MAIZE FUTURES AS A RISK MANAGEMENT AND PRICE DISCOVERY TOOL AND THEIR CESSATION FROM MARKET. -AN ANALYSIS WITH REFERENCE TO MAIZE GROWING DISTRICTS OF KARNATAKA, ANDHRA PRADESH AND TELANGANA

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Abstract

Commodity derivatives are risk management tools and are contracts built on commodities which will have transaction on the same day and settlement in the future. Futures are one among the derivative products which does the role of hedging and helps in price discovery of the underlying commodity. If the futures price of a commodity has to converge to the spot price in order to discover the price, information that affects the demand and supply factors leading to convergence need to be focused. Past research posted the establishment of organized futures exchanges, their role in price discovery with respect to some commodities as well as commodity indices. But the evidences are neither comprehensive nor conclusive in any manner. Empirical research on the subject over the last decade showed that the introduction of derivatives contracts improved the liquidity and reduced informational asymmetries in the market to some extent. Researchers attempted to find the impact of price information dissemination on price discovery and hence the benefits to market participants, both producers and consumers.

In this study authors attempted to evaluate the problem of information dissemination across market players in Karnataka, Andhra Pradesh and Telangana states with special reference to maize. Maize the 'queen of cereals', is the hope of...
India as a substitute to rice and wheat, to mitigate the shortage of million tonnes of food material that Indians will be facing very soon. It is known that maize futures which were given by both NCDEX and MCX platforms were serving the roles and in the recent times no new contracts were announced. This research tries to check whether the Information Dissemination Project implemented by Central Government of India, with help of commodity derivative exchanges was successful in disseminating the right information, at right time with right approach/tools, whether the stake holders got benefitted with information and maize futures and finally it tries to study whether the maize futures have helped in price discovery? The study is done with the help of primary data collected through questionnaires and secondary data collected through NCDEX and other spot markets. Statistical Package for the Social Sciences (SPSS) and E-Views are used to test the hypotheses framed hence, to prove the role of maize futures as a risk management and price discovery tool. Authors came out with the conclusion that maize futures do the role and future contracts can be rolled on for benefit of all the stakeholders

**Keywords:** Commodity Futures, Price Discovery, Risk Management and Price information Dissemination.

I. **Introduction**

Derivatives markets communicate valuable information on supply and demand conditions of underlying asset. Traders or corporate can procure or sell if this information implies that the current price is too low or too high. This informed trading, pushes prices towards their correct level. Producers, consumers and inventory holders of the commodity can use the information embedded in derivatives prices to make better resource allocations. Derivative markets reflect the price at which both buyer and seller have agreed to do the transaction on the commodity in the future indicating the expectations of the participants about the price of the commodity in the future course of time. Unless there is a manipulation, commodity derivative products are the exact providers of demand and supply information and price that participants are ready to pay in the near future. Futures prices increases when traders think that supply and demand are not meeting and shortage/scarcity of commodity may appear. In an opposite scenario, when traders feel that excess supply with lesser demand exists the prices tend to decline.

Commodity markets in emerging economies like India have been growing rapidly & exponentially. Trying to establish price discovery on Indian commodity exchanges is a difficult task especially for agricultural commodities as there is no single spot price for a commodity corresponding to a specified quality that is used as a reference price by all stakeholders across the country. Fact that the price discovery is the result of right information at right time, Central Government has implemented price dissemination project under Forward Markets Commission, Ministry of Consumer Affairs, Food & Distribution ministries. Greater efficiency of price discovery of spot market may help investors with more efficient strategies for hedging and speculating in futures. Moreover, a better understanding of the interconnectedness of these
markets would be useful for policy makers who coordinate the stability of financial markets.

