

**Efficiency of Commodity Future in Price Discovery of Turmeric and Chilly  
– A Study with Special reference to NCDEX****MadhuDruva Kumar<sup>1</sup>Dr.M.Lokanadha Reddy<sup>2</sup>****Abstract**

An efficient commodity futures market provides producers and consumer not only with correct price signals but also with tools for managing price risk. The futures market is developing in India. Now days, it attracts number of investors in the futures market. The futures market has to decide the prices of a commodity on the basis of demand and supply. At this juncture, there are many complications related to price signals, volatility spillovers, price discovery in spot and futures of Indian commodity market. It is important to know about the bi directional and unidirectional relationship between future and Spot markets in India, price discovery process and price forecasting in Indian agricultural commodities. The study analyses the efficiency of commodity futures in price discovery of turmeric and chilly traded in NCDEX for 2016 – 2018.

***Keywords: Commodity Future Market: Price Discovery*****I. INTRODUCTION**

Commodities are products which are outputs of primary sector of the economy. Commodities have commercial value and can be transacted. They are considered to be separate asset class. India being an agricultural economy for a long time, commodity market has a significant role to play. India is the second largest producer of agricultural outputs. With the change in the economic policies, our country has witnessed a sea change in the consumption pattern too. Many products which were not that popular in Indian markets have now captured the markets. At present India is the leading producer of many commodities as well as the leading consumer of many commodities too.

A commodity market is a place where commodities are bought and sold. With the advent of derivative trading in commodities, commodity derivative markets are now being considered as commodity markets. This is because commodity derivative markets involve

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trading, delivery and settlement of commodity transactions. Commodities have attracted quite a considerable interest as an investment avenue in recent years. Indian commodity derivative market has a very long history. However, the first organized commodity future trading was started in cotton in 1875 by Bombay Cotton Trade Association. The policies with regard to commodity future trading have taken several turns over the years where there were several years that witnessed a ban on trading. However with the adoption of liberalisation and globalization, commodity future trading has regained momentum. Today commodity derivatives constitute 5.5% of the trade (based on value) of the secondary market.

## A. Spices

‘Spices’ are aromatic substances of a plant origin, obtained from roots, flowers, fruits, seeds, leaves or bark. Spices are formed by a dried part of a plant, which distinguishes them from ‘Herbs’, spices are obtained from the leaves of herbaceous plants. And they are generally grown in warm tropical and sub- tropical climates. Condiments also differ from spices, as they are ediblesubstances.

### a) *Chilli – The Wonder Spice*

Global production of Chilli stands at about 20.00 lakh MT to 25 lakh MT per annum. India is the largest producer and contributes about 10 to 12 lakh MT annually followed by China, Nigeria, Peru, Bangladesh, Hungary. Domestically Andhra Pradesh contributes 49% of total production. Globally, India and China are of superior quality in the production of Chilli. Botanically Chilly is known as *Capsicum annum* L, Chilli is the dried ripe fruit of the genus *Capsicum*. Chilli is an annual sub herb and the dried ripe fruit forms the commercial part of the plant. The two important commercial qualities of chilly are its colour and pungency levels.

### b) *Turmeric – The Golden Spice*

India is the world’s largest producer of turmeric and produces nearly 80 to 85% of worlds total production stands 6 to 7 lakh per year. Andhra Pradesh, west Bengal, Orissa, Karnataka are the leading producers in India. It grows in tropical climatic conditions with temperature ranging between 20 to 30 degrees in irrigated as well as rain fed areas from sea level to 1200 meters above sea level.

## **II. REVIEW OF LITERATURE**

The review of existing literature is an important part of any research. The review of study has been grouped under the following heads:

- a) The studies on the commodities market in India
- b) The studies on relation between spot market and future markets in the commodities market

### **The studies on the commodities market in India**

**Narender L Ahuja (2006)** he concluded that since 2003, Commodity Derivatives market has made enormous progress by extending more number of commodity exchanges, trading activity and transparency. The volume and value of commodities in commodity market has shown unpredictable progress due to demand and supply in market forces and changing policy of the government concerning to commodity derivative. He suggested that to determine price, the promotion of barrier free trading in the future market and freedom of market forces will play important role.

