Measuring Efficiency of Selected Agriculture Commodities

Tanushree Sharma, Puja Sharma

Abstract– ***It has been observed that there is high fluctuation in eight agricultural commodities. In this study price discovery and causality has been studied in select six commodities out of the above mentioned eight commodities. We could not find sufficient data for cardamom and mentha oil. The commodities selected are chana,soyabean,soya oil,guargum,potato and pepper. The purpose is to study causality and price discovery in selected agri commodities.***

Design/methodology/approach - National Commodity Exchange of India (NCDEX) website. We could not found any cointegration between guargum and potato future and spot price. Single cointegration vector was being identified between spot and future prices of chana, Soyabean, soyarefined and Pepper. To measure causal nexus between future and spot price of the selected agricultural commodity Vector error correction model (VECM) is employed . This is consistent with market efficiency. Finally, impulse response function and Variance decomposition is used to see price discovery in these four commodities.

Findings - The investigation shows that future leads to spot in case of soyabean and soya oil. Whereas in case of chana and pepper we found bi-directional relationship. As per Impulse response function and Variance decomposition we found future price leads in case of Chana,Soyaoil,Soyabean and pepper and performs price discovery function.

Keywords : Agriculture commoditities, iCausality Price discovery JEL Classification: C13, G13, G14,

I. INTRODUCTION

In India, More than 58.4% of the total population survives on agriculture sector.This sector contributes approximately one-fifth of the total gross domestic product. Agricultural commodities are being categorized into two parts. Soft commodities which create huge volatility in a few agriculture commodities in the short term. These commodities are pepper, chana, guar gum, soya oil,corn, wheat, soybean, soybean oil, sugar. Hard commodities are mined from the ground like gold, oil, Aluminum. Thus we can say that India is fully richer in the agricultural sector. This shows that commodities are considered as a separate asset compare to all others.

As we all know that there is high fluctuation in the prices of the agricultural commodity in India. But we don't know the exact reasons for the price hike. Uncertain fluctuations in commodities create a major concern for policy makers. It is not an easy task to find out what is the reason for the increasing rate of commodities.

India rapidly increased in trading of different kinds of commodities. In 1939, there was more than 300 commodity exchange in India offering derivatives contracts on commodities like turmeric, cumin seed, chili, sugar, pepper, cotton, jute, oilseeds, etc. It has witnessed that commodity prices are fluctuating which led economists to theorize about the changes in commodities. Rising commodity prices will hit the poor very badly, so food prices are of major concern. In developing countries, the price elasticity for food is very high. The impact of speculation on the prices of agricultural commodities has been studied thoroughly in the literature.

II. REVIEW OF LITERATURE

Author name	Country	Commodity	Methodology	Findings
Biswas et al.[2]	India	MCX Gold, MCX Silver MCX Crude	Correlation ,Granger Causality	Granger causality was present and it supported SIH(Sequential information arrival hypothesis)
Kumar[5]	India	Pepper	Co-integration VECM	Impact of Futures prices are much larger than spot prices.
Thiyagarajan et al. [7]	India	Energy index Metal index, Agri index	VECM Model, Granger causality Test	Granger causality test indicates that there is short and long run causal relationship between the two indices.
Rao et al.[8]	India	Chilli	Conceptual and empirical methodology	The farmers. Absence of market players allows contracts to be exposed to price manipulation.

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Sharma et al.[9]	India	Guar seed	GARCH model(1,1) Granger causality test	A positive relationship is found among unexpected futures trading volume and spot returns volatility.
Malhotra et al.-[6]	India	Guar seed	Granger causality VECM Model	VECM results indicates unidirectional flow of information from the futures to spot market.
Chakraborty et al.[3]	India	Barley Maize Mustard seed pepper	VAR, GARCH(1,1)	The study result indicates that unexpected trading volume causes spot price volatility for selected agriculture commodities.
Tarun Soni [11]	India	Maize, Chana Soybean .Wheat	VECM Model Granger causality Wald test	The analysis disclosed long term relationship exist in three futures commodities out of four
Kumar et al.[12]	India	MCX COMDEX MCXAGRI MCXENERGY MCXMETAL	VECM (EGARCH)	Information flows from future to spot but no inverse relationship was found.
Swaroop et al.[4]	India	Nifty index futures	Linear regression model Chow test Garch	There is difference in pre and post data.
Ranganathan et al.[13]	India	Soybean	Cointegration GARCH	Market is inefficient in the short run and in long run market t s unbiased for soyabean.
Rajendra et al.[1]	India	Agricultural commodities	Conceptual	The supply and demand are the key factors for volatility in agriculture commodities.
Sharma[10]	India	Pepper	GARCH Granger causality	OI, unexpected open interest are significant to explain volatility in spot price of pepper.