Farmers in India became the epicenter of concern from 1990s as there was a gradual increase in farmer suicides. Historical information according to National Crime Records Bureau (NCRB) is most of the suicides have occurred in states of Andhra Pradesh, Maharashtra, Karnataka, Kerala and Punjab. The agriculture sector of Karnataka and erstwhile Andhra Pradesh states is characterized by lack of timely and reliable information. There is also absence of analysis on various aspects of business such as current prices, supply and demand movements, technical and scientific forecasting etc. similarly at the production side, information on yield, weather and their impact on agriculture and allied sectors is not done. A recent study taken up by the Govt. of Andhra Pradesh reported that more than 55 percent of the farmers are not getting the Minimum Support Price (MSP) and the similar case with the farmers of the Karnataka. Most of the farmers are tied to the traders and middlemen who are dealing with agricultural inputs like seed and money. Cost of cultivation has increased manifold in 90s and debt trap has increased as unorganized credit sources are higher. In addition to this, Karnataka and Andhra Pradesh in general have a vast drought-prone area includes northern districts of Karnataka and southern areas of Andhra Pradesh. When the unfavorable deviations in agriculture, significantly reduce income, there can be serious repercussions in the absence of effective risk management tools like derivatives. In this regard, research is mandatory to identify the significance of information dissemination and its impact on price discovery, and to know whether this information is used by all stakeholders to benefit through existing volatile scenarios.

Despite Maize called as the ‘queen of cereals’ with its productivity and adaptability to all climates and soils and huge demand across the world, growers are facing problems in production and marketing of Maize produced. Lack of market information regarding prevailing prices, increased arrivals in the markets due to introduction of high yielding varieties of maize, lack of storage facilities, lack of training in marketing system, malpractices prevailing in the markets of maize like excess weighment, delay in payment, auction, different kinds of arbitrary deductions for religious and charitable purposes, etc., growers' aggressive production practices often lead to change in crop returns and profitability. Despite Karnataka, Andhra Pradesh and Telangana are the major Maize producing states with world average productivity in few districts, the farmers in these states are facing problems in turning the production into profits. Despite measures and supportive policies initiated by Government of India, returns are considerably less to Maize farming community in these high maize yielding states.

II. Review of Literature

Review of literature is done by the authors on the commodity derivatives existence in India, maize production, price information dissemination, risk management through commodity derivatives and price discovery. Few of reviews are:

Mohan Paramkusam & Sivaramane [X], in their article “A Socio-Economic Status of Maize Farmers of Telangana and Andhra Pradesh, India”, examined maize cropping
pattern by the farmers and farmers’ socio-economic status of Karimnagar, Mahabubnagar and Guntur in Telangana and Andhra Pradesh where maize is a predominant crop. Authors observed agriculture in Telangana and Andhra Pradesh to the variations in social, political and market undercurrents. Their study came out with the opinion that maize is a remunerative successive crop in the three surveyed districts.

G. Ranganath, P.K. Mandanna & S. Kumar [VI] had made an attempt to analyze the structure and competitiveness of the maize market in Davanagere district of Karnataka state. The authors in their work “Structure and Competitiveness of the Maize market in Davanagere” had calculated the Lorenz co-efficient of inequality and found to be 0.206 which exposed the existence of a higher degree of competitiveness in Davanagere for maize as Davanagere market concentration was less.

K. Singha and A. Chakravorty [VIII], in the article “Crop Diversification in India: A Study of Maize Cultivation in Karnataka”, have discussed about crop diversification and maize cultivation in State of Karnataka. They opined that growth of population has made mandatory for the economy to focus on growth of agricultural production for availability of food and security along with the employment generation.

Narendra Singh Manohar, A. K. Dikshit, & B. S. Reddy [XI], in their research paper “Marketing Pattern of Maize, An Insight Household Survey Results in India: A Case Study”, Authors made an effort to talk about maize showcasing designs in India. The examination uncovered that greater part of little shape holders had brought down attractive maize surplus which brought about dis-economies of the size of transportation yielding lower returns.

