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"Market Efficiency of Agri Commodity Futures Market in India" An Example of Kharif Maize

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Abstract: Efficiency of Maize futures market has been examined in terms of price transmission, price discovery and extent of volatility. This paper is an attempt to find maize futures market and its efficiency through the fulfillment of two objectives, i.e. to find out long term and short term relationship between spot and futures market by empirically testing through Stationarity test, Cointegration analysis and Granger Causality test. Daily closing spot and futures prices of Maize was collected from NCDEX website for two kharif seasons' contracts. The empirical tests and analyses reveals that maize spot and futures market are cointegrated in a long run and have causal relationship in short run from spot to futures market. Thus, it confirms that maize spot market is causing changes in futures market for whatever new information comes to the market in the sample period considered for the study. These tests, to fulfill the price discovery function, are estimated to help in the process of price stabilization and safeguard the interests of farmers and different stakeholders in the market.

Keywords: Stationarity, NCDEX, Co-integration, Granger Causality.

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I. Introduction

Futures market under organised commodity exchanges perform two important functions viz., price discovery and risk management. These two functions are estimated to help in the process of price stabilization and safeguard the interests of farmers and different stakeholders in the market. Price discovery is a continuous process of arriving at a price, which a person buys and another sells a futures contract in a commodity exchange. Price discovery is a major economic function and, indeed, a major economic benefit of futures trading. Through this competition, all the available information is continuously transmitted into future price, providing a dynamic barometer of supply and demand. Further, Agriculture is known as the backbone of the Indian Economy, which plays a vital role for the economic development. Further, agricultural commodities have a significant weight in the GDP of our economy. Commodity prices represent an important variable in the economy. A few risks associated with the Indian agriculturists are price risk, yield risk, monsoon risk and so on. Price risk is one such risk which can be mitigated by hedging the price of agricultural commodities in futures market. In order to explore the price discovery mechanism, this study is undertaken to study and understand the relationship between maize spot and futures market in India.

II. Review of Literature

Literatures which were reviewed to analyse the agri commodity futures and spot market in India are as follows: Salvadi, et.al.(2008) studied the price discovery function of selected agri commodities (castor, cotton, peper and soya) in Indian Commodity Futures Market. Daily futures prices were collected from MCX and NCDEX for the study. Through the analysis of statistical data on price discovery of the selected agri commodities, the result showed that futures market in these commodities are not efficient. Further, the authors also studied the relationship between price, return, volume, market depth and volatility on these selected commodities, which shows that spot and futures markets are not integrated. Golaka et.al., (2008) examined the effect of introduction of Futures trading on Spot prices of Pulses. Methodology followed by the author is "wholesale price Index for commodities for a period from Jan 2001 to August 2007 was considered. Econometric test was conducted to check the influence of futures on spot market. Analysis of data was done using simple percentage, percentage variations, correlations, regression analysis and the GRANGER CASUALITY TEST. The results found was that in case of urad pulse, there is a significant increase in spot price volatility as an impact of futures trading. Elumalai, et.al.(2009), assessed the futures and spot price linkages for three agri commodities through Johnsen Co integration Analysis and Vector Error Correction Model. The result showed that these three commodity futures influenced the spot prices indicating its better hedge efficiency for producers to hedge their price risk in the futures market platform.

Vasisht, et.al. (2010), examined the volatility of maize spot and futures prices. The volatility indices were computed using the data for futures price of maize for the year 2007 and 2008 by using ARCH, co-integration, granger causality. The results had revealed that there is a long run price equilibrium relationship between the prices and it also resulted that there was volatility of spot and futures price of august month. The results also said that there is unidirectional causality from futures to spot market prices.

Trevor, et.al.(2011), discussed the theoretical relationship between spot and futures prices for commodities and by evaluating the empirical forecasting performance of futures prices relative to some alternative benchmarks. The results of this analysis is that futures prices have generally outperformed a random walk forecast, but not by a large margin, while both futures and a random walk noticeably outperform a simple extrapolation of recent trends. Finally concluded that futures prices, on average, outperform a random walk by a consideration margin when there is a sizeable difference between spot and future prices.

Moraes, et.al.(2011), using coffee spot prices from 2000 to 2010, analyzed the forecast performance of GARCH, EGACH and TGARCH. They use mean square error and Theil U to select the best model in each class. Their selected models are GARCH(2,1), EGARCH(1,1) and TGARCH(2,1). Among these models GARCH (2,1) was chosen as the best model to forecast coffee spot prices.

Sanjay, et.al.(2012), studied the price discovery relationship for ten agricultural commodities. Price discovery is confirmed for all commodities except Turmeric. Price discovery results are encouraging given the nascent character of commodity market in India. However, the market does not seem to be competitive.

Adalto, et.al.(2014), studied and estimated the models ARIMA and Volatility (GARCH, GJR and EGARCH) for forecasting the spot prices of coffee and cattle. Daily spot prices from January 2003 to December 2013 were used. Different ARIMA model and Volatility models (GARCH, GJR, EGARCH) were evaluated based on Schwarz criterion. The result says that, for cattle, ARIMA(1,1,1) with GARCH(2,2), GJR(5,6), and EGARCH(4,5) and for coffee, ARIMA(2,1,0) with GARCH(1,1), b, GJR(1,1,1) EGARCH(1,1,1) are the best fit model to forecast the price.