**Harvinder pal Kaur and Dr. Bimal Anjum (2013)** in his study examined that Commodity market has gained momentum in Indian economy. There are 21 regional commodity exchanges and 5 national commodity exchanges governed by Forward Market Commission. The two vital functions of the commodity derivatives for the economy is price discovery and risk management. Futures markets provide liquidity and facilities to hedge against future price risk. It helps buyers and sellers of agricultural products to quickly manage their trade at a fair price. Commodity trading also offers a chance for financial leverage to hedgers, speculators and other traders.

**MADHAVI & G. V. CHALAM (2017)** studied that agriculture is the backbone of India with a sizeable population live on it for employment and livelihood, the functioning of markets of agricultural produce is important for policy makers and other stockholders. The markets are expected to provide a reasonable price for farmers and traders. Due to seasonality, lack of storage facilities, yield differences across different geographical regions in our country, it is difficult to provide reasonable price. With recommendations of different Committees and after a prolonged debate, commodity derivatives trading restarted from the year 2003. The prices of agriculture commodities in 'Spot' and 'Futures' markets with a revolution in

information technology moved toward fairness and resulted in remunerative to farmers. Further, the profiles of select commodities and their price trends are analyzed. The price fluctuations might have made the Futures trading to pick-up the derivatives markets.

**KEVIN JIMMY**, Researcher & Adjunct Faculty (Public Economics), University of Tampere, Tampere, Finland, The study to understand that Commodities have various underlying financial values in terms of their derivatives globally. This study analyses the importance of derivative in Indian organized commodity markets. And also study about trading values, underlying parameters and their derivative faces, which have been undertaken to be reviewed and concluded by this paper.

#### **The studies on relation between spot market and future markets in the commodities market**

**Gouri Prava Samal (2017)** The paper evaluates the efficiency of Indian cotton futures prices in predicting future spot prices during the period January, 2013 to December, 2015 using Vector Auto Regression model and Granger causality tests. To check stationarity in futures and spot prices ADF test is applied. The results show that both the variables are stationary at level. The VAR model suggests that lag value of futures has more influence on spot price of cotton. The causality test has further indicated that futures markets have negligible ability to predict subsequent spot prices for cotton.

**Dr. K.NIRMALA, SWARNAL.C (2017)**, This study finds the univariate relationship or bivariate relationship between spot and futures prices of crude oil. ADF and GANGER CAUSALITY AND COINTEGRATION test is used to analyse the causal relationship. The results indicate that there is a univariate relationship where spot prices are discovered in futures markets.

**Vishweswar Sastry V. N. & Dr. Pundareeka Vittala(2017)**, In the present era commodity market can be said as physical and virtual market place for buying, selling and trading of primary products. These commodities are Soft agricultural commodities and Hard commodities. The main objective is to study the relationship between future and spot commodity price and to find the intensity of future trading on spot volatility of the selected commodities and to study the trading and settlement pattern of agriculture commodity needs and to facilitate yield to agricultural commodity.. It is been found that all commodities have

positive correlation and also found that Spot market volatility tends to affect futures market trading activity, measured by trading volumes liquidity

**Raghavendra RH, Velmurugan PS and Saravanan A(2016)**, This study empirically examines the relationship between spot and future prices of agricultural commodities such as Soya bean, Chana, Maize, Jeera and Turmeric for a period from January 2010 to March 2015 traded in NCDEX. The findings show that the existence of long-run equilibrium relationships between futures and spot prices for all the 5 agricultural commodities that were taken for this study. The commodities like Maize, Jeera and Turmeric have bivariate relationship where both spot and future markets influence each other in the price discovery process.

