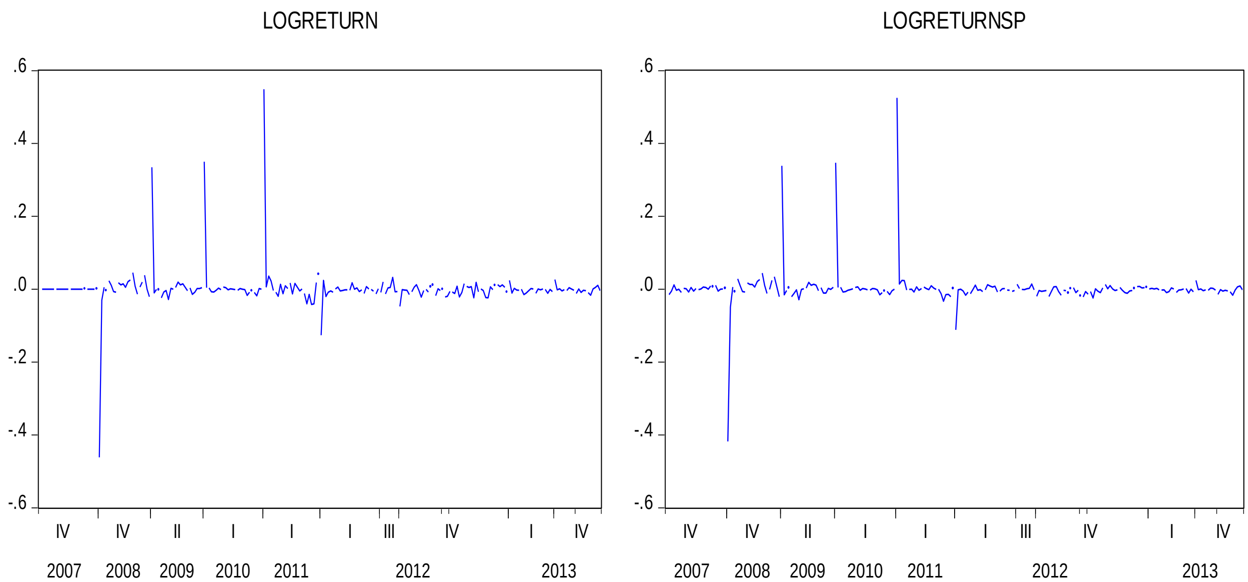


***Figure 7.3*: Graphical representation of log returns of Future and Spot prices (Rubber NM)**

It is clearly visible from Figure 7.3; the future prices plunged in the year 2008 creating a pronounced downward spike. The future prices soared in the year 2009, 2010 and 2011 creating three pronounced upward spikes.

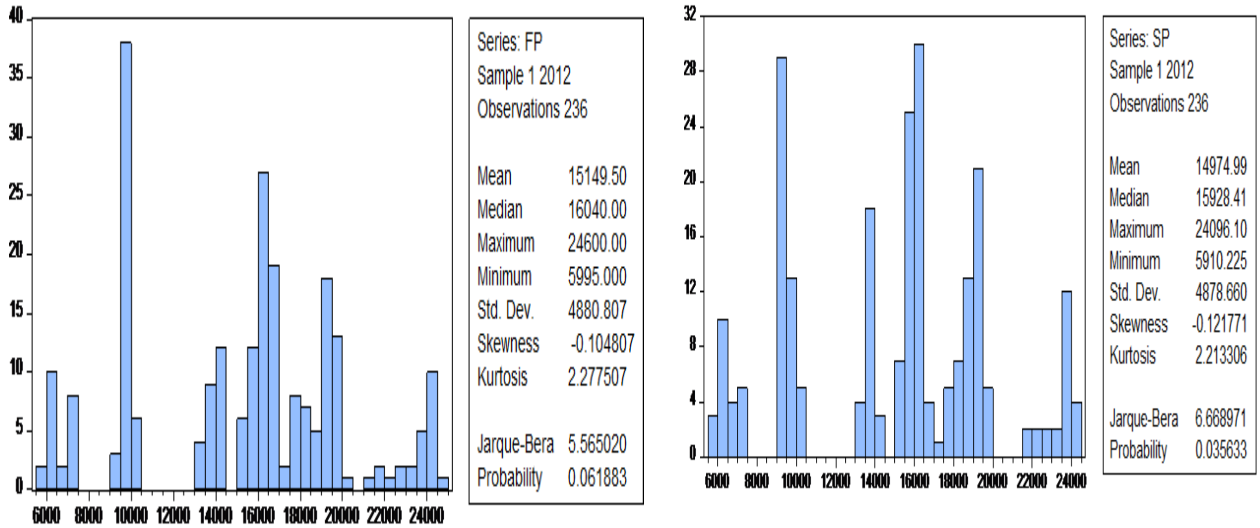


***Figure 7.4*: Descriptive Statistics (Rubber NM)**

From Figure 7.4; the maximum value of the future closing price is 24600 (spot to be 24096.10) and minimum to be 5995 (spot to be 5910.225). The mean is 15149.50 (14974.99) and the standard deviation is 4880.807 (4878.660), the standard deviation is very high for both the series, indicating variability in the prices of the rubber. The series are negatively skewed and are platykurtic. The null of normality for “Jarque-Bera test” can be rejected at 10% level of significance for future series, where as for spot series it can be rejected at 5% level of significance.

7.2.1.3 Distant Month Contracts

For rubber (distant month) contracts, the data was collected from April, 2012 to Nov’, 2012. There are total 116 observations in the data. Figure 7.5, is the graphical representation of log returns of future and spot prices ranging from year April, 2012 to Nov’, 2012.

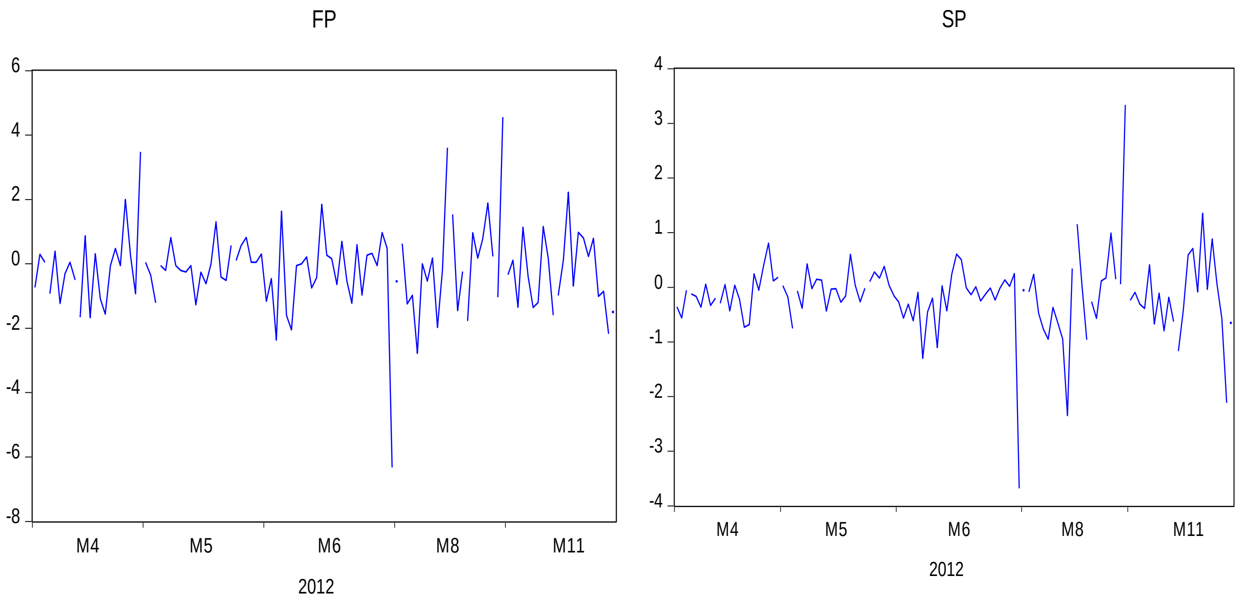


Figure 7.5: **Graphical representation of log returns of Future and Spot prices (Rubber DM)**

There are some pronounced upward and downward spikes visible in the graph of both future prices and spot prices.

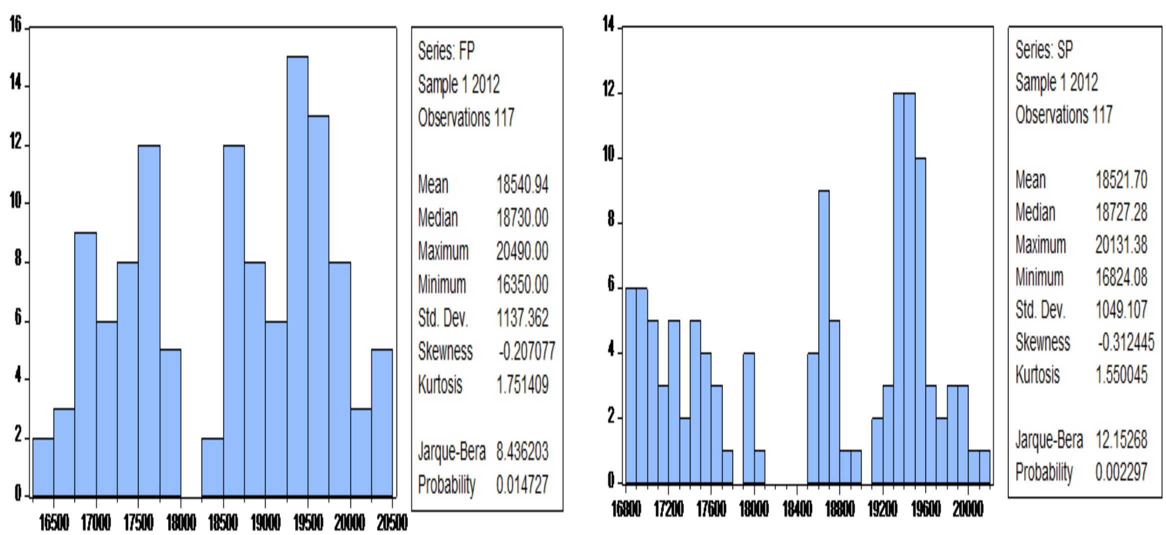


***Figure 7.6*:** **Descriptive Statistics (Rubber DM)**

From Figure 7.6; the maximum value of the future closing price is 20490 (spot to be 20131.38) and minimum to be 16350(spot to be16824.08). The mean is 18540.94(18521.70) and the standard deviation is 1137.362(1049.107), the standard deviation is less when compared to other aforementioned rubber future contracts, hence indicating lesser variability of the rubber (Distant Month) prices in comparison. Rubber distant future and spot series are platykurtic and negatively skewed, “Jarque-Bera test” is significant at 5% for Future series and at 1% for Spot series.

7.2.2 Cotton

The commodity ‘Cotton’ had been chosen from the ‘Fibre’ category of NCDEX. There are two types of future contracts for commodity ‘Cotton’ on NCDEX; they are Cotton 28.5 and Cotton 29. Cotton 29 had been chosen for the study as it was the active contract. There are total seventeen future contracts available. All the contracts belong to Distant Month category.

The daily closing prices of future and spot Cotton 29 were collected from the official website of NCDEX. The dates for future and spot closing prices series were matched and any unmatched dates were deleted from the series and the data after refinement ranged from Sep’, 2013 to Feb’, 2016.

There are total of 284 observations**.** Roll over methodology was used to construct the pooled series of future and spot prices of cotton. In the following section, the descriptive statistics and the stationarity of the data (future series and spot series) of the aforementioned contracts have been found out.

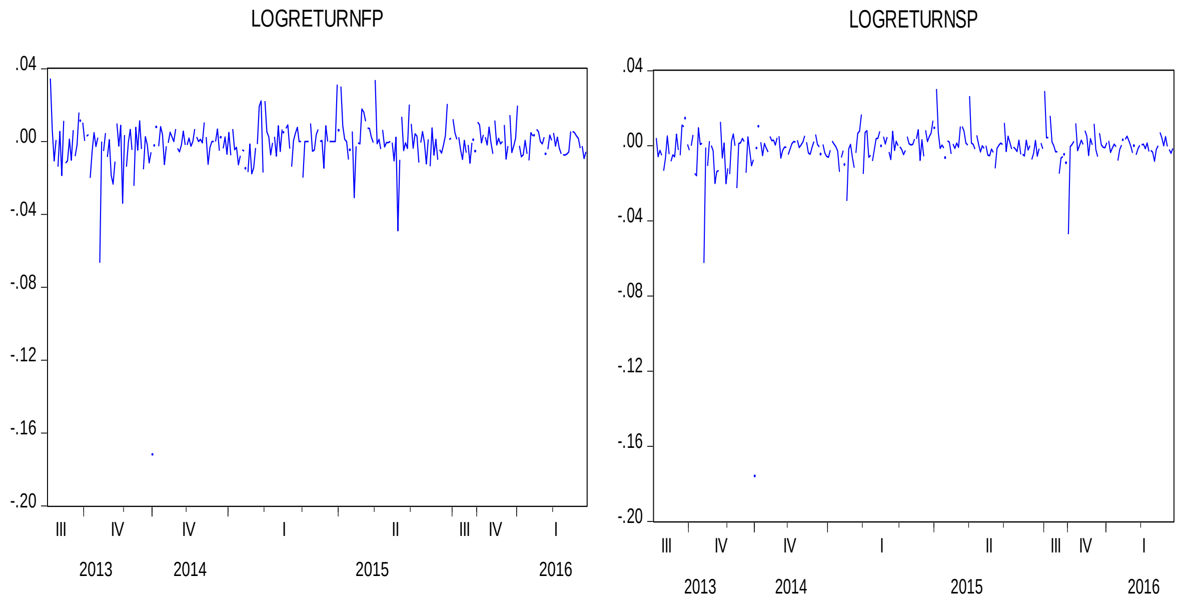


Figure 7.7: **Graphical representation of log returns of Future and Spot prices (Cotton)**

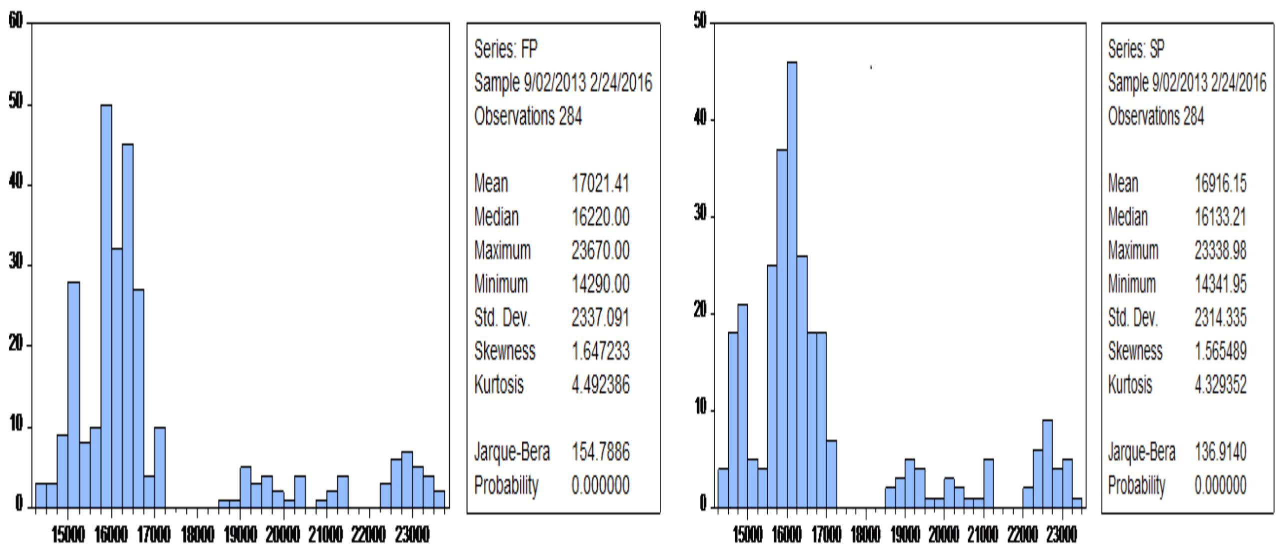


Figure 7.8: ***Descriptive Statistics (Cotton)***

From figure 7.8; it can be found out that the maximum value of the future closing price is 23670 (23338) and minimum is 14290 (14341.95). The mean is 17021.41 (16916.15) and the standard deviation is 2337.091 (2314.335), the standard deviation is little higher indicating variability in the prices of the cotton. The future and spot series are positively skewed and are leptokurtic. Jarque-Bera test for normality is significant for both the series.

7.2.3 Chilli

The commodity 'Chilli' had been chosen from the 'spices' category of NCDEX commodities. There are three types of future contracts for commodity 'chilli' on NCDEX. Chilli Teja Contract had been chosen for the study as presently it is the active contract. The daily closing prices of 'Chilli Teja' were collected from Sep', 2014 to Mar', 2016 and daily closing prices of spot 'Chilli Teja' were also collected for the same period. The data had been downloaded from the official website of NCDEX. There are total sixteen distant futures contract available.

Only one Near Month contract was present, hence it was not included in the study. The dates for future and spot closing prices series are matched and any unmatched dates are deleted from the series. After the refinement of data, the data collected was from 2nd Feb', 2015 to 23rd Feb', 2016.

Total of 116 observations are present for the commodity 'Chilli'. Roll over methodology was used to construct the pooled series of daily data. Figure 7.9, is the graphical representation of log returns of futures and spot series.

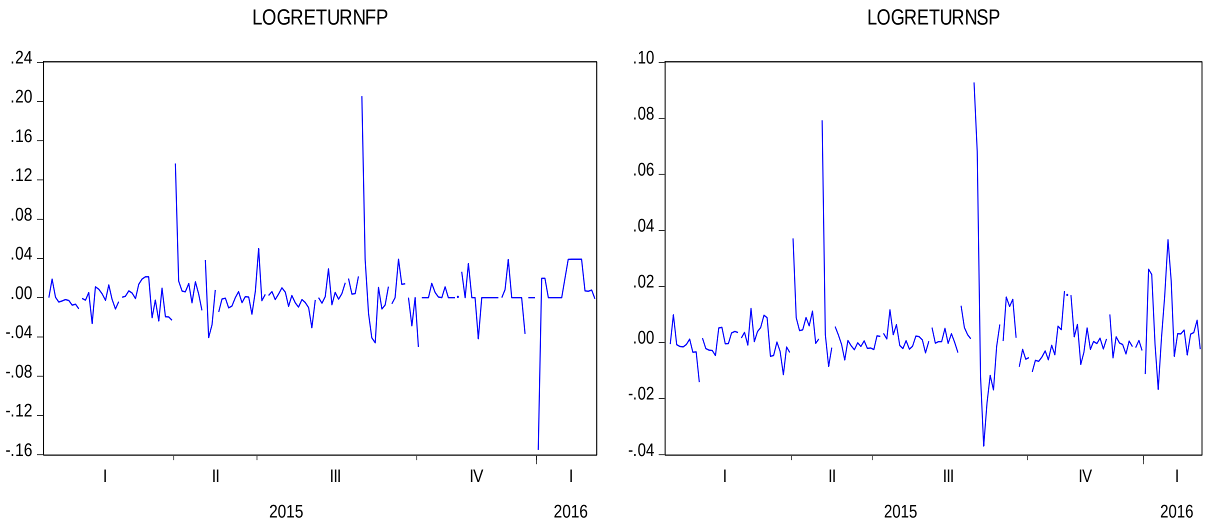


***Figure 7.9*: Graphical representation of log returns of Future and Spot prices (Chilli)**

As visible from the Figure 7.9, the future prices have few prominent downward spikes whereas spot prices have few prominent upward spikes.

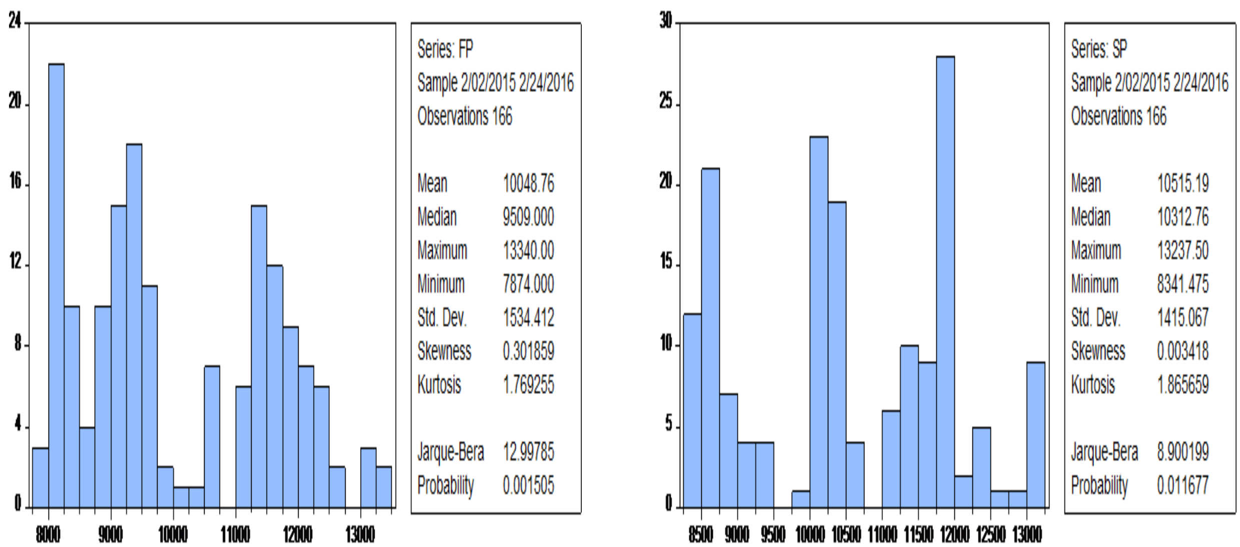


***Figure 7.10*: Descriptive Statistics (Chilli)**

From Figure 7.10; the maximum value of the future closing price is 13340(13237.50) and minimum is 7874 (8341.475). The mean is 10048.76 (10515.19) and the standard deviation is 1534.412 (1415.067), the standard deviation is little high for the spot series, when compare to the future prices of cotton. The future series and spot series of cotton are positively skewed and are platykurtic, "Jarque-Bera test is significant" for both the series.

7.2.4 Turmeric

The commodity 'Turmeric' had been chosen from the Spices category of NCDEX commodities. There is only one Turmeric contract available on NCDEX and hence was chosen for the study. There are total 87 contracts available for this contract, from April, 2005 to October, 2015. The daily closing prices of future and spot were collected for the same period. The data had been downloaded from the official website of NCDEX.

The dates for future and spot closing prices series were matched and any unmatched dates were deleted from the series.

For commodity 'turmeric', all the 87 contracts were distant months and after the refinement, the dates were ranging from June', 2007 to August, 2015.

There are total 1176 observations collected from 87 contracts. Roll over methodology was used to construct the pooled series of daily data. Figure 7.11, is the graphical representation of logreturns of future and spot prices ranging from year 2007 to 2015.

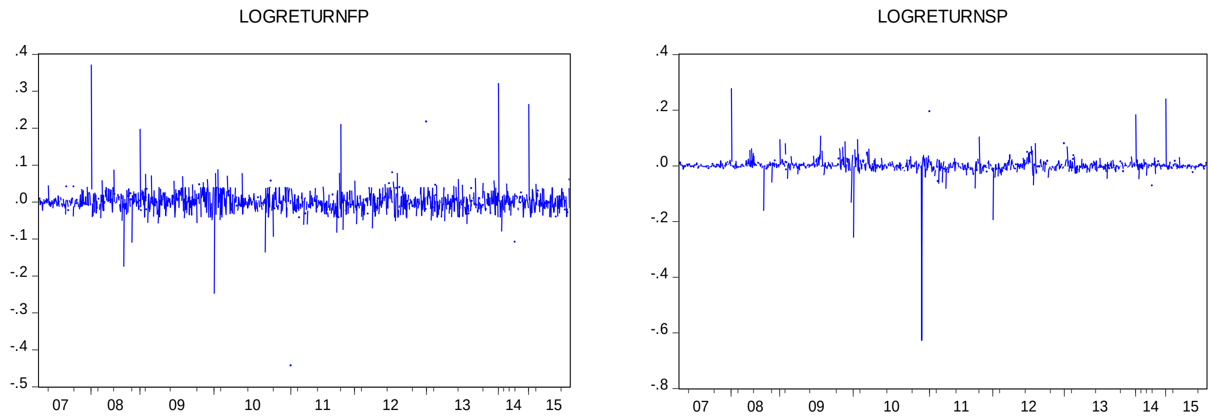


***Figure 7.11*: Graphical representation of log returns of Future and Spot prices (Turmeric)**

As, visible from the above figure 7.11, there are more prominent upward spikes in future series whereas in spot series there are more prominent downward spikes.

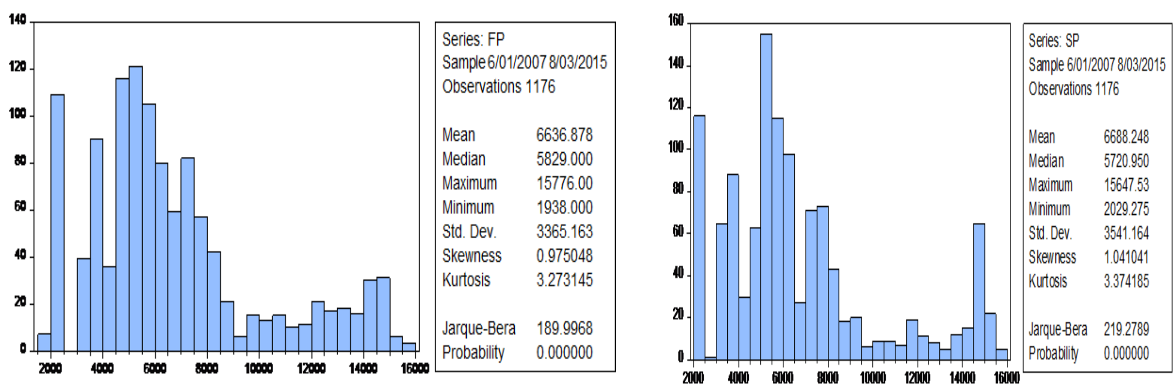


***Figure 7.12*: Descriptive Statistics (Turmeric)**

From Figure 7.12; the maximum value of the future closing price is 15776 (15647.53) and minimum is 1938 (2029.275). The mean is 6636.878 (6688.248) and the standard deviation is 3365.163 (3541.164), the standard deviation is high for the turmeric future and spot series, indicating high variability in the prices of the turmeric. Both the series are positively skewed and are displaying excess positive kurtosis (>3) i.e., they are leptokurtic. Jarque-Bera test for normality is significant for both the series.

7.3 Stationarity of the Data

Stationarity is an important and intuitive concept in the time series analysis. Stationarity process requires that the statistical parameters of data like variance, mean and autocorrelation remain same or constant over period of time. But mostly time series data like commodity or stock prices are non stationary. Any analysis like forecasting or modeling on non stationary data gives spurious result. Therefore, before starting the analysis, non stationary data have to be transformed into the stationary data. In most of the time series analysis the prerequisite is to test the stationarity of data, if data is not stationary then difference the data and again test for stationarity. Usually, at first difference the data becomes stationary, if require the data can be difference again.

To test the stationarity of data there are tests called as the Unit Root Tests which identify the presence or absence of unit root in data. If there is a unit root present in data, then the data is not stationary. Most common unit root tests used are DF (Dickey Fuller Test), ADF (Augmented Dickey Fuller Test), PP (Phillips Perron Test), KPSS (Kwiatkowski–Phillips–Schmidt–Shin).

For the present study, there are large gaps in dates of future prices because of the difference in the launching months of futures contract, and also as fluctuations in the prices of commodity futures are more; there is high probability that such data may have one or more structural break.

A structural break occurs when there is a sudden shift in time series, and occurrence of structural breaks in time series data may cause analytical errors. Presence of structural breaks also reduces the power of unit root tests.

Glynn, Perera and Verma (2007), in their meta-analysis paper have reviewed many papers relating to efficiency of unit root tests on data with structural breaks.
Some of the important papers discussed in their article are; **Perron (1989)** showed that "failure to allow for an existing break leads to a bias that reduces the ability to reject a false unit root null hypothesis". Therefore, Perron allowed an exogenous structural break in the ADF tests. **Zivot and Andrews (1992)** and **Perron (1997)** proposed "determining the break point 'endogenously' from the data".

As the present study is based on commodity futures data which is a pooled series constructed from various contracts which were launched in different months, it was suspected that there would be one or more structural breaks. Hence the need was felt to use a unit root test which gives accurate results on data with structural breaks. The study used Break Point Unit Root Test of Eviews 9.5 to test the stationarity of data.

Break Point Unit Root Test is based on the findings of Perron (1989), the present study had chosen innovational outliers "assumes that the break occurs gradually, with the breaks following the same dynamic path as the innovations", and chosen trending the data with intercept and trend break.

7.3.1 Rubber

7.3.1.1 Maturity Month Contracts (MMC)

Future Series

The stationarity of the data for Rubber Maturity Month Contracts is tested using the Break Point unit root test of E-views 9.5. Innovational outlier approach is selected and it is tested for trend and intercept. The test result is shown in table 7.1 below.

Table 7.1

Break Point Unit Root Test for Rubber Future (MMC)

Null Hypothesis: FP has a unit root

Break Date: 1/25/2010

Break Selection: Maximize intercept & trend break F-statistic

		t-Statistic	Prob.*
"Augmented Dickey-Fuller test statistic"		-8.747263	< 0.01
Test critical values:	1% level	-5.711386	

The null hypothesis of 'FP has a unit root' is rejected at 1% level of significance. Hence, it can be concluded that FP is stationary with no unit root a at 1% level of significance. There is a structural break identified on 1/25/2010. The graph showing the presence of structural break can be seen in Appendix B.

Spot Series

Table 7.2

Break Point Unit Root Test for Rubber Spot (MMC)

Null Hypothesis: SP has a unit root
Break Date: 1/25/2010
Break Selection: Maximize intercept & trend break F-statistic

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-8.552390	< 0.01
Test critical values: 1% level	-5.711386	

From table 7.2; the null hypothesis of 'SP has a unit root' is rejected at 1% level of significance. Hence, it can be concluded that SP is stationary with no unit root at 1% level of significance. There is a structural break identified on 1/25/2010. The graph showing the presence of structural break can be seen in Appendix B.

7.3.2 Near Month Contracts (NMC)

Future Series

From the below table 7.3, it is clearly evident that he null hypothesis of 'FP has a unit root' is rejected at 1% level of significance. Hence, it can be concluded that FP is stationary with no unit root at 1% level of significance. There is a structural break identified on 1/30/2010. The graph showing the presence of structural break can be seen in Appendix B.

Table 7.3

Break Point Unit Root Test for Rubber Future (NMC)

Null Hypothesis: FP has a unit root

Break Date: 1/30/2010

Break Selection: Maximize intercept & trend break F-statistic

		t-Statistic	Prob.*
"Augmented Dickey-Fuller test statistic"		-6.650603	< 0.01
Test critical values:	1% level	-5.711386	

Spot Series

Table 7.4

Break Point Unit Root Test for Rubber Spot (NMC)

Null Hypothesis: SP has a unit root

Break Date: 1/30/2010

Break Selection: Maximize intercept & trend break F-statistic

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.694742	< 0.01
Test critical values:	1% level	-5.711386	

From the table 7.4 above, it is clearly evident that the null hypothesis of 'SP has a unit root' is rejected at 1% level of significance. Hence, it can be concluded that SP is stationary with no unit root at 1% level of significance.

There is a structural break identified on 1/30/2010. The graph showing the presence of structural break can be seen in Appendix B.

7.3.1.3 Distant Month Contract (DMC)

Future Series

From the table 7.5 below, it is clearly evident that the null hypothesis of 'FP has a unit root' is rejected at 5% level of significance. Hence, it can be concluded that FP is stationary with no unit root at 5% level of significance. The graph showing the presence of structural break can be seen in Appendix B.

Table 7.5

Break Point Unit Root Test for Rubber Future (DMC)

Null Hypothesis: FP has a unit root
Break Date: 8/13/2012
Break Selection: Maximize intercept & trend break F-statistic

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-11.30685	< 0.01
Test critical values: 1% level	-5.711386	

Spot Series

From the table 7.6 below, it is clearly evident that the null hypothesis of 'SP has a unit root' is rejected at 1% level of significance. Hence, it can be concluded that SP is stationary with no unit root at 1% level of significance.

There is a structural break identified on 8/23/2012. The graph showing the presence of structural break can be seen in Appendix B.

Table 7.6

Break Point Unit Root Test for Rubber Spot (DMC)

Null Hypothesis: SP has a unit root

Break Date: 8/23/2012

Break Selection: Maximize intercept & trend break F-statistic

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.621065	< 0.01
Test critical values:	1% level	-5.711386	

7.3.2 Cotton29

Future Series

From the table 7.7 below, it is clearly evident that the null hypothesis of ‘FP has a unit root’ is rejected at 1% level of significance. Hence, it can be concluded that FP series is stationary with no unit root a at 1% level of significance. There is a structural break identified on 11/29/2013. The graph showing the presence of structural break can be seen in Appendix B.

Table 7.7

Break Point Unit Root Test for Cotton Future

Null Hypothesis: FP has a unit root

Break Date: 11/29/2013
Break Selection: Maximize intercept & trend break F-statistic

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.983128	< 0.01
Test critical values:	1% level	-5.711386	
	5% level	-5.155006	
	10% level	-4.860969	

Spot Series

From the table 7.8, it is clearly evident that the null hypothesis of 'SP has a unit root' is rejected at 5% level of significance. Hence, it can be concluded that SP is stationary with no unit root at 5% level of significance. There is a structural break identified on 11/29/2013. The graph showing the presence of structural break can be seen in Appendix B.

Table 7.8

Break Point Unit Root Test for Cotton Spot

Null Hypothesis: SP has a unit root

Break Date: 11/29/2013
Break Selection: Maximize intercept & trend break F-statistic

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.568544	0.0165
Test critical values:	1% level	-5.711386	
	5% level	-5.155006	
	10% level	-4.860969	

7.3.3 Chilli

From the table 7.9, it is clearly evident that the null hypothesis of ‘FP has a unit root’ is accepted. Hence, FP is not stationary and has a unit root. At first difference of FP series there is no unit root and series, therefore at first difference is stationary. There is a structural break identified on 11/23/2015. The graph showing the presence of structural break can be seen in Appendix B.

Table 7.9

Break Point Unit Root Test for Chilli Future

Null Hypothesis: FP has a unit root

Break Date: 11/30/2015
Break Selection: Maximize intercept & trend break F-statistic

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.834707	0.1059
Test critical values:	1% level	-5.711386	
	5% level	-5.155006	
	10% level	-4.860969	

Null Hypothesis: DFP has a unit root
Break Date: 11/23/2015

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.14536	< 0.01
Test critical values:	1% level	-5.711386	

Spot Series

From the below table 7.10, it is clearly evident that the null hypothesis of ‘SP has a unit root’ is accepted. Hence, SP is not stationary and has a unit root. At first difference of SP series, there is no unit root. There is a structural break identified on 9/07/2015. The graph showing the presence of structural break can be seen in Appendix B.

Table 7.10

Break Point Unit Root Test for Chilli Spot

Null Hypothesis: SP has a unit root
Break Date: 9/30/2015

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.839482	0.5400
Test critical values:	1% level	-5.711386	
	5% level	-5.155006	
Null Hypothesis: DSP has a unit root			
Break Date: 9/07/2015			
Augmented Dickey-Fuller test statistic		-10.61367	< 0.01
Test critical values:	1% level	-5.711386	

7.3.4 Turmeric

Future Series

From the table 7.11, it is clearly evident that the null hypothesis of 'FP has a unit root' is rejected at 1% level of significance. Hence, it can be concluded that FP is stationary with no unit root at 1% level of significance. There is a structural break identified on 11/30/2010 and the graph can be seen in Appendix B.

Table 7.11

Break Point Unit Root Test for Turmeric Future

Null Hypothesis: FP has a unit root

Break Date: 11/30/2010
Break Selection: Maximize intercept & trend break F-statistic

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.705310	< 0.01
Test critical values:	1% level	-5.711386	

Spot Series

From the table 7.12, it is clearly evident that the null hypothesis of 'SP has a unit root' is accepted at 1% level of significance. Hence, SP is not stationary and has a unit root. At first difference of SP series, no unit root was found and hence the spot series of turmeric is stationary at first difference. There is a structural break identified on 5/04/2010. The graph showing the presence of structural break can be seen in Appendix B.

Table 7.12

Break Point Unit Root Test for Turmeric Future

Null Hypothesis: SP has a unit root

Break Date: 11/09/2010

Break Selection: Maximize intercept & trend break F-statistic

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.525450	0.0185
Test critical values:	1% level	-5.711386	
	5% level	-5.155006	
	10% level	-4.860969	

Null Hypothesis: DSP has a unit root

Break Date: 5/04/2010

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-31.68714	< 0.01
Test critical values:	1% level	-5.711386	

7.4 Conclusion

Skewness and kurtosis are important concepts for investors to understand and therefore forms the part of descriptive statistics. The select commodities for the present study are positively skewed indicating upper tail of distribution is thicker than lower tail except Rubber (Near Month) and Rubber (Distant Month) which are negatively skewed therefore it appears there are slightly more downward spikes than upward spikes. Commodities which are positively skewed tend to be in contango whereas negatively skewed commodities display "backwardated characteristics like higher roll-yields, better past performance, lower hedgers' hedging pressures and higher speculators' hedging pressures".

As, popularly thought commodity futures prices because of their positive exposure to supply shocks need not be positively skewed **(kat and Oomen, 2006).** For evaluating a commodity futures returns, kurtosis is also an important descriptive statistics. Investors often consider kurtosis for returns of assets because the kurtotic values can offer an estimation of asset risk on prospective investments.

For the present study, commodities Turmeric and Cotton are leptokurtic whereas Chilli and Rubber are platykurtic. Distributions which are platykurtic produce less extreme outliers when compared to outliers found in a normal distribution. It is quite plausible that kurtosis in most of the commodities will be above normal since commodities are famous for their sometimes aggressive price swings. "The fatter the return distribution's tails, the higher the probability of an extreme outcome, and vice versa."**(Kat and Oomen, 2006; Cashin, Paul and C. John McDermott, 2002).**

Investors usually prefer constant and steady growth, hence would be mostly interested in assets with low kurtosis. Commodity prices and stock prices crash more than one would expect them to if the price changes were random, but while commodities tend to crash up, stocks tend to crash down. In general, commodity prices are positively skewed and positively kurtotic (fat-tailed) in contrast to equity prices, which are negatively skewed and positively kurtotic **(M. Ashton, 2011)**.

Standard deviation indicates the variability in prices, and all the select commodities exhibit high variability in prices; Rubber (Near Month) being the highest. Break point unit Root test was used to check the stationarity of the data as structural breaks were suspected in the data and other unit root tests would not have tested the stationarity efficiently.

The table 7.13 in the next page summarise the descriptives and stationarity of the select commodities.