In the article “Agricultural Marketing System in Telangana State – A Study”, author MudigondaRaju [IX] discussed about the existing marketing information sharing and present challenges involved in marketing of agricultural produce in Telangana state. In newly formed Telangana state, nearly 68 to 70% cultivation takes place in maize, cotton and rice. He opines that there is a need of adopting improved farm practices to enhance the production and productivity.

In the article “Performance Analysis of Indian Agricultural Commodity Market”, authors Angad Singh Maravi & Harisingh Gour [II], investigated on the status, growth and developmental policy alternatives for commodity derivative markets in agri commodities in India. In their study authors opined that the price of food grains and other agricultural commodities hold an important position in price structure of India.

Amrutha C.P. [III], explained about agricultural market information system, its necessity and importance in her study “Market Information System and Its Application for Agricultural Commodities in Karnataka State – A Case of Onion”. Her study concluded that market information expedites decisions, regulates the competition and strengthens the marketing system which steers the price discovery. She opined in her paper that it is indeed a necessity for the farmers to bank on informed decisions on crops particularly when they need to grow, when and where to send the produce, whether the crop can be stored for better prices etc.

In a study Athma Prashanta & K.P.Venugopala Rao [IV] took mentha oil futures as the sample unit and studied the commodity futures impact on price discovery and the
relationship between spot and futures market in the form of co-movement of prices. In article, “Agricultural commodity derivatives in India: A study of mentha oil futures”, the hypotheses framed were that futures prices do not Granger Cause spot prices and spot price does not Granger Cause futures prices. The study concluded that the effect of spot prices on futures price was more compared to the effect of futures on spot prices.

Dr. Sunitha Ravi [V] in her examination on “Price Discovery and Volatility Spillover in Indian Commodity Futures Markets Using Selected Commodities”, observed the results of the research study of Spot market price for Gaur seed and Ref Soyoil. It determines that the futures market of the commodities is more efficient when associated with spot market. The futures market additionally enables the spot market in the development of Price Discovery. The investigation was determined that the derivative instruments are accessible for the primary commodities significantly influence the volatility.

Jackline, S. and Deo, M. [VII] did a study on lead - lag relationship between the futures and spot prices. Their paper “Lead Lag Relationship between Futures and Spot Prices”, examined the relationship between the futures market and spot market for the lean hogs and pork bellies markets during the sample period January 2001 through May 2010 and quantifies the price discovery function of commodity futures prices in relation to spot prices of the sample markets. The econometric tools like Unit root tests and Pairwise Granger Causality tests were employed in the study.

**III. Objectives of research undertaken**

To examine the benefits of information dissemination and hedging, to the stakeholders of Commodity Derivatives Market in Karnataka, Telangana and Andhra Pradesh with reference to Maize.

Sub-Objective: To check whether traders and corporate have same opinion of farmers on benefits through information dissemination
To analyse the lead lag relationship between spot and futures prices of maize derivatives that leads to price discovery

**IV. Hypotheses Framed for the research study**

**Hypotheses:** In order to meet the first objective, the following hypotheses are used:

**HO1.1:** There are no linear relationships between ‘Having access to physical market prices of agri commodities’, farmer reference groups and ‘Hedging is effective for price’

**HO1.2:** There are no linear relationships between ‘Having access to physical market prices of agri commodities’, farmer reference groups and ‘Price discovery & Risk management through Commodity Derivatives’

**HO1.3:** There are no linear relationships between ‘Having access to physical market prices of agri commodities’, farmer reference groups and ‘Integration of rural, urban & global agricultural markets to fix price’

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H01.4: There are no linear relationships between ‘Having access to physical market prices of agri commodities’, farmer reference groups and ‘Price discovery through transparent price information dissemination’

The second objective was met with testing the following hypothesis:

HO2.1: There are no linear relationships between ‘Having access to physical market prices of agri commodities’, farmer reference groups and ‘Future Price leads Cash Price and Vice-versa’

HO2.2: There is no significant price discovery occurring in maize through lead lag relationship between maize spot and futures prices.