**K. Nirmala, Munilakshmi R, Sandhya V (2015)**. This study analyses which market influence to discover the price in Cardamom futures market using econometric tools like Augmented Dickey Fuller (ADF) test, Granger Causality test and Co-integration technique. Our findings suggest that, cardamom futures price movement can be used as price discovery vehicle for spot market transactions by taking daily closing data from 1st Jan 2012 to 31st Dec 2013. This study has been further validated by comparing the results of international futures cardamom prices.

**QiuMengyuan, Ocean University of China(2015)**, The futures prices of Chinese agricultural products are generally followed by the Chicago commodity exchange futures prices. The objective is to find the relationship between corn futures prices in China and corn future price United States. The Johansen Co-integration test is used to test the long run co integration and found that there is a long run co integration between two variables and VECM is used to know the causal relationship and indicated that corn futures prices in America had a significant effect on prices of China.. By comparison, the information in the corn market of America transfers faster and the U.S. corn futures market plays a leading role. This research also suggested about how to promote the development of China's corn futures market.

**G Vasantha and T Mallikarjunappa,(2015)** examines the lead-lag relationship of pepper in India by employing Johansen's co-integration test, ECM-EGARCH models. Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are used to check the stationarity of the price series. It was found that there is a long-run co integration between the two markets in

terms of price discovery. This result is further supported by the results of volatility spillover obtained from EGARCH model. Therefore, spot market influences in price discovery process. This paper will be immensely useful to the investors to hedge their market risk. Since the spot market is informationally more efficient than the futures market, hedgers can take spot market prices as base.

**DR ANURAG AGNIHOTRI; DR ANAND SHARMA(2011)**,The study explains the relationship of spot and future price of commodities. Zeera, Channa, Zink, and Natural Gas and their inter-relationship and consider the data from MCX and NCDEX. The standard deviations and correlation is used as the techniques of data analysis for this paper. It has collected the data of the total turnover of the derivative contracts in order to find out that the correlation between the two. The results indicate that the regression tests is more powerful detecting any convergence between two markets for Zeera,Zink, Channa, and not capable for detecting for natural gas.

### **Research Gap**

(i)The review of existing literature on studies on commodity market in India indicates that Indian Commodities Market is still an emerging forum in the arena of research. The numbers of quality research in the field are limited.

(ii) The review of literature on studies of spot market and future market shows that

a) There is a need to study the causal relationship between spot markets and future markets on various sectors of agricultural commodities

b)There is a need to study Price Forecasting

c) Arbitrage opportunities and challenges in commodity futures markets on different exchanges platforms.

### **III.OBJECTIVES**

1. To check Stationary of Commodity Prices and Returns.
2. To Estimate Long-run and short-run equilibrium(causality) relationship between two markets
3. To check the Uni-directional or Bi-directional relationship between two markets

**IV. METHODOLOGY**

**Data Collection**– Data is collected from National Commodity and Derivative Exchange(NCDEX) of daily closing prices from 2016 to 2018.

**Period of Study –**

The study uses daily closing prices of future and spot contract. The sample period is for 2 years from 2016 to 2018.

**Scope of the study –**

This study examines the relationship between spot and future prices of agricultural commodities such as Turmeric and Chilly from 2016 to 2018 traded in NCDEX,

**Hypotheses–**

$H_0$ : Time series data is non Stationery

$H_a$ : Time series data is Stationery

$H_0$ : There is no significant long-run and short run association between commodity futures and spot prices

$H_a$ : There is significant long-run and short run association between commodity futures and spot prices

$H_0$ : Spot price does not granger cause future

$H_a$ : Spot price does granger cause future

$H_0$ : Future does not granger cause spot

$H_a$ : Future does not granger cause spot

**Statistical Tools for Analysis**

- a) Augmented Dickey Fuller Test.
- b) Johansen's co-integration model and VECM Model.
- c) Ganger Causality Test