Table 7.13

Summary of the descriptive and stationarity of the select commodities

Name of the Commodity	Ser -ies	Skewness and Kurtosis	Inference	Jarque Bera	Standard Deviation	Stationarity
Turmeric	FP	0.97 and 3.27	Positively Skewed & Leptokurtic	189.99 (0.00)	3365.16	FP is stationary at 1%
	SP	1.04 and 3.37	Positively Skewed & Leptokurtic	9.27 (0.00)	3541.162	SP is stationary at first difference
Cotton	FP	1.64 and 4.49	Positively Skewed & Leptokurtic	154.78 (0.00)	2337.09	FP is stationary at 1%
	SP	1.56 and 4.32	Positively Skewed & Leptokurtic	136.91 (0.00)	2314.33	SP is stationary at 1%
Chilli	FP	0.30 and 1.76	Positively Skewed & Platykurtic	12.99 (0.00)	1534.41	FP is stationary at first difference
	SP	0.003 and 1.86	Slightly,Positively Skewed & Platykurtic	8.9 (0.011)	1415.06	SP is stationary at first difference
Rubber						
Maturity Month	FP	0.36 and 2.06	Positively Skewed & Platykurtic	5.51 (0.063)	4561.27	FP is stationary at 1%
	SP	0.38 and 2.09	Positively Skewed & Platykurtic	5.54 (0.062)	4568.96	SP is stationary at 1%
Near Month	FP	-0.10 and 2.27	Negatively Skewed & Platykurtic	5.56 (0.06)	4880.80	FP is stationary at 1%
	SP	-0.12 and 2.21	Negatively Skewed & Platykurtic	6.66 (0.035)	4878.66	SP is stationary at 1%
Distant Month	FP	-0.20 and 1.75	Negatively Skewed & Platykurtic	8.43 (0.014)	1137.36	FP is stationary at 1%
	SP	-0.31 and 1.55	Negatively Skewed & Platykurtic	12.15 (0.002)	1049.10	SP is stationary at 1%

CHAPTER EIGHT

MODELLING VOLATILITY

8.1 Introduction

Modeling volatility in financial markets have always been a lucrative area for researchers, as volatility indicates how risky the asset is and aids in selection of portfolio based on risk appetite of the investors, managing price risk through hedging, derivatives pricing and also helps policy makers. For functioning of competitive market, price fluctuations are a pre requisite and a normal feature. Price fluctuations or volatility has gained critical importance recently in the context of agricultural markets. Futures are floated for all types of commodities but future for agricultural commodities have more price fluctuations implying more volatility because of various factors like supply and demand, seasonality, adverse weather conditions, wrongly hoarding of the commodities by traders etc. Hence, agri-future commodities require accurate volatility forecasting and modeling.

8.2 Literature Review

The ingress of Commodity Futures Exchanges in India had created advents for speculation of the future price of agricultural commodities. Lack of a proper forecasting system can lead to price asymmetry. **Panda (2014)** had emphasized that speculators are gaining at the cost of farmers and traders due to price asymmetry caused by lack of proper forecasting model and also elaborated that “Unavailability of the relevant data and forecasting measures hinders traders and hedgers to enter into the futures market in India. This leads to biased speculation which leads to unavoidable fluctuations in price. Also, reduces the predictability of the market and makes it less useful for the genuine hedgers for trading and also leads to inappropriate price realization for farmers."

There is a dearth of literature on volatility modeling in equity markets but the literature for commodity futures market is less as it is still in its nascency in India. The success of a specific type of forecasting model which is applied to one type of market cannot be generalized for other markets. In recent years only, the volatility modeling using econometric techniques have gained importance. **(Sadorsky, 2006)**

Futures markets have two important functions of risk management and price discovery. Risk management is achieved through hedging which induces offsetting the price risk by taking an equal and opposite position in spot market, thus volatility modeling for futures is very important and they are categorized as highly risky, volatile investment tools as a little change in price can bring a large impact on trading **(Carvalho, da Costa, & Lopes, 2006).**

Volatility can be broadly classified into three types, historical volatility, conditional volatility and implied volatility. **Brooks (2002)** describes historical volatility as simply calculation of the standard deviation or variance of returns in the usual statistical notation over some historical period and this would become a forecast for all future periods. This was the traditional approach to forecast the volatility but there is growing evidence that volatility is predicted from relatively more sophisticated time series models.

According to **Poon and Granger (2003),** forecasting volatility in financial markets is an essential task. If volatility is interpreted as uncertainty, it becomes an important variable for many investment decisions and portfolio creations, and further elucidated that volatility is the variance or standard deviation calculated from a set of sample, and it should be attached to a distribution, only then it can be used as a risk. They also elaborated that "Investors and portfolio managers have certain levels of risk which they can bear. A good forecast of the volatility of asset prices over the investment holding period is a good starting point for assessing investment risk"

Autoregressive Moving-Average (ARMA) or Auto Regressive Integrated Moving-Average (ARIMA) models are mostly referred to as Box-Jenkins models as they were first made popular by them. This model analyzes and predicts value of a equally spaced univariate response time series as a linear combination of its own lagged (past) values, lagged errors (also called innovations or shocks), and current and lagged values of other time series. **(Box and Jenkins, 1970).**

ARIMA (p, d, q) model has 'p' autoregressive (AR) terms, 'q' moving average terms (MA), and'd' differencing operations. Integrated refers to the process of differencing the series. This describes a large set of models and numerical methods exist to fix the models for any combinations of given p, d, and q. This requires an automated approach to identify and estimate all the models in some subset of parameter space and choose the best one with lowest AIC value **(Akaike, 1974)**. Akaike's Information Criterion (AIC), have been always used in selecting predictors for regression, and in the same way it is also used in ARIMA models for determining the order. **Brockwell & Davis (1991)**, in their second edition of the volume, which is considered as the standard reference for linear time series states, "Our prime criterion for model selection [among ARMA models] will be the AIC".

There are three distinct stages in carrying out the ARIMA methodology or procedure they are Identification, Estimation and Diagnostic Checking. To construct the ARIMA model the prerequisite is the stationarity of the series, if required stationarize the series by differencing. Then, study the pattern of autocorrelations and partial autocorrelations and include the appropriate lags of (stationarised series or forecast errors) in the forecast equation. Select the model with lowest AIC and the model adequacy (diagnostic checking) should be checked. The select model residuals should be free of serial or auto correlation. Ljung-Box Q statistic is used to check the overall model adequacy of the model **(Bowerman et al, 2005).** According to **Zou, H et al, (2007)** ARIMA models are superior over other models in the same class and due to their statistical properties ARIMA models are highly accepted and applied. **Box et al.(2007)** have discussed various aspects of ARIMA approach in an excellent manner.

There are many research papers which have studied and compared the results from different time series forecasting techniques. It was found that ARIMA models have been preferred for short term forecasting when compared to artificial intelligent models **(Zou, H et al, 2007)**. ARIMA models are proposed to capture the linear characteristics in the time Series and are examples of typical linear models. Non constant volatility of data is one of the features of financial time series; the advantage of ARIMA model is to 'smooth away' the patterns and to correct local trends in the data. **(Tsay, 2002, p.80).**

Liu (1991) employed Box-Jenkins technique to study the dynamic relationships between US crude oil prices, gasoline prices and the stock of gasoline with transferring function models.

Kumar (1992) used time series ARIMA to investigate and forecast crude oil prices. ARMA (1, 2) model was the best fit in his study.

M. Shukla and Jharkharia (2011) took sales data of onion (perishable vegetable) from wholesale market of Ahmedabad in India and carried out the time series analysis using ARIMA model. ARIMA (2,0,1) was chosen, based on lowest AIC value and with MAPE in the range of 30%. They successfully validated the model using the sales data of potato from the same market. They claimed that the model can facilitate the whole sellers and farmers in effective decision making.

Y. Doshit, K. Adabar and S. Achuthan (2011), studied the price behaviour of wheat in India and have suggested an appropriate ARIMA model for forecasting wheat prices in short term. They found that for the short term (up to twelve months) "ARIMA (2,1,1),(0,1,2)12, ARIMA(0,1,1)(1,1,1)12 and ARIMA(2,1,2)(0,1,1)12 are superior for periods 1982-1990, 1991-2000, and 2001-2011", respectively. Mean Absolute Percentage Error (MAPE) ranged from 4.08 % to 5.54% for the given forecast. For 6-month forecast MAPE ranged from 2.34 % to 4.98 % and ARIMA (1,1,0) was found to be the best model (weekly prices) during the period Apr', 2005 to Jan', 2011." It was observed that alternative models of ARIMA required to be fitted, for the same period, depending on the frequency of the price series. Weekly data yielded a superior model for six month forecast than monthly data.

Panda (2014) proposed ARIMA (1,1,0) model with additive seasonality for forecasting of soybean prices, after conducting an econometric analysis of the data consisting of 160 observations for the prices of soybean and advocated that the model can be used by harvesters, traders to minimize the scope for speculation and also by regulators to minimize the role of speculators by predicting the future prices.

Banerjee (2014) forecasted the Indian stock indices, which have a strong impact on the Indian economy, by proposing and determining an ARIMA model. She predicted the Sensex through model validation and at the end conducted the recurrence validation.

Guha and Bandyopadhyay (2016) have determined ARIMA (1, 1, 1) as the best fit model for predicting the future values of gold. They have analyzed the values of MCX traded gold price for the past ten years, and have proposed six different models of ARIMA, out of which ARIMA (1, 1, 1) was chosen as the best fit.

Bannor and Melkamu(2016), have explored modeling and forecasting of monthly prices of wholesale mustard in Rajasthan using ARIMA, ARFIMA and ECM based on minimum values of AIC and BIC. They concluded that the mean absolute percentage error (MAPE) of ARFIMA (2, 0.449,1), ARIMA (1, 1, 1) , and ECM based on predictions from Jan', 2005 to Jun',2015 are 4.90 percent, 4.45 percent, and 8.11 percent respectively; whereas the MAPE of ARFIMA (2, 0.449,1), ARIMA (1,1, 1), and ECM based on predictions from January 2015 to June 2015 are 6.79 percent, 6.60 percent and 7.35 percent respectively.

Therefore, among the three models of multivariate ECM and univariate ARIMA and ARFIMA, ARIMA is the best model fit for forecasting of mustard prices in Rajasthan with the lowest MAPE value.

8.3 Empirical Analysis

8.3.1 Methodology

The present study ran a first-order auto regression of the log returns of the select commodities as it was indicative of AR (1) from the preliminary check of the auto correlation and partial autocorrelation functions. The residuals from this regression equation have been taken up for modeling of volatility and were tested for heteroskedasticity using ARCH LM test. There was no ARCH effect found in any of the commodities. As, the residuals were homoscedastic the study continued with the ARIMA modeling. If there is no ARCH effect in the residual, then the ARCH model is not required **(Zivot and Wang, 2006).**

ARIMA modeling consists of well-defined steps. The order of model is determined i.e. whether the data series is stationary (at level, I(0)) or has to be differenced (I(1) or I(2)) to make it stationary, and then an appropriate structure (AR, MA or ARMA) is identified. Previously identification was done by looking at the plots of Auto Correlation Function (ACF) and Partial Auto Correlation Function (PACF) but now with latest software version like E-Views 9.5, identification can be done by an automated iterative procedure i.e., many different possible models are identified and top twenty models with lowest AIC value are displayed in a Criteria graph or table. The model with lowest AIC value is estimated. The final step is diagnostic checking or verification **(Anderson, 1976)** and here the model adequacy is checked for the randomness of the residuals of the model and for the statistical significance of the parameters. The fitting process is usually guided by the 'principal of parsimony', i.e. The best model is the simplest possible model with the least parameters that describes the data adequately. For the present study the feature of 'Automatic ARIMA

Forecasting' of E-views software version 9.5 had been used to identify and estimate the ARIMA models.

8.3.2 RESULTS

8.3.2.1 Turmeric

The turmeric series is stationary at level (See Chapter VII) and hence it was not differenced further. ARIMA (2, 0, 2) was identified as the best fit with lowest AIC value and statistical significance. The coefficients of the model are significant except the constant. Coefficient of variance is significant and is less. The coefficients of the model are displayed in the given below table

Table 8.1

ARIMA (2, 0, 2) Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.001051	0.001082	0.971556	0.3315
AR(1)	-0.788192	0.011284	-69.84750	0.0000
AR(2)	-0.995282	0.007660	-129.9269	0.0000
MA(1)	0.780411	0.016070	48.56439	0.0000
MA(2)	0.987036	0.011637	84.81690	0.0000
SIGMASQ	0.001222	1.39E-05	87.83630	0.0000
R-squared	0.008471	AIC	-3.858915	
Adjusted R-squared	0.004230	Durbin-Watson stat	1.990249	

The select model ARIMA(2,0,2) was able to achieve greater randomness in the behavior of turmeric prices, there was no presence of autocorrelation (ACF) and partial autocorrelation (PACF) in the residuals, the Q statistic probabilities indicated that the null of ‘No serial correlation’(See Table C7, Appendix C), can be accepted and hence the model chosen is a good fit.

To check the forecast quality of the ARIMA(2, 0, 2) model, the forecast was made for the last twenty observations; when the forecast is made in e-views a plot of 95% confidence interval is produced, the realized values of the dependent or endogenous variable in a properly specified model, will differ from the forecasts by less than minus or plus two standard errors ninety five percent of the time **(Felipe, I.J. dos S; Mól, A.L.R; Almeida, V. de S; Brito, M.C. de., 2012).**

The chosen model ARIMA (2, 0, 2) proved to be increasingly positive and well within the plus or minus two standard errors (Figure 8.1)

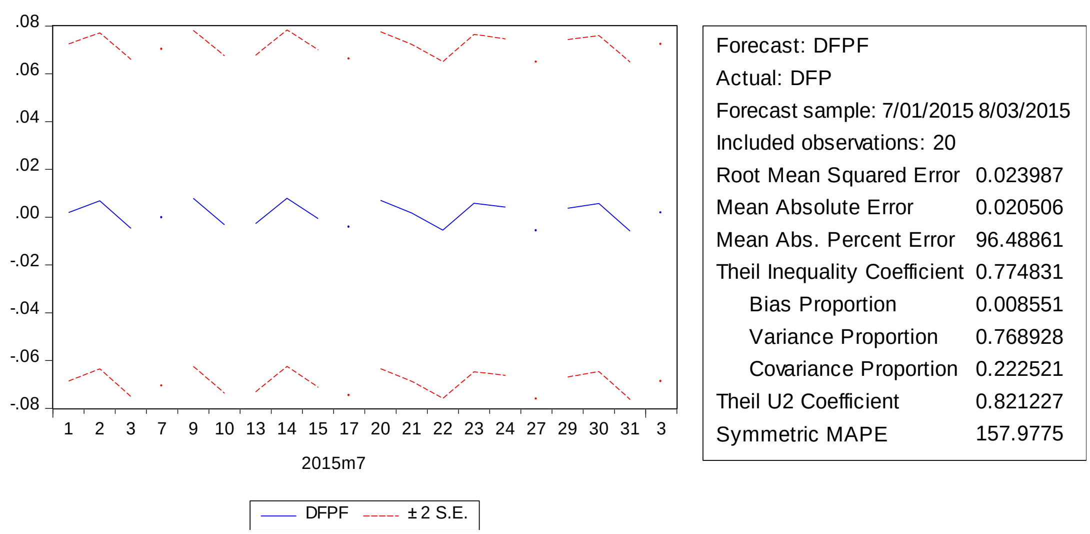


Figure 8.1: **Forecast of ARIMA (2, 0, 2)**

8.3.2.2 Chilli

The chilli series is not stationary at level (See Chapter VII) and hence it was differenced once to make it stationary. ARIMA (2, 1, 1) was identified as the best fit with lowest AIC value and statistical significance (See Figure C1-Criteria Graph, Appendix C).

Table 8.2

ARIMA (2, 1, 1) Model

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.002855	0.000378	7.545187	0.0000
AR(1)	1.088329	0.089677	12.13612	0.0000
AR(2)	-0.187897	0.103615	-1.813412	0.0716
MA(1)	-0.999999	232.3266	-0.004304	0.9966
SIGMASQ	0.000718	0.004195	0.171270	0.8642
R-squared	0.077769	AIC	-4.324893	
Adjusted R-squared	0.054713	Durbin-Watson stat	2.013364	

The select model ARIMA(2,1,1) was able to achieve greater randomness in the behavior of chilli prices, there was no presence of autocorrelation (ACF) and partial autocorrelation (PACF) in the residuals, the Q statistic probabilities indicated the null of 'No serial correlation' can be accepted (See Table C8, Appendix C), hence the model chosen is a good fit.

To check the forecast quality of the ARIMA (2, 1, 1) model, the forecast was made for the last twenty observations, the chosen model ARIMA (2, 1, 1) proved to be increasingly positive and well within the plus or minus two standard errors (Figure 8.2).

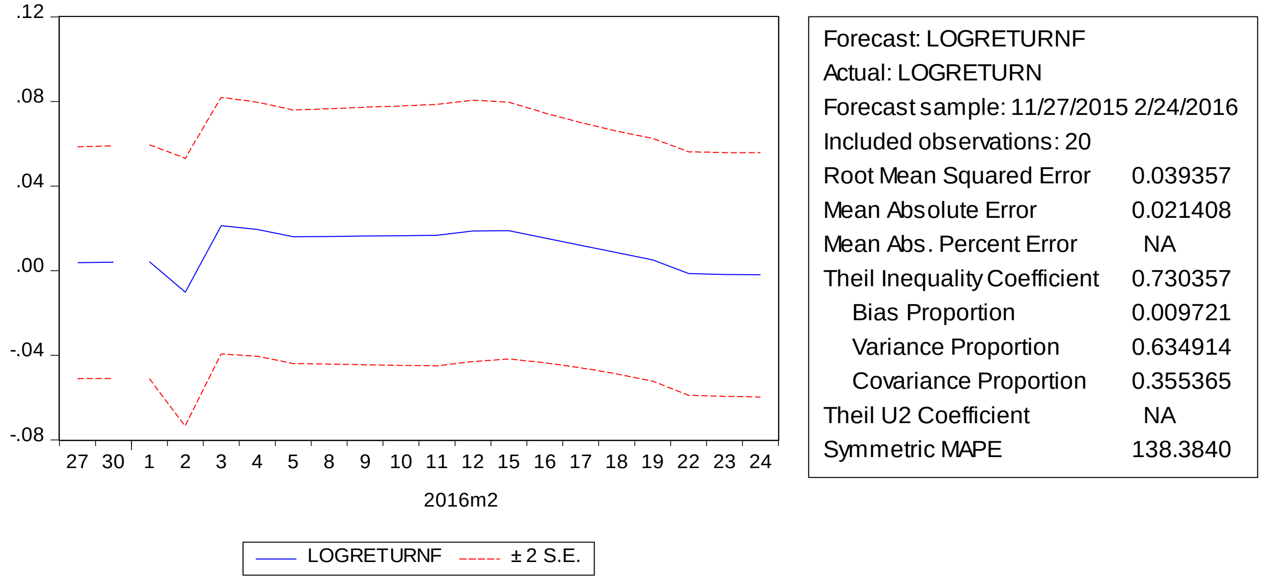


***Figure 8.2*: Forecast of ARIMA (2, 1, 1)**

8.3.2.3 Cotton

The cotton series is stationary at level (See Chapter VII) and hence it was not differenced. ARIMA (1, 0, 0) was identified as the best fit with statistical significance (See Figure C2-Criteria Graph, Appendix C). The select model ARIMA(1, 0, 0) was able to achieve greater randomness in the behavior of the prices, there was no presence of autocorrelation (ACF) and partial autocorrelation (PACF) in the residuals, the Q statistic probabilities indicated that the residuals are free of serial correlation (See Table C9, Appendix C), thus the model chosen is a good fit.

Table 8.3

ARIMA (1, 0, 0) Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	18608.58	2709.239	6.868561	0.0000
AR(1)	0.996611	0.006392	155.9272	0.0000

SIGMASQ	66995.35	1059.330	63.24312	0.0000
R-squared	0.987691	AIC	13.98897	
Adjusted R-squared	0.987603	Durbin-Watson stat	1.892710	

To check the forecast quality of the ARIMA (1, 0, 0) model, the forecast was made for the last twenty observations, the chosen model ARIMA (1, 0, 0) proved to be increasingly positive and well within the plus or minus two standard errors (Figure 8.3).

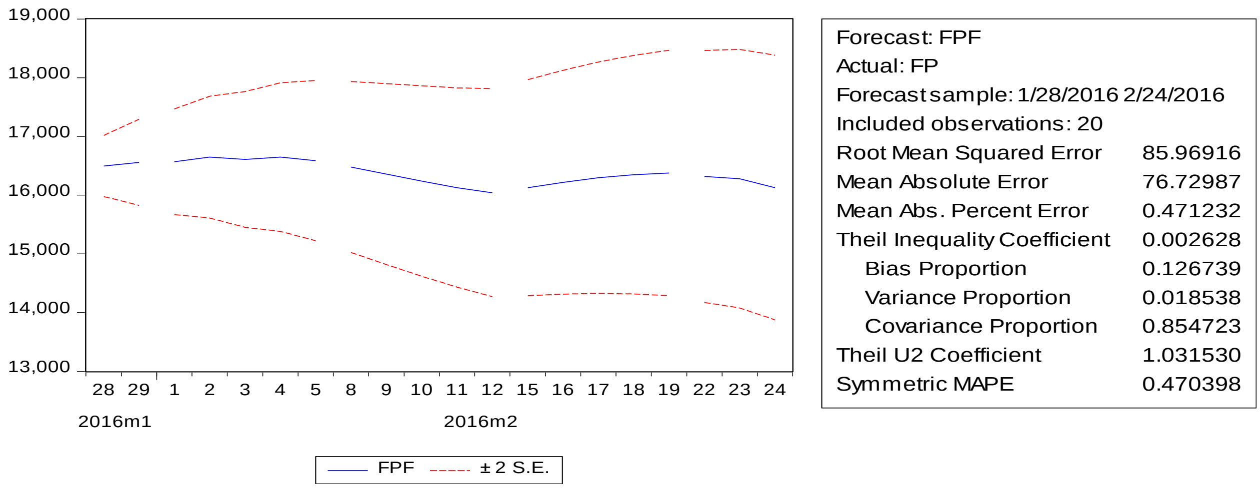


***Figure 8.3*:** Forecast of ARIMA (1.0, 0) (Cotton)

8.3.2.4 Rubber (Near Month)

The series is not stationary at level (See Chapter VII) and hence it was differenced once to make it stationary. ARIMA (1, 0, 0) was identified as the best fit with statistical significance (See Figure C3-Criteria Graph, Appendix C). The select model ARIMA(1, 0, 0) was able to achieve greater randomness in the behavior of the prices, there was no presence of autocorrelation (ACF) and partial autocorrelation (PACF) in the residuals, the Q statistic probabilities confirmed the absence of auto correlation in the residuals (See Table C10, Appendix C), indicating that the model chosen is a good fit.

Table 8.4

ARIMA (1, 0, 0) Model (Rubber NM)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	14227.04	3687.828	3.857836	0.0001
AR(1)	0.985094	0.014693	67.04643	0.0000
SIGMASQ	636135.6	11182.32	56.88762	0.0000
R-squared	0.973183	AIC	16.24138	
Adjusted R-squared	0.972953	Durbin-Watson stat	1.977545	

To check the forecast quality of the ARIMA (1, 0, 0) model, the forecast was made for the last twenty observations, the chosen model ARIMA (1, 0, 0) proved to be increasingly positive and well within the plus or minus two standard errors (Figure 8.4)

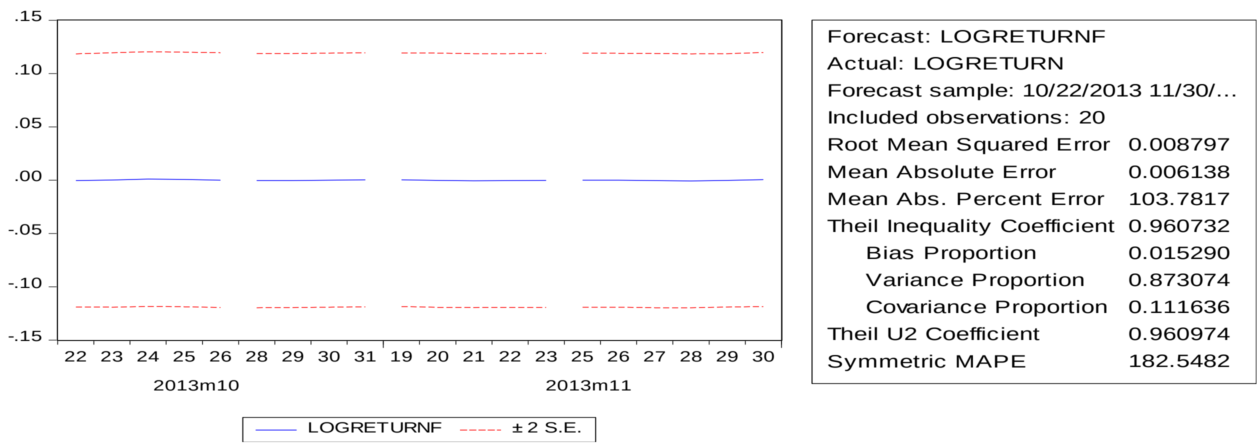


***Figure 8.4*: Forecast of ARIMA (1, 0, 0) (Rubber NM)**

8.3.2.5 Rubber (Maturity Month)

The series is stationary at level (See Chapter VII) and hence it was not differenced. ARIMA (1, 0, 0) was identified as the best fit with statistical significance (See Figure C4-Criteria Graph, Appendix C).The select model ARIMA (1, 0, 0) was able to achieve greater randomness in the behavior of the prices, there was no presence of autocorrelation (ACF) and partial autocorrelation (PACF) in the residuals, the Q statistic probabilities confirmed the absence of auto correlation in the residuals (See Table C11, Appendix C), indicating that the model chosen is a good fit.

Table 8.5

ARIMA (1, 0, 0) Model (Rubber MM)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	14681.88	3679.173	3.990539	0.0001
AR(1)	0.965698	0.035224	27.41589	0.0000
SIGMASQ	1305370.	72391.27	18.03215	0.0000
R-squared	0.936583	AIC	17.01239	
Adjusted R-squared	0.935189	Durbin-Watson stat	1.855574	

To check the forecast quality of the ARIMA (1, 0, 0) model, the forecast was made for the last twenty observations, The chosen model ARIMA (1, 0, 0) proved to be increasingly positive and well within the plus or minus two standard errors (Figure 8.5)

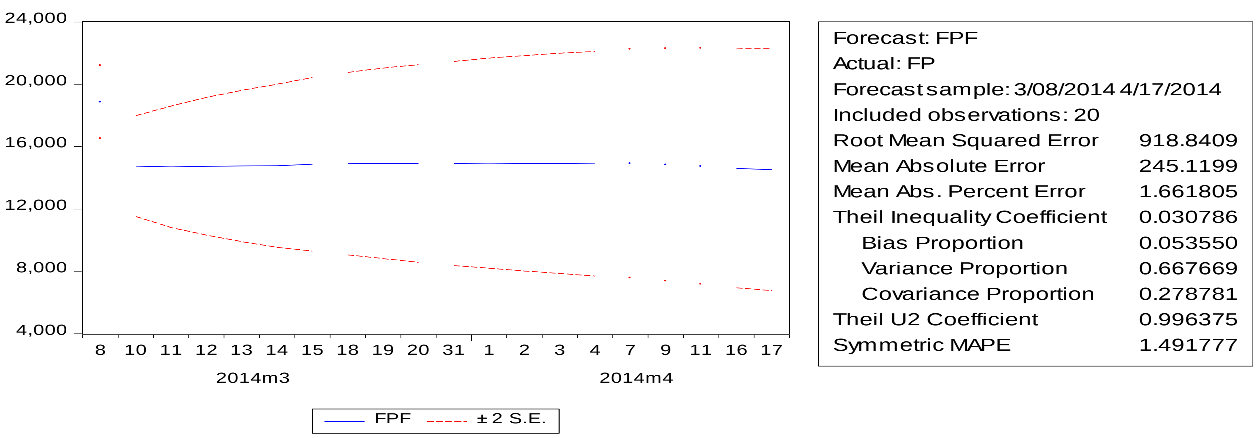


***Figure 8.5*: Forecast of ARIMA (1, 0, 0) (Rubber MM)**

8.3.2.6 Rubber (Distant Month)

The series is not stationary at level (See Chapter VII) and hence it was differenced once to make it stationary. ARIMA (2, 1, 2) was identified as the best fit with statistical significance (See Figure C5-Criteria Graph, Appendix C). The select model ARIMA(2,1,2) was able to achieve greater randomness in the behavior of the prices, there was no presence of autocorrelation (ACF) and partial autocorrelation (PACF) in the residuals, the Q statistic probabilities confirmed the absence of auto correlation in the residuals (See Table C12, Appendix C), indicating that the model chosen is a good fit.

Table 8.6

ARIMA (2, 1, 2) Model (Rubber DM)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.001733	0.001363	-1.270945	0.2064
AR(1)	0.771449	0.080963	9.528427	0.0000
AR(2)	-0.868514	0.106330	-8.168116	0.0000
MA(1)	-0.911632	0.579409	-1.573382	0.1185
MA(2)	0.998093	1.280851	0.779242	0.4375
SIGMASQ	0.000152	0.000183	0.833835	0.4062
R-squared	0.090738	AIC	-5.816930	
Adjusted R-squared	0.049408	Durbin-Watson stat	1.837110	

To check the quality of the ARIMA (2, 1, 2) model to make prices forecast, the forecast was made for the last twenty observations, the chosen model ARIMA(2, 1, 2) proved to be increasingly positive and well within the plus or minus two standard errors (Figure 8.6).

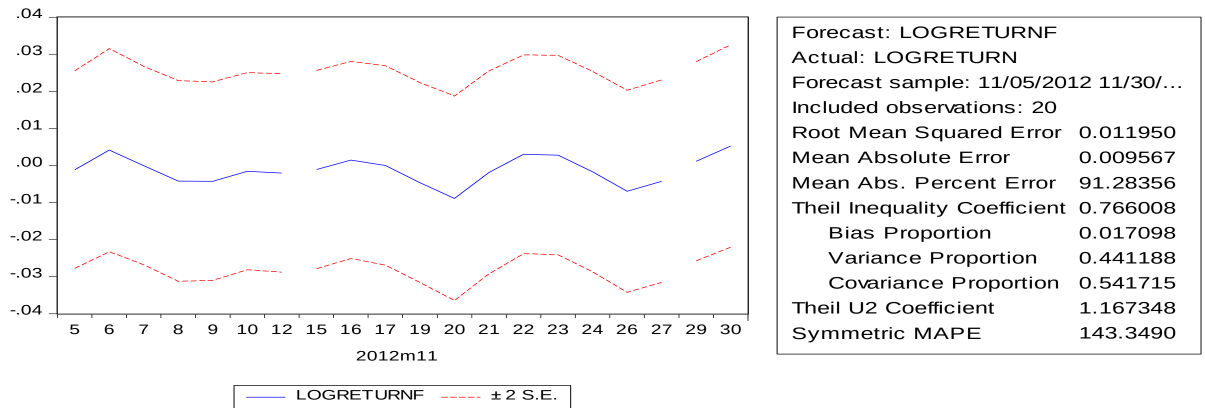


***Figure 8.6*: Forecast of ARIMA (2, 1, 2) (Rubber DM)**

8.4 Conclusion

It can be concluded that for the present study there was no ARCH effect found in the residuals of the price series of the select commodities. Hence, the data was modeled using ARIMA and validated for forecast accuracy. The selected models are displayed below.

Table 8.7

Summary of estimated ARIMA Models for the select commodities

Commodities	ARIMA
Turmeric	ARIMA(2,0,2)
Chilli	ARIMA(2,1,1)
Cotton	ARIMA(1,0,0)
Rubber Near Month	ARIMA(1,0,0)
Rubber Maturity Month	ARIMA(1,0,0)
Rubber Distant Month	ARIMA(2,1,2)

CHAPTER NINE

PRICE DISCOVERY AND RISK MANAGEMENT

9.1 Introduction

Price discovery and Risk management are the two vital functions of any derivative market. Risk Management is achieved through the process of hedging where as Price discovery is the efficiency of the futures market to absorb all the information and reflect it through the future price. Price discovery, according to **Schreiber and Schwartz (1986)**, is the process in which markets attempt to reach equilibrium prices. **Fama (1970)**, in Efficient Market Hypothesis describes a market as efficient that absorbs and reflects all the information. To remove high volumes of profit from "arbitraging on price differences", an efficient futures market send price signals to the spot market immediately, except for some transaction costs, the future prices become equals to spot prices. Futures market efficiency with "cost-of-carry (stochastic convenient yield) and no-arbitrage profit expectation" can be represented as:

$$\mathbf{F_{t,\,t\text{-}k} = S_{t,\,t\text{-}k} + d_{t}}$$

Where $F_{t,\,t\text{-}k}$ is the "futures price at time t for delivery at time t-k", d_t is the "cost-of-carry", and $S_{t\text{-}k}$ is "the expected spot price at the maturity of the contract", i.e. time t-k. If the cost-of-carry is zero or stationary, the arbitrage model implies that the "futures price is co-integrated with spot price". To ensure long-term efficiency of Indian commodity futures markets, two critical criteria must be met i.e. F and S must be integrated to the same order and they must also be co-integrated, otherwise F and S will tend to drift apart over time.

Futures are one of the most commonly traded derivatives and are more liquid when compare to spot or cash market because of high leverage, ease of shorting, low transaction cost and high transparency. This result in greater participation from traders and investors which in turn helps in quick absorption of information and aids the spot market in attainment of the equilibrium price. Futures market should be an unbiased estimator of spot market and it should lead the spot market but in reality sometimes because of the lesser participation from investors and traders or immature futures market the price discovery tends to happen in spot market. "The crux of the price discovery function hinges on whether the latest information" is reflected first in changed spot (cash) or in changed future prices **(Hoffman, 1932). Black (1976)** argues that in reaction to new information futures markets react quicker than their underlying spot markets due to advantages such as, more transparency, lower transaction costs and higher liquidity.

Risk arises in every aspect of human endeavour as it is inherent in human nature. Management of risk and risk itself both are inseparable and stakeholders exposed to risks have learnt to manage the impact of economic risk through a host of means which have grown manifold with the growing world economy. Commodity price volatility is one of such growing economic risk whose effect encompasses virtually everyone. The major risk faced by the participants of the commodity market is the price fluctuations or volatility. One of the most vital and practical applications of Commodity Futures Trading is to manage price risk through 'Hedging'. By the mechanism of hedging, the risk of price volatility or variability of a commodity can be managed. In order to hedge the position in commodity spot market, one simply have to enter an equal and opposite position in the CFM. "…Market based risk management instruments, despite several limitations; offer a promising alternative to traditional stabilisation schemes" **(World Bank, 1994).** In his article **Lokare (2007),** had mentioned many studies that have found, market-based derivative instruments sometimes as the only solution for managing commodity price volatility and also are superior. Hedging has various advantages and forms an integral part of the risk management strategies.

9.2 Significance of the Chapter

In the present study attempt has been made to examine the price discovery in commodity futures market of India. Plethora of studies have investigated price discovery in developed countries like USA. There are few studies which have investigated it in developing economies like India or China where futures market is still in nascent stage. Most of the studies in India were carried out for commodities with fewer observations of data or for commodities traded on regional exchanges. Even more the studies are very meager in India which had used the ARDL Co-integration approach, and to the best knowledge of the researcher had not come across any study using ARDL approach for price discovery and estimating hedge ratios on Indian Commodity Futures Market.

The present study intends to find out whether the futures markets have matured enough in the commodities of turmeric, chilli, cotton and rubber to discover the price. This will help the farmers and traders in increasing their bargaining power as they can take cues from the price signals of the futures market. There also exists a spate of literature which analyses the merits of hedging. The theoretical rationale on the significance of hedging is fortified with lot of analytical investigation. There is an exponential growth in recent years in the Indian Commodity Futures Market but at the same time it has undergone vicissitudes and blamed for speculative activities from time to time and even had witnessed banning of certain agri-commodities from future trading.

The present study felt the need to examine the effectiveness of Indian Commodity Futures in mitigating and managing the price risk through hedging as it has not been extensively researched for hedging effectiveness of the future contracts and in estimating the hedge ratio specifically using ARDL approach. This will help the farmers and traders to transfer their risk from spot to futures market and save themselves from the adversities of high price fluctuations in agri-commodities.

9.3 Review of Empirical Studies

Garbade and Sibler (1983) examined the price discovery function in four U.S. agricultural commodities and identified the dominance in futures market for the three liquid futures market when compare to spot market but failed to found the dominance in less liquid market. They concluded, "The evidence suggests that the cash markets for wheat, corn, and orange juice are largely satellites of the futures market for those commodities."

Brorsen, Von Bailey, and Richardson (1984) using time series analysis and causality tests investigated price discovery on Lubbock cotton spot prices and New York cotton futures prices and confirmed price discovery in cotton futures market and ascertained a unidirectional causality from futures to spot.

Kumar and Sunil (2004) examined the “price discovery in six Indian commodities exchanges for five commodities”. The empirical testing was done using ratio of standard deviations of spot and future rates. Besides, the study empirically analyzes the efficiency of the two markets by employing the "Johansen co-integration technique". They found the inability of CFM to incorporate information fully and confirmed inefficiency of futures market and concluded that the Indian agricultural CFM are not yet efficient and mature.

Chopra & Bessler (2005), found the presence of "price discovery for black pepper in the Kerala spot market and the nearby and first distant" futures markets using modern time series methods like ECM for co-integration and directed acyclic graphs. They elaborated that "evidence is ambiguous as to whether that discovery is in the nearby (the month closest to delivery) or distant contract (delivery beyond one month into the future). This evidence is somewhat different from that reported from the United States where, for agricultural commodities, the nearby contract is clearly the centre of price discovery. Possible reasons for this difference in incidence of price discovery are discussed and questions for future research are proposed".

Karmakar (2009) investigated the price discovery and volatility spillover using Johansen Co-integration and the VECM approach and found causality between the Nifty Index and its near month future and established a bidirectional relationship between the spot and futures market.

Mahalik, M.K., Acharya, D., & Babu, S.M. (2009), examined volatility spillovers and price discovery in Indian spot and CFM by using Johansen co-integration, VECM and the bivariate EGARCH model. They had used four spot and futures indices of MCX, Mumbai and employed daily data ranging from 12th June, 2005 to 31st December, 2008. The Vector Error Correction model results showed that commodity futures markets like natural logarithm of agriculture future price index (LAGRIFP), aggregate commodity index (LCOMDEXFP) and energy future price index (LENERGYFP) served the "price discovery" function in the spot market, indicating a flow of information from future to spot commodity markets, there was no co-integrating relationship found between metal spot price index (LMETALSP) and metal future price index (LMETALFP). The bivariate GARCH model results indicated that although the changes in one market can be predicted by the volatility in another market, the volatility spillovers from future to spot market are predominant in the case of LCOMDEX and LENERGY index while LAGRISP acts as a source of volatility towards agri-futures market.

Iyer Vishwanathan and Archana Pillai(2010), examined price discovery process and rate of convergence of information from spot market to futures market and vice versa. They took six commodities- nickel, copper gold, silver, and Gram (Chana). They used a two-regime threshold auto-regression method and a two-regime threshold vector auto-regression (TVAR). Their result supported the existence of price discovery in Indian commodity exchanges. Further, slow convergence of information in case of agricultural commodities and a high rate of convergence of information in case of metals had been found between different markets.

Sehgal, Rajput, & Dua(2012) examined price discovery in ten agricultural commodities "Chana, guar seeds, soya bean, Potato Agra, Kapas, Turmeric, Black Pepper, Barley, Maize and Castor seeds", and they confirmed price discovery in futures for all commodities besides "Turmeric". They used Johansen's Co-integration and Granger causality for the analysis of ten agricultural commodities, and found bi-directional Granger lead relationships between futures and spot in all agricultural commodities except

Turmeric in which there is no co-integration and hence no causality and is informationally inefficient.