Khalid, et.al.(2014), examined the techniques that forecast the market price of grains by using ARMA and WAVELET models. A monthly data consists of 300 observations starting from July 1983 to July 2013 were considered. It contains international prices of wheat, rice, barely and maize. Result with the help of three different error tests showed that wavelet forecasting method is the most appropriate one to forecast the grain prices. Prabhakaran, et.al.(2014), studied and forecasted the areas and production of rice in India for the time period from 1950-51 to 2011-12. ARIMA (1,1,1) model were used to forecast both the areas and production of rice for the next four years. As per the result, forecasted areas of production for the year 2015 to be about 44.75 thousand hectares with upper and lower limits 47.53 and 41.97 thousand hectares respectively and forecasted rice production to be about 104.37 thousand tonnes with upper and lower limits 115.26 and 93.48 thousand tonnes respectively.

Paul and Kimata (2016) exposed the effects of asymmetry, persistence, crisis on the volatility, price discovery, linkage and causality between the spot and futures price volatility by applying Granger causality test, ARCH and GARCH family models. Data was covered from 12th June 2000 to 30th September 2013 of two indices from Nifty stock market: one for spot and the other for futures market. The results claim that there is bidirectional causality between the selected markets. Spillover effect is significant from futures to spot market. As revealed by TGARCH and EGARCH model that there is a significant effect of negative news on volatility in Indian market. The US mortgage financial crisis has an impact on volatility of NIFTY. This claims that there is integrity between Indian stock market and global market. To conclude, this study tried to link the economic theory about spot and futures markets are cointegrated.

Need for the Study

In India, agricultural commodities have relevant weights in the GDP. Further, prices represent an important variable in the economy. Price volatility is common in the market. Further, futures market is known to be an efficient market in terms of price discovery in general. Few agri commodity futures market is efficient and a few are not. In this backdrop, the present study has been undertaken and an attempt is made to empirically test and analyse the relation for short and long run in maize futures market and spot market.

Objectives of the Study

1. To check the maize spot and futures price series are stationary series or not.
2. To find out empirically the long run co-movement relationship between maize spot and futures market.
3. To find out short run causality relationship between the two markets.

Hypotheses:

Following hypotheses have been framed in accordance with the set of objectives listed above.

1. For testing the Stationarity:
H0: "Maize prices are not Stationary"
H1: "Maize prices are Stationary"

2. For testing the long run relationship:
Ho: "There is no co-movement relationship between maize futures prices and maize spot prices".
H1: "There is co-movement relationship between maize futures prices and maize spot prices".

3. For testing the short run relationship:
H0: "Maize spot prices do not granger-cause the Maize futures prices"
H1: "Maize spot prices granger-cause the Maize futures prices"

H0: "Maize futures prices do not granger-cause the Maize spot prices"
H1: "Maize futures price granger-cause the Maize spot price"

III. Methodology Of The Study

The present study is based on empirical research. It focused at studying the stationarity of futures and spot prices of Maize commodity. This paper concentrates to examine to short and long run relationship between these two markets for the purpose of fulfilling the price discovery function of Maize futures market. For this purpose, daily closing prices of Maize (secondary data) were collected from NCDEX website for two kariff seasons' contracts, the period starting from September 2015 to May 2017 with the total observation of 240. Econometric tools such as unit root test like Augmented Dickey Fuller (ADF) test for stationarity check, Cointegration test and Granger Causality tests to check the long run and short run relation respectively were applied. All these tests were conducted and the results have been obtained by using EVIEWS software version 9.

Empirical Analysis and Discussion

Test of Stationarity

In order to test for the existence of unit roots (stationarity) and to determine the degree of differencing necessary to induce stationarity, we have applied the Augmented Dickey –Fuller test (ADF Test).

Test of hypotheses: H0: "Maize prices are not stationary"
H1: "Maize prices are stationary"

Table 1: Results of Augmented Dickey-Fuller Test for the Kharif Seasons of Maize

Sample Period	Variables	Level	First Difference	Inference
SAMPLE PERIOD I	SPOT	-1.939406 (0.6265)	-5.703287* (0.0000)	Non-Stationary Stationary
	FUTURES	-2.019060 (0.5838)	-8.782174* (0.0000)	Non-Stationary Stationary
SAMPLE PERIOD II	SPOT	-2.750038 (0.2187)	-5.885262* (0.0000)	Non-Stationary Stationary
	FUTURES	-2.445600 (0.3547)	-9.492665* (0.0000)	Non-Stationary Stationary
Notes: * – indicates significance at five per cent level. ( ) indicates P value				

Source: Eviews output

Interpretation of result

Above table 1 shows that maize spot and futures prices and their stationarity conditions. Futures and spot prices at their level, corresponding p values are (0.6265 and 0.5838 for period I and 0.2187 and 0.3547 for period II) more than 0.05 significance level, which has led us to conclude that null hypothesis cannot be rejected. In other words, the given price series have unit root and hence are **Non-Stationary in nature.** Futures price variable at their First order difference, by their corresponding p values are less than (all p values shows 0.000) the significance level of 0.05. This shows that the variable futures price and spot prices at their First order of differences do not have unit root and hence are **Stationary in nature.**

Johansen Co-integration test

In order to find out the long run relationship between maize spot and futures market price series, most widely used test, Johansen's Cointegration test is applied.
Ho: "There is no co-movement relationship between maize futures prices and maize spot prices".
H1: "There is co-movement relationship between maize futures prices and maize spot prices".