**Stationary of Commodity Spot and Futures Prices**

$H_0$ : there is no stationarity of spot and futures Prices

$H_a$ : there is a stationarity spot and futures Prices

**Testing Of Stationary of Commodity Spot and Futures Prices**

| <b>Augmented Dickey Fuller Test-Log Prices</b> |                     |               |                     |               |
|------------------------------------------------|---------------------|---------------|---------------------|---------------|
| <b>Particulars</b>                             | <b>Chilli</b>       |               | <b>Turmeric</b>     |               |
|                                                | <b>t-Statistics</b> | <b>Prob.*</b> | <b>t-Statistics</b> | <b>Prob.*</b> |
| <b>Log Spot Prices</b>                         | -1.214064           | 0.3698        | -0.386124           | 0.0118        |
| <b>Log Future Prices</b>                       | -2.823031           | 0.8113        | -1.880741           | 0.0481        |

Sources: NCDEX website

**Augmented Dickey Fuller Test-Ln Futures and Spot prices**

| <b>Augmented Dickey Fuller Test- Ln Futures and Spot prices</b> |                     |               |                     |               |
|-----------------------------------------------------------------|---------------------|---------------|---------------------|---------------|
| <b>Particulars</b>                                              | <b>Chilli</b>       |               | <b>Turmeric</b>     |               |
|                                                                 | <b>t-Statistics</b> | <b>Prob.*</b> | <b>t-Statistics</b> | <b>Prob.*</b> |
| <b>Log Spot Prices</b>                                          | -12.93770           | 0.0000        | -18.60438           | 0.0000        |
| <b>Log Future Prices</b>                                        | -10.950643          | 0.0000        | -11.12707           | 0.0000        |

Sources: NCDEX website

Test critical values: 1% level -3.438948; 5% level -2.865225; 10% level -2.568788

\*MacKinnon (1996) one-sided p-values. Since the probability value is less than 0.05, hence null hypothesis is rejected.

The table shows the results of stationarity test on the ln values of prices and returns series of spot and futures of Chilli and turmeric respectively. The result of the ADF test confirm that that the data series of spot and future prices is non-stationary at level form ( $p > 0.05$ ) and the data series of spot and futures return is stationary ( $p < 0.05$ ). Hence johanson test of cointegration is used to check long-run equilibrium relationship between spot and futures prices of sample commodities. As the result of co-integration is sensitive to lag length, AIC criteria has been applied and it is found that the optimal lag length is 2 days for Chilli, and 5 days for turmeric respectively.

**Long run Association between Commodities Futures and Spot Prices**

$H_0$ : There is no significant long-run association between commodity futures and spot prices

$H_a$ : There is a significant long-run association between commodity futures and spot prices

Estimation of Long run Association between Commodities Futures and Spot Prices

| Johansen co integration test        |             |              |                |        |                      |                |         |
|-------------------------------------|-------------|--------------|----------------|--------|----------------------|----------------|---------|
| LSP LFP-Chilli- Near Month Contract |             |              |                |        |                      |                |         |
| Hypothesized                        | Eigen value | Trace Test   |                |        | Max-Eigen Value Test |                |         |
| No. of CE(s)                        |             | Static Value | Critical Value | Prob.* | Static Value         | Critical Value | Prob.** |
| None.*                              | 0.024578    | 141.4353     | 25.87211       | 0.0000 | 134.832              | 19.387         | 0.0001  |
| At most 1                           | 0.003718    | 6.602400     | 12.51798       | 0.0578 | 6.60240              | 12.517         | 0.0587  |

LSP LFP-Turmeric- Near Month Contract

| Hypothesized | Eigen value | Trace Test   |                |        | Max-Eigen Value Test |                |         |
|--------------|-------------|--------------|----------------|--------|----------------------|----------------|---------|
| No. of CE(s) |             | Static Value | Critical Value | Prob.* | Static Value         | Critical Value | Prob.** |
| None.*       | 0.031797    | 63.00782     | 25.87211       | 0.0000 | 52.53161             | 19.38704       | 0.0000  |
| At most 1    | 0.000114    | 10.47622     | 12.51798       | 0.1072 | 10.47622             | 12.51798       | 0.1072  |