Methodology adopted for research
The study was an empirical in nature. With the help of quantitative analysis, relationship of different stakeholders of commodity markets to prevailing market price of the commodities was studied.

Sampling was done using Judgmental Sampling Technique.

Sample Unit: Farmers, Traders & Corporate Entities.

Sample Size: A total of 759 stakeholders (559 Farmers, 154 Traders & 44 Corporate Entities) from few districts of Karnataka, Telangana and Andhra Pradesh states were selected. Major Maize producing districts of Karnataka (0.95 million tonnes) Davanagere, Bellary, Chitradurga and Dharwad, in Telangana state Nizamabad, Mahabubnagar, Karimnagar the predominant maize growing districts, Similarly, Kurnool & Guntur districts of Andhra Pradesh were considered for study.

Fig. 1. (a) Karnataka (b) Andhra Pradesh (c) Telangana

Nature & Sources of research data:
As the part of descriptive study, collection of data was done in two methods,

Primary data: Data required to study the awareness on uses of commodity derivative markets was collected through survey method, by serving the questionnaires to the respondents.

Secondary data: Maize futures contract prices of NCDEX commodity derivatives exchange for 5 years was collected. Spot prices of Maize crop in cash segment was collected for the same duration.

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V. Data Analysis & Findings

Objective 1:
Data collected through questionnaires is analysed and tested for hypotheses at 5% significance level with the help of Regression Analysis. This model is used to know whether information is helping in price discovery and risk management in commodity derivatives.

Regression Model: \[ Y = a + \beta_1 X_1 + X_2 + e \]

\( H_{01,1} \): There are no linear relationships between ‘Having access to physical market prices of agri commodities’, farmer reference groups and ‘Hedging is effective for price’

Regression Model:

| R       | R Square | Adjusted R Square | Std. Error | F value | Sig. value |
|---------|----------|-------------------|------------|---------|------------|
| 0.777   | 0.60     | 0.60              | 0.35       | 382.32  | .000       |

| Hedging is effective for price |
|--------------------------------|

| Unstandardized Coefficients | Standardized Coefficients | T      | Sig.   |
|-----------------------------|---------------------------|--------|--------|
| B                            | Std. Error                | Beta   |        |
| (Constant)                  | 1.210                      | .245   | 4.935  | .000   |
| v57.8.2 Have access to      | .447                       | .061   | .213   | 7.310  | .000   |
| physical market prices of   |                           |        |        |        |        |
| agri commodities            |                           |        |        |        |        |
| Farmers vs. Traders         | .638                       | .032   | .460   | 19.889 | .000   |
| Farmers vs. Corporates      | 1.253                      | .070   | .526   | 17.908 | .000   |

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IV: (Constant), v103.11.15 Agree that Stakeholders utilize disseminated price information, v57.8.2 Have access to physical market prices of agri. Commodities. Type: Farmer (ref. group). DV: Hedging is effective for price

**Interpretation:** The above table (Table 1 & 2) shows the impact of ‘Having access to physical market prices of agri commodities’ and farmer reference groups on ‘Hedging is effective for price’.

The correlation coefficient value (R) is 0.777 for Model, which exhibits a excellent amount of correlation between the independent variables with the F-ratio being 382.32 and its associated significance level being small (P<0.01). F significant results that, there is strong relation between dependent and independent variables. The R square value gives us the goodness of fit of the regression model. Model2 significant values (p<0.05) three stakeholders differ in their opinion.