Murugananthi, Shivakumar, Ajjan, & Sivakumar, (2013) confirmed the price discovery in turmeric futures market in India using Johansen's co-integration and Granger Causality. This paper investigated the relationship between turmeric spot price prevailed in Erode market and futures price traded on National Commodity and Derivatives Exchange (NCDEX) for over a period of eight years (2004 -2012). It was found that futures price of turmeric led the spot market and unidirectional causality was confirmed from futures market to spot market. In the short run, when the turmeric series was in disequilibrium the results of Vector Error Correction model indicated that greater adjustment was made by the spot price to re-establish the equilibrium. The result of the study confirmed that the turmeric futures market is efficient, since it played a fair role in price discovery and there is price transfer from futures to spot market.

(Jain & Biswal) examines the price discovery and information sharing relationships between the "S&P CNX NIFTY" index and its futures using An Autoregressive Distributed Lag (ARDL) Bounds Test for co-integration and found that the spot index and its futures are co-integrated and used augmented VAR approach of Toda & Yamamoto to test for direction of causality in prices. Results indicated higher efficiency in the spot market i.e. unidirectional causality from spot to futures market was confirmed.

Blau (1944) stated "commodity futures exchanges are market organisations especially developed for facilitating the shifting of risks due to unknown future changes in commodity prices; i.e., risks which are of such a nature that they cannot be covered by means of ordinary insurance." Research work on 'hedging' has its theoretical underpinnings to **Keynes (1939)** and **Hicks (1939)**, **Working (1948)** and **Markowitz (1959);** the Keynes–Hicks hypothesis states "risk reduction is the prime motive of hedging and hedgers pay a premium to speculators who assume these risks." Traditionally, hedging has been motivated by the "desire to reduce risk by taking a position opposite to the exposure. Hedging is defined as taking equal but opposite positions in the cash and futures market. The quest for better hedge has always been elusive". In empirical financial research, the productive use of futures contract in hedging decisions has become center of debate for finding out 'optimal hedge ratio' and 'hedging effectiveness'**. Johnson (1960) and Stein (1961)** adopted a portfolio approach and their portfolio theory states that primary use of hedging is insuring against price risks, and the optimal hedging strategy is to integrate price risk avoidance with expected utility or profit maximization Existence of basis risk is recognized by the portfolio approach and by minimizing the variance of spot-futures portfolio determines the optimal futures position.

On these lines, **Ederington (1979)** defined hedging effectiveness as a percent reduction in the variance between the unhedged and the hedged returns. Optimal hedge ratio until then had been estimated using the OLS and the R-squared of the regression on historical returns of futures and spot prices had been considered as the measure of hedging effectiveness. Optimal hedge ratio or minimum variance hedge ratio should be the one that generates the minimum portfolio variance. The determination of the optimal hedge ratio and hedging effectiveness is one of the important theoretical issues.

Kroner and Sultan (1993) argued that if there is a co-integrating relationship between the futures and the spot returns then the hedge ratio obtained from OLS, becomes a biased one and vector error correction model should be used to estimate the optimal hedge ratio. They estimated the MV hedge ratio for the five currencies using the error-correction model with a GARCH error. Both within-sample and out-of-sample evidence showed that the hedging strategy proposed by them was potentially superior to the conventional strategies.

Ghosh (1993), did an analysis of three indices the S&P 500 futures using the Engle–Granger two-step test, and found S&P 500 futures price to be co-integrated with each of the three spot prices: DJIA, S&P 500 and NYSE. Using the error-correction model (ECM), the hedge ratio was estimated and Out-of-sample performance was found to be better for the hedge ratios from the error-correction model compared to the Ederington model.

Kumar, Singh, and Pandey (2008), examined "hedging effectiveness of futures contract on a financial asset and commodities in Indian markets". They estimated dynamic (VAR-MGARCH) and constant hedge ratio (OLS, VAR, and VECM) for S&P CNX Nifty index futures, Gold futures and Soybean futures. They found that in most of the cases estimates from time varying hedge ratio provided highest variance reduction when compared to constant hedge ratio.

Dey and Maitra, (2012), selected 'pepper' as a commodity to explore the price discovery with a series of tests, namely co-integration, error correction with weak exogeneity, Granger causality, and forecast error variance decomposition and confirmed unidirectional causality from futures to spot prices in the Indian pepper futures market, the adjustment of shocks or innovations in the futures market was found to be relatively faster than that of the spot market.

Dey and Maitra, (2016), examined whether commodity futures markets in India helped rationalize farmers' price expectation or not. "It has become an ongoing debate whether Indian commodity futures markets can accommodate farmers. The study starts with questions on the efficiency and other roles of commodity futures markets." They studied efficiency, causality and divergence/convergence of futures markets of pepper, coffee, and natural rubber (NR) by employing error correction, co-integrations, and causality models. Their analysis showed that pepper futures market is efficient in price discovery, while NR and coffee spot markets did the process faster. Coffee and pepper spot and futures prices exhibit the convergence; NR showed sign of divergence. Unidirectional causality was observed in pepper futures to spot while, bidirectional causality was observed in coffee and rubber.

Nambiar and Balasubramanian (2016), analysed and compared price behaviour in Indian Rubber Spot and Future prices during pre recession and post recession. They collected daily closing prices of rubber futures and spot during the year 2004-2014 from NMCE, and used Vector autoregressive (VAR) method for assessing the short run causality between the two price series of Rubber. Their results revealed that during the post recession period the Rubber futures had played its inherent function of price discovery.

The effect of the maturity on hedging effectiveness of futures was examined by **Ripple and Moosa (2007).** Monthly and daily data for near month and distant month contracts of crude oil futures and spot prices were analysed for the estimation of hedge ratio and hedging effectiveness. The empirical results revealed that hedging of futures is more effective for near month contracts than distant month contracts. They suggested that this could be because of higher correlation between spot prices and near month futures prices than with distant futures prices. The result also revealed that hedge ratios were lower for near month hedging.

Yang (2001), considered "….three months futures contracts and rolled over to the next three months contracts on the first day of delivery month. OLS Regression, BVAR, ECM and MGARCH methods have been used." He found that out of three constant hedge ratios derived from the above mentioned methods, ECM generated highest hedge ratio value and that MGARCH dynamic hedge ratios provided the greatest degree of variance reduction but generated the smallest rate of return. The hedge ratio estimated from the conventional OLS regression model performed the worst in terms of reducing portfolio variance, but yielded the highest rate of return.

Lee, C.-F., Lin, F. L., Tu, H. C. and Chen, M (2009) compared the estimation of hedge ratio and hedging effectiveness within three alternative models of error correction model (ECM) and Auto Regressive Distributed Lag (ARDL) co-integration models and ordinary least squares (OLS) model, using six index futures contracts where the futures prices were associated with nearest-to-maturity contracts futures contracts. The empirical results of their study showed that the OLS, ECM and short-run ARDL hedge ratios were different for different hedging horizons and approach the naive hedge ratio of unity as the length of hedging period was increased and the estimates of the long-run ARDL hedge ratios were close to the naive hedge ratio of unity. In addition, the in-sample hedging effectiveness, in terms of portfolio variances, tends to decrease when the hedging horizon increases. The out-of-sample hedging effectiveness of the, short-run ARDL and long-run ARDL, ECM hedge ratios outperformed the OLS hedge ratio. It can be concluded from their findings that the length of time interval had an important impact on in-sample hedging effectiveness and the estimation of hedge ratio, but the effect was minimal for the out-of-sample periods.

Dinica and Armeanu (2014), estimated the optimal hedging ratio of the non-ferrous metals traded on the London Metals Exchange using three methods: the error-correction model, the ordinary least squares regression, and the auto regressive distributed lag model. The results showed that the optimal hedge ratio and hedging effectiveness had increased with the hedging horizon, converging to one for long tenors. Their findings also showed greater in-sample hedging effectiveness for more complex models, but the increase in performance was not significant for the out-of-sample analysis.

E.R. Salvadi and P. Ramasundaram (2008), found commodity futures market in India had failed to provide an efficient hedge against the price risk specifically in agricultural commodities. The results showed there is no price discovery because there was no integration of futures and the spot market. Exchange specific factors like infrequent trading, non awareness of future market among farmers, low market depth and thin volume, lack of effective participation of members, etc attributed to the market imperfection.

Kumar Brajesh and Pandey Ajay (2009), examined hedging effectiveness of seven non-agricultural (Gold, Silver, Copper, Aluminium, Zinc, Crude oil and Natural gas) and four agricultural (Soybean, Corn, Guar seed and Castor seed) futures contracts traded in India. Using vector error correction model (VECM) and CCC-MGARCH model they estimated constant hedge ratio and dynamic hedge ratios respectively and found that futures contracts of agricultural commodities provide higher hedging effectiveness (30-70%) as compared to futures of non-agricultural commodities (20%).

Narsimhulu and Satyanarayana S.V. (2016) examined the efficiency of Indian agri-commodity futures in price discovery and risk management in India, using Johansen's test of co-integration (VECM), Wald chi-square test, and Granger causality test. The risk-management function was investigated using OLS (ordinary least squares) method and VECM to determine optimal hedge ratio (OHR) and hedge effectiveness (HE). Daily closing spot and future prices of Chana, Chilli, and Turmeric (commodities traded on NCDEX) for a period of 10 years (2004 – 2013) were analysed and was found that there was a long-run relationship between commodity spot and futures prices of the three commodities. "…. The VECM results revealed that there is a long-run causality running from futures prices to spot prices, which enable the spot market to adjust its short-run deviations from long-run equilibrium path with nearly 2.17%, 2.78%, and 4.41% speed of adjustments in Chana, Chilli, and Turmeric, respectively. The Granger causality test results revealed that there is only a unidirectional causality from futures returns to spot returns of commodities - Chilli and Turmeric.

However, in the case of Chana, there is a bi-directional causality between futures and spot returns. According to hedge ratios of OLS and VECM results, it was found that the commodity futures provide 50%, 56%, and 55% variance reduction in their spot prices of Chana, Chilli, and Turmeric, respectively. It was observed that the commodity futures were more effective in hedging, and the near month futures contracts are suitable for hedging".

Ali and Gupta (2011), assessed the relationships between spot prices and future market prices of major Indian agricultural commodities, traded at National Commodity & Derivatives Exchange Ltd, using Johansen's co-integration analysis and Granger causality tests. Results revealed significant co-integration in futures and spot prices for all the commodities (maize, chickpea, castor seed, pepper, black lentil, soybean and sugar) except for wheat and rice. The causality test categorizes the commodities based on direction of relationship between spot and future prices. Short term relationship by causality anlaysis suggested that futures market have stronger ability to predict subsequent spot prices for chickpea, castor seed, soybean and sugar as compared to maize, pepper and black lentil, where bi-directional relationships exist in short run.

9.4 Methodology

The rationale behind using the concept of co-integration is that it confirms a long-run equilibrium relationship between the two price series though in the short-run, they may drift from each other but they will be brought back together by the market forces. **Wang and Ke (2005)** explained use of co-integration or long run relationship for investigating the efficiency in futures market as on price convergence, it provides predictive signal.

The co-integration is a necessary condition between the spot price and futures price for market efficiency as it confirms that there exist a long-run equilibrium relationship between the spot and future series. It is imperative to test the causality to assess the direction of relationship among the spot and future series **(Moosa, 1999; Bryant *et al.*, 2006).** Most of the studies have used Johansen Co-integration to investigate price discovery which necessitates that the series should be integrated of the same order, amongst other restrictions, and therefore depends on the power of unit root tests being used. It also suffers from the problem of endogenity.

These drawbacks have been overcome by recently developed Auto Regressive Distributed Lag (ARDL) bounds test proposed by **Pesaran and Shin (1999) and Pesaran et al. (2001)** to test for co-integration. ARDL model can be used for I(0) or I(1) data or even for fractional integrated data. It cannot be used for data of I(2) order. The estimates obtained from ARDL method are unbiased and efficient as it can differentiate dependent and explanatory variables solving the problem of endogenity and also problems arising in the presence of serial correlation. It also allows for uneven lags unlike Johansen co-integration test.

Thus, ARDL is a more robust test when compare to Johansen test. The ARDL model is a general dynamic specification. "It regresses the differenced form of the dependent variable on lagged forms of the differences and level of the independent variables".

Eviews 9.5 have come with the new feature for developing ARDL model, making the lag and best model selection much easier. For the given maximum lag specified by the user, this test automatically develops the best model for the selected criteria.

In the second stage the ARDL Bound test is run for examining the long run relationship between the two variables. There are two critical values, lower bound and upper bound values. If the sample statistic falls below the lower critical value the null hypothesis of 'no co-integration' is rejected and if the sample statistic is above the upper bound value the null is rejected and the altenate hypothesis that there exists long run relationship is accepted. If the sample statistic falls between the lower and upper bound then the result is inconclusive. If there exists long run equilibrium between the two variables then short run dynamics can be investigated using the Wald test.

A statistically significant error correction coefficient indicates the speed of adjustment towards (the long-run equilibrium) in response to a short-run deviation and suggests that this market reacts to any disequilibrium between futures and spot prices. This is identical to saying that "this market adjusts to price movements originating in the other market**" (Garbade and Silber, 1983)**. Once the ARDL model has been estimated, **Pesaran and Pesaran (1997)** suggested applying the cumulative sum of recursive residuals (CUSUM) and the CUSUM of square (CUSUMSQ) tests to assess the parameter constancy. CUSUM tests were proposed by **Brown et al. (1975)**.

Pesaran (1997) argued that "the existence of long-run relationship between the futures price F_t and spot price S_t does not depend on whether F_t is I(1) (i.e. $\rho_f = 1$). Without loss of generality, he assumed that $|\rho_s| < 1, \gamma \neq 0, \lambda = 0$.

$$\Delta S_t = \alpha_s(1-\rho_s) - (1-\rho_s)S_{t-1} + \gamma F_{t-1} + \varepsilon_{s,t} \quad (1)$$

$$\Delta F_t = \alpha_f(1-\rho_f) - (1-\rho_f)F_{t-1} + \varepsilon_{f,t} \quad (2)$$

Under the assumptions that ε_s and ε_f are jointly normally distributed,

$$\varepsilon_{s,t} = (\sigma_{sf} / \sigma_f^2)\, \varepsilon_{f,t} + v_t.$$

Using this result in Equation (1) and (2),

$$\Delta S_t = \alpha_1 + \alpha_2 S_{t-1} + \alpha_3 F_{t-1} + \beta \Delta F_t + v_t \tag{3}$$

where

$\alpha_1 = \alpha_s (1-\rho_s) - \alpha_f (\sigma_{sf} / \sigma_f^2)(1-\rho_f)$, $\alpha_2 = -(1-\rho_s)$, $\alpha_3 = [\gamma + (\sigma_{sf} / \sigma_f^2)(1-\rho_f)]$ and

$\beta = (\sigma_{sf} / \sigma_f^2)$."

Chen, Lee and Shrestha (2004) have applied the Equation (3) to "simultaneously obtain the short-run hedge ratio given by the estimate of β and the long-run hedge ratio given by the estimate of $-\alpha_3/\alpha_2$". The equation (3) is valid if both spot and futures price series are stationary and or both the series are unit-root processes and are co-integrated. For the "in-sample analysis", the HE is given by the "adjusted R^2" statistic. It can be defined as the "ratio of the variance of the unhedged position minus variance of hedge position over the variance of unhedged position". It indicates the variance of the "un-hedged portfolio" that was eliminated through hedging. The models having the greatest values of R^2 will be considered as the most effective for the hedging purpose.

Co-integration tests cannot find the lead lag relationship between the variables. This relationship is important in price discovery and can be determined using Granger Causality test. According to **Granger (1969),** if X is causing Y, then the values of Y can be predicted accurately using the past or lagged values of X. According to Granger Theorem if there exist a long run relationship or co-integration between the two variables then there must be causality between the two. This causality can be unidirectional where the information flows only from one market to another or it can be bidirectional where the information flows from both the market and exert pressure on each other.

If the co-integration test results indicate that the variables are co-integrated, then the Vector Error Correction (VEC) model estimation is used. The long-run relationship or co-integration between the variables indicates that there is Granger Causality in at least one direction which can be known by the lagged error-correction term and the F-statistic. The significance of t-statistic on the coefficient of the ECTt-1 (Lagged Error Correction Term) represents the long-run causal relationship whereas the short-run causality is represented by the F-statistic on the regressor (explanatory) variables. The equation where the 'null hypothesis of no co-integration' is rejected is estimated with an error-correction term.

The present study had employed ARDL Co-integration model because it is a more robust model when compared to Johansen Co-integration and to the best of the researcher's knowledge there are no Indian studies available using ARDL to examine the price discovery or to estimate optimal hedge ratios of Indian Commodity Futures Market.

9.5 Result

9.5.1 Turmeric

ARDL model was estimated for log values of FP and SP variables of Turmeric (Distant Month) data, using E-views 9.5. Two models were selected taking SP and FP as dependent variable. The maximum number of lags for principal regressor and the dependent variable was set as eight. Also, intercept and linear trend as (fixed) regressors have been chosen. (i.e, they won't be lagged.).

Akaike Information Criterion (AIC) had been selected as the basis for determining the lag orders for the regressors. Finally model ARDL (3, 2) (SP as dependent variable) with R square value as 0.997(see Table D1, Appendix D) and ARDL (2, 1) (FP as dependent model) with R square value as 0.996 were selected (see Table D3, Appendix D), it can also be seen how well the top twenty model specifications have performed in terms of minimizing AIC (see Figure D1-Criteria Graphs, Appendix D)

Now, it was pertinent to check for the residuals of the select ARDL (3, 2) and ARDL (2, 1) model for serial independence, as the parameter estimates would not be consistent because of the lagged values of the variable SP and FP that appeared as regressors in the respective model.

The estimated ARDL (3, 2) and ARDL (2, 1) model should be checked for serial correlation and stability. The following tests have been used for the same:

Table 9.1

Breusch-Godfrey Serial Correlation LM Test for Turmeric

Dependent Variable SP

F-statistic	0.200732	Prob. F(2,1163)	0.8182
Obs*R-squared	0.404776	Prob. Chi-Square(2)	0.8168

Dependent Variable FP

F-statistic	0.144257	Prob. F(2,1166)	0.8657
Obs*R-squared	0.290422	Prob. Chi-Square(2)	0.8648

To check for the presence of serial correlation in residuals, Breusch-Godfrey Serial Correlation LM Test was used. As seen, from the test result displayed in table 9.1, the F-statistic is 0.2007(0.144), and R square value is 0.4047(0.290), hence the Null of “No Serial Correlation” can be accepted. Therefore, ARDL (3, 2) and ARDL (2, 1) are free of serial correlation.

CUSUM Test for stability

Cusum test had been used to test the stability of the model. From the below figure 9.1, it is clearly evident that the model is stable. The blue line is well within the two dotted red lines.

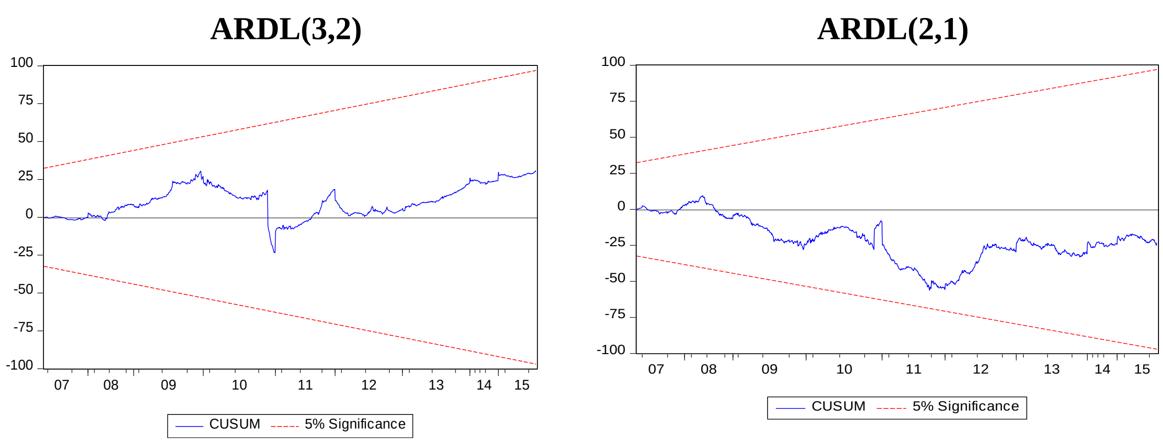


Figure 9.1: **CUSUM test for stability (Turmeric)**

The next step is to check for co-integration between the two variables FP and SP and vice versa. ARDL Bound Test had been used for this study, to test the co-integration between the variables. The following table displays the output of the ARDL Bound Test:

Table 9.2

ARDL Bounds Test (Turmeric)

Null Hypothesis: No long-run relationships exist

Dependent Variable: SP			Dependent Variable: FP		
Test Statistic	Value	k	Test Statistic	Value	k
F-statistic	17.99578	1	F-statistic	7.170923	1
Critical Value Bounds			Critical Value Bounds		
Significance	I0 Bound	I1 Bound	Significance	I0 Bound	I1 Bound
10%	4.05	4.49	10%	4.05	4.49
5%	4.68	5.15	5%	4.68	5.15
2.5%	5.3	5.83	2.5%	5.3	5.83
1%	6.1	6.73	1%	6.1	6.73

The table 9.2 above displays the result of Bound test for both the models, F-statistic for the Bounds Test is 17.99578 (7.17)[6], and it has clearly exceeded even the 1% critical value for the upper bound. Hence, the hypothesis of "No Long-Run Relationship" can be rejected strongly for both the models. There exist a strong long run relationship between the future price and spot prices of Turmeric (Distant Month Contracts) commodity. There is co-integration between the series indicating Granger causality at least in one direction, to determine the direction of Granger Causality F-statistic should be significant and lagged error term should be negative and significant. The ARDL co integrating and long run form for the two models is display in table below

[6] Note: The value in parentheses is for the second model where log(FP) is the dependent variable. From, here now the values in parenthesis will denote the values of second model where log(FP) is the dependent variable.

Table 9.3

ARDL Co-integrating and Long Run Form (Turmeric)

Dependent Variable	Variable	Coefficient	Std. Error	t-Statistic	Prob.
SP	CointEq(-1)	-0.068157	0.009268	-7.353912	0.0000
Long Run Coefficients	LOG(FP)	1.031045	0.023737	43.436900	0.0000
	@TREND	-0.000060	0.000036	-1.665511	0.0961
Cointeq1 = LOG(SP) - (1.0310*LOG(FP) -0.0001*@TREND)					
FP	CointEq(-1)	-0.052396	0.011287	-4.642155	0.0000
Long Run Coefficients	LOG(SP)	0.918348	0.035586	25.806283	0.0000
	@TREND	0.000031	0.000055	0.565913	0.5716
Cointeq2 = LOG(FP) - (0.9183*LOG(SP) + 0.0000*@TREND)					

From table 9.3; as required, the error-correction coefficient is negative -0.068157(-0.05239), and is very significant. Therefore, the speed of adjustment towards long run equilibrium is 6.815% (5.23%) for a single period (for the present study it is daily i.e., one day). The co-integration equations for both the models are reported and it can be inferred from the equation 1 that if there is a one percent change in variable FP then variable SP will also change by one percent and from equation 2, if there is one percent change in variable SP, variable FP will change by 0.91 percent The long-run coefficients from the co integrating equations are also reported with their respective standard errors and they are significant.

As, the long run relationship between the variable FP and variable SP had been established, the short run dynamics can also be investigated. The study had used Wald Test for the same. The output of the WALD test is display in the table 101. The F statistic value of Wald Test is 88.97 (245.53) and chi square value is 177.94 (245.53); the null hypothesis "c(5)=c(6)=0"("c(4)=0") is clearly rejected and therefore it can be reported that there exist short run relationship from FP to SP and also from SP to FP.

Table 9.4

Short Run Causality (Wald Test) (Turmeric)

Dependent Variable: SP; Null Hypothesis: C(5)=C(6)=0			
Test Statistic	**Value**	**df**	**Probability**
F-statistic	88.97348	(2, 1165)	0.0000
Chi-square	177.9470	2	0.0000
Dependent Variable: FP; Null Hypothesis: C(4)=0			
F-statistic	245.5320	(1, 1168)	0.0000
Chi-square	245.5320	1	0.0000

Long run hedge ratio ($-\alpha_{F(-1)}/\alpha_{S(-1)}$) can be calculated as 0.3816 and short run hedge ratio (β) is 1.031. Hedging effectiveness (Adj. R square) is 25% (see Table D2, Appendix D).

9.5.2. Rubber (Maturity Month)

The maximum number of lags for principal regressor and the dependent variable is set as eight. Also, 'Restricted Linear Trend' as (fixed) regressor had been chosen for both the models. Akaike Information Criterion (AIC) had been selected as the basis for determining the lag order for the regressors. Model ARDL (1, 8) (where SP as dependent variable) with R square value as 0.999(see table D5, Appendix D), and ARDL (8, 1) (where FP as dependent variable) with R square value of 0.999 (see table D7, Appendix D) were selected, it can also be seen how well the top twenty model specifications have performed in terms of minimizing AIC. (see Figure D2- Criteria Graphs, Appendix D).

The estimated models ARDL (1, 8) and ARDL (8, 1) are checked for serial correlation and stability. As seen, from the test result displayed in table 9.5, the F-statistic is 0.0924 (0.1089), hence the Null of “No Serial Correlation” can be accepted and therefore both the ARDL models are free of serial correlation.

Table 9.5

Breusch-Godfrey Serial Correlation LM Test (Rubber-MM)

F-statistic	0.092414	Prob. F(2,72)	0.9118
Obs*R-squared	0.220201	Prob. Chi-Square(2)	0.8957
F-statistic	0.108983	Prob. F(2,72)	0.8969
Obs*R-squared	0.259562	Prob. Chi-Square(2)	0.8783

CUSUM Test for stability

Cusum test have been used to test the stability of the models. From the figure 9.1 below, it is clearly evident that the models are stable.

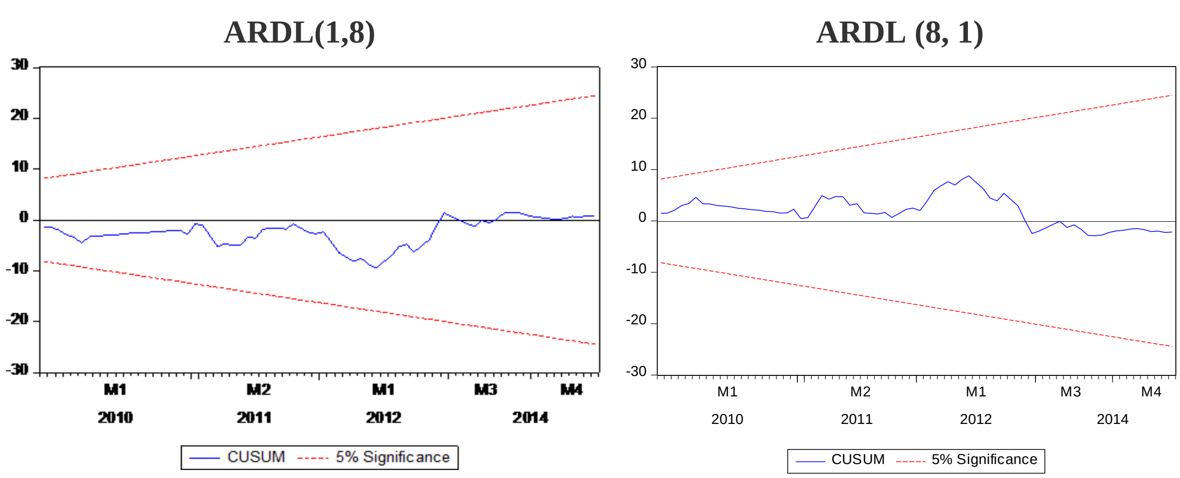


Figure 9.2: **CUSUM test for stability (Rubber MM)**

Table 9.6

ARDL Bounds Test (Rubber MM)

Null Hypothesis: No long-run relationships exist

ARDL(1, 8)			**ARDL(8, 1)**		
Test Statistic	Value	K	Test Statistic	Value	k
F-statistic	11.68755	1	F-statistic	11.11299	1
Critical Value Bounds			Critical Value Bounds		
Significance	I0 Bound	I1 Bound	Significance	I0 Bound	I1 Bound
10%	4.05	4.49	10%	4.05	4.49
5%	4.68	5.15	5%	4.68	5.15
2.5%	5.3	5.83	2.5%	5.3	5.83
1%	6.1	6.73	1%	6.1	6.73

F-statistic for the ARDL (1, 8) Bounds Test is 11.6875, and for ARDL (8, 1) is 11.112, for both the models, it has exceeded even the 1% critical value for the upper bound. Hence, the hypothesis of "No Long-Run Relationship" can be rejected strongly. There exist a long run relationship between the future prices and spot prices of Rubber (Maturity Month).

If there is co-integration between the two series then there must be Granger Causality at least in one direction. The ARDL co-integrating and long run form have been displayed in table 9.7

Table 9.7

ARDL Co-integrating and Long Run Form (Rubber MM)

Dependent Variable	Variable	Coefficient	Std. Error	t-Statistic	Prob.
SP	CointEq(-1)	-0.604810	0.100787	-6.000858	0.0000
Long Run Coefficients	LOG(FP)	1.001774	0.006145	163.023090	0.0000
	@TREND	0.000010	0.000070	0.146249	0.8841
Cointeq (1)= LOG(SP) - (1.0018*LOG(FP) -0.0000*@TREND)					
FP	CointEq(-1)	-0.576443	0.098512	-5.851497	0.0000
Long Run Coefficients	LOG(SP)	0.997566	0.006231	160.107697	0.0000
	@TREND	-0.000015	0.000071	-0.204796	0.8383
Cointeq (2)= LOG(FP) - (0.9976*LOG(SP) -0.0000*@TREND)					

As required, the error-correction coefficient for both the models are negative -0.604 (-0.576), and are very significant (0.00). Thus, there exist bi-directional causality between FP and SP. Both spot and futures market of Rubber Maturity Month assimilate new information and help in price discovery.

In short run, the speed of adjustment towards long run equilibrium is 60.48% (57.64%) of Spot and Futures market respectively for a single period (for the present study it is daily i.e., one day).

The co- integration equations 1 and 2 for both the models are reported and it can be inferred from the equation 1 that if there is a one percent change in variable FP then variable SP will also change by one percent and from equation 2, if there is one percent change in variable SP, variable FP will also change by 0.99 percent The long-run coefficients from the co-integrating equations are also reported with their respective standard errors and they are significant.

As, the long run relationship between the variable FP and variable SP had been established, the short run causality can also be investigated. The output of the WALD test is displayed in the table 109. The F statistic value of Wald Test is 4.654(15.389); the null hypotheses "C(3)=C(4)=C(5)=C(6)=C(7)=C(8)=C(9)=C(10)=0" and "C(10)=0" are clearly rejected and therefore it can be reported that there exist short run causality from FP to SP and also from SP to FP.

Table 9.8

Short Run Causality (Wald Test) (Rubber MM)

Dependent Variable: SP; Null Hypothesis: C(3)=C(4)=C(5)=C(6)=C(7)=C(8)=C(9)=C(10)=0			
Test Statistic	**Value**	**df**	**Probability**
F-statistic	4.654960	(8, 74)	0.0001
Chi-square	37.23968	8	0.0000
Dependent Variable: FP; Null Hypothesis: C(10)=0			
F-statistic	15.38904	(1, 74)	0.0002
Chi-square	15.38904	1	0.0001

Long run hedge ratio ($-\alpha_{F(-1)}/\alpha_{S(-1)}$) can be calculated as 1 and short run hedge ratio (β) is 1.. Hedging effectiveness (Adj. R square) is 99.04% (see Table D6, Appendix D).

9.5.3 Rubber (Near Month)

The maximum number of lags for principal regressor and the dependent variable is set as eight. Also, Restricted Constant as (fixed) regressors have been chosen for model 1 (where SP is the dependent variable) and for model 2 (where FP is the dependent variable) none had been taken as the fixed regressor. Akaike Information Criterion (AIC) had been selected as the basis for determining the lag order for the regressors.

There are one seventy two different ARDL models that were considered, but finally model ARDL (2, 2) with R square value as 0.999 (see table D13, Appendix D) and ARDL (2, 2) with R square value of 0.99 (see table D15, Appendix D) were selected, it can also be seen how well the top twenty model specifications have performed in terms of minimizing AIC (see Figure D4- Criteria Graphs, Appendix D).

The estimated models ARDL (2, 2) and ARDL (2, 2) are checked for serial correlation and stability. As seen, from the test result displayed in table 9.9, the F-statistic is 0.772 (0.709), hence the Null of "No Serial Correlation" can be accepted and therefore both the ARDL models are free of serial correlation.

Table 9.9

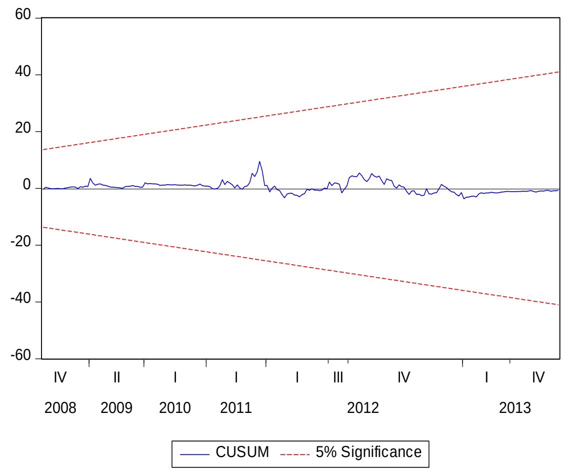
Breusch-Godfrey Serial Correlation LM Test (Rubber NM)

F-statistic	0.772549	Prob. F(2,227)	0.4630
Obs*R-squared	1.581977	Prob. Chi-Square(2)	0.4534
F-statistic	0.709185	Prob. F(2,227)	0.4931
Obs*R-squared	1.453029	Prob. Chi-Square(2)	0.4836

CUSUM Test for stability

Cusum test had been used to test the stability of the models. From the figure 9.3 below, it is clearly evident that the models are stable.

ARDL(2,2) **ARDL(2,2)**



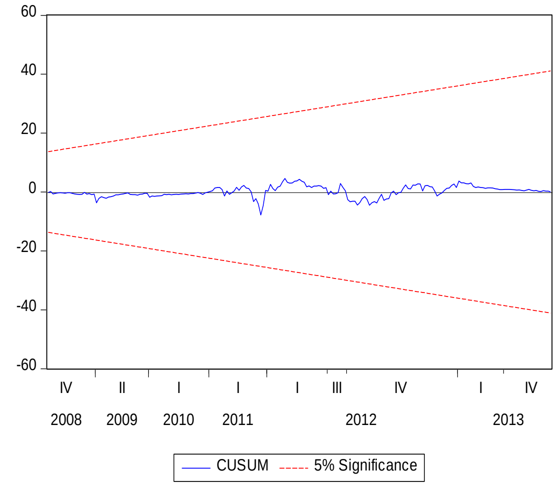


Figure 9.3: CUSUM test for stability (Rubber NM)

The next step is to check for co-integration between the two variables FP and SP. The following table 9.10 displays the output of the ARDL Bound Test:

Table 9.10

ARDL Bounds Test (Rubber NM)

Dependent Variable: SP			Deperndent Variable: FP		
Test Statistic	Value	k	TestStatistic	Value	k
F-statistic	5.6768	1	F-statistic	6.178	1
Critical Value Bounds			Critical Value Bounds		
Significance	I0 Bound	I1 Bound	Significance	I0 Bound	I1 Bound
10%	2.44	3.28	10%	2.44	3.28
5%	3.15	4.11	5%	3.15	4.11
2.5%	3.88	4.92	2.5%	3.88	4.92
1%	4.81	6.02	1%	4.81	6.02

F-statistic for the Bounds Test is 5.67 (6.17); for ARDL (2, 2) where SP is the dependent variable, it has exceeded the 2.5% critical value for the upper bound, whereas for the other model, it has just exceeded the 1 % critical value for upper bound. Hence, the hypothesis of "No Long-Run Relationship" can be rejected for both the models at 2.5% and 1% respectively.

There exist a strong long run relationship between the future price and spot prices of Rubber (Near Month Contracts) commodity. There is co-integration between the two series indicating Granger causality at least in one direction. The ARDL co-integrating and long run form for the two models is displayed in the table 9.11.

Table 9.11

ARDL Co-integrating and Long Run Form (Rubber NM)

Dependent Variable	**Variable**	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
SP	CointEq(-1)	-0.101273	0.029990	-3.376871	0.0009
Long Run Coefficients	LOG(FP)	0.999014	0.000604	1654.800770	0.0000
Cointeq = LOG(SP) - (0.9990*LOG(FP))					
FP	CointEq(-1)	-0.111335	0.031603	-3.522930	0.0005
Long Run Coefficients	LOG(SP)	1.001045	0.000575	1739.830143	0.0000
Cointeq(2) = LOG(FP) - (1.0010*LOG(SP))					

As required, the error-correction coefficient for both the models are negative -0.1012 (-0.1113), and are very significant. Thus, there exist bi-directional causality between FP and SP. Both spot and futures market of Cotton Distant Month assimilate new information and help in price discovery.

In short run, the speed of adjustment towards long run equilibrium is 10.12% (11.13%) of Spot and Futures market respectively for a single period (for the present study it is daily i.e., one day). The co- integration equations 1 and 2 for both the models are reported and it can be inferred from the equation 1 that if there is a one percent change in variable FP then variable SP will also change by 0.99 percent and from equation 2, if there is one percent change in variable SP, variable FP will also change by one percent. The long-run coefficients from the co-integrating equations are also reported with their respective standard errors and they are significant.

As, the long run relationship between the variable FP and variable SP had been established, the short run causality can also be investigated. The output of the WALD test is display in the table 9.12. The F statistic value of Wald Test is 361.9 (368.14) and chi square value is 723.80 (736.286); the null hypothesis "c(4)=c(5)=0"("c(4)=c(5)=0"is clearly rejected and therefore it can be reported that there exist short run relationship from FP to SP and also from SP to FP.

Table 9.12

Short Run Causality (Wald Test) (Rubber NM)

Dependent Variable: SP; Null Hypothesis: C(4)=C(5)=0			
Test Statistic	**Value**	**df**	**Probability**
F-statistic	361.9007	(2, 229)	0.0000
Chi-square	723.8014	2	0.0000
Dependent Variable: FP; Null Hypothesis: C(4)=c(5)=0			
F-statistic	368.1435	(2, 229)	0.0000
Chi-square	736.2869	2	0.0000

Long run hedge ratio ($-\alpha_{F(-1)}/\alpha_{S(-1)}$) can be calculated as 0.99 and short run hedge ratio (β) is 1, Hedging effectiveness (Adj. R square) is 97.5% (see Table D14, Appendix D).

9.5.4 Rubber (Distant Month)

The maximum number of lags for principal regressor and the dependent variable is set as eight. Akaike Information Criterion (AIC) had been selected as the basis for determining the lag order for the regressors.

ARDL (2, 2) with R square value as 0.99 (see table D17, Appendix D) and ARDL (2, 1) with R square value of 0.97 (see table D19, Appendix D) were selected, it can also be seen how well the top twenty model specifications have performed in terms of minimizing AIC.(see Figure D5-Criteria Graphs, Appendix D).

The estimated models ARDL (2, 2) and ARDL (2, 1) are checked for serial correlation and stability. As seen, from the test result displayed in table 9.13, the F-statistic is 0.518 (0.997), hence the Null of “No Serial Correlation” can be accepted and therefore both the ARDL models are free of serial correlation.