Sources: NCDEX website

Trace test indicates 1 co-integrating eqn(s) at the 0.05 level; Ma-eigenvalue test indicates 1 co-integrating eqn(s) at the 0.05 level;

\* denotes rejection of hypothesis at the 0.05 level;

\*\* MacKinnon-Haug-Michelis (1999) p-values

The table shows the results of Johansen test of co-integration. The result reveals that there is a presence of one co-integration equation between spot and future prices of Chilli and turmeric and this signifies the long run association. The trace results points out the number of co-integration equations are less than or equal to one; whereas Maximum Eigen value test results confirm the presence of one integration equation. To examine the lead-lag relationship or the long-run and short-run speed adjustment/ convergence towards equilibrium between spot and futures prices, the study uses the vector error correction model (VECM) as spot and future prices are integrated.

### Long-run and short-run adjustments (causality) between spot and futures prices

$H_0$ : There are no long-run and short-run adjustments (causality) between spot and futures prices

$H_a$ : There are long-run and short-run adjustments (causality) between spot and futures prices

### Estimation of long-run and short-run adjustments (causality) between spot and futures prices

| VEC-vector error correction estimates of LSP LFP for near month contract |                |            |            |            |            |
|--------------------------------------------------------------------------|----------------|------------|------------|------------|------------|
|                                                                          |                | Chilli     |            | Turmeric   |            |
| Error correction                                                         |                | D(LSP)     | D(LFP)     | D(LSP)     | D(LFP)     |
| CointEq1                                                                 | Coefficient    | - 0.020198 | 0.034379   | - 0.033055 | 0.021019   |
|                                                                          | standard error | (0.01179)  | (0.01684)  | (0.03719)  | (0.02936)  |
|                                                                          | t-statistics   | [ -2.3254] | [ 2.50236] | [3.77939]  | [1.03469]  |
|                                                                          | Prob.          | 0.0186     | 0.0089     | 0.0007     | 0.0945     |
| D(LSP(-1))                                                               | Coefficient    | -0.228672  | 0.001219   | -0.534887  | 0.003363   |
|                                                                          | standard error | (0.04445)  | (0.00436)  | (0.06185)  | (0.03175)  |
|                                                                          | t-statistics   | [-5.14488] | [ 0.27967] | [-8.64786] | [ 0.10590] |
|                                                                          | Prob.          | 0.7695     | 0.0632     | 0.1642     | 0.2734     |
| D(LSP(-2))                                                               | Coefficient    |            |            | -0.329447  | 9.41E-05   |
|                                                                          | standard error |            |            | (0.06189)  | (0.03177)  |
|                                                                          | t-statistics   |            |            | [-5.32352] | [ 0.00296] |
|                                                                          | Prob.          |            |            | 0.0164     | 0.6530     |
| D(LSP(-3))                                                               | Coefficient    |            |            | -0.184839  | 0.011209   |
|                                                                          | standard error |            |            | (0.05660)  | (0.02906)  |
|                                                                          | t-statistics   |            |            | [-3.26544] | [ 0.38571] |
|                                                                          | Prob.          |            |            | 0.0000     | 0.0001     |
| D(LSP(-4))                                                               | Coefficient    |            |            | -0.057665  | 0.035513   |
|                                                                          | standard error |            |            | (0.04306)  | (0.02211)  |
|                                                                          | t-statistics   |            |            | [-1.33913] | [ 1.60639] |
|                                                                          | Prob.          |            |            | 0.5643     | 0.4783     |
| D(LFP(-1))                                                               | Coefficient    | 0.199189   | -0.003836  | 0.503003   | -0.002501  |
|                                                                          | standard error | (0.47508)  | (0.04657)  | (0.09393)  | (0.04822)  |
|                                                                          | t-statistics   | [ 0.41927] | [-0.08236] | [ 5.35508] | [-0.05187] |
|                                                                          | Prob.          | 0.0228     | 0.2784     | 0.0000     | 0.2317     |
| D(LFP(-2))                                                               | Coefficient    |            |            | 0.333514   | 0.083395   |
|                                                                          | standard error |            |            | (0.09429)  | (0.04841)  |
|                                                                          | t-statistics   |            |            | [ 3.53698] | [ 1.72271] |
|                                                                          | Prob.          |            |            | 0.3491     | 0.5893     |
| D(LFP(-3))                                                               | Coefficient    |            |            | 0.294787   | 0.041348   |
|                                                                          | standard error |            |            | (0.09075)  | (0.04659)  |