**H01.2:** There are no linear relationships between ‘Having access to physical market prices of agri commodities, farmer reference groups and ‘Price discovery & Risk management through Commodity Derivatives’

**Table 3 Values of Price discovery & Risk management through Commodity**

| R   | R Square | Adjusted R Square | Std. Error | F value | Sig value |
|-----|----------|-------------------|------------|---------|-----------|
| 0.812 | 0.66 | 0.66 | 0.30 | 486.00 | .000 |

**Table 4 Price discovery & Risk management through Commodity Derivatives**

| Unstandardized Coefficients | Standardized Coefficients | t | Sig. |
|------------------------------|--------------------------|---|------|
| (Constant)                   | -.214 | .206 | -1.036 | .300 |
| v57.8.2 Have access to physical market prices of agri commodities | .803 | .051 | .422 | 15.607 | .000 |
| Farmers vs. Traders          | .362 | .027 | .288 | 13.432 | .000 |
| Farmers vs. Corporates       | .979 | .059 | .453 | 16.642 | .000 |

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IV: (Constant), v103.11.15 Agree that Stakeholders utilize disseminated price information, v57.8.2 Have access to physical market prices of agri. Commodities, Type: Farmer (ref. group), DV: Price discovery & Risk management through Commodity Derivatives

**Interpretation:** The correlation coefficient value (R) is 0.812 for Model1 (Table 3 & 4), which exhibits an excellent amount of correlation between the independent variables (‘Having access to physical market prices of agri commodities’ and farmer reference groups) and dependent variable (Price discovery & Risk management through Commodity Derivatives), with the F-ratio being 486.00 and its associated significance level being small (P<0.01). F significant results that, there is strong relation between dependent and independent variables. The R square value gives us the goodness of fit of the regression model. Model2 significant values (p<0.05) three stakeholders differ in their opinion.

H₀₁.₃: There are no linear relationships between ‘Having access to physical market prices of agri commodities, farmer reference groups and 'Integration of rural urban & global agricultural markets to fix price’

### Table 5 Values of Integration of rural urban & global agricultural markets

| R       | R Square | Adjusted R Square | Std. Error | F value | Sig value |
|---------|----------|-------------------|------------|---------|-----------|
| 0.811   | 0.66     | 0.66              | 0.34       | 481.04  | .000      |

### Table 6 Integration of rural urban & global agricultural markets to fix price

| (Constant) | Unstandardized Coefficients | Standardized Coefficients | T       | Sig.  |
|------------|-----------------------------|---------------------------|---------|-------|
|            | B                           | Std. Error                | Beta    |       |
| (.666)     | .238                        |                           | 2.795   | .005  |
| v57.8.2    | Have access to physical market prices of agri commodities | .583                   | .059    | .266  | 9.809    | .000    |
| Farmers vs. Traders | .732                   | .031                      | .506    | 23.479| .000    |
| Farmers vs. Corporates | 1.225                   | .068                      | .492    | 18.021| .000    |
IV: (Constant), v103.11.15 Agree that Stakeholders utilize disseminated price information, v57.8.2 Have access to physical market prices of agri. Commodities, Type: Farmer (ref.group). DV: Integration of rural urban & global agricultural markets to fix price

**Interpretation:** The correlation coefficient value (R) is 0.811 for Model Model1 (Table 5 & 6), which exhibits an excellent amount of correlation between the independent variables (‘Having access to physical market prices of agri commodities’ and farmer reference groups) and dependent variable (Integration of rural urban & global agricultural markets to fix price), with the F-ratio being 481.04 and its associated significance level being small (P<0.01). F significant results that, there is strong relation between dependent and independent variables. The R square value gives us the goodness of fit of the regression model. Model2 significant values (p<0.05) three stakeholders differ in their opinion.