Table 9.13

Breusch-Godfrey Serial Correlation LM Test (Rubber DM)

F-statistic	0.518642	Prob. F(2,108)	0.5968
Obs*R-squared	1.094009	Prob. Chi-Square(2)	0.5787
F-statistic	0.997587	Prob. F(2,109)	0.3721
Obs*R-squared	2.067163	Prob. Chi-Square(2)	0.3557

CUSUM Test for stability

Cusum test have been used to test the stability of the models. From the below figure 9.4, it is clearly evident that the models are stable

SP as Dependent Variable **FP as Dependent Variable**

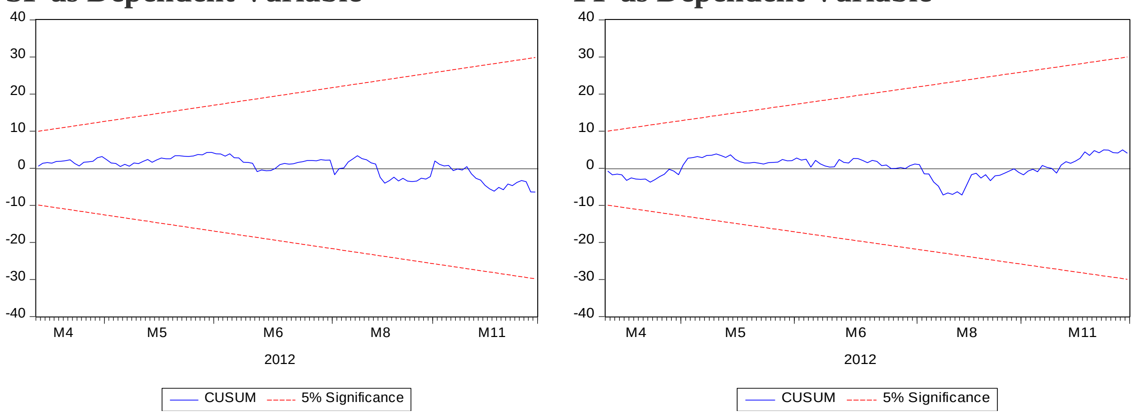


Figure 9.4: **CUSUM test for stability (Rubber DM)**

The following table 9.14 displays the output of the ARDL Bound Test.

Table 9.14

ARDL Bounds Test (Rubber DM)

Null Hypothesis: No long-run relationships exist

Dependent Variable: SP			Dependent Variable: FP		
Test Statistic	Value	K	Test Statistic	Value	k
F-statistic	7.697873	1	F-statistic	4.385647	1
Critical Value Bounds			Critical Value Bounds		
Significance	I0 Bound	I1 Bound	Significance	I0 Bound	I1 Bound
10%	2.44	3.28	10%	2.44	3.28
5%	3.15	4.11	5%	3.15	4.11
2.5%	3.88	4.92	2.5%	3.88	4.92
1%	4.81	6.02	1%	4.81	6.02

F-statistic for the Bounds Test is 7.69 (4.38), and for ARDL (2, 2) where SP is the dependent variable, it has exceeded the 1% critical value for the upper bound, whereas for the other model, it has just exceeded the 5 % critical value for upper bound. Hence, the hypothesis of "No Long-Run Relationship" can be rejected for both the models at 1% and 5% respectively.

There exist a strong long run relationship between the future prices and spot prices of Rubber (Distant Month) commodity.

There is co-integration between the two series indicating Granger causality at least in one direction. The ARDL co-integrating and long run form is displayed in table 9.15.

Table 9.15

ARDL Co-integrating and Long Run Form (Rubber DM)

Dependent Variable	Variable	Coefficient	Std. Error	t-Statistic	Prob.
SP	CointEq(-1)	-0.101486	0.025748	-3.941536	0.0001
Long Run Coefficients	LOG(FP)	0.999090	0.000498	2004.772853	0.0000
Cointeq(1) = LOG(SP) - (0.9991*LOG(FP))					
FP	CointEq(-1)	-0.166005	0.055801	-2.974948	0.0036
Long Run Coefficients	LOG(SP)	1.000194	0.000541	1849.795761	0.0000
Cointeq(2) = LOG(FP) - (1.0002*LOG(SP))					

As required, the error-correction coefficient for both the models are negative -0.1014(-0.1660), and are very significant. Thus, there exist bi-directional causality between FP and SP. Both spot and futures market of Rubber (Distant Month) assimilate new information and help in price discovery. In short run, the speed of adjustment towards long run equilibrium is 10.14% (16.6%) for a single period (for the present study it is daily i.e., one day).

The co- integration equations 1 and 2 for both the models are reported and it can be inferred from the equation 1 that if there is a one percent change in variable FP then variable SP will also change by 0.99 percent and from equation 2, if there is one percent change in variable SP, variable FP will also change by one percent The long-run coefficients from the co-integrating equations are also reported with their respective standard errors and they are significant.

As, the long run relationship between the variable FP and variable SP had been established, the short run causality can also be investigated. The output of the WALD test is displayed in the table 9.16. The F statistic value of Wald Test is 22.62(145.25); the null hypothesis “c(4)=0”(“c(4)=0” is clearly rejected and therefore it can be reported that there exist short run relationship from FP to SP and also from SP to FP.

Table 9.16

Short Run Causality (Wald Test) (Rubber DM)

Dependent Variable: SP; Null Hypothesis: C(4)=0			
Test Statistic	**Value**	**df**	**Probability**
F-statistic	22.62657	(2, 110)	0.0000
Chi-square	45.25314	2	0.0000
Dependent Variable: FP; Null Hypothesis: C(4)=0			
F-statistic	85.57447	(1, 111)	0.0000
Chi-square	85.57447	1	0.0000

Long run hedge ratio ($-\alpha_{F(-1)}/\alpha_{S(-1)}$) can be calculated as 0.99 and short run hedge ratio (β) is 0.99, Hedging effectiveness (Adj. R square) is 55.99% (see Table D18, Appendix D).

9.5.5 Cotton 29

The maximum number of lags for principal regressor and the dependent variable is set as eight. For model 1 (where SP is the dependent variable) and for model 2 (where FP is the dependent variable) ‘none’ had been taken as the fixed regressor. Akaike Information Criterion (AIC) had been selected as the basis for determining the lag order for the regressors. Model ARDL (1, 2) with R square value as 0.995 (see table D9, Appendix D) and ARDL (2, 2) with R square value of 0.995 (see table D11, Appendix D) were selected, it can also be seen how well the top twenty model specifications have performed in terms of minimizing AIC.(see Figure D3-Criteria Graphs, Appendix D).

The estimated models ARDL (1, 2) and ARDL (2, 2) are checked for serial correlation and stability. As seen, from the test result displayed in table 9.17, the F-statistic is 1.12 (1.84), hence the Null of "No Serial Correlation" can be accepted and therefore ARDL (1, 2) and ARDL (2, 2) are free of serial correlation.

Table 9.17

Breusch-Godfrey Serial Correlation LM Test (Cotton)

F-statistic	1.122648	Prob. F(2,276)	0.3269
Obs*R-squared	2.275594	Prob. Chi-Square(2)	0.3205
F-statistic	1.848927	Prob. F(2,275)	0.1594
Obs*R-squared	3.741669	Prob. Chi-Square(2)	0.1540

CUSUM Test for stability

Cusum test had been used to test the stability of the models. From the figure 9.5 below, it is evident that the models are stable.

ARDL(1,2) **ARDL(2,2)**

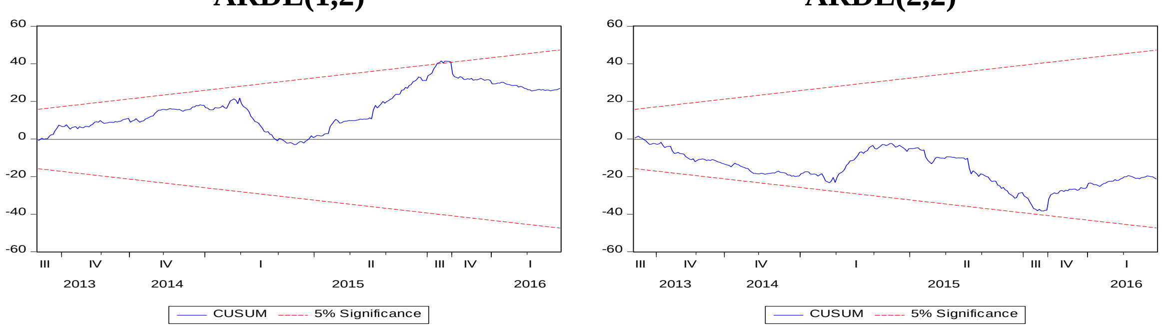


Figure 9.5: **CUSUM test for stability (Cotton)**

The following table 9.18 displays the output of the ARDL Bound Test

Table 9.18

ARDL Bounds Test (Cotton)

Null Hypothesis: No long-run relationships exist

Dependent Variable: SP			**Dependent Variable: FP**		
Test Statistic	Value	k	Test Statistic	Value	k
F-statistic	7.711672	1	F-statistic	5.945780	1
Critical Value Bounds			Critical Value Bounds		
Significance	I0 Bound	I1Bound	Significance	I0 Bound	I1 Bound
10%	2.44	3.28	10%	2.44	3.28
5%	3.15	4.11	5%	3.15	4.11
2.5%	3.88	4.92	2.5%	3.88	4.92
1%	4.81	6.02	1%	4.81	6.02

F-statistic for the Bounds Test is 7.71 (5.94), and for ARDL (1, 2), it has exceeded even the 1% critical value for the upper bound, whereas for ARDL (2, 2), it has exceeded the 2.5% critical value for upper bound. Hence, the hypothesis of "No Long-Run Relationship" can be rejected for both the models at 1% and 2.5% respectively. There exist a long run relationship between the future prices and spot prices of Cotton (Distant Month Contracts) commodity.

There is co-integration between the series indicating Granger causality at least in one direction. The ARDL co-integrating and long run form for the two models is display in the table 9.19.

Table 9.19

ARDL Co-integrating and Long Run Form (Cotton)

Dependent Variable	Variable	Coefficient	Std. Error	t-Statistic	Prob.
SP	CointEq(-1)	-0.102395	0.026026	-3.934314	0.0001
Long Run Coefficients	LOG(FP)	0.999108	0.000474	2107.358675	0.0000
Cointeq = LOG(SP) - (0.9991*LOG(FP))					
FP	CointEq(-1)	-0.099824	0.028896	-3.454633	0.0006
Long Run Coefficients	LOG(SP)	1.000429	0.000531	1884.463683	0.0000
Cointeq(2) = LOG(FP) - (1.0004*LOG(SP))					

As required, the error-correction coefficient for both the models are negative -0.1023(-0.0998), and are very significant. Thus, there exist bi-directional causality between FP and SP. Both spot and futures market of Cotton Distant Month assimilate new information and help in price discovery. In short run, the speed of adjustment towards long run equilibrium is 10.23% (9.98%) for a single period (for the present study it is daily i.e., one day). The co- integration equations 1 and 2 for both the models are reported and it can be inferred from the equation 1 that if there is a one percent change in variable FP then variable SP will also change by 0.99 percent and from equation 2, if there is one percent change in variable SP, variable FP will also change by one percent The long-run coefficients from the co-integrating equations are also reported with their respective standard errors and they are significant.

As, the long run relationship between the variable FP and variable SP had been established, the short run causality can also be investigated. The output of the WALD test is displayed in the table 121. The F statistic value of Wald Test is 125.26(141.88) and chi square value is 250.53(283.76); the null hypothesis “c(3)=c(4)=0”(“c(4)=c(5)=0”) is clearly rejected and therefore it can be reported that there exist short run relationship from FP to SP and also from SP to FP.

Table 9.20

Short Run Causality (Wald Test) (Cotton)

Dependent Variable: SP; Null Hypothesis: C(3)=C(4)=0			
Test Statistic	**Value**	**df**	**Probability**
F-statistic	125.2669	(2, 278)	0.0000
Chi-square	250.5339	2	0.0000
Dependent Variable: FP; Null Hypothesis: C(4)=C(5)=0			
F-statistic	141.8817	(2, 277)	0.0000
Chi-square	283.7633	2	0.0000

Long run hedge ratio can be calculated as 1.0 and short run hedge ratio is 0.99. Hedging effectiveness (Adj. R square) is 65.06% (see Table D10, Appendix D). The commodity ‘chilli’ did not have co-integration between the series.

9.6 Conclusion

The present study reports price discovery, hedge ratios and hedging effectiveness of future contracts in agricultural commodities like turmeric, cotton, chilli and rubber. If ‘futures price leads spot price’, future market is said to be efficient and it implies that futures market is the first, in absorbing and reflecting the new information than the spot market and if farmers are provided with future price information they will benefit from future price signals. But, if futures market is not mature enough i.e., the participants are less resulting in low volume of transactions and less liquidity then, the futures market will not be efficient, and the 'spot price leads futures price', and the farmers will not benefit from the futures market.

There can also be bidirectional information flow between futures and spot market; it implies that both the markets are efficient, and helping in price discovery, signifying developed agricultural commodity markets. For, the present study all the commodities' future and spot prices are co-integrated and there exists bi-directional Granger long and short run causality between them. The results are in line with **Sehgal, Rajput, & Dua (2012)** findings, they found bi-directional causality in nine out of ten agricultural commodities they selected. **Kushankur Dey, Debasish Maitra (2016)** also confirmed bi directional causality in Rubber and Coffee. **Ali and Gupta (2011)**, confirmed bi directional causality in short run in maize, pepper and black lentil. **Garbade and Silber (1983)** found that the spot market also played a role in price discovery in the selected seven commodities suggesting that there must be a flow of information from spot to futures market. Further, they also found that price discovery role of spot market in those seven commodities was a result of the market liquidity and size.

In the short run, for the present study, when the commodities series were in disequilibrium the results indicated that greater adjustment was made by the spot price to re-establish the equilibrium except rubber 'near month' and 'distant month' where the speed of adjustment for the future series were more.

Bose (2007) felt the need for systematic investigation of effectiveness of commodity and stock derivatives markets in transferring the risk. The present research estimated the hedge ratios and investigated the hedging effectiveness provided by the turmeric, chilli, cotton and rubber futures market. It is one of the important elements of success of futures contracts. The hedge ratios are high for all the commodities and are near to one (naïve hedge ratio). The hedging effectiveness is more than fifty percent (56% to 99%) for all commodities except turmeric (25%). The hedging effectiveness for rubber maturity month contracts (99.04%) and rubber near month contracts (97.55%) are high when compare to rubber distant month contract (55.99%). **Narsimhulu and Satyanarayana S.V. (2016)** estimated the hedge ratios for chilli, turmeric and chana and concluded that commodity futures were more effective in hedging, and the near month futures contracts were suitable for hedging. **Ripple and Moosa (2007)** also found that hedging of futures is more effective for near month contracts than distant month contracts. They suggested that this could be because of higher correlation between spot prices and near month futures prices than with distant futures prices.

Lee, C.-F., Lin, F. L., Tu, H. C. and Chen, M. L. (2009) found that "short-run ARDL hedge ratios were different for different hedging horizons and approach the naive hedge ratio of unity as the length of hedging period was increased and the estimates of the long-run ARDL hedge ratios were close to the naive hedge ratio of unity". **Dinica and Armeanu (2014)**, showed that the optimal hedge ratio had increased with the hedging horizon, converging to one for long tenors. Their findings also showed greater in-sample hedging effectiveness for more complex models (ECM and ARDL).

Table 9.21

Summary (Co-Integration and Granger Causality)

Commodity	Dependent Variable	Speed of Adjustment	$t_{ECT(-1)}$	F-Statistic	Granger Causality	
					Long Run	Short Run
Turmeric (Distant Month)	SP	6.8%	-7.353 (0.000)	88.973 (0.000)	FP Granger causing SP	FP→SP
	FP	5.2%	-4.642 (0.000)	245.532 (0.000)	SP Granger causing FP	SP→FP
Cotton (Distant Month)	SP	10.23%	-3.934 (0.000)	125.266 (0.000)	FP causing SP	FP→SP
	FP	9.98%	-3.454 (0.000)	141.881 (0.000)	SP Granger causing FP	SP→FP
Rubber (Maturity Month)	SP	60.48%	-6.000 (0.000)	4.654 (0.000)	FP causing SP	FP →SP
	FP	57.64%	-5.851 (0.000)	15.389 (0.000)	SP Granger causing FP	SP→FP
Rubber (Near Month)	SP	10.12%	-3.376 (0.000)	361.9 (0.000)	FP Granger causing SP	FP →SP
	FP	11.13%	-3.522 (0.000)	368.14 (0.000)	SP causing FP	SP→FP
Rubber (Distant Month)	SP	10.14%	-3.941 (0.000)	22.62657 (0.000)	FP Granger causing SP	FP →SP
	FP	16.6%	-2.974 (0.003)	85.57447 (0.000)	SP Causing FP	SP→FP

Table 9.22

Hedge Ratios and Hedging Effectiveness

Commodities	Short Run	Long Run	Hedging Effectiveness
Turmeric(Distant Month)	1.03	1.00	24.86%
Cotton(Distant Month)	0.99	1.00	65.06%
Rubber(Maturity Month)	1	1	99.04%
Rubber(Near Month)	0.99	1	97.55%
Rubber(Distant Month)	0.99	0.99	55.99%

CHAPTER TEN

COMMODITY FUTURES MARKET AND INFLATION

The objective of this chapter is to conduct an empirical and analytical investigation of the link between 'commodity prices and inflationary dynamics'. This chapter shall provide evidence on causal dynamics between the two variables (commodity price and inflation). As discussed in greater detail below, the main contribution emerges from the fact that the causality had been investigated.

The sharp increase in international commodity prices since 2008 had increased the empirical focus on studying the impact of commodity futures trading on Inflation. In India, there are studies which support the argument that "Futures trading is the cause of increased Inflation", and there are some studies which are inconclusive about it and some vehemently denied the role of futures trading in inflation of the commodity prices. Hence, the present study tried to find if agri-futures trading is causing inflation in India, by taking 'WPI'(Inflation Index) as a proxy for inflation in India and 'Dhaanya'(NCDEX Index) as an indicator of futures trading in agricultural commodities. Therefore, the present chapter is dedicated to examine analytically if there is any causation or impact of agri-futures trading on inflation.

10.1 Introduction

Inflation can be defined as a sustained augment in the general level of prices for services and goods and is measured as an increase in annual percentage. It occurs due to an imbalance between supply and demand of money, increase in taxes on products, changes in production and distribution cost etc. When an economy experiences inflation, the value of currency diminishes. This means that each "unit of currency" buys fewer services and goods. Consumers are the one who are worse affected by inflation. Consumers find it difficult to afford the basic commodities because of the increased prices of day-to-day goods.

Formula for Inflation

Inflation can be defined as "The percentage change in the value of the Wholesale Price Index (WPI) on a year-on year basis. It effectively measures the change in the prices of a basket of goods and services in a year." In India, inflation is calculated by taking the WPI as base.

$$\frac{(\text{“WPI in the month of current year”} - \text{“WPI in the same month of the previous year”})}{\text{“WPI in same month of the previous year”}} \times 100$$

WPI is an indicator of changes in prices of goods traded in the **wholesale market**. It measures the changes in the prices of the commodities charged by whole sellers and manufacturers and the changes are measured at selected stages before goods could reach to the retailers and WPI is released on a weekly basis in India.

DHAANYA

It is a "Value Weighted Index, computed in real time using the prices of the ten most liquid commodity futures traded on the NCDEX platform." It is an agriculture index of NCDEX and contributes about seventy five percent of futures trading in agriculture on the exchange's platform. It's components have been selected from various sub-sectors such as grains, spices, oil seeds and other crops of national importance to ensure proper diversification. It is a reliable benchmark based upon a "transparent, simple and easy to understand methodology" for the NCDEX traded agri-commodities. Every three months, the "weightage and components" of the index gets revised based on the trade liquidity, crop season, and production size on the NCDEX. It is a rolling index and is computed using the "near month (closest expiry) prices of futures contracts". Mr. Vijay Kumar, Chief Business Officer of NCDEX, informed that "The index will provide a vital source of information to value-chain participants, market participants, economists, statisticians, research agencies and agriculture insurance providers."

10.2 Literature Review

FMC, the regulatory authority for CFM in India had banned futures trading from time to time in the agricultural commodities to stem the soaring inflation. The commodities which were banned are given in the below table

Table 10.1

Commodities Suspended and Revoked

Commodities	**Suspended On**	**Suspension Continues/Revoked**
Tur and Urad	23rd Jan', 2007.	Continues
Wheat	27th Feb', 2007.	Continues
Rice	27th Feb', 2007.	Revoked on 14th May, 2009
Soya Oil and Chana	7th May, 2008.	Revoked on 30th, Nov', 2008.
Potato, Rubber, Sugar	26th May, 2009.	Revoked on 30th Sept, 2010.
Guar Gum and Guar Seed	7th Mar', 2012.	Revoked on 10th Mar', 2013.

Source: IIM Blog

Against the backdrop of growing realization that unscrupulous activity was causing distortion in the futures market and stoking inflation, in 2007 an Expert Committee on Futures Trading was constituted by the Government of India, to study the effects of futures trading on prices of agricultural commodities. Prof. Abhijit Sen was appointed as the chairman of the expert panel. The panel did not find any correlation between futures trading and inflation and did not recommend a ban on futures trading, but wanted the existing temporary suspension to continue for some more time, also suggested the strengthening of commodity exchanges and FMC in order to facilitate perfect functioning of futures trading in a translucent manner. The panel further elaborated that there was no perfect model statistically to find the linkage between increase in prices of essential commodities and futures trading.

Futures trading in the aforementioned commodities had been suspended based on the perception that the price volatility in the spot market had increased because of the futures trading which lead to higher inflation. Several studies supported this argument but did not find any conclusive empirical evidence. **(Nath and Lingareddy, 2008; Pavaskar and Ghosh, 2008; Sen, 2008).**

IMF (2006), perceptions are often driven by observation of correlation rather than assessment of causality. The assessment of IMF based on causality suggested "…little support for the hypothesis that speculative activity (as measured by net long non-commercial positions) affects either price levels over the long run or price swings in the short run. In contrast, there is evidence (both across commodities and over time) that speculative positions follow price movements."

Raizada and Sahi (2006) studied the efficiency of Indian CFM in India and have analysed it's effect on inflation and social welfare in the economy. They made use of Johansen's co- integration approach on futures of wheat from different forecasting horizons ranging from one week to three months, they found that wheat futures were not efficient even in the short run and also "…. the growth in volumes of commodity futures markets was causing a significant impact on the inflation." **Sahi (2007)** also observed that spot price volatility of raw jute and wheat was impacted by a weak destabilizing impact of futures trading.

Chopra (2005) asserts that traders buy out the commodities cheaply through future contracts and create false scarcity by raising the prices artificially.

Bose (2008) did not agree that futures market caused the price increase in the commodities. She emphasized that "There is a need to not only analyze the supply and demand side factors leading to sustained high levels of inflation, but also to understand the role participants can possibly play in the market, rather than associate higher levels of futures activity directly with mispricing in the futures markets."

UNCTAD (2010) argued that commodity futures market is the major cause of increase in price because of "Financialization of Commodity Markets" i.e., increasing interest in commodities as an "asset class".

RBI (2010) studied the impact of futures trading in "banned commodities" on their spot prices. The empirical analysis using Granger causality did not provide any conclusive evidence in support of the relationship between futures and prices. It was stated in the report that "Commodity prices in India seem to be influenced more by other drivers of price changes, particularly demand supply gap in specific commodities, the degree of dependence on imports and international price movements in these commodities".

N. Barua and Mahanta(2012), study results revealed that the "effect of futures prices on spot prices for different commodities differs which implies that there is no uniform impact of commodity derivatives trading on the spot prices of the wide assortment of commodities that are traded. This actual unfolding of events vindicates the position that inflationary pressures stems from a number of factors." These factors could be supply side constraints, the diversion of land for bio-fuel production, the global rise in prices of food and oil, the adoption of an expansionary fiscal policy and loose monetary policy in emerging economies. Hence, they concluded that the policy of across-the-board restriction of futures trading in agricultural commodities appears to be inequitable, unjustifiable, and counter-productive.

As, it is evident from the above studies, there had been no attempt made in India to examine the short and long run between commodity prices and inflation, this motivated the researcher to empirically investigate the causal relation. Internationally, **Ciner (2011)** had used the consumer price index (CPI) to measure inflation and the Thomson Reuter/Jeffries CRB commodity futures index to represent commodity prices. Data (Total of 327 observations) was collected from a Bloomberg terminal, the frequency of the series was monthly and the data cover the period between February of 1983 and April of 2010, he conducted a nonlinear analysis utilizing the frequency dependent regression approach which detected no significant relation between commodity prices and inflation, but the frequency decomposition analysis showed that there was actually a positive and significant link between the long term commodity price shocks and rate of inflation. He also examined Granger causality relations, which was conducted within the context of vector autoregression models and examined both short term and long term causality and the results showed that, similar to the regression results, causality from commodities to inflation was obtained only in the long term as no causality was detected at high frequencies(short term).

10.3 Empirical Analysis

To examine empirically the impact of agri futures trading on inflation, the present study has tried to investigate the long run relationship between the two using ARDL Models and if there exists long run relationship, and then is there any causation between them? WPI have been chosen as inflation index and Dhaanya as representative index for agri futures because it is based on ten most liquid agri futures contracts, the weightage of ‘Non-Food Articles’ in WPI is 0.877 and the weightage of NCDEX traded commodities is 0.705 and, the weightage of ‘Manufactured Articles’ like edible oils, sugar etc., in WPI is 3.042 and the weightage of NCDEX traded commodities is 0.78(See tables E1, E2 and E3, Appendix E)

10.3.1 Descriptives and Stationarity

The dhaanya and wpi indices both are platykurtic i.e., the kurtosis is less than 3, dhaanya is positively skewed where as wpi is negatively skewed. The standard deviation for dhaanya index is high where as for wpi it is comparatively low.

Table 10.2

Descriptives of 'Dhaanya' and 'WPI'

Name of the Index	Skewness	Kurtosis	Jarque Bera	Standard Deviation
DHAANYA	0.255	1.300	13.77(0.001)	814.04
WPI	-0.0793	1.5253	9.623(0.008)	23.97

Both the indices are checked for stationarity using Break Point Unit Root test suspecting any structural breaks in the indices. Innovational outlier was chosen and the series was checked at Trend and Intercept. The result of dhaanya unit root test is displayed in the table below

As evident, from the table 10.3, the dhaanya index is stationary at level, and at 1% level of significance. The structural break is identified and is displayed in the figure 10.3.

Table 10.3

Break Point Unit Root Test (Dhaanya)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.113118	< 0.01
Test critical values:	1% level	-5.711386	
	5% level	-5.155006	
	10% level	-4.860969	

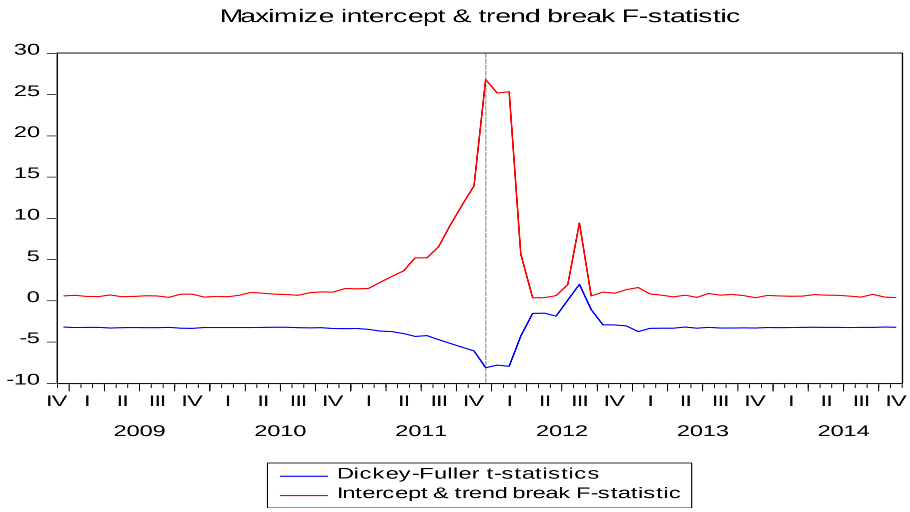


Figure 10.1: **Structural Break (Dhaanya)**

The WPI index is also tested for stationarity using Break Point Unit Root Test at Trend and Intercept for the chosen model Innovational Outlier. The series is not stationary at level but is stationary at first difference. The unit root test result is given below in the table 10.4.

Table 10.4

Break Point Unit Root Test (WPI)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.069426	0.8425
Test critical values:	1% level	-5.711386	
	5% level	-5.155006	
	10% level	-4.860969	

Null Hypothesis: DWPI has a unit root

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.975777	< 0.01
Test critical values:	1% level	-5.711386	
	5% level	-5.155006	
	10% level	-4.860969	

The structural break is identified and is displayed in the figure 10.2.

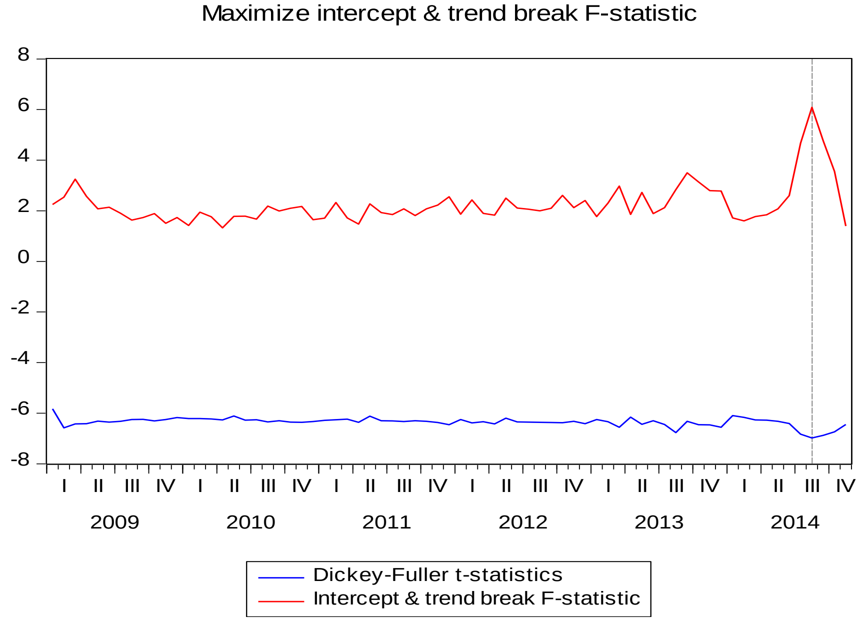


Figure 10.2: **Structural Break (WPI)**

To check whether dhaanya is causing WPI, both the series should be tested for causality. Granger Causality test is used to check the same. The causality sometimes may be spurious if there is no strong long run relationship between the two series. Therefore, both the indices were checked for long run relationship or co-integration. ARDL Bound test was chosen for testing the co-integration between the two aforementioned series as both the series are of not same order, dhaanya is I(0) whereas WPI is I(1). ARDL is superior to Johansen Cointegration and for ARDL it does not matter whether the series are of same order or stationary.

10.3.2 Data

Monthly observations of Dhaanya and WPI indices were collected. The data ranges from jan', 2007 to sept', 2015. There are total 105 observations that are collected. The historical data of Dhaanya was downloaded from the official website of NCDEX and the WPI data was downloaded from official website of RBI.

10.3.3 Result

The ARDL model was estimated using E.Views 9.5. The maximum lag was chosen as twelve where as the fixed regressor was chosen as 'None'. ARDL (8, 6) was selected (see E1: criteria graph in Appendix E) and the R-square value of the selected model is 0.998 (see table E4, Appendix E). The diagnostics confirmed that the model is free of serial correlation, and is stable. The diagnostic tests are given below.

Table 10.5

Breusch-Godfrey Serial Correlation LM Test

(Dhaanya &WPI)

F-statistic	0.808891	Prob. F(2,80)	0.4490
Obs*R-squared	1.922680	Prob. Chi-Square(2)	0.3824

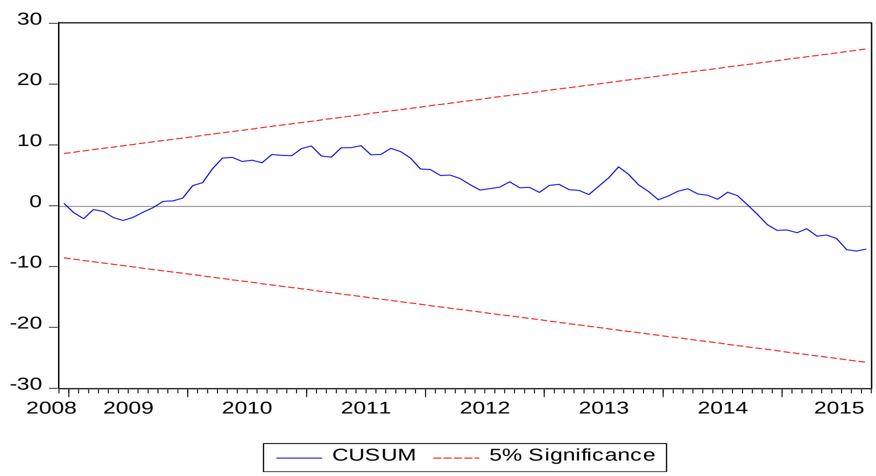


Figure 10.3: **CUSUM Test (Dhaanya & WPI)**

The ARDL (8, 6) model after the diagnostics is tested for long run relationship using ARDL Bound Test. The test results are displayed in the given table 10.6 below.

Table 10.6

ARDL Bounds Test (Dhaanya and WPI)

Null Hypothesis: No long-run relationships exist

Test Statistic	Value	K
F-statistic	1.410070	1

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.44	3.28
5%	3.15	4.11
2.5%	3.88	4.92
1%	4.81	6.02

As clearly evident from the table 10.6 above, the F-statistic value of 1.410 did not cross the upper bound even at 10% level of significance. The ARDL model was again estimated using Rest.Linear Trend as fixed regressor (Trend Specification). The selected model was ARDL (2, 10) with the least AIC value (See E2: Criteria Graph in Appendix E). The R-square value is 0.998 for the estimated model (see table E5, Appendix E). The ARDL (2, 10) model estimated using Rest.Linear as fixed regressor, is free of serial correlation, and is stable. The diagnostic results are given below:

Table 10.7

Breusch-Godfrey Serial Correlation LM Test
(Dhaanya & WPI) 2

F-statistic	0.563790	Prob. F(2,78)	0.5714
Obs*R-squared	1.353763	Prob. Chi-Square(2)	0.5082

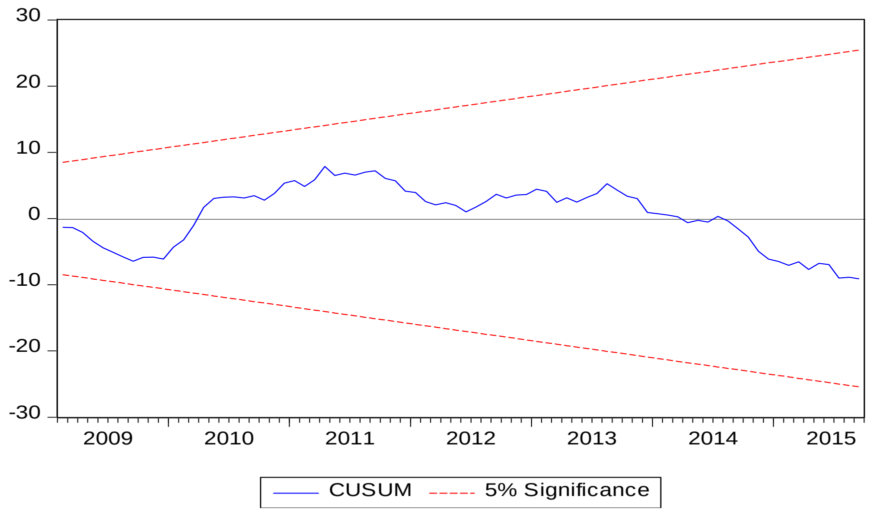


Figure 10.4: **CUSUM test for stability (Dhaanya & WPI) 2**

This model is tested for long run relationship using Bound Test

Table 10.8

ARDL Bounds Test (Dhaanya & WPI) 2

Null Hypothesis: No long-run relationships exist

Test Statistic	Value	K
F-statistic	2.288800	1

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	4.05	4.49
5%	4.68	5.15
2.5%	5.3	5.83
1%	6.1	6.73

As, clearly evident from the table above, the F-statistic value of 2.28 did not cross the upper bound even at 10% level of significance. Hence, it is evident that there exist no long run relationship between the Dhaanya and WPI.

The ARDL model estimated using Unrest. Constant as fixed regressor is ARDL (2, 10) with lowest AIC value (See E3: Criteria Graph, Appendix E). The R-square value of the model is 0.998 (see table E6, Appendix E); it is free of serial correlation, and is stable. The diagnostics are given below.

Table 10.9

Breusch-Godfrey Serial Correlation LM Test (Dhaanya & WPI) 3

F-statistic	0.696561	Prob. F(2,79)	0.5013
Obs*R-squared	1.646243	Prob. Chi-Square(2)	0.4391

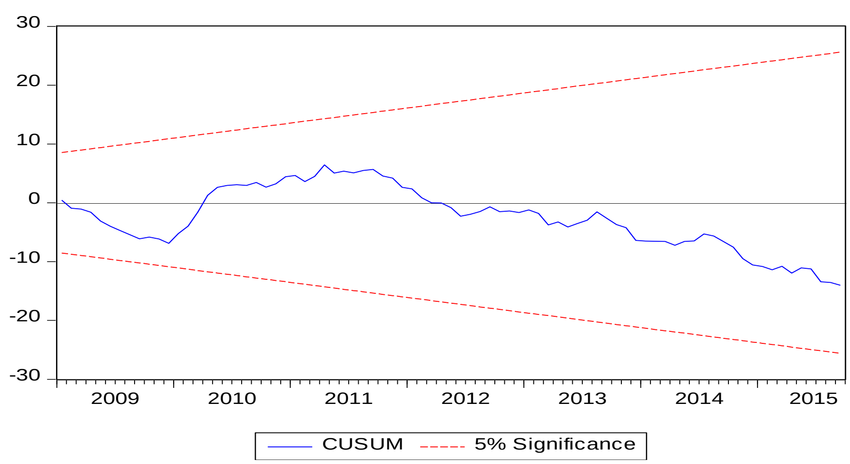


***Figure 10.5*: CUSUM test for stability (Dhaanya & WPI) 3**

ARDL (2, 10) was tested for long run relationship using ARDL Bounds test. The result is displayed in the given table 10.10.

Table 10.10

ARDL Bounds Test (Dhaanya and WPI) 3

Null Hypothesis: No long-run relationships exist

Test Statistic	Value	K
F-statistic	3.086813	1
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	4.04	4.78
5%	4.94	5.73
2.5%	5.77	6.68
1%	6.84	7.84

The F-statistic value of 3.086 did not exceed the upper bound even at 10% significance accepting the Null of 'No Long Run Relationship'.

Further, the ARDL was estimated using Rest.Constant as Fixed Regressor for max lag as twelve. Out of the 156 estimated models the model (2, 10) was chosen with the least AIC value (See E4: Criteria Graph in Appendix E). The R-Square value is 0.998 for the selected model (see table E7, Appendix E), the diagnostics displayed below confirmed that model is free of serial correlation, and is stable.