|                    |                |           |          |            |            |
|--------------------|----------------|-----------|----------|------------|------------|
|                    | t-statistics   |           |          | [ 3.24822] | [ 0.88744] |
|                    | Prob.          |           |          | 0.4873     | 0.2851     |
| D(LFP(-4))         | Coefficient    |           |          | 0.018808   | -0.110828  |
|                    | standard error |           |          | (0.08377)  | (0.04301)  |
|                    | t-statistics   |           |          | [ 0.22452] | [-2.57706] |
|                    | Prob.          |           |          | 0.0000     | 0.2784     |
| R-Squared          |                | 0.000557  | 0.534997 | 0.018845   | 0.364550   |
| Adj R-Squared.     |                | -0.005768 | 0.532054 | 0.006698   | 0.356683   |
| F-statistics       |                | 0.088075  | 5.782875 | 1.551476   | 1 .341181  |
| Prob(F-statistics) |                | 0.0000    | 0.000045 | 0.00000    | .002264    |

Sources: NCDEX website

Note: p values denote significance level at the 5% level of significance

The table shows the error correction terms (ECT) of spot and futures prices of Chilli and turmeric for different lags and indicates the long-run and short-run speed adjustments (convergence) towards equilibrium or long-run steady state. When the coefficient of error correction term (coefficient of cointEq1) is negative in sign, (Chilli -0.020198, turmeric - 0.03305) and significant ( $p < 0.05$ ) this implies that there is a long-run causality running from futures prices to dependent spot prices which enable the spot market to adjust to the short-run deviation from long-run equilibrium path nearly 2.01% and 3.30% speed of adjustments in sample commodities, that is, Chilli and turmeric, respectively. The speed of correction in the futures market of Chilli is 3.43% against spot market, which indicates a highly informative futures market. At the same time, insignificant ECT of ln futures prices of turmeric indicates futures market efficiency towards maintaining stable long-run equilibrium

### Presence of Short-run Causality between Futures and Spot Prices

$H_0$ : There is no Presence of Short-run Causality between Futures and Spot Prices

$H_a$ : There is a Presence of Short-run Causality between Futures and Spot Prices

Estimation of Presence of Short-run Causality between Futures and Spot Prices

| Wald Test- LSP LFP- Near Month Contract |        |          |        |          |          |        |
|-----------------------------------------|--------|----------|--------|----------|----------|--------|
| test statistic                          | Chilli |          |        | Turmeric |          |        |
|                                         | Value  | Df       | Prob.  | Value    | Df       | Prob.  |
| F-Statistic                             | 4.721  | (2,1150) | 0.0079 | 12.640   | (4,1481) | 0.0000 |
| Chi-Square                              | 9.485  | 2        | 0.0077 | 34.910   | 4        | 0.0000 |

Sources: NCDEX website

Note: p values denote significance level at the 5% level of significance

Since the probability value is less than 0.05, null hypothesis is rejected hence alternative hypothesis is accepted

The table reveals the results of Wald chi-square test that the joint value of all the coefficient of ln futures prices of Chilli and turmeric at select lag lengths are not equal to zero, which indicates the presence of the short-run causality between the spot and futures markets of commodities under study ( $p < 0.05$ )