**H01.4:** There are no linear relationships between ‘Having access to physical market prices of agri commodities, farmer reference groups and ‘Price discovery through transparent price information dissemination’

**Table 7 Values of Price discovery through transparent price information dissemination**

|        | R     | R Square | Adjusted R Square | Std. Error | F value | Sig value |
|--------|-------|----------|-------------------|------------|---------|-----------|
| Model2 | 0.916 | 0.84     | 0.84              | 0.27       | 1301.60 | .000      |

IV: (Constant), v103.11.15 Agree that Stakeholders utilize disseminated price information, v57.8.2 Have access to physical market prices of agri. Commodities, Type: Farmer (ref.group). DV: Price discovery through transparent price information dissemination

**Interpretation:** The correlation coefficient value (R) is 0.916 for Model (Table 7 & 8), which exhibits an excellent amount of correlation between the independent variables (‘Having access to physical market prices of agri commodities’ and farmer reference groups) and dependent variable (Price discovery through transparent price information dissemination), with the F-ratio being 1301.60 and its associated significance level being small (P<0.01). F significant results that, there is strong relation between dependent and independent variables. The R square value gives us the goodness of fit of the regression model. Model2 significant values (p<0.05) three stakeholders differ in their opinion.

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Table 8 Price discovery through transparent price information dissemination

|                                | Unstandardized Coefficients | Standardized Coefficients | t     | Sig.  |
|--------------------------------|-----------------------------|---------------------------|-------|-------|
|                                | B                           | Std. Error                | Beta  |       |
| (Constant)                     | 2.360                       | .191                      | 12.384| .000  |
| v57.8.2 Have access to physical market prices of agri commodities | .160                         | .048                      | .063  | 3.365 | .001  |
| Farmers vs. Traders            | 1.372                       | .025                      | .815  | 55.091| .000  |
| Farmers vs. Corporates         | 1.410                       | .054                      | .486  | 25.938| .000  |

Objective 2:

H_{02.1}: There are no linear relationships between ‘Having access to physical market prices of agri commodities, farmer reference groups and ‘Future Price leads Cash Price and Vice-versa’

Table 9 Values of Future Price leads Cash Price and Vice-versa

| R     | R Square | Adjusted R Square | Std. Error | F value | Sig value |
|-------|----------|-------------------|------------|---------|-----------|
| 0.894 | 0.80     | 0.80              | 0.26       | 995.04  | .000      |

IV: (Constant), v103.11.15 Agree that Stakeholders utilize disseminated price information, v57.8.2 Have access to physical market prices of agri. Commodities, Type: Farmer (ref.group). DV: Future Price leads Cash Price and Vice-versa

Interpretation: The correlation coefficient value (R) is 0.894 for Model1 (Table 9 & 10), which exhibits an excellent amount of correlation between the independent variables (‘Having access to physical market prices of agricultural commodities’ and farmer reference groups) and dependent variable (Future Price leads Cash Price and Vice-versa), with the F-ratio being 995.04 and its associated significance level being small (P<0.01). F significant results that, there is strong relation between dependent and independent variables. The R square value gives us the goodness of fit of the regression model. Model2 significant values (p<0.05) three stakeholders differ in their opinion.

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Table 10 Future Price leads Cash Price and Vice-versa

|                                | Unstandardized Coefficients | Standardized Coefficients | t     | Sig.  |
|--------------------------------|-----------------------------|---------------------------|-------|-------|
| (Constant)                     | 1.220                       | .181                      | 6.728 | .000  |
| v57.8.2 Have access to physical market prices of agri commodities | .445                        | .045                      | .204  | 9.837 | .000  |
| Farmers vs. Traders            | 1.066                       | .024                      | .743  | 44.99 | .000  |
| Farmers vs. Corporates         | 1.073                       | .052                      | .434  | 20.74 | .000  |

The lead and lag relation between spot and futures prices are tested with econometrics toll e-views, using different hypotheses. The following sequence of steps are required to test hypothesis 2 and hence second objective. OLS model used for analysis on time series data need to meet assumptions that are tested and found to be satisfying. Jarque-Bera test probability used for normality, Breusch-Pagan-Godfrey test was used to check the heteroscedasticity, Breusch-Godfrey Serial Correlation test was used to check the auto correlation among the variables considered for the study.