Table 10.11

Breusch-Godfrey Serial Correlation LM Test (Dhaanya and WPI) 3

F-statistic	0.696561	Prob. F(2,79)	0.5013
Obs*R-squared	1.646243	Prob. Chi-Square(2)	0.4391

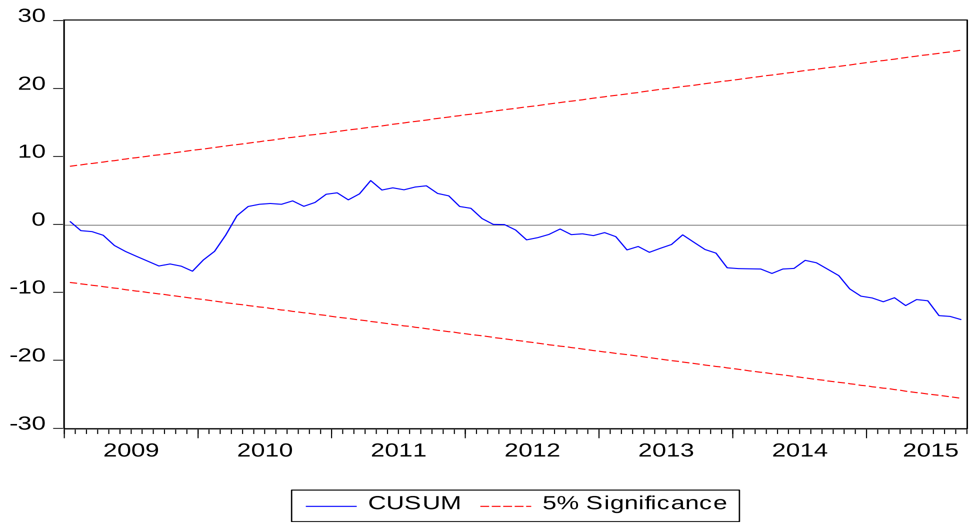


Figure 10.6: **CUSUM test for stability (Dhaanya & WPI) 4**

ARDL (2, 10) was checked for long run relationship using ARDL Bound Test. The result is displayed in the given table 10.12 below. The F-statistic value did not cross the upper bound even at 10% level of significance, indicating there is no long run relationship between the two series of Dhaanya and WPI.

Table 10.12

ARDL Bounds Test (Dhaanya and WPI) 3

Null Hypothesis: No long-run relationships exist

Test Statistic	Value	K
F-statistic	3.046582	1
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	3.02	3.51
5%	3.62	4.16
2.5%	4.18	4.79
1%	4.94	5.58

All the selected models did not exhibit long run relationship between the two variables Dhaanya and WPI. As there was no co-integration established between the two variables, it was tested for causality under unrestricted Vector Auto Regression. Lag six was selected based on AIC criteria, and the result of VAR Granger Causality test is displayed in the table 10.13 below.

Table 10.13
VAR Granger Causality/Block Exogeneity Wald Tests

Dependent variable: LOGRETURNWPI			
Excluded	Chi-sq	Df	Prob.
DHAANYA	12.98802	6	0.0432
All	12.98802	6	0.0432
Dependent variable: DHAANYA			
Excluded	Chi-sq	Df	Prob.
LOGRETURNWPI	5.989972	6	0.4243
All	5.989972	6	0.4243

As, it can be seen from the table there is causality between dependent variable WPI and Dhaanya, i.e., Dhaanya is causing WPI at 5% level of significance.

10.4 Conclusion

Monthly observations of both the indices from 2007 till 2015 were taken and tested for co-integration and causality. It is established that there is no long run relationship between the two indices; Dhaanya and WPI. Granger causality under VAR showed that

Dhaanya is causing WPI at 5% level of significance, suggesting commodities futures are signaling changes in inflation.

Ciner (2011) examined the link between commodity indices and inflation and found that "commodities tend to signal changes in inflation".

Sen (2008) says that "it is difficult to distinguish whether futures markets cause increases (or decreases) in spot prices as both markets reflect the same fundamental supply-demand conditions almost simultaneous".

The ARDL models estimated and selected using different Fixed Regressors (Trend Specification) are displayed in the given table 10.14.

Table 10.14

Summary of ARDL Models

ARDL MODEL	**Selected Model (AIC)**	**Residual Diagnostics of Selected Model**		**Bound Test Result**
		Serial Correlation	**Stability**	
Rest. Constant as Fixed Regressor	ARDL(2,10)	Absent	Stable	No Cointegration
UnRest.Constant	ARDL(2,10)	Absent	Stable	No Cointegration
Rest. Linear Trend	ARDL(2,10)	Absent	Stable	No Cointegration
None	ARDL(8,6)	Absent	Stable	No Cointegration

CHAPTER ELEVEN

SUMMARY AND SUGGESTIONS

The present chapter summarizes the findings and key observations from the empirical and analytical research output and to answer the research questions that were formulated based on the existent literature on Commodity Futures Market. This chapter also highlights the contribution of the present research to theory and practice, suggestions or policy implications, limitations and future scope.

11.1 Objectives and the Respective Findings of the Study

I. To study the awareness of CFM among the farmers of Telangana.

There was no awareness found in the sample of farmers of Telangana about CFM.

II. To identify the factors responsible for fostering or impeding the percolation of CFM.

Table 11.1

Factors Fostering and Impeding the Farmers, Traders & Investors' Participation in CFM

Farmers	Traders	Investors
Factors Impeding the Percolation of CFM to the Farmers:	**Factors Impeding**	**Factors Impeding**
Average Land Holding	Contract size(large)	Transaction Cost is high
Average Output	Warehouses(very few)	Brokerage Fees
Source of Finance	Transportation cost (Borne	Contract Size

	by the traders)	
Risk Management Techniques	No clear rules for grading the crop.	**Factors Fostering**
Lack of storage places like warehouses	Maintenance of the warehouses not up to the mark	Leverage
Cash Urgency	Any losses in warehouse, has to be borne by the traders.	Ease of Liquidity
Lack of Basic Education	High fluctuating prices of commodity.	Mark to Market
Electricity shortage as a result they are unable to irrigate their complete land at a time and thus cannot cultivate the whole land though they are capable of.	Traders do not trust the quality of the commodity traded by NCDEX.	Investment Hedge
	Factors Fostering Traders Participation in CFM:	Diversification
	Transaction Hedge is one of the reasons why traders prefer CFM.	
	Traders also participate to earn profits through speculative activities.	
	NCDEX as an alternate market.	
	Easy to liquidate the position.	
	Squaring off the position at any time with the provision of cash settlement.	

III. To study the functioning of Rubber Market of Kerala and carry out a comparative study between the planters of Kerala and Farmers of Telangana.

The present study had observed that the factors which were impeding the small or marginal farmers of Chilli, Turmeric and Cotton in Telangana from participation in CFM were even present in the small rubber growers. But, the Rubber Board and the Government of India have helped these small growers in overcoming many of their problems by forming "Rubber Producer Societies" and therefore they are able to aggregate their latex produce, even these societies are helping them to further process their produce of latex into rubber sheets which are giving them twin advantage of increased shelf life and ease of grading too. These RPS are further grouped together to form trading companies with 51% stake of Rubber Board and 49% of RPS. Thus, these RPS registered under Charitable Act, have made everything favourable and conducive to the small growers of rubber, to participate in CFM not directly but through trading companies. The other factors which distinguished the Telangana's small and marginal farmers are these planters have high literacy rate, more educated, have other source of incomes, keep themselves updated with latest rubber news and rubber price fluctuations, no cash urgency, able to get maximum farm gate price, are given adequate training for cultivation and adoption of new techniques, covered under good insurance schemes by Rubber Board etc.

IV. To model the volatility of the select commodities.

Commodities	ARIMA
Turmeric	ARIMA(2,0,2)
Chilli	ARIMA(2,1,1)
Cotton	ARIMA(1,0,0)
Rubber Near Month	ARIMA(1,0,0)
Rubber Maturity Month	ARIMA(1,0,0)
Rubber Distant Month	ARIMA(2,1,2)

V. To study the Price Discovery and Risk Management functions of Commodity Futures Market:

a) To study whether future lead spot or not.

b) To study the effectiveness of Commodity Futures Market in providing 'transaction hedge' for market participants in select commodities.

c) To study the effectiveness of Commodity Futures Market in providing an 'investment hedge' to potential investors.

Table 11.2

Price Discovery in Select Commodities

Commodity	**Dependent Variable**	**Speed of Adjust ment**	**Research Hypotheses**				
					Long Run	**Short Run**	
Turmeric (Distant Month)	SP	6.8%	H1:There is cointegration between FP and SP	Accepted	FP Granger causing SP	FP →SP	Accepted
	FP	5.2%			SP Granger causing FP	SP →FP	Accepted
Chilli (Distant Month)	SP	-	H1:There is cointegration between FP and SP	Rejected	-	-	-
	FP	-			-	-	-
Cotton (Distant Month)	SP	10.23%	H1:There is cointegration between FP and SP	Accepted	FP Granger causing SP	FP →SP	Accepted
	FP	9.98%			SP Granger causing FP	SP→ FP	Accepted
Rubber (Maturity Month)	SP	60.48%	H1:There is cointegration between FP and SP	Accepted	FP Granger causing SP	FP →SP	Accepted
	FP	57.64%			SP Granger causing FP	SP→ FP	Accepted
Rubber (Near Month)	SP	10.12%	H1:There is cointegration between FP and SP	Accepted	FP Granger causing SP	FP →SP	Accepted
	FP	11.13%			SP causing FP	SP→ FP	Accepted
Rubber (Distant Month)	SP	10.14%	H1:There is co-integration between FP and SP	Accepted	FP Granger causing SP	FP →SP	Accepted
	FP	16.6%			SP Granger causing FP	SP→ FP	Accepted

Table: 11.3

Hedge Ratios and Hedging Effectiveness

Commodities	Short Run	Long Run	Hedging Effectiveness
Turmeric(Distant Month)	1.03	1.00	24.86%
Cotton(Distant Month)	0.99	1.00	65.06%
Rubber(Maturity Month)	1	1	99.04%
Rubber(Near Month)	0.99	1	97.55%
Rubber(Distant Month)	0.99	0.99	55.99%

VI. To study the Causal relationship between inflation and Dhaanya.

Hypothesis: Dhaanya is causing WPI : **ACCEPTED**

11.2 Suggestions:

1. The yield or output of an individual farmer was not in level with size of the futures contracts of NCDEX. If, the Telangana farmers have to participate in CFM to hedge their produce there should be some Co-operatives like 'RPS' of rubber growers of Kerala who can act as aggregators.
2. The Rubber Board had taken inspiration from the AMUL model of Gujarat and successfully formed RPS. Likewise the Government of Telangana can consider implementing this proven model of RPS in promoting such co-operatives in Telangana. Aggregators or Co-Operative societies can aggregate or collect the produce from the farmers and invest or sell on their behalf.

3. Mini contracts have been introduced in “Multi Commodity Exchange of India (MCX)” for metal traders who cannot afford a large contract size; on the same lines in NCDEX too, mini contracts can be launched.
4. The agricultural produce by the farmers might not be of “same quality” as that of the NCDEX futures contracts “quality’ specifications” because for farmers it can be a gamble in monsoon and poor farmers also cannot afford all the time pesticides or fertilizers. Such quality produce can be taken and sold on discounted rates.
5. The farmers are hesitant even to take their produce to AMC because they have to bear the transportation cost and are not sure whether the produce will be accepted after the quality check, it is suggested that an official from AMC or NCDEX or Co-operatives can be appointed at each mandal for quality inspection.
6. The co-operatives or the Government can take an initiative to build a warehouse at each mandal, so that the farmers can store and wait for good remunerative rates for their produce. The farmers cannot store their produce even for twenty four hours as it is open for the vagaries of the weather.
7. The maintenance of government warehouses in Agricultural Market Committee is not up to the mark, it should be improved, and the godowns should be scientifically maintained. Schemes like ‘Rythu Bandhu Pathakam’ are good but farmers are not storing their produce at the godowns of AMC because of the poor maintenance and pest infestation.
8. It is suggested that an office by NCDEX for the farmers at each APMC can be started where the produce can be collected directly from the farmers, instead of the traders, this could result in good remunerative prices for farmers and even the farmers can aggregate their produce and participate directly in CFM.

9. The present study has found bi-directional causality between future and spot prices in the select commodities except chilli, indicating an efficient future and agriculture markets. If the farmers are not participating directly in CFM at least they can reap the benefits of CFM by taking signals from the futures market. The price signals from an efficient futures market will help in strengthening of the bargaining power of the farmers. But, unfortunately the Telangana farmers have no awareness about 'future price'.
10. This leads us to suggest, that the Government should make it possible to educate farmers about future price and make ways to disseminate information pertaining to futures price on daily basis so that farmers can take the price signaling in futures market to their advantage for decisions like what crop to sow, cropping pattern, to store the produce or not, which market to sell? etc., and to give them an upper hand in bargaining. Some of the APMCs in North India have started installing 'Price Tickers' which disseminate the live future prices, such Price Tickers can also be installed in Telangana APMCs.
11. Awareness programs conducted by NCDEX are usually conducted in cities, it can be suggested that the awareness programs should be launched in the villages and mandals so that it is accessible to the farmers. Training should be provided to the farmers along with awareness as the farmers lack the basic education.
12. The yield of the farmers specifically in Telangana can be increased by solving the problems of electricity and water and educating the tribal farmers (which are in large numbers especially in Adilabad district) about the advanced techniques in agriculture as they are still using the old methods of ploughing the lands with bullocks.
13. Majority of the farmers do not know about the advanced 'Risk Management Techniques'. With the loan from the banks the farmers are compulsorily purchasing insurance, but the

irony is that the farmers do not know about it or those who know about it have not been able to claim it, as it seems the damage is checked mandal wise and sometimes the mandal is so large enough that the rain could cause damage in one village but other villages in the same mandal remain unaffected. The practicality of the claim of such schemes should be checked otherwise the schemes meant for the welfare ('Insuring Risk') are becoming a cause of more risk or damage. The farmers should be made aware of various risk management techniques inclusive of hedging.

14. The utmost concern for any Indian farmer which is more important than mitigating the price risk is 'stable and regular income'. The farmers are totally dependent on agriculture for their livelihood. Participating in CFM means paying 'transaction cost and tax', brokerage fees, membership fees, margin requirements etc., which are unaffordable when compare to their meager income. The Government should take initiatives to diversify their occupation and make them earn income through other modes; like the Rubber Board have trained the small growers to earn income in off season or the dormant period by culturing bee hives for honey, selling rubber wood etc. The Organization for Economic Cooperation and Development (OECD) is a strong proponent of this approach, arguing that "the long-term future for most semi-subsistence farming households lies outside agriculture, so there is a need for measures that facilitate income diversification and the exploitation of non-farm activities" (OECD, 2007: 14)
15. As such, the rubber growers do not have 'cash urgency' like farmers of Telangana and can wait for remunerative price not 'Minimum Support Price' like the farmers who unfortunately most of the time sells below the minimum.
16. The Government can act as a facilitator between farmers and NCDEX.

17. Farmers still rely on informal source of debt as the loan from banks is very low. The Government should think on lines of ‘Price Stabilisation Fund’. Specifically the rules of loan relating to warehousing should be relaxed.
18. The grading system at NCDEX godowns should be improved with much clarity on the rules.
19. Number of warehouses of NCDEX across the country should be increased.
20. The findings of the present research can be helpful for the Government in understanding the price volatility risk and to forecast the future prices of the select agricultural commodities. Also, the estimation of hedge ratios and their hedging effectiveness would indicate how successful the contracts in mitigating the price risk were. The methodology and tools used can be helpful in the field of financial risk management.
21. The co-integration and causal relationship between future and spot prices of the select commodities will help the regulators to know which markets can be used for price signaling.
22. The present research also found that Dhaanya is causing WPI i.e., CFM is causing inflation. Detailed study should be done about the commodities which are suspected of creating inflation before launching their contracts; and utmost care should be taken before banning or suspending any commodity because it may create uncertainty as questions would be raised on the regulation of the market and also may affect other characteristics like liquidity of the market. CFM is also an alternate class used for diversification needs of investors and is heading towards ‘financialisation’ with faster information flow between the markets and establishing linkages across the world markets. Therefore, any strategy to curb inflation pertaining to CFM should be executed only after gathering and

authenticating the essential information about the ‘inflationary characteristic’ of the commodity.

23. Engaging investors, arbitrageurs and other speculators is no doubt essential but that should not be the principal criterion while designing the futures contracts. NCDEX should design contracts in such a way that the primary purpose of the existence of CFM should be served i.e., the farmers and traders should be able to hedge against price adversaries. The environment should be conducive so that farmers and traders can use CFM for hedging and price signaling. To make this possible it is required that Government should take some strong steps for the welfare of farmers and agriculture sector should be made a strong sector. It can be done by making it a ‘remunerative option’ which attracts investment. “The vibrant agriculture markets including derivatives markets are the frontline institutions to provide early sign of future prospect of the sector.” (Sen, 2007). It is the need of the hour that Government takes appropriate steps on the lines of developed and efficient markets like Rubber with (Highest Farm Gate Price) which also majorly comprised of small growers.

In case of India, Commodity Futures Market hase a significant role in the price risk management process as it is an agriculture dominated economy. India is “one of the top producers of commodities, 5th largest in the world, engaging 57% of the world population and contributes 22% to the GDP”.

“Moreover, why is it not asked: who are the players in these markets, after all? Are they the farmers reeling under the burden of accumulated debts who enter these casino-kind of markets on top of their primary occupation that is inherently a gamble in monsoon and now also the machinations of the input suppliers, final produce markets and public policies? It is common knowledge that if the holders of huge stocks of any commodity have an opportunity to hedge their stocks, they would do so at prices way above the spot prices (that is, the prices at which they have done their stockpiling) in order to guard against low prices when they have to de-hoard these goods with short shelf-life.)" (Kamal Nayan Kabra, 2008)

UNCTAD documents the fact that "three fourths of the 1.2 billion people living on less than $1 a day live and work in rural areas, about half of the world's hungry people are from smallholder farming communities, another 20 per cent are rural landless and about 10 per cent live in communities whose livelihoods depend on herding, fishing or forest resources" (UNCTAD, 2006a: 3).

Food and Agriculture Organization (2004: 34), "improving the productivity of small-scale farmers has a ripple effect that spreads benefits throughout poor rural communities…boosting the incomes of the rural population as a whole, including landless labourers who make up a large part of the population of the poor and hungry in many countries" .

11.3 Limitations and Future Research Scope:

The present study is confined to the farmers, traders and investors of Telangana and the same can be extended to the other states of India. Price discovery and volatility modelling can be done for other commodities of the exchanges, as well.

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APPENDIX A

FACTORS FOSTERING OR IMPEDING PERCOLATION OF CFM AND EFFECTIVENESS OF INVESTMENT HEDGE: INVESTOR'S PERSPECTIVE

Correlation Matrix

		DifBrkr	Fees	TCosts	IMargin	ConSize	ComLtrcy	AprhnsNew	Vltlty	InvstHedge	Spec	PD	Arbtrg	Dvsftn	DifFrmlts
Correlation	DifBrkr	1.000	.565	.223	.280	.319	.211	.271	.016	.047	.106	-.056	.099	-.260	.497
	Fees	.565	1.000	.337	.534	.461	.374	.490	.063	.099	.216	.100	-.078	-.145	.363
	TCosts	.223	.337	1.000	.595	.647	.326	.655	.446	.325	.212	.223	.049	-.033	.236
	IMargin	.280	.534	.595	1.000	.526	.397	.524	.231	.368	.300	.214	.054	-.036	.341
	ConSize	.319	.461	.647	.526	1.000	.380	.760	.332	.286	.289	.268	.064	-.037	.151
	ComLtrcy	.211	.374	.326	.397	.380	1.000	.366	.165	.226	.320	.157	.171	.249	.242
	AprhnsNew	.271	.490	.655	.524	.760	.366	1.000	.289	.328	.272	.184	.093	.054	.094
	Vltlty	.016	.063	.446	.231	.332	.165	.289	1.000	.411	.336	.463	.256	.255	-.031
	InvstHedge	.047	.099	.325	.368	.286	.226	.328	.411	1.000	.353	.624	.456	.427	.153
	Spec	.106	.216	.212	.300	.289	.320	.272	.336	.353	1.000	.396	.406	.116	.242
	PD	-.056	.100	.223	.214	.268	.157	.184	.463	.624	.396	1.000	.349	.386	.081
	Arbtrg	.099	-.078	.049	.054	.064	.171	.093	.256	.456	.406	.349	1.000	.220	-.080
	Dvsftn	-.260	-.145	-.033	-.036	-.037	.249	.054	.255	.427	.116	.386	.220	1.000	.052
	DifFrmlts	.497	.363	.236	.341	.151	.242	.094	-.031	.153	.242	.081	-.080	.052	1.000

a. Determinant = .002

Anti-image Matrices

		DifBrkr	Fees	TCosts	IMargin	ConSize	ComLtrcy	AprhnsNew	Vltlty	InvstHedge	Spec	PD	Arbtrg	Dvsftn	DifFrmlts
Anti-image Covariance	DifBrkr	.424	-.179	.039	.065	-.056	-.011	-.015	-.069	-.015	.111	.069	-.173	.145	-.238
	Fees	-.179	.418	.058	-.138	.012	-.093	-.095	.021	.046	-.033	-.084	.109	.033	.000
	TCosts	.039	.058	.353	-.112	-.061	-.046	-.116	-.174	-.011	.086	4.64E-5	.000	.099	-.108
	IMargin	.065	-.138	-.112	.443	-.027	-.070	-.004	.016	-.111	-.026	.031	.008	.072	-.070
	ConSize	-.056	.012	-.061	-.027	.334	-.066	-.162	-.020	.021	-.023	-.086	.045	.051	.029
	ComLtrcy	-.011	-.093	-.046	-.070	-.066	.640	.021	.042	.041	-.098	.060	-.069	-.201	-.006
	AprhnsNew	-.015	-.095	-.116	-.004	-.162	.021	.302	.048	-.052	-.055	.075	.002	-.088	.095
	Vltlty	-.069	.021	-.174	.016	-.020	.042	.048	.568	-.022	-.132	-.106	.016	-.117	.135
	InvstHedge	-.015	.046	-.011	-.111	.021	.041	-.052	-.022	.415	.017	-.183	-.143	-.118	-.038
	Spec	.111	-.033	.086	-.026	-.023	-.098	-.055	-.132	.017	.580	-.085	-.209	.109	-.178
	PD	.069	-.084	4.649E-5	.031	-.086	.060	.075	-.106	-.183	-.085	.475	-.038	-.080	-.010
	Arbtrg	-.173	.109	.000	.008	.045	-.069	.002	.016	-.143	-.209	-.038	.566	-.033	.169
	Dvsftn	.145	.033	.099	.072	.051	-.201	-.088	-.117	-.118	.109	-.080	-.033	.540	-.145
	DifFrmlts	-.238	.000	-.108	-.070	.029	-.006	.095	.135	-.038	-.178	-.010	.169	-.145	.499
Anti-image Correlation	DifBrkr	.552[a]	-.425	.101	.150	-.150	-.022	-.041	-.140	-.036	.224	.154	-.353	.303	-.519
	Fees	-.425	.747[a]	.151	-.321	.032	-.181	-.266	.043	.110	-.067	-.188	.224	.069	-.001
	TCosts	.101	.151	.767[a]	-.283	-.178	-.096	-.354	-.389	-.030	.190	.000	-.002	.228	-.257
	IMargin	.150	-.321	-.283	.844[a]	-.070	-.132	-.010	.033	-.258	-.051	.068	.016	.147	-.150
	ConSize	-.150	.032	-.178	-.070	.833[a]	-.142	-.509	-.046	.055	-.052	-.215	.104	.120	.072
	ComLtrcy	-.022	-.181	-.096	-.132	-.142	.805[a]	.049	.069	.079	-.162	.108	-.115	-.342	-.011
	AprhnsNew	-.041	-.266	-.354	-.010	-.509	.049	.757[a]	.117	-.147	-.131	.199	.006	-.217	.245
	Vltlty	-.140	.043	-.389	.033	-.046	.069	.117	.734[a]	-.046	-.230	-.204	.029	-.212	.254
	InvstHedge	-.036	.110	-.030	-.258	.055	.079	-.147	-.046	.782[a]	.036	-.413	-.295	-.250	-.084
	Spec	.224	-.067	.190	-.051	-.052	-.162	-.131	-.230	.036	.684[a]	-.161	-.365	.195	-.330
	PD	.154	-.188	.000	.068	-.215	.108	.199	-.204	-.413	-.161	.748[a]	-.074	-.158	-.021
	Arbtrg	-.353	.224	-.002	.016	.104	-.115	.006	.029	-.295	-.365	-.074	.561[a]	-.060	.318
	Dvsftn	.303	.069	.228	.147	.120	-.342	-.217	-.212	-.250	.195	-.158	-.060	.508[a]	-.280
	DifFrmlts	-.519	-.001	-.257	-.150	.072	-.011	.245	.254	-.084	-.330	-.021	.318	-.280	.485[a]

a. Measures of Sampling Adequacy(MSA)

APPENDIX B

DESCRIPTIVE STATISTICS AND STATIONARITY OF THE DATA

Rubber Maturity Month Contracts

Figure B1: Structural Break in ‘Future Series’

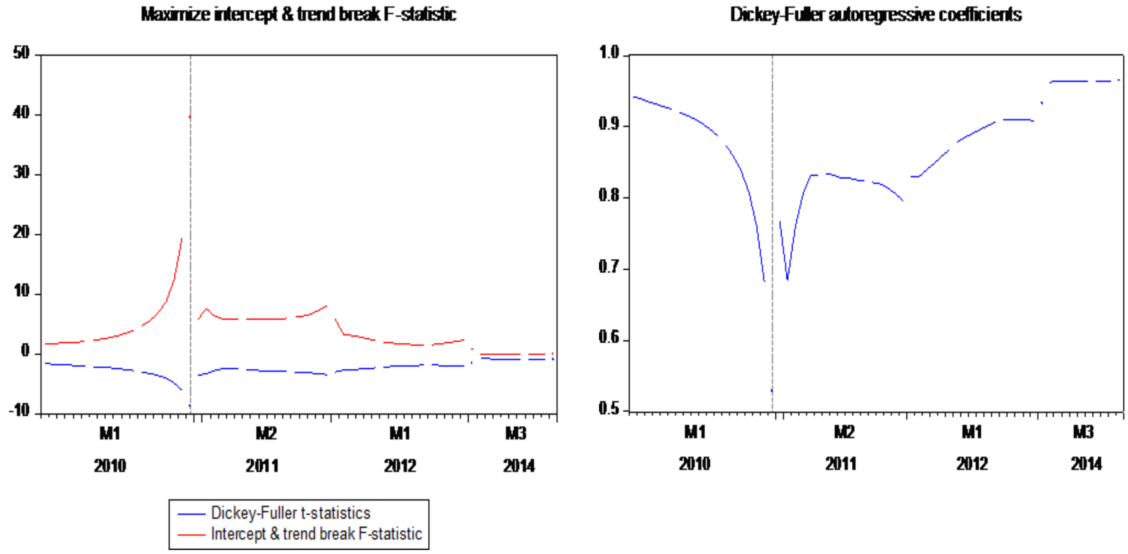
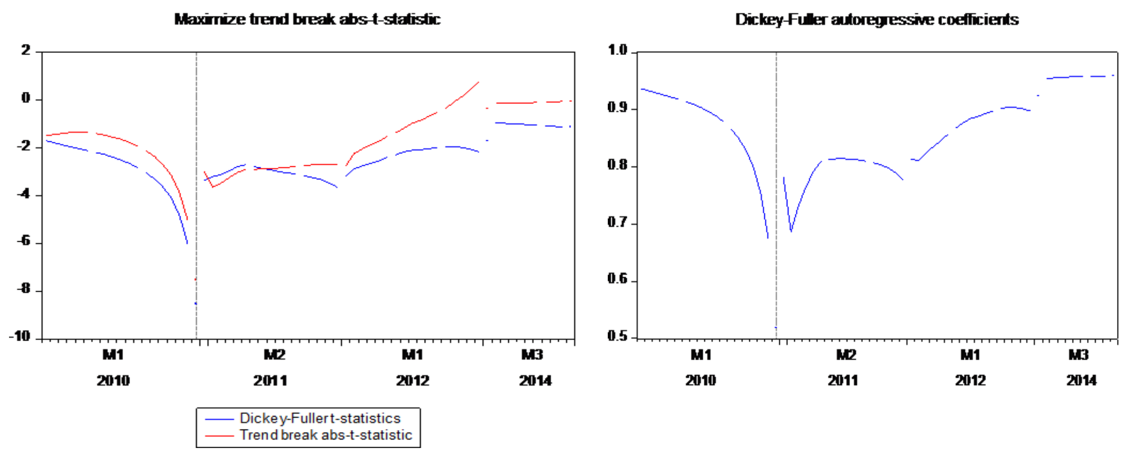


Figure B2: Structural Break in ‘Spot Series’



Rubber Near Month Contracts

Figure B3: Structural Break in ‘Future Series’

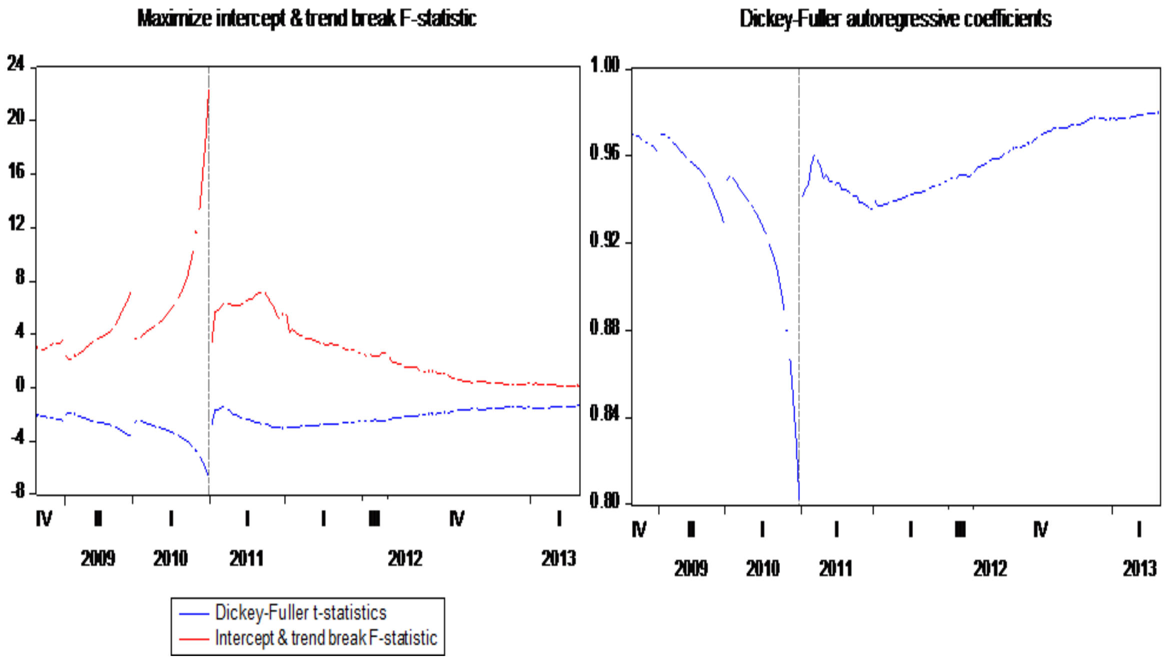
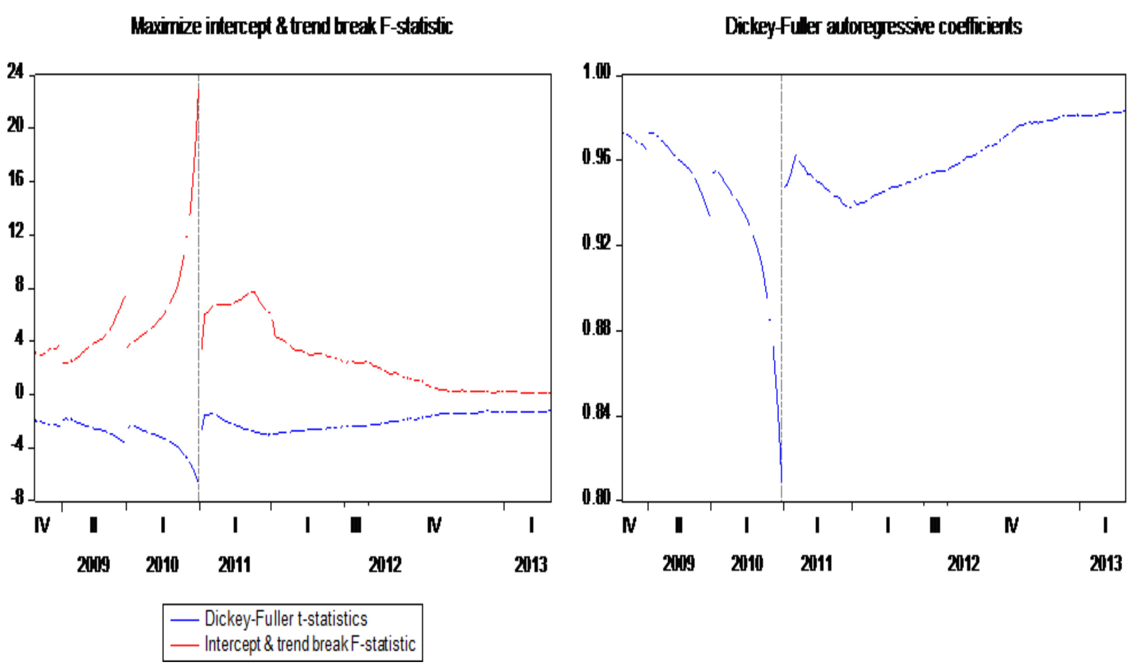


Figure B4: Structural Break in ‘Spot Series’



Rubber Distant Month Contracts

Figure B5: Structural Break in 'Future Series'

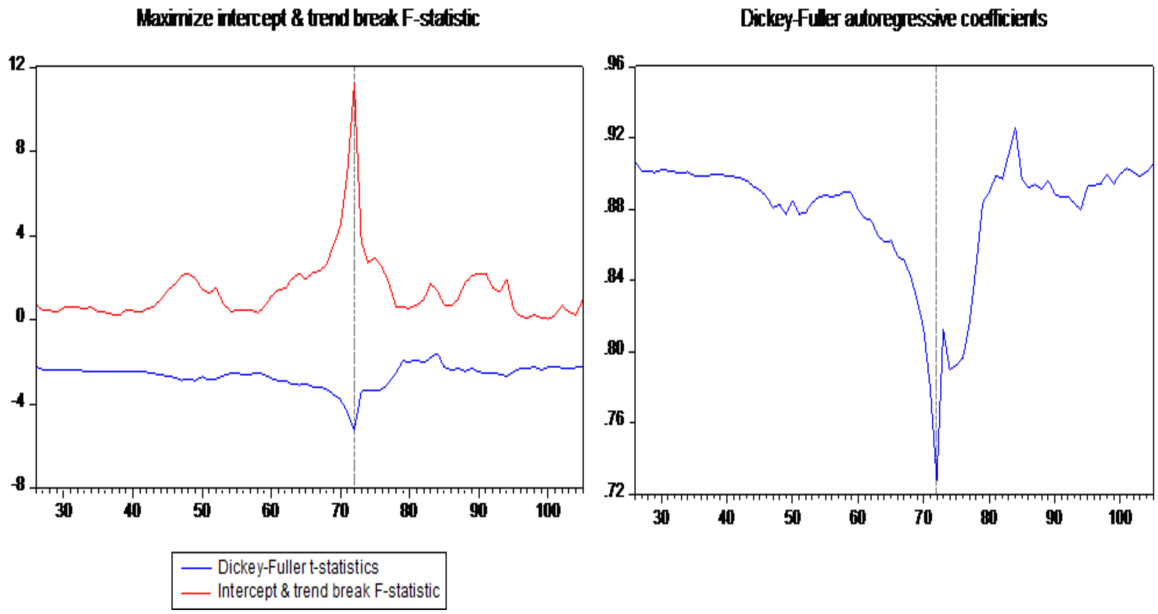
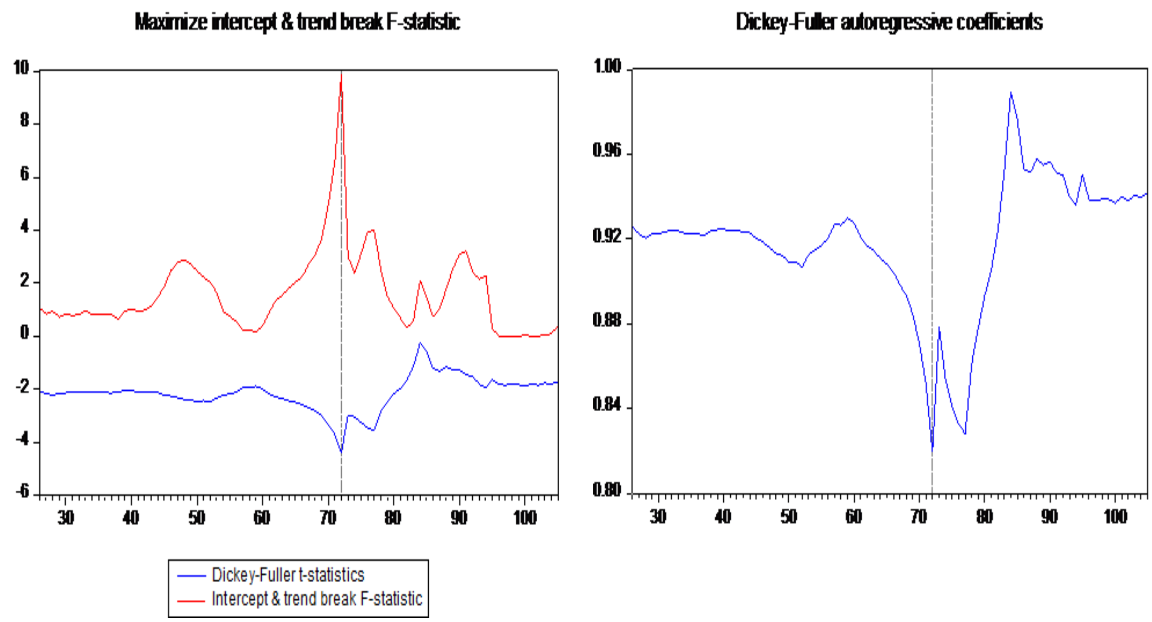


Figure B6: Structural Break in 'Spot Series'



Cotton

Figure B7: Structural Break in 'Future Series'