### Direction of Causality-Granger Causality

$H_0$ : There is no significant impact of commodity futures prices to spot prices

$H_a$ : There is a significant impact of commodity futures prices to spot prices

#### Estimation of Direction of Causality-Granger Causality

| PAIRWISE GRANGER CAUSALITY TESTS |            |                  |                 |        |                  |                     |        |
|----------------------------------|------------|------------------|-----------------|--------|------------------|---------------------|--------|
| SR FR- Near Month Contract       | CHILLI     |                  |                 |        | TURMERIC         |                     |        |
| Null Hypothesis                  | Lag Length | Obs<br>erv<br>ns | F-<br>Statistic | Prob.  | Obs<br>erv<br>ns | F-<br>Statis<br>tic | Prob.  |
| FR does not Granger Cause SR     | 1          | 478              | 6.011           | 0.009  | 740              | 34.32               | 0      |
| FR does not granger cause FR     |            |                  | 4.6098          | 0.192  |                  | 3.784               | 0.0962 |
| FR does not granger cause SR     | 2          | 477              | 5.0565          | 0.0009 | 739              | 33.60               | 0      |
| FR does not granger cause FR     |            |                  | 3.79077         | 0.233  |                  | 2.721               | 0.4701 |
| FR does not granger cause SR     | 3          | 476              | 0.04002         | 0.0005 | 738              | 32.66               | 0      |
| FR does not granger cause FR     |            |                  | 2.6632          | 0.1475 |                  | 2.539               | 0.5396 |
| FR does not Granger Cause SR     | 4          | 475              | 0.05385         | 0.0007 | 737              | 28.53               | 0      |
| FR does not granger cause FR     |            |                  | 2.445           | 0.2458 |                  | 1.992               | 0.1842 |
| FR does not Granger Cause SR     | 5          | 474              | 0.20218         | 0.0071 | 736              | 22.62               | 0      |
| FR does not granger cause FR     |            |                  | 2.3188          | 0.4425 |                  | 1.439               | 0.2761 |

Sources: NCDEX website

Note: p values denote significance level at the 5% level of significance

Since probability value is less than 0.05 in all lags of spot rate, hence null hypothesis is rejected. But for future rate, probability value is more than 0.05; hence null hypothesis is rejected. That means future price is influencing the spot price.

The Table presents the results of granger causality. The granger causality test was conducted from lag one to lag five to assess the direction of causality on all the week days prices in futures and spot market. The result disclosure that there is only a unidirectional causality from futures return to spot returns of commodities chilli and turmeric.( $p < 0.05$ )

## **V FINDINGS**

- \* The Johansen co-integration tests reveals that there is a long-run association, that is equilibrium between spot and futures prices of chilli and turmeric
- \* The VECM results reveals that the coefficient of error correction term(coefficient of cointEq1) is negative in sign (Chilli -0.020198, turmeric -0.03305) and significant ( $p < 0.05$ ). This implies that there is a long-run causality running from futures prices to dependent spot prices which enable the spot market to adjust to the short-run deviation from long-run equilibrium path nearly 2.01% and 3.30% speed of adjustments in sample commodities, that is, Chilli and turmeric, respectively. The speed of correction in the futures market of Chilli is 3.43% against spot market, which indicates a highly informative futures market. At the same time, insignificant ECT of ln futures prices of turmeric indicates futures market efficiency towards maintaining stable long-run equilibrium
- \* Granger Causality tests disclosure that there is only a unidirectional causality from futures return to spot returns of commodities chilli and turmeric.( $p < 0.05$ )

## **VI CONCLUSION**

It is concluded that there is a long-term association, that is, equilibrium between commodity future and spot prices of sample commodities. This indicates there is long-run arbitrage opportunity. The result of co-integration and VECM highlight that futures market contributes largely to the price discovery, suggesting that news are first aggregated in the prices of the futures and then transferred to the spot market. The result of the granger causality between

futures and spot price suggested that the futures market dominates the spot market of chilli and turmeric.

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