Stationarity is the statistical characteristics of time series where in its mean and variance are constant over time. (i.e. not a random walk/ has no unit root), otherwise the time series is said to be non-stationary. If a variable ‘x’ under time series is stationary without differencing (level x_t) and it is shown as I (0). If the series has stationarity with first difference (1st differenced value x_t, x_{t-1}), it is I (1) or called as integrated of order one (1), and the series has stationarity with second difference it is designated as I(2) and so on.

Phillips–Perron test: “In inferential statistics, the Phillips–Perron test is used in time series analysis to test the null hypothesis that a time series is integrated at log order 1. Phillips-Perron tests assess the null hypothesis of a unit root in a univariate time series y. Tests use the model: y_t = c + δt + a y_{t-1} + e(t).

H_0: The spot and futures price series of maize is not stationary and has unit root
Table 11 Phillips-Perron Test results for spot and futures prices of maize at First Difference

| PP test results for log of spot and futures prices of maize at First Difference | Phillips-Perron Test |
|---|---|
| | t statistic | P value |
| ΔLn Spot _Prices | H₀⁵ | -38.80 | 0.0000 |
| ΔLn Futures _Price | H₀⁶ | -32.24 | 0.0000 |

**Interpretation:** the Phillips-Perron test values (Table 11), for 1st difference I(1), as P value is lower than 0.05, we reject the null hypothesis in case of spot prices of maize (p=0.000) as well as futures prices of maize (p=0.0000). to conclude that the spot and futures price series of maize at level are stationary at first difference.

**Co Integration Analysis:**
Set of integrated variables are said to be cointegrated if stochastic trend which exhibit the nature of upward and downward trend is driving them jointly. Linear combinations that link the variables to a common trend path are called cointegrating relationships. **Johansen Cointegration Test** has been carried out to determine the existence of a long-run relationship between spot and futures prices of maize for the pairs of series.

**Johansen Cointegration test:**
“If two price series are integrated of log order 1 (Table 12), then those series can be modeled by co-integrated analysis. To test the long run equilibrium relationship between the spot and futures price series, Johansen cointegration framework was used. With two time series, spot price (Sₜ) and futures prices (Fₜ) each of which is I(1), the co-integration regression equation is:

\[ Sₜ = η₀ + η₁Fₜ + εₜ \]

Where, \( Sₜ \) = Spot price at time \( t \), \( η₀ \) = Constant

\( η₁ \) is the regression co-efficient measures the influence of \( Fₜ \) on \( Sₜ \), and \( εₜ \) is the residuals or error terms. The spot price and futures prices will be co-integrated if and only if \( εₜ \) is stationary”.

**The following hypotheses were framed.**

\( H₀₁ \): There is no significant relationship between the variables, futures price and spot price

\( H₀₂ \): There is a single relationship that exists between the variables, futures price and spot price.
Table 12 Johansen’s Co integration Results At Lag order 1

| H0  | H1  | Eigen Value | Trace Statistic | Max Eigen Statistics |
|-----|-----|-------------|----------------|---------------------|
|     |     |             | Trace         | Max Eigen          |
|     |     |             | Statistic     | Statistics         |
|     |     |             | λ trace | P value |     |     |     |
|     |     |             |          |          |     |     |     |
| r = 0 | r ≥ 1 | 0.014338 | 16.52411 | 0.0349 | 15.71283 | 0.0293 |
| r = 1 | r ≥ 2 | 0.000745 | 0.811280 | 0.3677 | 0.811280 | 0.3677 |

* indicates significance at 5% level

The null hypothesis r = 1 is not rejected at 5% level by both the trace and max Eigen method indicating there is at least one co integrated equation. Hence it is inferred that there is an equilibrium relationship between maize futures and spot in the long run.