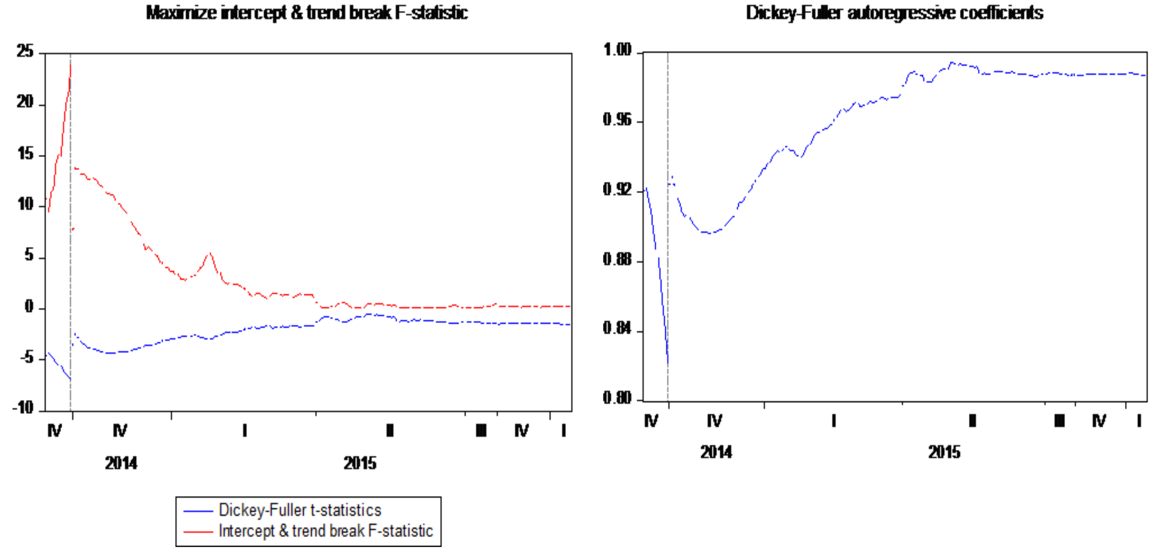
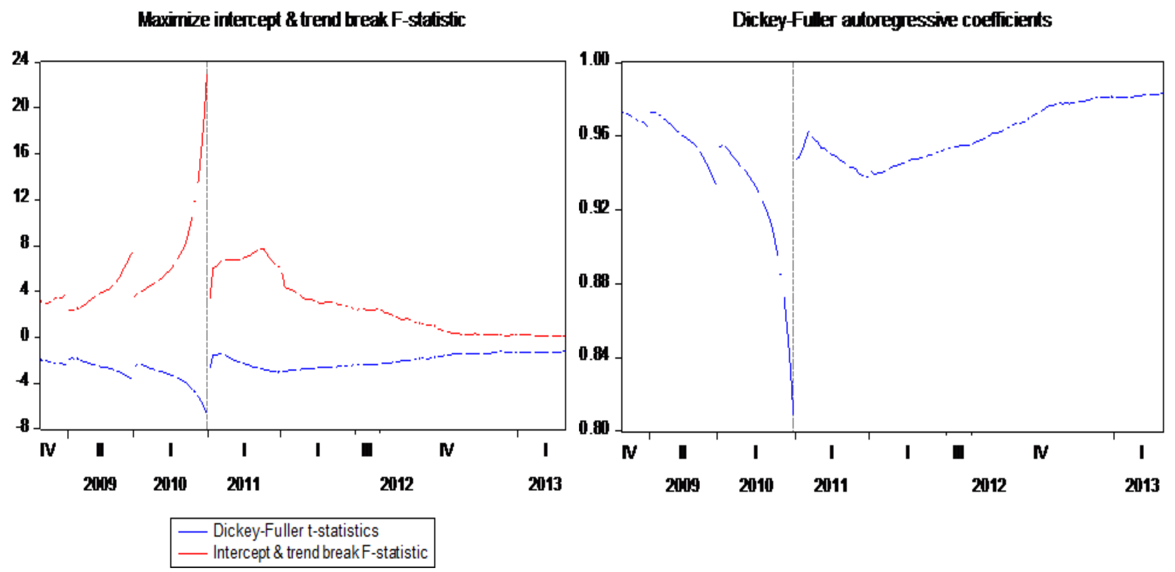


Figure B8: Structural Break in 'Spot Series'



Chilli Contracts

Figure B9: Structural Break in 'Future Series'

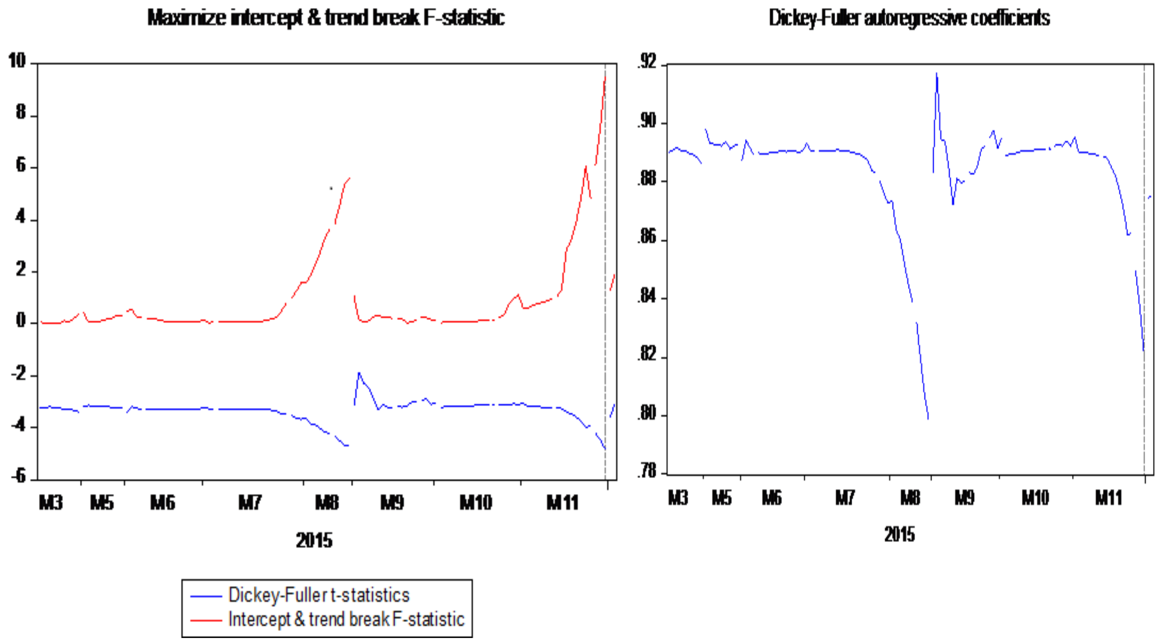
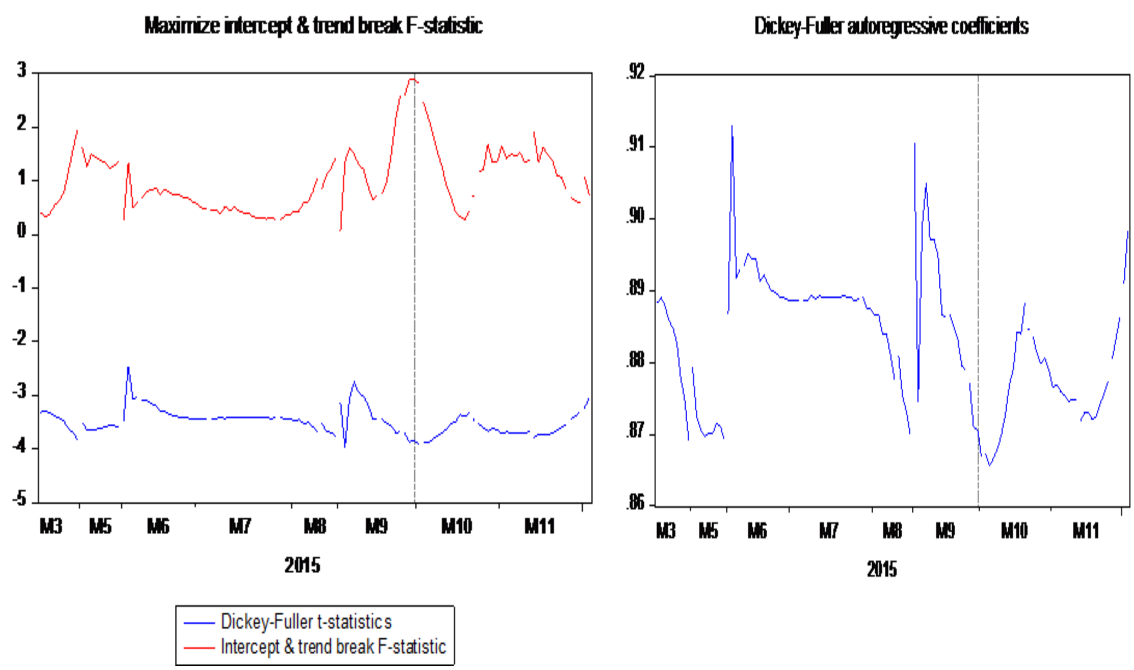


Figure B10: Structural Break in 'Spot Series'



Turmeric Contracts

Figure B11: Structural Break in ‘Future Series’

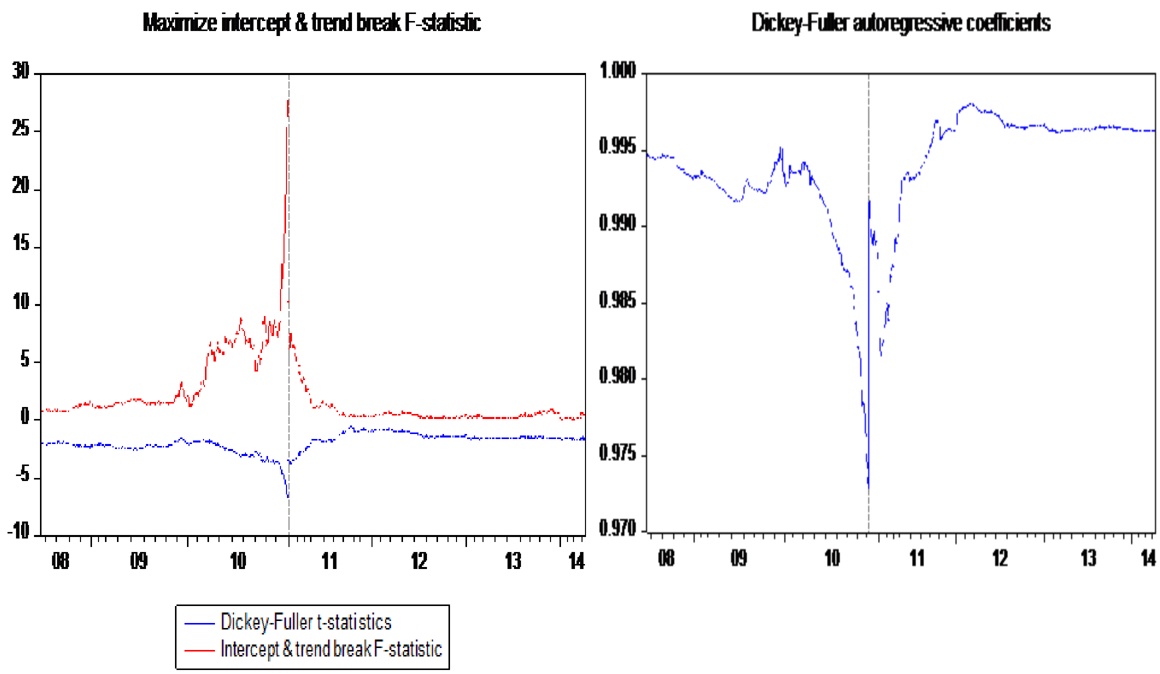
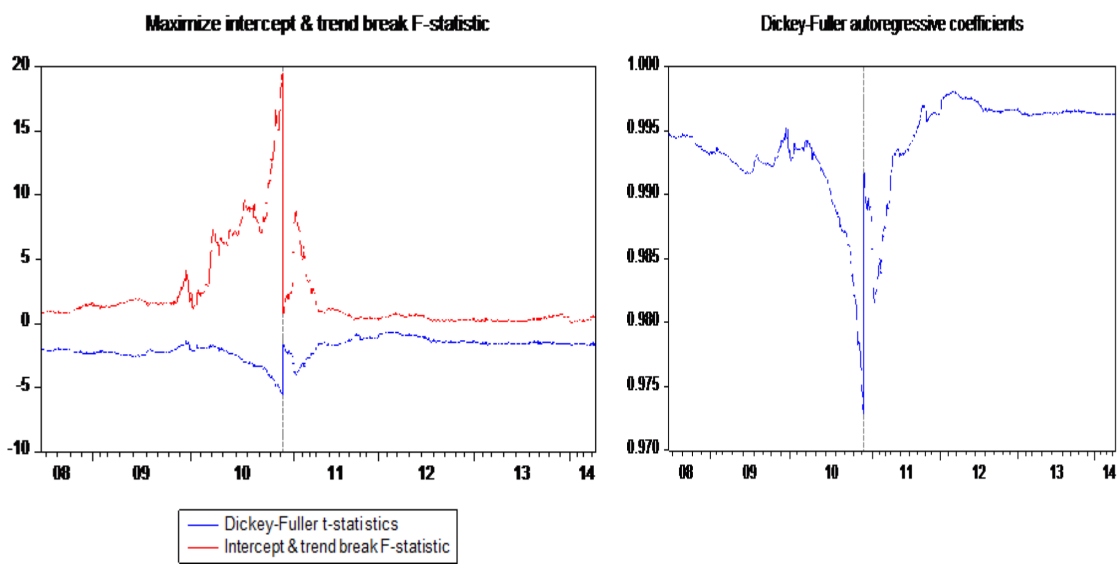


Figure B12: Structural Break in ‘Spot Series’



APPENDIX C

MODELLING VOLATILITY

Turmeric

Table C1

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
|*******	|*******	1	0.996	0.996	1168.9	0.000
|*******	| |	2	0.992	0.016	2329.1	0.000
|*******	| |	3	0.987	-0.002	3480.7	0.000
|*******	| |	4	0.984	0.023	4624.0	0.000
|*******	| |	5	0.980	-0.003	5759.2	0.000
|*******	| |	6	0.976	0.017	6886.7	0.000
|*******	| |	7	0.972	0.006	8006.4	0.000
|*******	| |	8	0.968	0.001	9118.7	0.000
|*******	| |	9	0.965	-0.007	10223.	0.000
|*******	| |	10	0.961	-0.035	11320.	0.000
|*******	| |	11	0.956	-0.031	12407.	0.000
|*******	| |	12	0.952	0.012	13486.	0.000
|*******	| |	13	0.948	-0.024	14556.	0.000
|*******	| |	14	0.944	0.030	15618.	0.000
|*******	| |	15	0.940	0.048	16673.	0.000
|*******	| |	16	0.937	0.004	17720.	0.000
|*******	| |	17	0.933	0.035	18762.	0.000
|*******	| |	18	0.930	-0.017	19796.	0.000
|*******	| |	19	0.926	-0.019	20824.	0.000
|*******	| |	20	0.922	-0.039	21843.	0.000
|*******	| |	21	0.918	-0.018	22855.	0.000
|*******	| |	22	0.914	-0.018	23858.	0.000
|*******	| |	23	0.910	-0.033	24853.	0.000
|*******	| |	24	0.905	0.003	25839.	0.000
|******|	| |	25	0.902	0.041	26817.	0.000
|******|	| |	26	0.898	-0.005	27787.	0.000
|******|	| |	27	0.894	-0.018	28750.	0.000
|******|	| |	28	0.890	0.019	29705.	0.000
|******|	| |	29	0.886	-0.006	30653.	0.000
|******|	| |	30	0.882	-0.011	31592.	0.000
|******|	| |	31	0.877	-0.001	32523.	0.000
|******|	| |	32	0.873	-0.006	33446.	0.000
|******|	| |	33	0.869	0.026	34362.	0.000
|******|	| |	34	0.865	-0.019	35270.	0.000
|******|	| |	35	0.861	0.014	36171.	0.000
|******|	| |	36	0.858	0.001	37065.	0.000

Chilli

Table C2

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|*******	.|*******	1	0.963	0.963	156.84	0.000
.|*******	*|. |	2	0.920	-0.113	300.69	0.000
.|******|	.|. |	3	0.877	-0.003	432.28	0.000
.|******|	.|. |	4	0.837	0.007	552.76	0.000
.|******|	.|. |	5	0.796	-0.027	662.57	0.000
.|***** |	.|. |	6	0.760	0.045	763.38	0.000
.|***** |	.|. |	7	0.730	0.036	856.74	0.000
.|***** |	.|. |	8	0.704	0.050	944.28	0.000
.|***** |	.|. |	9	0.684	0.042	1027.3	0.000
.|***** |	.|* |	10	0.671	0.092	1107.7	0.000
.|***** |	.|. |	11	0.660	0.014	1186.1	0.000
.|***** |	.|. |	12	0.648	-0.030	1262.0	0.000
.|***** |	.|. |	13	0.635	0.017	1335.6	0.000
.|***** |	.|. |	14	0.624	0.019	1406.9	0.000
.|**** |	.|. |	15	0.612	0.005	1476.1	0.000
.|**** |	.|* |	16	0.606	0.094	1544.2	0.000
.|**** |	.|. |	17	0.604	0.069	1612.5	0.000
.|**** |	.|* |	18	0.609	0.103	1682.4	0.000
.|**** |	**|. |	19	0.597	-0.249	1750.0	0.000
.|**** |	.|. |	20	0.584	0.064	1815.2	0.000
.|**** |	.|. |	21	0.572	-0.020	1878.1	0.000
.|**** |	.|. |	22	0.558	-0.009	1938.3	0.000
.|**** |	.|. |	23	0.539	-0.034	1995.1	0.000
.|**** |	.|. |	24	0.522	0.014	2048.5	0.000
.|**** |	.|. |	25	0.502	-0.021	2098.5	0.000
.|*** |	.|. |	26	0.481	-0.039	2144.6	0.000
.|*** |	.|. |	27	0.462	0.004	2187.4	0.000
.|*** |	.|. |	28	0.447	0.024	2227.8	0.000
.|*** |	.|. |	29	0.437	0.009	2266.6	0.000
.|*** |	.|. |	30	0.427	0.014	2304.0	0.000
.|*** |	.|. |	31	0.416	-0.018	2339.8	0.000
.|*** |	.|. |	32	0.403	-0.059	2373.6	0.000
.|*** |	*|. |	33	0.384	-0.066	2404.6	0.000
.|*** |	.|. |	34	0.364	-0.039	2432.6	0.000
.|** |	.|. |	35	0.343	-0.029	2457.7	0.000
.|** |	.|. |	36	0.326	-0.008	2480.5	0.000

Cotton

Table C3

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|*******	.|*******	1	0.983	0.983	277.36	0.000
.|*******	*|. |	2	0.963	-0.108	544.31	0.000
.|*******	.|. |	3	0.941	-0.043	800.26	0.000
.|*******	.|. |	4	0.920	0.021	1045.9	0.000
.|******|	.|. |	5	0.899	-0.012	1281.3	0.000
.|******|	.|. |	6	0.879	-0.008	1506.9	0.000
.|******|	.|. |	7	0.857	-0.042	1722.3	0.000
.|******|	.|. |	8	0.837	0.051	1928.6	0.000
.|******|	.|. |	9	0.816	-0.061	2125.4	0.000
.|******|	.|. |	10	0.798	0.070	2314.0	0.000
.|******|	.|. |	11	0.779	-0.011	2494.8	0.000
.|***** |	.|. |	12	0.761	-0.020	2667.8	0.000
.|***** |	.|. |	13	0.743	0.012	2833.5	0.000
.|***** |	.|. |	14	0.725	-0.030	2991.8	0.000
.|***** |	.|. |	15	0.707	-0.005	3142.8	0.000
.|***** |	.|. |	16	0.689	-0.017	3286.7	0.000
.|***** |	*|. |	17	0.668	-0.079	3422.5	0.000
.|***** |	.|. |	18	0.646	-0.046	3550.0	0.000
.|**** |	.|. |	19	0.623	-0.043	3668.8	0.000
.|**** |	.|. |	20	0.599	0.005	3779.2	0.000
.|**** |	*|. |	21	0.574	-0.068	3881.1	0.000
.|**** |	.|. |	22	0.549	-0.030	3974.5	0.000
.|**** |	.|. |	23	0.524	0.013	4059.9	0.000
.|**** |	.|. |	24	0.499	-0.031	4137.6	0.000
.|*** |	.|. |	25	0.473	-0.047	4207.6	0.000
.|*** |	.|. |	26	0.447	-0.001	4270.6	0.000
.|*** |	.|. |	27	0.422	-0.007	4326.9	0.000
.|*** |	.|* |	28	0.403	0.139	4378.3	0.000
.|*** |	*|. |	29	0.380	-0.136	4424.4	0.000
.|*** |	.|. |	30	0.358	0.005	4465.4	0.000
.|** |	.|. |	31	0.336	-0.029	4501.6	0.000
.|** |	.|. |	32	0.314	0.021	4533.4	0.000
.|** |	.|. |	33	0.293	-0.006	4561.2	0.000
.|** |	.|. |	34	0.273	0.001	4585.5	0.000
.|** |	.|* |	35	0.255	0.075	4606.7	0.000
.|** |	.|. |	36	0.238	-0.036	4625.2	0.000

Rubber Near Month

Table C4

<table>
<tr><th>Autocorrelation</th><th>Partial Correlation</th><th></th><th>AC</th><th>PAC</th><th>Q-Stat</th><th>Prob</th></tr>
<tr><td>.|*******</td><td>.|*******</td><td>1</td><td>0.984</td><td>0.984</td><td>231.41</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>2</td><td>0.968</td><td>-0.010</td><td>456.28</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>3</td><td>0.950</td><td>-0.064</td><td>673.85</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>4</td><td>0.931</td><td>-0.037</td><td>883.83</td><td>0.000</td></tr>
<tr><td>.|*******</td><td>.|. |</td><td>5</td><td>0.913</td><td>0.004</td><td>1086.5</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>6</td><td>0.895</td><td>0.017</td><td>1282.2</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>7</td><td>0.878</td><td>0.005</td><td>1471.3</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>8</td><td>0.861</td><td>-0.003</td><td>1654.0</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>9</td><td>0.845</td><td>-0.003</td><td>1830.5</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>10</td><td>0.827</td><td>-0.033</td><td>2000.5</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>11</td><td>0.810</td><td>-0.016</td><td>2164.1</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>12</td><td>0.791</td><td>-0.033</td><td>2321.1</td><td>0.000</td></tr>
<tr><td>.|******|</td><td>.|. |</td><td>13</td><td>0.773</td><td>-0.001</td><td>2471.6</td><td>0.000</td></tr>
<tr><td>.|***** |</td><td>.|. |</td><td>14</td><td>0.755</td><td>-0.015</td><td>2615.7</td><td>0.000</td></tr>
<tr><td>.|***** |</td><td>.|. |</td><td>15</td><td>0.736</td><td>-0.020</td><td>2753.3</td><td>0.000</td></tr>
<tr><td>.|***** |</td><td>.|. |</td><td>16</td><td>0.718</td><td>0.007</td><td>2884.9</td><td>0.000</td></tr>
<tr><td>.|***** |</td><td>.|. |</td><td>17</td><td>0.699</td><td>-0.021</td><td>3010.3</td><td>0.000</td></tr>
<tr><td>.|***** |</td><td>.|. |</td><td>18</td><td>0.682</td><td>0.014</td><td>3130.0</td><td>0.000</td></tr>
<tr><td>.|***** |</td><td>.|. |</td><td>19</td><td>0.666</td><td>0.055</td><td>3244.8</td><td>0.000</td></tr>
<tr><td>.|***** |</td><td>.|. |</td><td>20</td><td>0.652</td><td>0.017</td><td>3355.2</td><td>0.000</td></tr>
<tr><td>.|***** |</td><td>.|. |</td><td>21</td><td>0.638</td><td>0.034</td><td>3461.7</td><td>0.000</td></tr>
<tr><td>.|***** |</td><td>.|. |</td><td>22</td><td>0.627</td><td>0.041</td><td>3564.9</td><td>0.000</td></tr>
<tr><td>.|**** |</td><td>.|. |</td><td>23</td><td>0.615</td><td>-0.022</td><td>3664.8</td><td>0.000</td></tr>
<tr><td>.|**** |</td><td>.|. |</td><td>24</td><td>0.602</td><td>-0.066</td><td>3760.8</td><td>0.000</td></tr>
<tr><td>.|**** |</td><td>.|* |</td><td>25</td><td>0.593</td><td>0.139</td><td>3854.5</td><td>0.000</td></tr>
<tr><td>.|**** |</td><td>***|. |</td><td>26</td><td>0.573</td><td>-0.379</td><td>3942.2</td><td>0.000</td></tr>
<tr><td>.|**** |</td><td>.|. |</td><td>27</td><td>0.552</td><td>0.010</td><td>4024.1</td><td>0.000</td></tr>
<tr><td>.|**** |</td><td>.|. |</td><td>28</td><td>0.531</td><td>-0.016</td><td>4100.2</td><td>0.000</td></tr>
<tr><td>.|**** |</td><td>.|. |</td><td>29</td><td>0.509</td><td>-0.014</td><td>4170.7</td><td>0.000</td></tr>
<tr><td>.|**** |</td><td>.|. |</td><td>30</td><td>0.488</td><td>-0.000</td><td>4235.7</td><td>0.000</td></tr>
<tr><td>.|*** |</td><td>.|. |</td><td>31</td><td>0.468</td><td>-0.012</td><td>4295.7</td><td>0.000</td></tr>
<tr><td>.|*** |</td><td>.|. |</td><td>32</td><td>0.447</td><td>-0.052</td><td>4350.6</td><td>0.000</td></tr>
<tr><td>.|*** |</td><td>.|. |</td><td>33</td><td>0.426</td><td>-0.011</td><td>4400.7</td><td>0.000</td></tr>
<tr><td>.|*** |</td><td>.|. |</td><td>34</td><td>0.404</td><td>-0.018</td><td>4446.2</td><td>0.000</td></tr>
<tr><td>.|*** |</td><td>.|. |</td><td>35</td><td>0.383</td><td>-0.000</td><td>4487.3</td><td>0.000</td></tr>
<tr><td>.|*** |</td><td>.|. |</td><td>36</td><td>0.362</td><td>-0.016</td><td>4524.1</td><td>0.000</td></tr>
</table>

Rubber Maturity Month

Table C5

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |*******	. |*******	1	0.959	0.959	89.289	0.000
. |*******	.*|. |	2	0.915	-0.071	171.32	0.000
. |******|	. |. |	3	0.868	-0.049	245.95	0.000
. |******|	. |. |	4	0.818	-0.049	313.11	0.000
. |******|	. |. |	5	0.770	-0.018	373.20	0.000
. |***** |	. |. |	6	0.721	-0.033	426.47	0.000
. |***** |	. |. |	7	0.672	-0.019	473.37	0.000
. |***** |	. |. |	8	0.626	-0.007	514.47	0.000
. |**** |	. |. |	9	0.577	-0.062	549.80	0.000
. |**** |	. |. |	10	0.529	-0.019	579.83	0.000
. |*** |	. |. |	11	0.479	-0.051	604.79	0.000
. |*** |	. |. |	12	0.429	-0.035	625.05	0.000
. |*** |	. |. |	13	0.379	-0.039	641.04	0.000
. |** |	. |. |	14	0.328	-0.035	653.21	0.000
. |** |	. |. |	15	0.279	-0.028	662.10	0.000
. |** |	. |. |	16	0.230	-0.035	668.20	0.000
. |* |	. |. |	17	0.182	-0.026	672.06	0.000
. |* |	. |* |	18	0.143	0.082	674.50	0.000
. |* |	. |* |	19	0.116	0.101	676.13	0.000
. |* |	. |. |	20	0.090	-0.033	677.12	0.000
. |. |	. |. |	21	0.069	0.022	677.71	0.000
. |. |	. |. |	22	0.048	-0.031	677.99	0.000
. |. |	**|. |	23	0.012	-0.221	678.01	0.000
. |. |	. |. |	24	-0.026	-0.052	678.10	0.000
. |. |	. |. |	25	-0.064	-0.030	678.63	0.000
.*|. |	.*|. |	26	-0.104	-0.074	680.08	0.000
.*|. |	. |. |	27	-0.145	-0.043	682.89	0.000
.*|. |	. |. |	28	-0.185	-0.048	687.58	0.000
**|. |	.*|. |	29	-0.227	-0.079	694.72	0.000
**|. |	.*|. |	30	-0.269	-0.071	704.92	0.000
**|. |	. |. |	31	-0.312	-0.061	718.83	0.000
***|. |	. |. |	32	-0.353	-0.048	736.98	0.000
***|. |	. |. |	33	-0.391	-0.013	759.61	0.000
***|. |	. |. |	34	-0.428	-0.046	787.14	0.000
***|. |	. |* |	35	-0.447	0.200	817.67	0.000
***|. |	. |. |	36	-0.465	-0.004	851.24	0.000

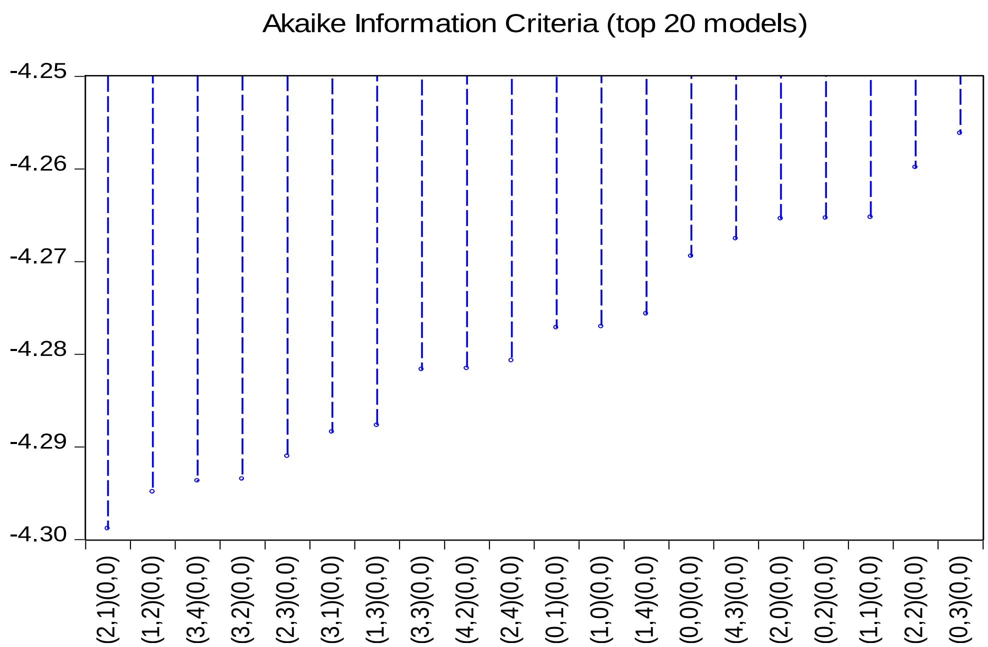
Rubber Distant Month

Table C6

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|*******	.|*******	1	0.956	0.956	109.79	0.000
.|*******	.|. |	2	0.918	0.044	211.92	0.000
.|******|	.|. |	3	0.886	0.048	307.79	0.000
.|******|	.|. |	4	0.852	-0.025	397.28	0.000
.|******|	.|. |	5	0.819	-0.004	480.74	0.000
.|******|	*|. |	6	0.780	-0.092	557.11	0.000
.|***** |	.|. |	7	0.747	0.035	627.67	0.000
.|***** |	.|. |	8	0.721	0.072	694.04	0.000
.|***** |	.|. |	9	0.689	-0.065	755.25	0.000
.|***** |	.|. |	10	0.659	-0.003	811.69	0.000
.|***** |	.|. |	11	0.632	0.026	864.16	0.000
.|**** |	.|. |	12	0.605	-0.023	912.64	0.000
.|**** |	.|. |	13	0.585	0.072	958.50	0.000
.|**** |	.|. |	14	0.568	0.042	1002.1	0.000
.|**** |	.|. |	15	0.557	0.071	1044.4	0.000
.|**** |	.|. |	16	0.541	-0.064	1084.7	0.000
.|**** |	.|. |	17	0.527	0.033	1123.4	0.000
.|**** |	.|. |	18	0.519	0.049	1161.3	0.000
.|**** |	.|. |	19	0.512	0.008	1198.5	0.000
.|**** |	.|. |	20	0.500	-0.032	1234.5	0.000
.|**** |	.|. |	21	0.487	-0.026	1268.9	0.000
.|*** |	.|. |	22	0.472	-0.025	1301.6	0.000
.|*** |	.|. |	23	0.462	0.018	1333.2	0.000
.|*** |	*|. |	24	0.436	-0.165	1361.7	0.000
.|*** |	.|. |	25	0.407	-0.048	1386.8	0.000
.|*** |	.|. |	26	0.379	-0.041	1408.8	0.000
.|** |	.|. |	27	0.347	-0.060	1427.4	0.000
.|** |	.|. |	28	0.316	-0.024	1443.1	0.000
.|** |	*|. |	29	0.277	-0.095	1455.2	0.000
.|** |	*|. |	30	0.235	-0.084	1464.0	0.000
.|* |	.|. |	31	0.203	0.052	1470.7	0.000
.|* |	.|. |	32	0.174	0.051	1475.7	0.000
.|* |	.|. |	33	0.151	0.047	1479.5	0.000
.|* |	.|. |	34	0.126	-0.043	1482.1	0.000
.|* |	*|. |	35	0.096	-0.072	1483.7	0.000
.|* |	.|. |	36	0.075	0.021	1484.7	0.000

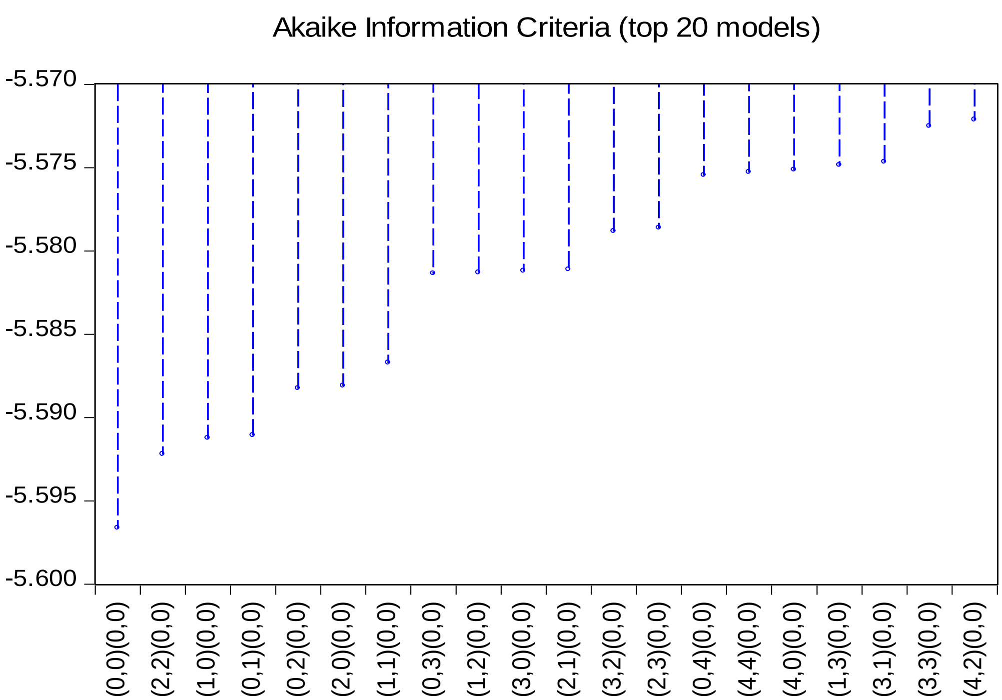
Chilli

Figure C1: Criteria Graph Chilli



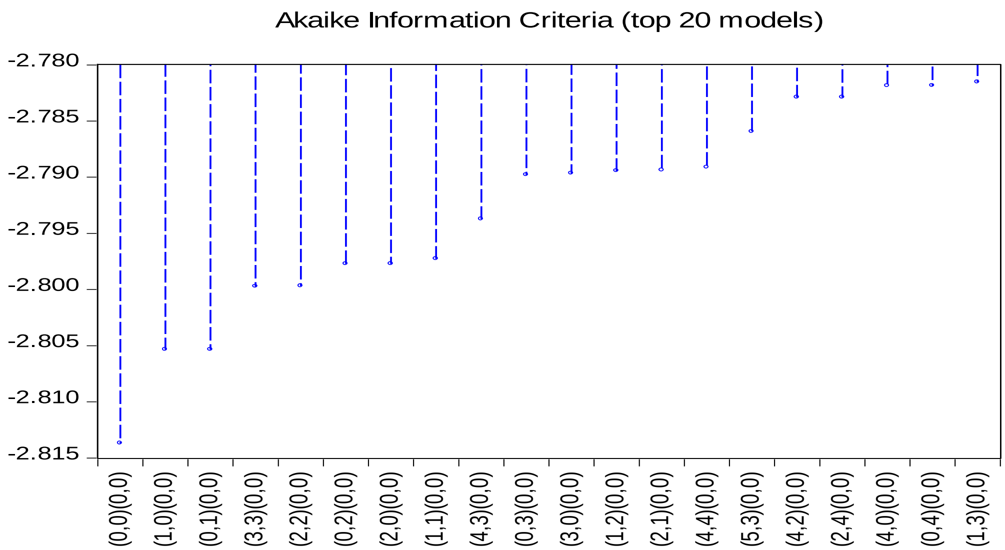
Cotton

Figure C2: Criteria Graph Cotton



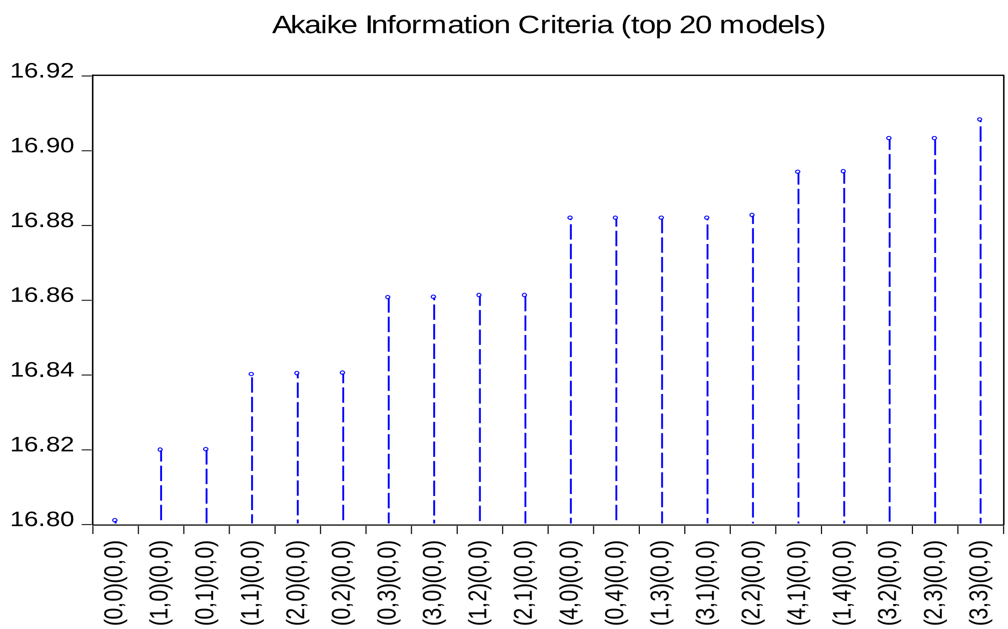
Rubber Near Month

Figure C3: Criteria Graph



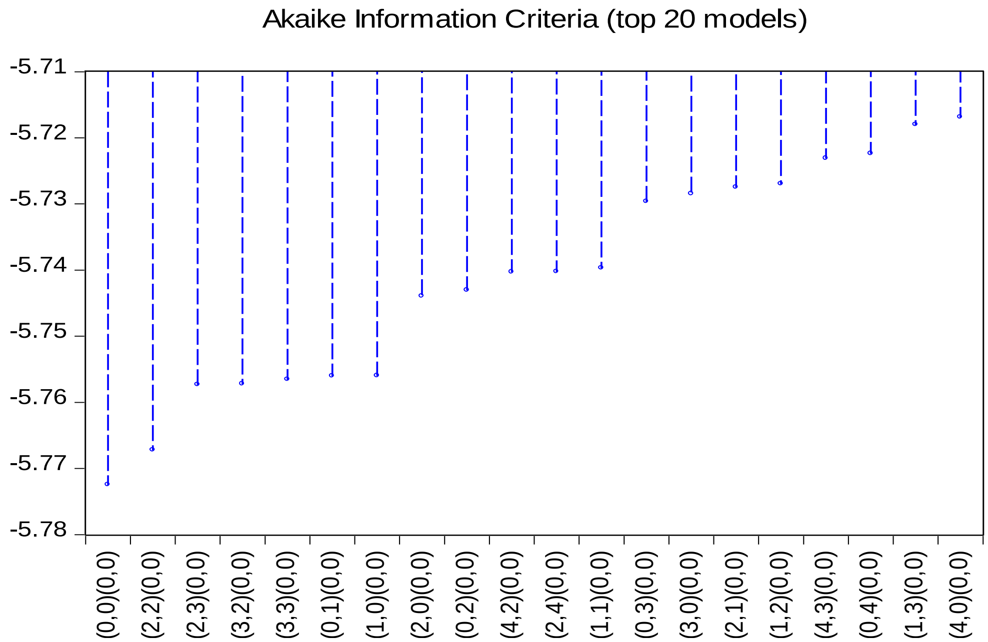
Rubber Maturity Month

Figure C4: Criteria Graph



Rubber Distant Month

Figure C5: Criteria Graph



Turmeric

Table C7

Q-statistic probabilities adjusted for 4 ARMA terms

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
| |	| |	1	0.004	0.004	0.0160	
| |	| |	2	-0.011	-0.011	0.1630	
| |	| |	3	0.001	0.001	0.1653	
| |	| |	4	0.021	0.021	0.6883	
| |	| |	5	0.008	0.008	0.7603	0.383
| |	| |	6	0.002	0.002	0.7653	0.682
| |	| |	7	0.006	0.007	0.8143	0.846
| |	| |	8	0.026	0.026	1.6211	0.805
| |	| |	9	0.037	0.037	3.2745	0.658
| |	| |	10	0.017	0.017	3.6060	0.730
| |	| |	11	-0.009	-0.009	3.7032	0.813
| |	| |	12	0.013	0.012	3.9042	0.866
| |	| |	13	-0.029	-0.031	4.8775	0.845
| |	| |	14	-0.016	-0.017	5.1777	0.879
| |	| |	15	-0.020	-0.021	5.6322	0.897
| |	| |	16	-0.035	-0.037	7.0947	0.851
| |	| |	17	0.047	0.045	9.6881	0.719
| |	| |	18	0.023	0.021	10.320	0.738
| |	| |	19	0.038	0.040	12.091	0.672
| |	| |	20	0.016	0.019	12.404	0.716
| |	| |	21	0.024	0.025	13.078	0.731
| |	| |	22	0.007	0.009	13.144	0.783
| |	| |	23	-0.032	-0.030	14.375	0.761
| |	| |	24	-0.012	-0.011	14.536	0.802
| |	| |	25	0.017	0.015	14.882	0.829
| |	| |	26	0.013	0.007	15.077	0.859
| |	| |	27	-0.024	-0.029	15.761	0.865
| |	| |	28	-0.029	-0.032	16.752	0.859
| |	| |	29	-0.004	-0.012	16.769	0.890
| |	| |	30	-0.020	-0.022	17.242	0.902
| |	| |	31	0.004	0.006	17.262	0.924
| |	| |	32	-0.042	-0.035	19.359	0.887
| |	| |	33	0.021	0.030	19.885	0.896
| |	| |	34	-0.009	-0.007	19.973	0.917
| |	| |	35	-0.021	-0.016	20.510	0.924
| |	| |	36	-0.015	-0.013	20.777	0.936