TABLE 2: Estimated Results for Johansen Co-Integration test Rank test- trace & maximum eigenvalue test

Sample Period	vector (r)	Trace test Statistics	5 % Critical value for Trace Statistics	Probability Value for Trace Statistics	Maximal Eigen Value	5 % Critical value for Max-Eigen Statistics	Probability Value for Max-Eigen Statistics	Remarks
SAMPLE PERIOD IV	H_0: r = 0	22.52199**	15.49471	0.0135	17.575944**	14.26460	0.0423	Cointegrated
	H_1: r ≥ 1	2.946044	3.841466	0.2610	2.946044	3.841466	0.2610	
SAMPLE PERIOD V	H_0: r = 0	26.03865**	12.32090	0.0002	25.93411**	11.22480	0.0001	Cointegrated
	H_1: r ≥ 1	0.104541	4.129906	0.7903	0.104541	4.129906	0.7903	

Notes: ** – indicates significance at five per cent level. The significant of the statistics is based on 5 per cent critical values obtained from Johansen and Juselius (1990). r is the number of cointegrating vectors. H_0 represents the null hypothesis of presence of no cointegrating vector and H_1 represents the alternative hypothesis of presence of cointegrating vector.

Source: Eviews Output

Interpretation of result

Johansen cointegration test was performed to investigate the long-run relationship between the Maize spot and futures commodity markets for the respective sample periods of Khariff season and the results are presented in the Table 2. The maximum eigen value and trace statistics for the respective sample period of Kharif seasons is found to be statistically significant(0.0423 and 0.0001 respectively for both the periods) at five percent level, rejecting the null of no cointegration relation between the Maize spot and futures commodity market prices. The empirical results confirm long-term relationship between spot and future prices in the case of both sample periods of Khariff season.

Johansen Granger Causality Test

To empirically test the short run causality relation between two markets, Granger causality test is been used with the following hypothesis and table.

H0: "Maize spot prices do not granger-cause the Maize futures prices"
H1: "Maize spot prices granger-cause the Maize futures prices"

TABLE 3: Estimated Results for Johansen Granger Causality from Maize spot to futures price series.

NULL HYPOTHESIS	Sample Period	Obs.	F Statistic	P value	Decision
Maize spot prices do not granger-cause Maize futures prices	Period I	100	2.87013	0.0416	Reject
	Period II	133	3.63486	0.0291	Reject

Source: Eviews output

Interpretation of the result

Table 3 reveals the results of causational relation from maize spot to futures market. For both the sample periods, p values (0.0416 and 0.0291) are less than 0.05 level of significance. Therefore, rejecting the null hypothesis and accepting the alternative hypothesis means that maize spot prices causing maize futures price changes in the market.

Further,

H0: "Maize futures prices do not granger-cause the Maize spot prices"
H1: "Maize futures price granger-cause the Maize spot price"

TABLE 4: Estimated Results for Johansen Granger Causality from Maize futures to spot price series.

NULL HYPOTHESIS	Sample Period	Obs.	F Statistic	P value	Decision
Maize Futures prices do not granger-cause Maize spot prices	Period I	100	0.78752	0.4579	Accept
	Period II	133	1.97328	0.1432	Accept

Source: Eviews Output

Interpretation of the result

Table 4 reveals the results of causational relation from maize futures to spot market. For both the sample periods, p values (0.4579 and 0.1432) are more than 0.05 level of significance. Therefore, accepting the null hypothesis and rejecting the alternative hypothesis means that maize futures prices do not cause maize spot price changes in the market.

IV. Conclusion

In the present study, an attempt has been made to investigate the price discovery process between maize spot and futures market in the Indian context. The findings indicate that as most of the times series variables, the variables spot and futures prices are non-stationary at level and became stationary at first difference. There is co-integration or long term equilibrium relationship between maize spot and futures market of the selected sample periods. Granger causality shows one way causal relation from spot to futures market. The findings indicate that maize futures market is not efficient and do not play a leading role over the maize spot market. Spot market assimilates new market information quicker than futures market and serves as a price discovery vehicle. Here, maize spot market leads the futures market indicating that the maize spot market performs the function of price discovery. The findings will be useful to the different market participants or stakeholders to hedge their price risk. As the spot market is more efficient in transmitting and reflecting the information into price movement than the futures market, regulatory reforms and exchange platform has to look into the different aspects which makes and leads the futures market more efficient than that of the maize spot market.

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