Once co-integration is established it is mandatory to find the causality to assess the direction of relation between the variables. Granger’s causality test is implemented in this study

**Granger Causality:**

“Granger had given a model to check whether a change in one cointegrated variable in time series does bring change in another variable (Table 13). The following two OLS regressions used in Granger causality test explains the above concept:

\[ Y_t = \alpha_0 + \Sigma \alpha_i Y_{t-i} + \Sigma \beta_i X_{t-i} + U_t \]

\[ X_t = \alpha_0 + \Sigma \alpha_i X_{t-i} + \Sigma \beta_i Y_{t-i} + U_t \]  

where \( i = 1 \) to \( m \) and \( t \) indicates time \( t \). \( Y_t \) = Spot price at time \( t \), whereas \( Y_{t-i} \) = lagged spot price,

\( X_t \) = Future price at time \( t \), whereas \( X_{t-i} \) = lagged future price

Granger causality test was used to test the dynamic relationship between spot and future price of maize”. and hypotheses framed is: \( H_0: \) Futures’ price does not lead spot price.

Table 13 Granger’s causality test results

| Test Statistic | Value | Df  | Probability |
|---------------|-------|-----|-------------|
| F-static      | 1.607172 | 2,1082 | 0.2009 |
| Chi-square    | 3.214343 | 2 | 0.2005 |

There is no short-term causality from spot to futures as probability is greater than 0.05 and we need to accept the null hypothesis that there is no short-term causality. From the above test we can conclude that: There is long run causality from spot to futures & There is no short-term causality from spot to futures

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VI. Findings

Regression model built between the **independent variables** ‘Have access to physical market prices of agricultural commodities’, farmer reference groups and **dependent variables** (DV): 1: Hedging is effective for price, DV2: Price Discovery & Risk Management through Commodity Derivatives, DV3: Future Price leads Cash Price and Vice-versa, DV4: Integration of Rural Urban & Global Agricultural Markets to fix Price, and DV5: Price discovery through transparent price information dissemination, have exhibited an excellent amount of correlation indicating the impact of price information dissemination, existence of benefits through information based hedging. Regression model through correlation specifies that future price leads spot price. However, model 2 in each regression analysis concludes that stakeholders do have different opinions on levels of benefits through hedging. It is evident through the significant values that are arising as the common opinion on impact of independent variables on dependent variables of research.

Stationarity levels of maize Spot and futures prices (secondary data) were checked with Phillip-Perron test and found that they were stationary at 1st differenced value, i.e. I(1). Co-integration has existed between maize futures price and maize spot price. The cointegration test null hypothesis r = 1 is not rejected at 5% level by both the trace and max Eigen method indicating there is at least one co-integrated equation. The spot and futures price move together closely over time and their difference will be stationary. Hence it is inferred that there is an equilibrium relationship between maize futures and spot in the long run. Lead-lag relation is occurring between the derivative and spot markets. There is a long run causality between derivatives and spot markets of maize crop.

VII. Conclusions

Agri marketing in India has gained its importance and is the focus of the policy makers now, as they have realized that both production & marketing are necessary for the agri sustainability. In this line, Indian government has implemented ‘Price Information Dissemination Project’ to educate the stakeholders of agricultural sector about the prevailing market conditions on commodities, demand and supply conditions and price that is fixed. The idea behind the project was to help stakeholders to realize the market conditions and can make informed decisions on production, marketing and hedging. The researchers tried to find the level of awareness among the stakeholders about the price information dissemination project and its impact on benefits in terms of returns and price discovery of maize. Maize is the third high productivity cereal in India and considered as the alternative to rice and wheat. Despite of growth and continuous demand for maize from the industry, maize farmers are not able to realize good returns. Hence the study focused on maize and tried to explore the awareness of hedging benefits. It may be concluded that awareness on benefits of hedging is existing among stakeholders and price discovery through derivatives is occurring. Researchers suggest continuing the maize futures, as they are performing the role specified and suggest looking any other supporting alternative to improve the volumes of the contracts instead of shedding them completely.
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