Chilli

Table C8

Q-statistic probabilities adjusted for 3 ARMA terms

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|. |	.|. |	1	-0.007	-0.007	0.0087	
.|. |	.|. |	2	0.032	0.032	0.1774	
.|. |	.|. |	3	-0.008	-0.007	0.1873	
.|. |	.|. |	4	0.068	0.067	0.9700	0.325
.|. |	.|. |	5	-0.003	-0.002	0.9719	0.615
.|. |	.|. |	6	0.020	0.016	1.0447	0.790
.|. |	.|. |	7	-0.039	-0.038	1.3053	0.860
.|. |	.|. |	8	0.003	-0.003	1.3065	0.934
*|. |	*|. |	9	-0.083	-0.081	2.5377	0.864
.|. |	.|. |	10	-0.017	-0.021	2.5874	0.920
.|. |	.|. |	11	0.044	0.054	2.9337	0.938
.|. |	.|. |	12	-0.024	-0.023	3.0337	0.963
.|. |	.|. |	13	-0.018	-0.009	3.0957	0.979
.|. |	.|. |	14	-0.008	-0.005	3.1064	0.989
*|. |	*|. |	15	-0.123	-0.128	5.8773	0.922
.|. |	.|. |	16	-0.034	-0.039	6.0946	0.943
*|. |	*|. |	17	-0.142	-0.142	9.8380	0.774
.|* |	.|* |	18	0.091	0.091	11.379	0.725
.|. |	.|. |	19	-0.037	-0.018	11.637	0.769
.|. |	.|. |	20	0.002	0.011	11.638	0.822
.|. |	.|. |	21	-0.011	0.012	11.663	0.864
.|. |	.|. |	22	0.006	-0.024	11.669	0.899
.|. |	.|. |	23	-0.037	-0.034	11.930	0.918
.|. |	.|. |	24	0.036	-0.001	12.185	0.934
.|. |	.|. |	25	0.033	0.033	12.403	0.948
.|. |	.|. |	26	-0.028	-0.042	12.562	0.961
.|. |	.|. |	27	-0.045	-0.037	12.969	0.967
.|. |	.|. |	28	-0.043	-0.035	13.341	0.972
.|. |	.|. |	29	-0.004	-0.030	13.344	0.981
.|. |	.|. |	30	-0.011	-0.020	13.367	0.987
.|. |	.|. |	31	0.067	0.064	14.302	0.985
.|* |	.|. |	32	0.075	0.051	15.476	0.981
.|. |	.|. |	33	-0.008	0.005	15.490	0.987
.|. |	.|. |	34	-0.027	-0.043	15.641	0.990
*|. |	*|. |	35	-0.095	-0.101	17.547	0.982
.|. |	.|. |	36	0.054	0.016	18.173	0.983

Cotton

Table C9

Q-statistic probabilities adjusted for 1 ARMA term

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|. |	.|. |	1	0.039	0.039	0.4360	
.|. |	.|. |	2	0.067	0.065	1.7177	0.190
.|. |	.|. |	3	-0.009	-0.014	1.7429	0.418
.|. |	.|. |	4	-0.024	-0.027	1.9050	0.592
.|. |	.|. |	5	0.060	0.064	2.9652	0.564
.|. |	.|. |	6	0.031	0.030	3.2415	0.663
.|. |	.|. |	7	-0.051	-0.063	3.9956	0.677
.|. |	.|. |	8	0.022	0.023	4.1323	0.764
*|. |	*|. |	9	-0.154	-0.146	11.129	0.195
.|. |	.|. |	10	0.036	0.042	11.505	0.243
.|. |	.|. |	11	-0.014	-0.004	11.566	0.315
.|. |	.|. |	12	0.017	0.016	11.648	0.391
.|. |	.|. |	13	-0.012	-0.019	11.691	0.471
.|. |	.|. |	14	0.055	0.073	12.590	0.480
.|. |	.|. |	15	-0.005	-0.004	12.599	0.558
.|* |	.|* |	16	0.096	0.075	15.374	0.425
.|. |	.|. |	17	0.029	0.033	15.636	0.479
.|. |	.|. |	18	0.036	0.002	16.042	0.521
.|. |	.|. |	19	-0.040	-0.040	16.529	0.556
.|* |	.|* |	20	0.086	0.088	18.800	0.470
.|. |	.|. |	21	0.030	0.030	19.074	0.517
.|. |	.|. |	22	0.071	0.043	20.646	0.481
.|. |	.|. |	23	0.021	0.037	20.788	0.534
.|. |	.|. |	24	0.049	0.044	21.535	0.548
.|. |	.|. |	25	-0.056	-0.046	22.531	0.548
.|. |	*|. |	26	-0.060	-0.071	23.651	0.540
.|. |	.|. |	27	-0.057	-0.040	24.683	0.537
.|* |	.|** |	28	0.213	0.214	39.042	0.063
.|. |	.|. |	29	-0.006	0.003	39.051	0.080
.|. |	.|. |	30	0.006	-0.031	39.061	0.100
.|. |	.|. |	31	-0.048	-0.025	39.809	0.109
.|. |	.|. |	32	-0.035	-0.021	40.202	0.125
.|. |	.|. |	33	0.002	-0.010	40.204	0.151
.|. |	.|. |	34	-0.014	-0.057	40.266	0.180
.|. |	.|. |	35	-0.007	0.003	40.283	0.212
.|. |	.|. |	36	0.001	-0.028	40.283	0.248

Rubber Near Month

Table C10

Q-statistic probabilities adjusted for 1 ARMA term

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|. |	.|. |	1	-0.000	-0.000	2.E-05	
.|. |	.|. |	2	0.029	0.029	0.1982	0.656
.|. |	.|. |	3	0.022	0.022	0.3112	0.856
.|. |	.|. |	4	-0.025	-0.026	0.4633	0.927
.|. |	.|. |	5	-0.021	-0.022	0.5677	0.967
.|. |	.|. |	6	-0.011	-0.010	0.5959	0.988
.|. |	.|. |	7	-0.019	-0.016	0.6804	0.995
.|. |	.|. |	8	0.005	0.006	0.6858	0.998
.|. |	.|. |	9	0.018	0.019	0.7687	0.999
.|. |	.|. |	10	0.008	0.008	0.7856	1.000
.|. |	.|. |	11	0.024	0.021	0.9256	1.000
.|. |	.|. |	12	-0.009	-0.011	0.9473	1.000
.|. |	.|. |	13	-0.004	-0.005	0.9508	1.000
.|. |	.|. |	14	-0.010	-0.010	0.9763	1.000
.|. |	.|. |	15	-0.028	-0.025	1.1700	1.000
.|. |	.|. |	16	0.011	0.012	1.1981	1.000
.|. |	.|. |	17	-0.019	-0.017	1.2914	1.000
.|. |	.|. |	18	-0.052	-0.053	1.9945	1.000
.|. |	.|. |	19	-0.036	-0.039	2.3373	1.000
.|. |	.|. |	20	-0.027	-0.026	2.5302	1.000
.|. |	.|. |	21	-0.038	-0.035	2.8970	1.000
.|. |	.|. |	22	-0.050	-0.051	3.5391	1.000
.|. |	.|. |	23	0.032	0.032	3.8021	1.000
*|. |	*|. |	24	-0.087	-0.087	5.8101	1.000
.|** |	.|** |	25	0.274	0.275	25.722	0.367
.|. |	.|. |	26	0.002	-0.004	25.723	0.422
.|. |	.|. |	27	0.023	0.018	25.866	0.470
.|. |	.|. |	28	0.004	-0.013	25.870	0.526
.|. |	.|. |	29	0.002	0.015	25.871	0.580
.|. |	.|. |	30	0.001	0.013	25.871	0.632
.|. |	.|. |	31	0.016	0.023	25.939	0.678
.|. |	.|. |	32	0.000	0.007	25.939	0.724
.|. |	.|. |	33	-0.008	-0.013	25.955	0.766
.|. |	.|. |	34	0.005	-0.007	25.961	0.803
.|. |	.|. |	35	0.002	-0.002	25.963	0.837
.|. |	.|. |	36	0.024	0.004	26.128	0.861

Rubber Maturity Month

Table C11

Q-statistic probabilities adjusted for 1 ARMA term

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
. |. |	. |. |	1	0.062	0.062	0.3742	
. |. |	. |. |	2	0.042	0.038	0.5459	0.460
. |. |	. |. |	3	0.041	0.037	0.7164	0.699
. |. |	. |. |	4	-0.001	-0.007	0.7164	0.869
. |. |	. |. |	5	0.006	0.003	0.7202	0.949
. |. |	. |. |	6	-0.010	-0.011	0.7294	0.981
. |. |	. |. |	7	-0.026	-0.025	0.7979	0.992
. |. |	. |. |	8	0.030	0.034	0.8942	0.996
. |. |	. |. |	9	-0.011	-0.012	0.9072	0.999
. |. |	. |. |	10	0.022	0.023	0.9593	1.000
. |. |	. |. |	11	0.006	0.001	0.9628	1.000
. |. |	. |. |	12	0.010	0.009	0.9740	1.000
. |. |	. |. |	13	0.003	-0.001	0.9748	1.000
. |. |	. |. |	14	-0.010	-0.011	0.9864	1.000
. |. |	. |. |	15	-0.003	-0.001	0.9873	1.000
. |. |	. |. |	16	-0.030	-0.031	1.0924	1.000
.*|. |	.*|. |	17	-0.157	-0.152	3.9822	0.999
. |. |	. |. |	18	-0.034	-0.015	4.1168	0.999
. |. |	. |. |	19	-0.014	0.003	4.1417	1.000
. |. |	. |. |	20	-0.024	-0.011	4.2111	1.000
. |. |	. |. |	21	-0.007	-0.004	4.2166	1.000
. |** |	. |** |	22	0.218	0.229	10.179	0.976
. |. |	. |. |	23	0.015	-0.012	10.209	0.984
. |. |	. |. |	24	-0.002	-0.027	10.209	0.990
. |. |	. |. |	25	0.030	0.026	10.330	0.993
. |. |	. |. |	26	-0.018	-0.022	10.371	0.996
. |. |	. |. |	27	0.004	-0.000	10.374	0.997
. |. |	. |. |	28	0.010	0.016	10.387	0.998
. |. |	. |. |	29	-0.006	0.011	10.391	0.999
. |. |	. |. |	30	-0.000	-0.019	10.391	0.999
. |. |	. |. |	31	-0.034	-0.034	10.558	1.000
. |. |	.*|. |	32	-0.061	-0.069	11.106	1.000
. |. |	. |. |	33	-0.034	-0.040	11.274	1.000
**|. |	**|. |	34	-0.284	-0.330	23.379	0.892
. |. |	. |. |	35	-0.034	-0.011	23.555	0.910
. |. |	. |. |	36	-0.005	0.027	23.558	0.929

Rubber Distant Month

Table C12

Q-statistic probabilities adjusted for 4 ARMA terms

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
.|. |	.|. |	1	0.069	0.069	0.5640	
.|. |	.|. |	2	-0.018	-0.023	0.6044	
.|. |	.|. |	3	0.007	0.010	0.6105	
.|. |	.|. |	4	0.005	0.003	0.6133	
.|. |	.|. |	5	0.058	0.058	1.0251	0.311
.|. |	.|. |	6	-0.031	-0.039	1.1431	0.565
*|. |	*|. |	7	-0.150	-0.144	3.9835	0.263
.|. |	.|. |	8	0.050	0.070	4.3016	0.367
.|. |	*|. |	9	-0.054	-0.070	4.6709	0.457
*|. |	*|. |	10	-0.123	-0.117	6.6155	0.358
.|. |	.|. |	11	-0.049	-0.031	6.9277	0.436
.|. |	.|. |	12	-0.022	-0.004	6.9943	0.537
.|. |	.|. |	13	0.007	-0.009	7.0000	0.637
*|. |	*|. |	14	-0.088	-0.106	8.0304	0.626
.|* |	.|* |	15	0.100	0.152	9.3766	0.587
.|. |	.|. |	16	-0.014	-0.064	9.4019	0.668
*|. |	*|. |	17	-0.103	-0.137	10.882	0.621
.|. |	.|. |	18	0.023	0.048	10.953	0.690
*|. |	*|. |	19	-0.086	-0.104	11.998	0.679
.|. |	.|. |	20	0.052	0.030	12.389	0.717
.|. |	.|. |	21	0.026	-0.019	12.487	0.770
**|. |	**|. |	22	-0.263	-0.230	22.534	0.209
.|* |	.|* |	23	0.114	0.135	24.430	0.180
.|* |	.|. |	24	0.099	0.037	25.882	0.170
.|. |	.|. |	25	0.035	0.054	26.066	0.204
.|. |	.|. |	26	0.030	-0.018	26.204	0.243
.|. |	.|. |	27	-0.033	-0.012	26.371	0.284
.|* |	.|. |	28	0.083	0.064	27.429	0.285
.|. |	*|. |	29	-0.008	-0.138	27.439	0.334
*|. |	*|. |	30	-0.161	-0.108	31.579	0.207
*|. |	*|. |	31	-0.084	-0.099	32.702	0.207
.|. |	*|. |	32	-0.057	-0.085	33.235	0.227
.|. |	.|. |	33	0.017	0.015	33.281	0.267
.|. |	.|. |	34	-0.043	-0.036	33.588	0.298
*|. |	*|. |	35	-0.200	-0.177	40.362	0.121
.|. |	.|. |	36	0.037	-0.006	40.599	0.142

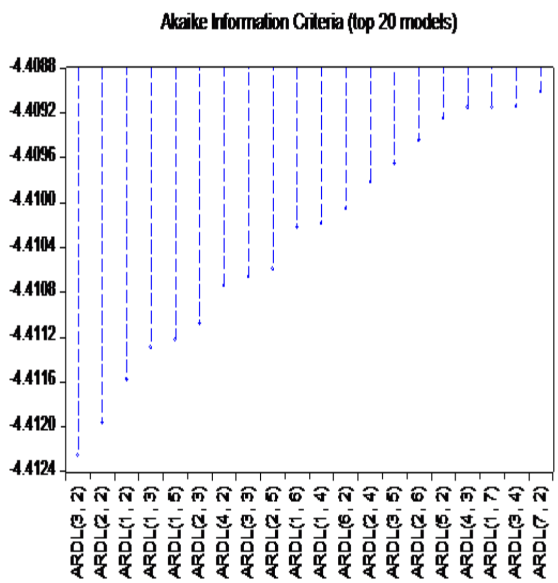
APPENDIX D

PRICE DISCOVERY AND RISK MANAGEMENT

Turmeric

Figure D1: Criteria Graphs

SP as Dependent Variable | **FP as Dependent Variable**



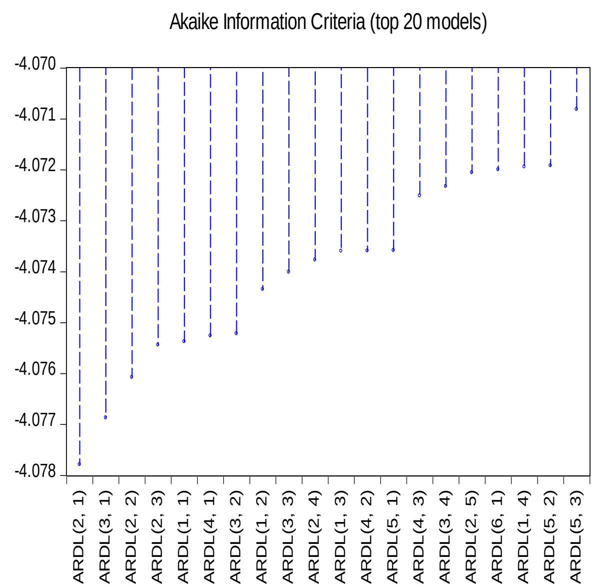


Table D3

Selected Model: ARDL (2, 1)

Dependent Variable: LOG(FP)
Dynamic regressors (8 lags, automatic): LOG(SP)
Fixed regressors: C @TREND
Number of models evalulated: 72

Variable	Coefficient	Std. Error	t-Statistic	Prob.*

LOG(FP(-1))	0.888174	0.027163	32.69841	0.0000
LOG(FP(-2))	0.059430	0.027046	2.197360	0.0282
LOG(SP)	0.533529	0.030852	17.29311	0.0000
LOG(SP(-1))	-0.485412	0.030978	-15.66946	0.0000
C	0.036763	0.016249	2.262531	0.0238
@TREND	1.62E-06	2.91E-06	0.556653	0.5779

R-squared	0.996246	Mean dependent var	8.676035
Adjusted R-squared	0.996230	S.D. dependent var	0.510406
S.E. of regression	0.031339	Akaike info criterion	-4.082790
Sum squared resid	1.147153	Schwarz criterion	-4.056888
Log likelihood	2402.598	Hannan-Quinn criter.	-4.073023
F-statistic	61993.81	Durbin-Watson stat	2.002477
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

Table D4

ARDL (2, 1) Bound Test

Dependent Variable: DLOG(FP)
Sample: 6/05/2007 8/03/2015
Included observations: 1174

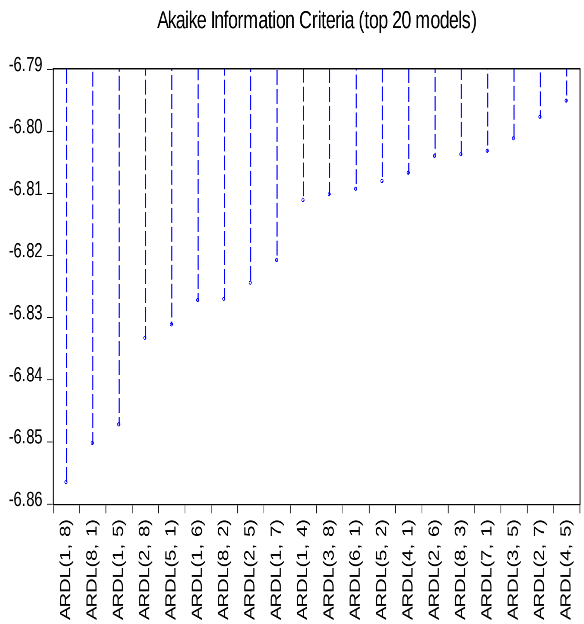
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(FP(-1))	-0.059430	0.027046	-2.197360	0.0282
DLOG(SP)	0.533529	0.030852	17.29311	0.0000
C	0.036763	0.016249	2.262531	0.0238
@TREND	1.62E-06	2.91E-06	0.556653	0.5779
LOG(SP(-1))	0.048118	0.011136	4.320745	0.0000
LOG(FP(-1))	-0.052396	0.011593	-4.519722	0.0000

R-squared	0.207580	Mean dependent var	0.001045
Adjusted R-squared	0.204188	S.D. dependent var	0.035130
S.E. of regression	0.031339	Akaike info criterion	-4.082790
Sum squared resid	1.147153	Schwarz criterion	-4.056888
Log likelihood	2402.598	Hannan-Quinn criter.	-4.073023
F-statistic	61.19334	Durbin-Watson stat	2.002477
Prob(F-statistic)	0.000000		

Rubber (Maturity Month)

Figure D2: Criteria Graphs

ARDL(1, 8)



ARDL(8, 1)

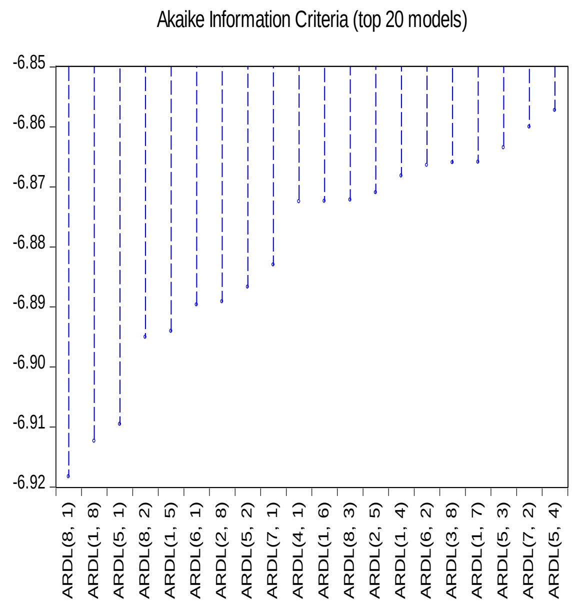


Table D5

Selected Model ARDL (1, 8)

Dependent Variable: LOG(SP)
Included observations: 86 after adjustments
Maximum dependent lags: 8 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (8 lags, automatic): LOG(FP)
Fixed regressors: C @TREND
Number of models evaluated: 72
Selected Model: ARDL(1, 8)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOG(SP(-1))	0.395190	0.102972	3.837845	0.0003
LOG(FP)	1.026706	0.011347	90.48655	0.0000
LOG(FP(-1))	-0.435372	0.107543	-4.048339	0.0001
LOG(FP(-2))	-0.001313	0.016065	-0.081751	0.9351

LOG(FP(-3))	-0.004406	0.015871	-0.277592	0.7821
LOG(FP(-4))	0.046840	0.015854	2.954533	0.0042
LOG(FP(-5))	-0.030637	0.016462	-1.861083	0.0667
LOG(FP(-6))	0.017598	0.015882	1.108055	0.2714
LOG(FP(-7))	0.010585	0.015865	0.667205	0.5067
LOG(FP(-8))	-0.024118	0.011368	-2.121487	0.0372
C	-0.012145	0.034924	-0.347752	0.7290
@TREND	6.20E-06	4.23E-05	0.146666	0.8838

R-squared	0.999347	Mean dependent var	9.678667
Adjusted R-squared	0.999250	S.D. dependent var	0.268738
S.E. of regression	0.007360	Akaike info criterion	-6.856596
Sum squared resid	0.004009	Schwarz criterion	-6.514129
Log likelihood	306.8336	Hannan-Quinn criter.	-6.718769
F-statistic	10294.10	Durbin-Watson stat	1.969233
Prob(F-statistic)	0.000000		

Table D6

ARDL (1, 8) Bound Test

Test Equation:
Dependent Variable: DLOG(SP)
Included observations: 86

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(FP)	1.026706	0.011347	90.48655	0.0000
DLOG(FP(-1))	-0.014549	0.011495	-1.265710	0.2096
DLOG(FP(-2))	-0.015863	0.011388	-1.392917	0.1678
DLOG(FP(-3))	-0.020268	0.011534	-1.757218	0.0830
DLOG(FP(-4))	0.026572	0.011743	2.262834	0.0266
DLOG(FP(-5))	-0.004066	0.011393	-0.356862	0.7222
DLOG(FP(-6))	0.013533	0.011307	1.196840	0.2352
DLOG(FP(-7))	0.024118	0.011368	2.121487	0.0372
C	-0.012145	0.034924	-0.347752	0.7290
@TREND	6.20E-06	4.23E-05	0.146666	0.8838
LOG(FP(-1))	0.605883	0.103455	5.856499	0.0000
LOG(SP(-1))	-0.604810	0.102972	-5.873540	0.0000

R-squared	0.991724	Mean dependent var	0.004652
Adjusted R-squared	0.990493	S.D. dependent var	0.075490
S.E. of regression	0.007360	Akaike info criterion	-6.856596
Sum squared	0.004009	Schwarz criterion	-6.514129

resid			
Log likelihood	306.8336	Hannan-Quinn criter.	-6.718769
F-statistic	806.1008	Durbin-Watson stat	1.969233
Prob(F-statistic)	0.000000		

Table D7

Selected Model ARDL (8, 1)

Dependent Variable: LOG(FP)
Maximum dependent lags: 8 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (8 lags, automatic): LOG(SP)
Fixed regressors: C @TREND
Number of models evaluated: 72
Selected Model: ARDL(8, 1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOG(FP(-1))	0.438025	0.103387	4.236750	0.0001
LOG(FP(-2))	0.000805	0.015578	0.051662	0.9589
LOG(FP(-3))	0.004372	0.015389	0.284085	0.7771
LOG(FP(-4))	-0.045601	0.015365	-2.967955	0.0040
LOG(FP(-5))	0.029994	0.015955	1.879979	0.0640
LOG(FP(-6))	-0.017093	0.015399	-1.109993	0.2706
LOG(FP(-7))	-0.010229	0.015383	-0.664975	0.5081
LOG(FP(-8))	0.023285	0.011026	2.111875	0.0381
LOG(SP)	0.965265	0.010667	90.48655	0.0000
LOG(SP(-1))	-0.390226	0.099474	-3.922887	0.0002
C	0.015425	0.033843	0.455781	0.6499
@TREND	-8.44E-06	4.10E-05	-0.205853	0.8375

R-squared	0.999382	Mean dependent var	9.680784
Adjusted R-squared	0.999290	S.D. dependent var	0.267855
S.E. of regression	0.007137	Akaike info criterion	-6.918304
Sum squared resid	0.003769	Schwarz criterion	-6.575837
Log likelihood	309.4871	Hannan-Quinn criter.	-6.780477
F-statistic	10877.85	Durbin-Watson stat	1.966499
Prob(F-statistic)	0.000000		

Table D8

ARDL (8, 1) Bound Test

Test Equation:
Dependent Variable: DLOG(FP)
Method: Least Squares
Date: 04/01/16 Time: 16:00
Sample: 5/14/2009 4/17/2014
Included observations: 86

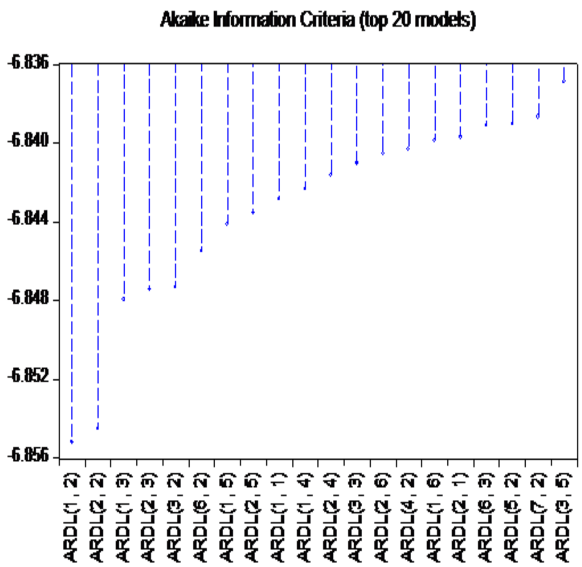
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(FP(-1))	0.014468	0.011139	1.298785	0.1981
DLOG(FP(-2))	0.015273	0.011044	1.382868	0.1709
DLOG(FP(-3))	0.019644	0.011184	1.756441	0.0832
DLOG(FP(-4))	-0.025957	0.011380	-2.280950	0.0254
DLOG(FP(-5))	0.004037	0.011046	0.365493	0.7158
DLOG(FP(-6))	-0.013056	0.010965	-1.190722	0.2376
DLOG(FP(-7))	-0.023285	0.011026	-2.111875	0.0381
DLOG(SP)	0.965265	0.010667	90.48655	0.0000
C	0.015425	0.033843	0.455781	0.6499
@TREND	-8.44E-06	4.10E-05	-0.205853	0.8375
LOG(SP(-1))	0.575039	0.100735	5.708439	0.0000
LOG(FP(-1))	-0.576443	0.101173	-5.697612	0.0000

R-squared	0.991595	Mean dependent var	0.004683
Adjusted R-squared	0.990345	S.D. dependent var	0.072633
S.E. of regression	0.007137	Akaike info criterion	-6.918304
Sum squared resid	0.003769	Schwarz criterion	-6.575837
Log likelihood	309.4871	Hannan-Quinn criter.	-6.780477
F-statistic	793.6232	Durbin-Watson stat	1.966499
Prob(F-statistic)	0.000000		

Cotton 29

Figure D3: Criteria Graphs

ARDL(1,2)



ARDL(2,2)

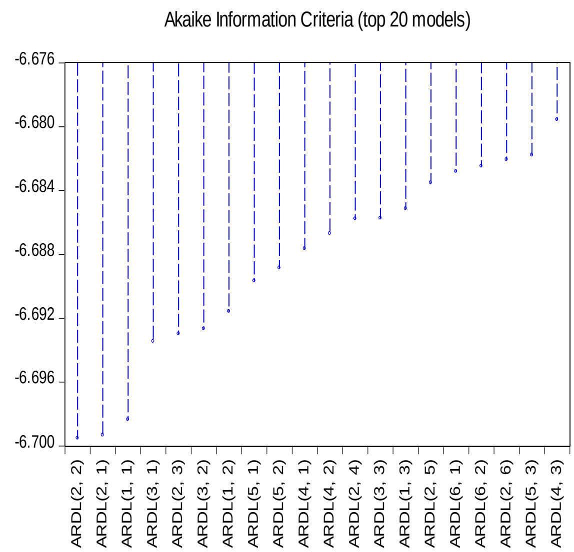


Table D9

Selected Model ARDL (1, 2)

Dependent Variable: LOG(SP)
Sample (adjusted): 9/04/2013 2/24/2016
Included observations: 282 after adjustments
Maximum dependent lags: 8 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (8 lags, automatic): LOG(FP)
Fixed regressors:
Number of models evalulated: 72
Selected Model: ARDL(1, 2)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOG(SP(-1))	0.897605	0.026271	34.16662	0.0000
LOG(FP)	0.740530	0.032502	22.78412	0.0000
LOG(FP(-1))	-0.561099	0.050334	-11.14756	0.0000
LOG(FP(-2))	-0.077128	0.032482	-2.374492	0.0183

R-squared	0.995991	Mean dependent var	9.725399
Adjusted R-squared	0.995948	S.D. dependent var	0.122753

S.E. of regression	0.007814	Akaike info criterion	-6.851800
Sum squared resid	0.016973	Schwarz criterion	-6.800141
Log likelihood	970.1038	Hannan-Quinn criter.	-6.831084
Durbin-Watson stat	2.146883		

Table D10

ARDL (2, 2) Bound Test

Dependent Variable: DLOG(SP)
Method: Least Squares
Included observations: 282

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(FP)	0.740530	0.032502	22.78412	0.0000
DLOG(FP(-1))	0.077128	0.032482	2.374492	0.0183
LOG(FP(-1))	0.102303	0.026254	3.896673	0.0001
LOG(SP(-1))	-0.102395	0.026271	-3.897564	0.0001

R-squared	0.660615	Mean dependent var	-0.001337
Adjusted R-squared	0.656953	S.D. dependent var	0.013341
S.E. of regression	0.007814	Akaike info criterion	-6.851800
Sum squared resid	0.016973	Schwarz criterion	-6.800141
Log likelihood	970.1038	Hannan-Quinn criter.	-6.831084
Durbin-Watson stat	2.146883		

Table D11

Selected Model: ARDL (2, 2)

Dependent Variable: LOG(FP)
Sample (adjusted): 9/04/2013 2/24/2016
Included observations: 282 after adjustments
Number of models evalulated: 72
Selected Model: ARDL(2, 2)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*

LOG(FP(-1))	0.786801	0.059059	13.32234	0.0000
LOG(FP(-2))	0.113375	0.058853	1.926405	0.0551
LOG(SP)	0.879880	0.038544	22.82776	0.0000
LOG(SP(-1))	-0.695268	0.073256	-9.490959	0.0000
LOG(SP(-2))	-0.084745	0.063162	-1.341719	0.1808

R-squared	0.995267	Mean dependent var	9.731703
Adjusted R-squared	0.995198	S.D. dependent var	0.122707
S.E. of regression	0.008503	Akaike info criterion	-6.679280
Sum squared resid	0.020026	Schwarz criterion	-6.614708
Log likelihood	946.7785	Hannan-Quinn criter.	-6.653386
Durbin-Watson stat	2.028917		

*Note: p-values and any subsequent tests do not account for model selection.

Table D12

ARDL (2, 2) Bound Test

Dependent Variable: DLOG(FP)
Sample: 9/04/2013 2/24/2016
Included observations: 282

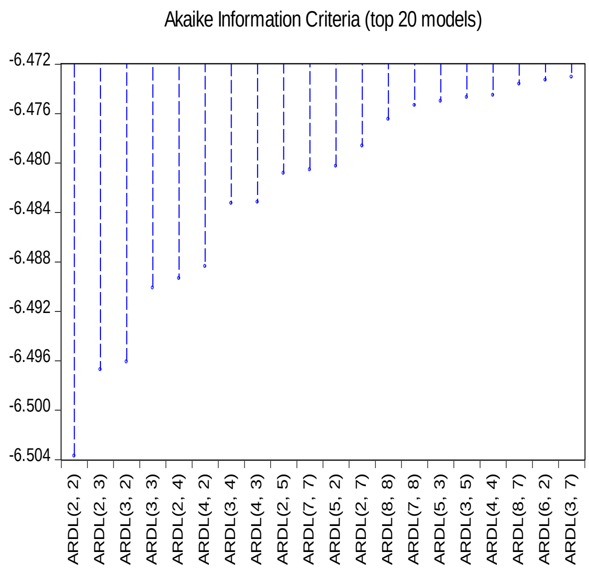
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(FP(-1))	-0.113375	0.058853	-1.926405	0.0551
DLOG(SP)	0.879880	0.038544	22.82776	0.0000
DLOG(SP(-1))	0.084745	0.063162	1.341719	0.1808
LOG(SP(-1))	0.099867	0.029220	3.417713	0.0007
LOG(FP(-1))	-0.099824	0.029201	-3.418533	0.0007

R-squared	0.655551	Mean dependent var	-0.001360
Adjusted R-squared	0.650577	S.D. dependent var	0.014384
S.E. of regression	0.008503	Akaike info criterion	-6.679280
Sum squared resid	0.020026	Schwarz criterion	-6.614708
Log likelihood	946.7785	Hannan-Quinn criter.	-6.653386
Durbin-Watson stat	2.028917		

Rubber (Near Month)

Figure D4: Criteria Graphs

ARDL(2,2)



ARDL (2, 2)

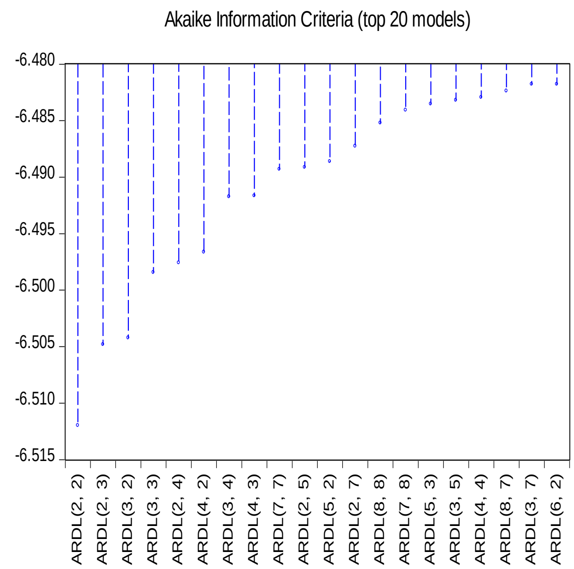


Table D13

Selected Model (2, 2)

Dependent Variable: LOG(SP)
Method: ARDL
Included observations: 234 after adjustments
Maximum dependent lags: 8 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (8 lags, automatic): LOG(FP)
Fixed regressors: C
Number of models evalulated: 72
Selected Model: ARDL(2, 2)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOG(SP(-1))	0.699222	0.063596	10.99474	0.0000
LOG(SP(-2))	0.197632	0.063117	3.131183	0.0020
LOG(FP)	0.939219	0.009943	94.46492	0.0000
LOG(FP(-1))	-0.626472	0.060891	-10.28841	0.0000

LOG(FP(-2))	-0.209338	0.060194	-3.477705	0.0006
C	-0.003499	0.015742	-0.222257	0.8243

R-squared	0.999446	Mean dependent var	9.555589
Adjusted R-squared	0.999433	S.D. dependent var	0.369914
S.E. of regression	0.008805	Akaike info criterion	-6.601654
Sum squared resid	0.017677	Schwarz criterion	-6.513056
Log likelihood	778.3935	Hannan-Quinn criter.	-6.565931
F-statistic	82200.23	Durbin-Watson stat	2.033982
Prob(F-statistic)	0.000000		

Table D14

ARDL BOUND TEST (2, 2)

Test Equation:
Dependent Variable: DLOG(SP)
Sample: 12/04/2007 11/30/2013
Included observations: 234

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(SP(-1))	-0.197632	0.063117	-3.131183	0.0020
DLOG(FP)	0.939219	0.009943	94.46492	0.0000
DLOG(FP(-1))	0.209338	0.060194	3.477705	0.0006
C	-0.003499	0.015742	-0.222257	0.8243
LOG(FP(-1))	0.103409	0.032214	3.210107	0.0015
LOG(SP(-1))	-0.103146	0.031782	-3.245428	0.0013

R-squared	0.975522	Mean dependent var	0.002154
Adjusted R-squared	0.974985	S.D. dependent var	0.055672
S.E. of regression	0.008805	Akaike info criterion	-6.601654
Sum squared resid	0.017677	Schwarz criterion	-6.513056
Log likelihood	778.3935	Hannan-Quinn criter.	-6.565931
F-statistic	1817.291	Durbin-Watson stat	2.033982

Table D15

Selected Model ARDL (2, 2)

Dependent Variable: LOG(FP)
Included observations: 234 after adjustments
Maximum dependent lags: 8 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (8 lags, automatic): LOG(SP)
Fixed regressors:
Number of models evalulated: 72
Selected Model: ARDL(2, 2)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOG(FP(-1))	0.669414	0.063378	10.56228	0.0000
LOG(FP(-2))	0.219252	0.062951	3.482913	0.0006
LOG(SP)	1.038841	0.010897	95.33244	0.0000
LOG(SP(-1))	-0.719876	0.067429	-10.67609	0.0000
LOG(SP(-2))	-0.207514	0.066076	-3.140546	0.0019
R-squared	0.999372	Mean dependent var		9.568393
Adjusted R-squared	0.999361	S.D. dependent var		0.365530
S.E. of regression	0.009242	Akaike info criterion		-6.508888
Sum squared resid	0.019562	Schwarz criterion		-6.435057
Log likelihood	766.5399	Hannan-Quinn criter.		-6.479119
Durbin-Watson stat	2.033969			

*Note: p-values and any subsequent tests do not account for model selection.

Table D16

ARDL (2, 2) Bound Test

Test Equation:
Dependent Variable: DLOG(FP)
Method: Least Squares
Sample: 12/04/2007 11/30/2013
Included observations: 234

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(FP(-1))	-0.219252	0.062951	-3.482913	0.0006
DLOG(SP)	1.038841	0.010897	95.33244	0.0000
DLOG(SP(-1))	0.207514	0.066076	3.140546	0.0019

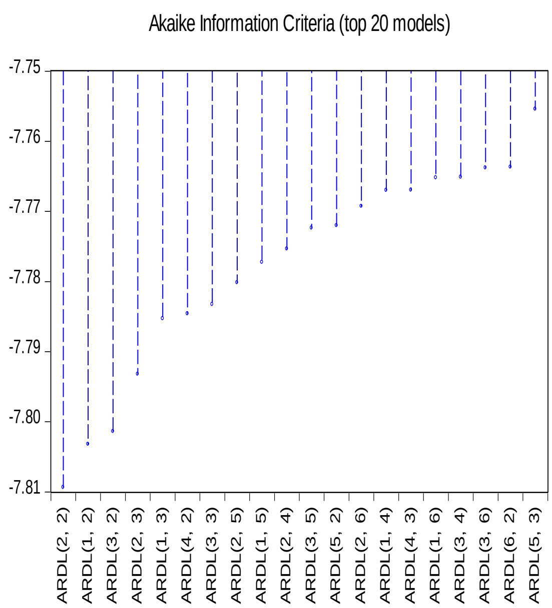
LOG(SP(-1))	0.111451	0.032094	3.472675	0.0006
LOG(FP(-1))	-0.111335	0.032050	-3.473744	0.0006

R-squared	0.975601	Mean dependent var	0.001920
Adjusted R-squared	0.975175	S.D. dependent var	0.058660
S.E. of regression	0.009242	Akaike info criterion	-6.508888
Sum squared resid	0.019562	Schwarz criterion	-6.435057
Log likelihood	766.5399	Hannan-Quinn criter.	-6.479119

Rubber (Distant Month)

Figure D5: Criteria Graphs

ARDL(2,2)(SP as dependent variable)



ARDL(2,1)(FP as dependent variable)

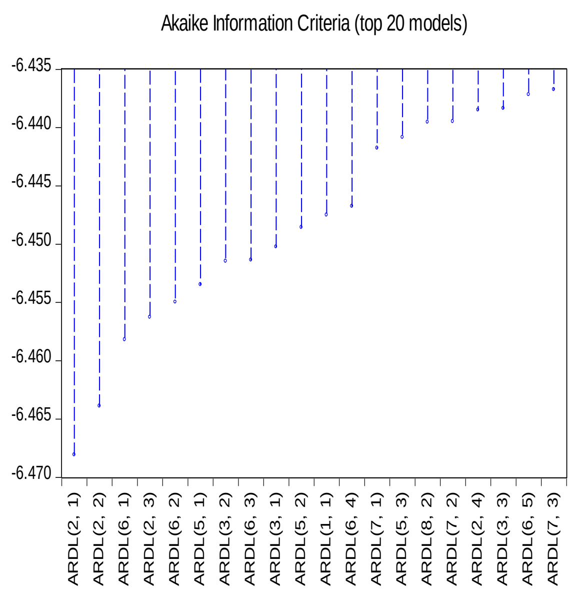


Table D17

Selected Model ARDL (2, 2)

Dependent Variable: LOG(SP)
Included observations: 115 after adjustments
Maximum dependent lags: 8 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (8 lags, automatic): LOG(FP)
Fixed regressors:
Number of models evalulated: 72
Selected Model: ARDL(2, 2)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOG(SP(-1))	0.772337	0.090105	8.571509	0.0000
LOG(SP(-2))	0.126177	0.082159	1.535761	0.1275
LOG(FP)	0.366197	0.033896	10.80351	0.0000
LOG(FP(-1))	-0.100931	0.057019	-1.770120	0.0795
LOG(FP(-2))	-0.163872	0.046002	-3.562266	0.0005

R-squared	0.993351	Mean dependent var	9.823639
Adjusted R-squared	0.993109	S.D. dependent var	0.056668
S.E. of regression	0.004704	Akaike info criterion	-7.838248
Sum squared resid	0.002434	Schwarz criterion	-7.718903
Log likelihood	455.6993	Hannan-Quinn criter.	-7.789807
Durbin-Watson stat	1.999945		

Table D18

ARDL (2, 2) Bound Test

Test Equation:
Dependent Variable: DLOG(SP)
Included observations: 115

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(SP(-1))	-0.126177	0.082159	-1.535761	0.1275
DLOG(FP)	0.366197	0.033896	10.80351	0.0000
DLOG(FP(-1))	0.163872	0.046002	3.562266	0.0005
LOG(FP(-1))	0.101394	0.028446	3.564379	0.0005
LOG(SP(-1))	-0.101486	0.028451	-3.567025	0.0005

R-squared	0.575392	Mean dependent var	-0.001509

Adjusted R-squared	0.559952	S.D. dependent var	0.007091
S.E. of regression	0.004704	Akaike info criterion	-7.838248
Sum squared resid	0.002434	Schwarz criterion	-7.718903
Log likelihood	455.6993	Hannan-Quinn criter.	-7.789807

Table D19

Selected Model ARDL (2, 1)

Dependent Variable: LOG(FP)
Included observations: 115 after adjustments
Maximum dependent lags: 8 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (8 lags, automatic): LOG(SP)
Fixed regressors:
Number of models evaluated: 72
Selected Model: ARDL(2, 1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOG(FP(-1))	0.669162	0.075755	8.833232	0.0000
LOG(FP(-2))	0.164832	0.074770	2.204513	0.0296
LOG(SP)	1.391480	0.129782	10.72166	0.0000
LOG(SP(-1))	-1.225443	0.132471	-9.250647	0.0000

R-squared	0.977717	Mean dependent var	9.824142
Adjusted R-squared	0.977115	S.D. dependent var	0.061034
S.E. of regression	0.009233	Akaike info criterion	-6.497888
Sum squared resid	0.009463	Schwarz criterion	-6.402413
Log likelihood	377.6286	Hannan-Quinn criter.	-6.459135
Durbin-Watson stat	2.151758		

Table D20

ARDL (2, 1) Bound Test

Test Equation:
Dependent Variable: DLOG(FP)
Included observations: 115

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(FP(-1))	-0.164832	0.074770	-2.204513	0.0296
DLOG(SP)	1.391480	0.129782	10.72166	0.0000
LOG(SP(-1))	0.166038	0.056064	2.961597	0.0037
LOG(FP(-1))	-0.166005	0.056052	-2.961618	0.0037

R-squared	0.512145	Mean dependent var	-0.001627
Adjusted R-squared	0.498959	S.D. dependent var	0.013044
S.E. of regression	0.009233	Akaike info criterion	-6.497888
Sum squared resid	0.009463	Schwarz criterion	-6.402413
Log likelihood	377.6286	Hannan-Quinn criter.	-6.459135

APPENDIX E

INFLATION

Table E1: Food Articles – Classification and Weightage

Classification	**Weightage in WPI**	**Total Number of Commodities in the Group**	**Number of Commodities Traded on NCDEX**	**Commodities Traded on NCDEX**	**Weightage of NCDEX traded Commodities**
Cereals	3.37	7	3	Barley, Wheat, & Maize	1.350
Pulses	0.716 0	5	1	Gram	0.335 0
Vegetables	1.735 0	11	00	-	00
Fruits	2.1070	13	00	-	00
Milk	3.2380	1	00	-	00
Eggs, Meat & Fish	2.4130	7	00	-	00
Condiments & Spices	0.5690	9	4	Turmeric, Chilli, Coriander & Cumin	0.3020
Other Food Articles	0.1830	2	00	-	00
Total	14.3370	55	8	1.9870	Total

Source: Monthly Commodities Report of NCDEX(Jul'2016)

Table E2: Non-Food Articles – Classification and Weightage

Commodity Classification	Weightage in WPI	Total Number of Commodities in the Group	Number of Commodities Traded on NCDEX	Commodities Traded on NCDEX	Weightage of NCDEX traded Commodities
Fibre	0.8770	6.	1	Raw Cotton	0.7050
Oil Seeds	1.78	11.	2	Soybean, RM Seed	0.7
Other Non-Food Articles	1.3860	9.	1	Guar seed,	0.0480
Flowers	0.2130	3.	00	-	00
Total	4.2570	29.	4	1.462	Total

Source: Monthly Commodities Report of NCDEX (Jul', 2016)

Table E3: Manufactured Products - Classification and Weightage

Commodity Classification	Weightage in WPI	Total Number of Commodities in the Group	Number of Commodities Traded on NCDEX	Commodities Traded on NCDEX	Weightage of NCDEX traded Commodities
Edible oils	3.0420	10.	2.	Soy oil ,Palm oil	0.780
Sugar, Khandsari & Gur	2.0880	6.	1.	Sugar	1.7370
Oil cakes	0.4940	5.	1.	Cotton seed, oilcake	0.1290
Total	5.6250	21.	4.	2.6460	Total

Source: Monthly Commodities Report of NCDEX (Jul', 2016)

Figure E1: Criteria Graph

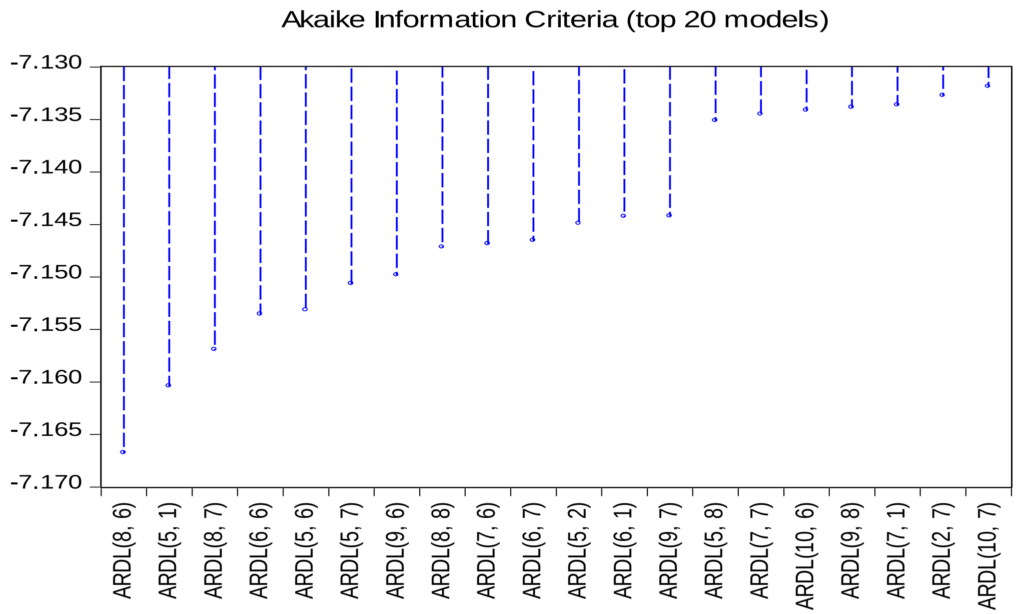


Table E4: ARDL (8, 6) Model with 'NONE' as FIXED Regressor (Trend Specification)

Dependent Variable: LOG(WPI)
Selected Model: ARDL(8, 6)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOG(WPI(-1))	1.424721	0.104336	13.65514	0.0000
LOG(WPI(-2))	-0.320145	0.177773	-1.800868	0.0754
LOG(WPI(-3))	0.160307	0.180174	0.889737	0.3762
LOG(WPI(-4))	-0.491701	0.182657	-2.691934	0.0086
LOG(WPI(-5))	0.063290	0.181910	0.347918	0.7288
LOG(WPI(-6))	0.011377	0.182058	0.062490	0.9503
LOG(WPI(-7))	0.349598	0.178270	1.961060	0.0533
LOG(WPI(-8))	-0.193347	0.104680	-1.847031	0.0683
LOG(DHAANYA)	0.037057	0.015905	2.329926	0.0223
LOG(DHAANYA(-1))	-0.045880	0.027063	-1.695289	0.0938
LOG(DHAANYA(-2))	0.018019	0.027326	0.659434	0.5115
LOG(DHAANYA(-3))	-0.008449	0.026144	-0.323166	0.7474
LOG(DHAANYA(-4))	-0.032355	0.026272	-1.231542	0.2216
LOG(DHAANYA(-5))	0.077108	0.025856	2.982216	0.0038
LOG(DHAANYA(-6))	-0.048127	0.015575	-3.089939	0.0027

R-squared	0.998543	Mean dependent var	5.022186
Adjusted R-squared	0.998294	S.D. dependent var	0.149972

S.E. of regression	0.006195	Akaike info criterion	-7.188979
Sum squared resid	0.003147	Schwarz criterion	-6.790827
Log likelihood	363.6655	Hannan-Quinn criter.	-7.027986
Durbin-Watson stat	1.889771		

*Note: p-values and any subsequent tests do not account for model selection.

Figure E2: Criteria Graph

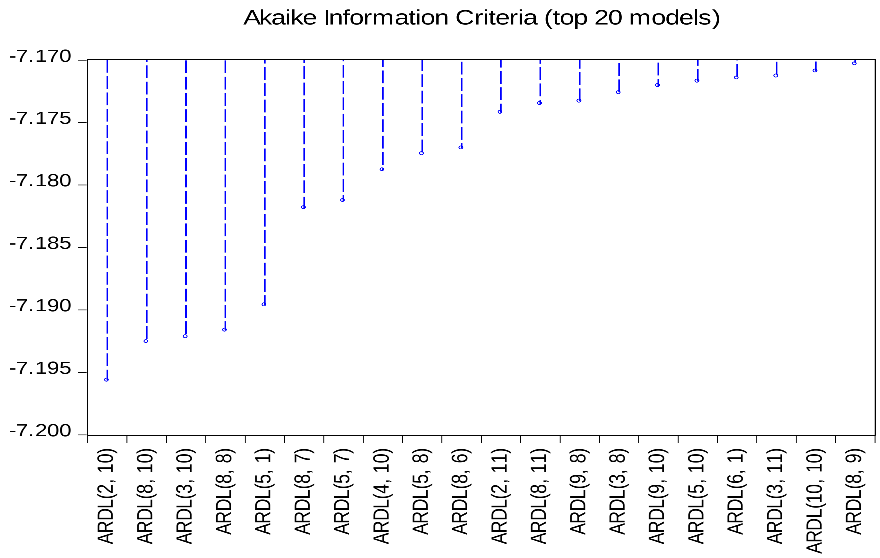


Table E5: ARDL(2, 10) with Unrestd.Constant as Fixed Regressor

Dependent Variable: LOG(WPI)
Method: ARDL

Sample (adjusted): 2007M11 2015M09
Included observations: 95 after adjustments
Maximum dependent lags: 12 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (12 lags, automatic): LOG(DHAANYA)
Fixed regressors: C
Number of models evalulated: 156
Selected Model: ARDL(2, 10)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOG(WPI(-1))	1.502093	0.092500	16.23882	0.0000

LOG(WPI(-2))	-0.546564	0.092840	-5.887169	0.0000
LOG(DHAANYA)	0.054511	0.015793	3.451500	0.0009
LOG(DHAANYA(-1))	-0.068894	0.026711	-2.579223	0.0117
LOG(DHAANYA(-2))	0.028337	0.027121	1.044830	0.2992
LOG(DHAANYA(-3))	0.017400	0.026772	0.649957	0.5176
LOG(DHAANYA(-4))	-0.071454	0.027234	-2.623679	0.0104
LOG(DHAANYA(-5))	0.108255	0.028504	3.797912	0.0003
LOG(DHAANYA(-6))	-0.081274	0.027598	-2.944964	0.0042
LOG(DHAANYA(-7))	0.002672	0.026296	0.101606	0.9193
LOG(DHAANYA(-8))	0.038208	0.025875	1.476651	0.1436
LOG(DHAANYA(-9))	-0.049975	0.025255	-1.978844	0.0512
LOG(DHAANYA(-10))	0.033520	0.015380	2.179519	0.0322
C	0.143076	0.058819	2.432466	0.0172

R-squared	0.998435	Mean dependent var	5.027813
Adjusted R-squared	0.998184	S.D. dependent var	0.146348
S.E. of regression	0.006236	Akaike info criterion	-7.181502
Sum squared resid	0.003150	Schwarz criterion	-6.805142
Log likelihood	355.1214	Hannan-Quinn criter.	-7.029424
F-statistic	3975.624	Durbin-Watson stat	2.132370
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

Questionnaire for Investors of Commodity Futures Market

I, Rukhsana am a Phd Scholar from University of Hyderabad. I am doing research on Performance of Commodity Futures Market. In this connection, I request you to kindly fill the following questions and give your valuable opinions and suggestions which will be helpful for my research.

Please answer by encircling the number which depicts how strongly you agree or disagree with the following statements.
1='Strongly Disagree' 2= 'Disagree' 3= 'Neutral' 4= 'Agree' 5= 'Strongly Agree'
Plz. Do not encircle any number if you don't know about the statement.

Section I

1. Difficult to find a broker who trades in Commodity Futures Market.	1	2	3	4	5
2. There are difficult formalities to start investing in Commodity Futures Market.	1	2	3	4	5
3. The brokerage fees is high	1	2	3	4	5
4. The transaction costs paid are high	1	2	3	4	5
5. The initial margin amount for a contract is low.	1	2	3	4	5
6. Contract size is a hinderance for a contract of choice.	1	2	3	4	5
7. Computer knowledge for Commodity futures Trading is essential.	1	2	3	4	5
8. There are apprehensions to adopt new techniques.	1	2	3	4	5
9. Commodity Futures Market is highly volatile.	1	2	3	4	5

Section II

1. Are you a speculator or hedger? Please Tick.

Speculator ☐ Hedger ☐ Both ☐

1. As a hedger, one is able to hedge/ manage the price risk effectively. (Investment Hedge)	1	2	3	4	5
2. As a speculator, one is able to make profits in Commodity Futures segment.	1	2	3	4	5
3. Commodity Futures Market is a place where price is discovered.(Future price helps you in predicting spot price.)	1	2	3	4	5

Section III

1. It is easy to make profit by purchasing/selling in futures market and simultaneously selling/purchasing in cash market.(Arbitrage)	1	2	3	4	5
2. Commodity Futures Market helps in diversification i.e. The risk in stock market positions can be offset in Commodity Futures Market by taking an equal and opposite position.	1	2	3	4	5

Section IV

1. Does 'Mark to Market' mechanism is efficient and effective?
   YES ☐ NO ☐

2. Is it easy to liquidate the position (Ease of Liquidity)?
   YES ☐ NO ☐

3. Commodity Futures Market gives the advantage of starting with a fraction amount of actual contract value (Leverage)
   YES ☐ NO ☐

4. Do you feel Commodity Futures Market is the cause of increase in inflation?
   YES ☐ NO ☐

5. Are they happy with the functioning of Commodity Futures Trading?
   YES ☐ NO ☐

6. What make you invest in Commodity Futures Market? Please Tick.

Risk Management(Through Hedging)	
Price Discovery	
Diversification Benefits	
More Profit making through speculation	

7. Do you suggest any improvement for Commodity Futures Trading?

Name:		Brokerage House:
Age:	City:	District:
State :		Ph.No:

Dear Sir/Madam, I am Rukhsana, a Ph.d Scholar from the University of Hyderabad, Gachibowli. I am pursuing my research on the Performance of Commodities Futures Market in India. Since my research aims to improve your trading with a solution to address to your problems - by carrying out an in-depth study. Hence, I request you to kindly extend your full co-operation and fill-in the following questions and give your valuable opinion and suggestions, which will be important for my research, so this will be helpful to traders like you!

Questionnaire for 'Traders' of CFM

SECTION I

1. Name of the Commodity & Variety traded?

   Crop-----------------   Variety------------

2. From whom do you purchase the commodity?(Please Tick)
   - Farmers ☐
   - Commission Agents ☐
   - Brokers ☐
   - Others ☐ , Please Specify ____________________

3. How much quantity of the crop is purchased from the farmer/commission agent?

Year	**Quantity**
2013-14	
2012-13	
2011-10	

4. What are your sources of finance?

Source of Finance	**Please Tick**	**Purpose**
1. Banks		
2. Money Lenders		
3. Self		
4. Others	Please Specify	

SECTION II

1. Are you aware of Commodities Futures Trading (Please Tick)?
   Yes. ☐ N☐

2. How did you come to know about Commodity Futures Market?
   a) News Paper ☐
   b) Television ☐
   c) Friends ☐
   d) Melas ☐
   e) Awareness Program ☐

3. Do you participate in Commodity Futures Trading?

Yes ☐ Please fill the following table:

Name of the Commodity	**Exchange Name**	**Contract Size**	**Margin Money Deposited**	**Position Taken**	**Decision on position taken through (plz. Tick)**
				Do you purchase the crop ☐ (Long) Do you Sell your crop ☐ (Short)	a)☐ Friends b)☐ Broker's Advice c)☐ News Papers d)☐ Television e)☐ Websites f)☐ Intuition g)☐ Others

4. What are the causes of participation in Commodity Futures Market?
   a. Guessing the future price and making profits **(Speculation).** ☐
   b. Locking the price now and saving it from low price in the season ☐ **(Price Risk Management)**.
   c. Others Please Mention ☐
      1. ______________________________
      2. ______________________________

SECTION III

Please select and encircle the number below that best represents how you feel about the following statements.	
1. Computer knowledge is essential for Commodity Futures Trading.	Strongly Disagree 1 2 3 4 5 Strongly Agree
2. "I do not feel safe in CFM Trading".	Strongly Disagree 1 2 3 4 5 Strongly Agree
3. Finding a broker for Commodity Futures Market is difficult.	Strongly Disagree 1 2 3 4 5 Strong Agree

4. Contract size for participating in Commodity Futures Market is large.	Strongly Disagree 1 2 3 4 5 Strongly Agree
5. Need of cash prevents one from participating in Commodity Futures Trading.	Strongly Disagree 1 2 3 4 5 Strongly Agree

SECTION IV

What is the average storage in months for your commodity?____________________

1. Do you get any other help from bank for Commodity Futures Trading (Eg: Warehousing)? If

☐ Yes,

What kind of help did you get from the bank?_________________________

☐ No.

Please select and encircle the number below that best represents how you feel about the following statements.	
1. Warehousing (storing in godowns) of the crop for Futures Trading is costly.	Strongly Disagree 1 2 3 4 5 Strongly Agree
2. Transportation cost of crop to the specific warehouse is costly.	Strongly Disagree 1 2 3 4 5 Strongly Agree
3. There are delays in the Physical Delivery of crop by Commodity Futures Market.	Strongly Disagree 1 2 3 4 5 Strongly Agree
4. People are afraid of down grading (Giving low quality grade when actually the crop is of good quality or grade) by Commodity Futures Market.	Strongly Disagree 1 2 3 4 5 Strongly Agree

SECTION V

Please select and encircle the number below that best represents how you feel about the following statements.	
1. There are formalities before entering commodity Futures Market (example: documents to be submitted, brokers,	Strongly Disagree 1 2 3 4 5 Strongly Agree

money deposited etc.).	
2. Trading on Commodity Futures Market is difficult.	Strongly Disagree 1 2 3 4 5 Strongly Agree

SECTION VI

Please select and encircle the number below that best represents how you feel about the following statements.	
1. Fluctuation in commodity prices is high. .	Strongly Disagree 1 2 3 4 5 Strongly Agree
2. It is easy to liquify your position.	Strongly Disagree 1 2 3 4 5 Strongly Agree

SECTION VII

5. What are the risk management techniques known and adopted by you? Please Tick.

Risk Management Techniques	Adopted Now
1. Insurance	
2. Hedging i. Forward ☐ ii. Future ☐	
3. Others(please specify below)	

Please select and encircle the number below that best represents how you feel about the following satements.	
1. Transaction hedge is successful for you-Locking your price of the commodity now and selling the crop in future.(Please answer only if you are practicing 'hedging' risk management technique)	Strongly Agree 1 2 3 4 5 Strongly Disagree

2. Commodity Futures Market is efficient in carrying out Risk Management Function. (Hedging-saving from Price Risk).	Strongly Agree 1 2 3 4 5 Strongly Disagree

SECTION VIII

1. How do you seek spot(present) price of the crop?(please tick)

1. News Papers	
2. Television	
3. Mandis	
4. Price Tickers made available by MCX	
5. Friends	
6. Seek MSP to assess the Spot Price	
7. e-choupal	
8. Seek Future Price to assess the Spot Price	

2. Whom do you sell your produce?

	Please Tick
a) Traders(Whole sellers/Retailers)	
b) Customers Directly	
c) Commodities Future Market	
d) Brokers/Commission Agent.	
e) Others	Please Specify ______________________

3. What is the motivation behind selling your produce?

	Please Tick
To earn a decent profit (i.e. whenever the target is attained).	
To sell at whatever price (Cash Urgency).	
To invest or to store till it fetches the maximum profit.	
To invest in futures market and earn profit	
To invest in future market and save from price risk.	
Others Pease Specify: 1. 2.	

Please select and encircle the number below that best represents how you feel about the following statements.	
1. Futures price always gives you idea about the spot or present price of the commodity.	Strongly Agree 1 2 3 4 5 Strongly Disagree

SECTION IX

1. Do you feel you have an edge over other traders who are not participating in Commodity Futures Market? If 'yes', please specify in what ways? Please Tick.

YES ☐
Earning more Profits ☐
Saving Oneself from Price Risk ☐
Future Price helping to know the spot(current) Price ☐
Others Please Specify: ☐ 1. 2. 3.

No. ☐

Please select and encircle the number below that best represents how you feel about the following statements.	
1. Gained profit by selling or buying your crop in Commodity Futures Market and vice versa (opposite) in another market (Arbitrage)	Strongly Disagree 1 2 3 4 5 Strongly Agree
2. There are advantages of trading in Commodity Futures Market.	Strongly Disagree 1 2 3 4 5 Strongly Agree
3. Feel more benefitted when compared to other traders who are not participating.	Strongly Disagree 1 2 3 4 5 Strongly Agree
4. Increase in prices of commodity is due to 'bad crop'.	Strongly Disagree 1 2 3 4 5 Strongly Agree
5. Increase in prices of crop is due to decrease in import or increase in export	Strongly Disagree 1 2 3 4 5 Strongly Agree
6. Inflation in prices (increase in prices) is due to Commodity Futures Trading.	Strongly Disagree 1 2 3 4 5 Strongly Agree
7. Commodity Futures Trading should be banned by Government to control inflation.	Strongly Disagree 1 2 3 4 5 Strongly Agree
8. You are 'HAPPY' with the functioning	Strongly Disagree 1 2 3 4 5 Strongly

of Commodity Futures Trading.	Agree

Do you suggest any improvements for futures trading?

-

SECTION X

Name:	Age:
Village:	District:
State:	Ph. No:

Questionnaire for Investors of Commodity Futures Market

I, Rukhsana am a Phd Scholar from University of Hyderabad. I am doing research on Performance of Commodity Futures Market. In this connection, I request you to kindly fill the following questions and give your valuable opinions and suggestions which will be helpful for my research.

Please answer by encircling the number which depicts how strongly you agree or disagree with the following statements.
1='Strongly Disagree' 2= 'Disagree' 3= 'Neutral' 4= 'Agree' 5= 'Strongly Agree'
Plz. Do not encircle any number if you don't know about the statement.

Section I

1. Difficult to find a broker who trades in Commodity Futures Market.	1	2	3	4	5
2. There are difficult formalities to start investing in Commodity Futures Market.	1	2	3	4	5
3. The brokerage fees is high	1	2	3	4	5
4. The transaction costs paid are high	1	2	3	4	5
5. The initial margin amount for a contract is low.	1	2	3	4	5
6. Contract size is a hinderance for a contract of choice.	1	2	3	4	5
7. Computer knowledge for Commodity futures Trading is essential.	1	2	3	4	5
8. There are apprehensions to adopt new techniques.	1	2	3	4	5
9. Commodity Futures Market is highly volatile.	1	2	3	4	5

Section II

2. Are you a speculator or hedger? Please Tick.

Speculator ☐ Hedger ☐ Both ☐

1. As a hedger, one is able to hedge/ manage the price risk effectively. (Investment Hedge)	1 2 3 4 5
2. As a speculator, one is able to make profits in Commodity Futures segment.	1 2 3 4 5
3. Commodity Futures Market is a place where price is discovered.(Future price helps you in predicting spot price.)	1 2 3 4 5

Section III

1. It is easy to make profit by purchasing/selling in futures market and simultaneously selling/purchasing in cash market.(Arbitrage)	1 2 3 4 5
2. Commodity Futures Market helps in diversification i.e. The risk in stock market positions can be offset in Commodity Futures Market by taking an equal and opposite position.	1 2 3 4 5

Section IV

8. Does 'Mark to Market' mechanism is efficient and effective?
   YES ☐ NO ☐

9. Is it easy to liquidate the position (Ease of Liquidity)?
   YES ☐ NO ☐

10. Commodity Futures Market gives the advantage of starting with a fraction amount of actual contract value (Leverage)
    YES ☐ NO ☐

11. Do you feel Commodity Futures Market is the cause of increase in inflation?
    YES ☐ NO ☐

12. Are they happy with the functioning of Commodity Futures Trading?
    YES ☐ NO ☐

13. What make you invest in Commodity Futures Market? Please Tick.

Risk Management(Through Hedging)	
Price Discovery	
Diversification Benefits	
More Profit making through speculation	

14. Do you suggest any improvement for Commodity Futures Trading?

Name:		Brokerage House:
Age:	City:	District:
State :		Ph.No:

NEWS PUBLISHED IN NEWSPAPERS

రైతుల పరిస్థితి దయనీయం

ఉత్పత్తుల ధర నిర్ణయం సరిగ్గా లేదు

'వస్తువుల భవిష్య మార్కెట్టు నిర్వహణ' పరిశోధకురాలు రుక్సానా

మామడ, న్యూస్‌టుడే: పంట పండించిన రైతుకు మద్దతు ధర దక్కడం లేదు. ఎలాంటి పంటలు పండిస్తే లాభాలొస్తాయో తెలియదు. పంట వేసేటప్పుడు ఒక ధర ఉంటోంది. చేతికొచ్చాక తగ్గిపోతోంది. వారి పరిస్థితి దయనీయంగా ఉంది.. అంటూ హైదరాబాద్ విశ్వవిద్యాలయంలో 'ఇండియాలో వస్తువుల భవిష్య మార్కెట్టు నిర్వహణ'(కమోడిటీ ఫ్యూచర్ మార్కెట్)అనే అంశంపై పరిశోధన చేస్తున్న రుక్సానా అన్నారు.

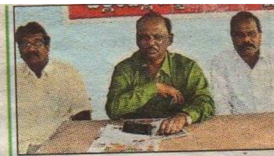
రైతు బంధం పథకం గురించి రైతులకు తెలియదు..

తన పరిశోధనలో భాగంగా జిల్లాలోని వివిధ ప్రాంతాల్లో పర్యటించారు. మామడ మండలానికి వచ్చిన ఆమె గోండుగూడ, గాయిద్‌పల్లి, ఆరెపల్లి తదితర గ్రామాల్లో రైతులను కలిశారు. పత్తి, పసుపు, మిర్చి తదితర పంటలపై రైతులతో చర్చించారు. మద్దతు ధర నిర్ణయం, ధరల హెచ్చుతగ్గుల అంశం, విపత్తు రక్షణ తదితర అంశాలపై ఆమె రైతుల నుంచి వివరాలు సేకరించారు. అసలు మద్దతు ధర లభిస్తోందా.. పెట్టుబడికి దిగుబడికి గిట్టుబాటవుతోందా అన్న విషయంపై రైతుల నుంచి లోతుగా వివరాలు సేకరించారు. రైతు బంధు పథకాన్ని రైతులు ఉపయోగించుకోవడం లేదనే విషయాన్ని గమనించానని, అసలు ఆ పథకం ఉందన్న విషయమే రైతులకు తెలియదని ఆవేదన వ్యక్తం చేశారు. వ్యవసాయ విపణుల్లో సౌకర్యాలు పెరగాల్సిన అవసరం ఉందన్నారు.

పుస్తకం రూపంలో ప్రభుత్వం దృష్టికి తీసుకెళ్తా...

పెట్టుబడులు సైతం వెళ్లని విధంగా కొన్ని పంటల ధరలు ఉన్న విషయాన్ని ఆధారాలతో పుస్తకంగా తయారు చేస్తాను. ఈ విషయాన్ని ప్రభుత్వం దృష్టికి తీసుకెళ్లాలన్న ఆలోచన ఉంది. పరిశోధనతో పాటు రైతులకు మేలు జరగాలన్న ఆశయంతో ఈ నిర్ణయం తీసుకున్నాను. వ్యవసాయ రంగానికి మంచి ప్రాధాన్యం ఇచ్చి సాగు విస్తీర్ణాన్ని పెంచకుంటే భవిష్యత్తులో ఎదురయ్యే కష్టాలను ఆమె వివరించారు. వ్యవసాయ రంగాన్ని నిర్లక్ష్యం చేస్తే నష్టం పూడ్చలేనంతగా ఉంటుందన్నారు. రైతుల ఇబ్బందులను స్థానిక నాయకులు రాంరెడ్డి, రాందాస్ పరిశోధకురాలికి వివరించారు.

గోండుగూడలో రైతులతో మాట్లాడుతున్న రుక్సానా



మాట్లాడుతున్న మాజీ ఎమ్మెల్యే గుండా మల్లేష్

చుండూరు బాధితులకు న్యాయం చేయాలి

బెల్లంపల్లి పట్టణం, న్యూస్‌టుడే: దేశంలో దళితులపై సుదీర్ఘ కాలం నుంచి దాడులు జరుగుతున్నప్పటికీ ప్రభుత్వాలు నిస్సహాయ స్థితిలో ఉండడం దారుణమని మాజీ ఎమ్మెల్యే గుండా మల్లేష్ అన్నారు. శుక్రవారం బెల్లంపల్లిలో సీపీఐ కార్యాలయంలో ఏర్పాటు చేసిన విలేకరుల సమావేశంలో మాట్లాడారు. చుండూరు బాధితులకు న్యాయం చేయాలని ఆయన కోరారు. పట్టపగలే దళితులను హత్య చేసిన అగ్రవర్ణాల వారిని కాపాడే ప్రయత్నాలు చేయడం దారుణమని విమర్శించారు. ఈ నెల 16న జిల్లా కలెక్టరేట్ల ఎదుట నిరసన కార్యక్రమాలు చేపడతామన్నారు. సమావేశంలో సీపీఐ జిల్లా సహాయ కార్యదర్శి కత్తెరశాల పోశం, సీపీఐ పట్టణ కార్యదర్శి పి. శేషగిరిరావు, నాయకులు విలియం, మాణిక్యం తదితరులు పాల్గొన్నారు.

సాక్షి e-paper

మార్కెట్‌ను సందర్శించిన హెచ్‌సీయూ రీసెర్చ్ స్కాలర్

వరంగల్ సిటీ, న్యూస్‌లైన్ : స్టడీ టూర్‌లో భాగంగా హైదరాబాద్ సెంట్రల్ యూనివర్సిటీ (హెచ్‌సీయూ) రీసెర్చ్ స్కాలర్ సైదారుక్మాన బుధవారం వరంగల్ వ్యవసాయ మార్కెట్‌ను సందర్శించారు. ఉస్మానియా రిటైర్డ్ ప్రొఫెసర్ అశ్మి, డాక్టర్ అస్నత్, ఆదర్శ రైతు పోలం రమణారెడ్డితో కలిసి ఆమె మార్కెట్‌కు వచ్చారు. పలువురు రైతులతో మాట్లాడి క్రయవిక్రయాల తీరు, ధర వివరాలు తెలుసుకున్నారు. అనంతరం ఆమె మార్కెట్ చాంబర్‌కు వెళ్లి కార్యదర్శి ఉప్పుల శ్రీనివాస్‌తో సమావేశమయ్యారు. రైతులకు మద్దతు ధర లభించాలంటే ఎవరు చొరవ చూపాలని కార్యదర్శిని అడిగారు. మిర్చి ఖరీదుదారులు తక్కువ మంది ఉండటంతో మద్దతు ధర లభించడం లేదని కార్యదర్శి వివరించారు. ప్రభుత్వం వేరే కొనుగోలుదారులను ఏర్పాటు చేస్తే రైతులకు మంచి ధర లభించే అవకాశం ఉంటుందని కార్యదర్శి వారికి తెలిపారు. రెండో ప్రత్యామ్నాయం లేకపోయేసరికి ఖరీదుదారులు ఇష్టానుసారంగా కొనుగోలు చేస్తున్నారని, తాము కూడా ఖరీదుదారులను బలవంతం చేసే పరిస్థితి లేదని కార్యదర్శి శ్రీనివాస్ చెప్పారు. ప్రభుత్వం కొనుగోలు సంస్థను ఏర్పాటు చేస్తేనే పోటీతత్వంతో మిర్చి రైతులకు మంచి ధర లభించే అవకాశం ఉందని, లేదంటే ఎన్ని సంవత్సరాలైనా పరిస్థితి ఇలానే ఉంటుందని ఆదర్శ రైతు రమణారెడ్డి రీసెర్చ్ స్కాలర్‌కు వివరించారు.

కార్యదర్శితో మాట్లాడుతున్న సైదారుక్మాన

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This is to certify that, **Ms. Syeda Rukhsana Khalid**, Research Scholar, presented a paper entitled **"Sustainability growth: Making comodity future market inclusive"** in PSB: PPP National Conference 2013, organized by the Department of Management Studies, Indian Institute of Technology Roorkee.

Dr. Usha Lenka	Dr. Anil Kumar Sharma
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A Two Day National Conference on
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January 30-31, 2013

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Institute of Public Enterprise, Hyderabad

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This is to certify that Mr./Ms./Dr./Prof..... Syeda Rukhsana Khalid

from...... University of Hyderabad

has presented a paper on.. Basics Risk in Commodities Future Market

in a Two Day National Conference on "Risk Management in Banking, Insurance and Financial Services" on 30th – 31st January, 2013 held at Institute of Public Enterprise, O U Campus, Hyderabad.

Prof. R K Mishra
Director, IPE

Dr Inder Sekhar Yadav & Dr A Pawan Kumar
Conference Conveners, IPE

PERFORMANCE OF COMMODITY FUTURE MARKET IN INDIA: A STUDY OF SELECT VARIABLES

by Syeda Rukhsana Khalid

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PERFORMANCE OF COMMODITY FUTURE MARKET IN INDIA
: A STUDY OF SELECT VARIABLES

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