III. METHODOLOGY AND DATA

Daily closing prices of spot and futures of Soyabean, Chana ,soyarefined, Guargum, Potato and Pepper are used as secondary data. The data set has been comprised from November 2006 to April 2016 . Near month futures prices are used for the study as they are mostly traded as compared to next month and far month future contracts. Data has been retrieved from the National Commodity Exchange of India(NCDEX) website.

IV. EMPIRICAL RESULTS AND DISCUSSIONS

Johansen's Cointegration test is used to examine the long-run relationship between spot and future prices and its results are presented in Table-II. No cointegration was found between spot and future price of potato and Guar gum(refer Table I).

Table-I - Johansen's Cointegration Test Results

Commodity	Hypothesized No. of CE(s)	Eigen Value	Trace Statistic	Critical Value	Prob.**
Chana	None	0.059178	9.629463	15.49471	0.0203
	At most 1	0.006789	0.96729	3.841466	0.3254
Soyabean	None *	0.030664	51.52274	15.49471	0.0000
	At most 1	0.001179	1.879826	3.841466	0.1704
Soya Oil	None *	0.040237	60.04337	15.49471	0.0000
	At most 1	0.000312	0.452581	3.841466	0.5011
Guargum	None *	0.064171	144.7169	15.49471	0.0001
	At most 1 *	0.02456	39.46387	3.841466	0.0000
Potato	None	0.019789	12.45223	14.2646	0.0948
	At most 1*	0.00698	4.363562	3.841466	0.0367
Pepper	None *	0.065144	109.197	15.49471	0.0001
	At most 1	1.22E-06	0.00198	3.841466	0.9611

Note : * denotes rejection of the hypothesis at the 0.05 level

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

To further study long run relationship VAR model is applied , impulse response function and variance decomposition are used to further elaborate relationship for chana, Soyabean, soyarefined and Pepper future and spot prices. Figures illustrates the estimated impulse response functions for ten days period. The graphs of impulse response functions depicted in Figure I. Figure outline ten periods ahead forecasting for chana,Soyabean, soyarefined, and Pepper.

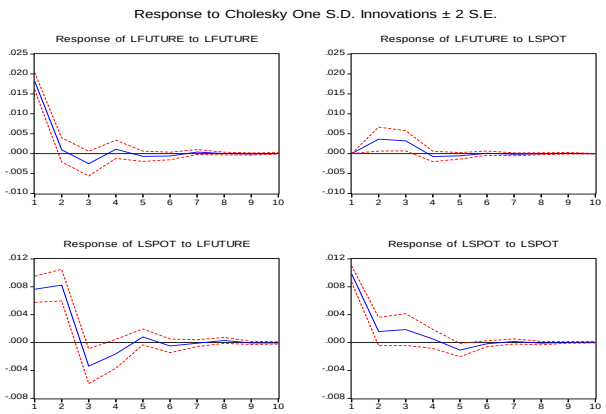

Fig. I –Impulse Response Function of Chana–

Table II: Variance decomposition of Chana

Panel A: Variance Decomposition of LSPOT:			Panel B:Variance Decomposition of LFUTURE:		
Period	LFUTURE	LSPOT	Period	LFUTURE	LSPOT
1	37.66341	62.33659	1	100	0
10	57.53465	42.46535	10	93.30247	6.697527

The shape of the impulse response graphs narrate that spot market has a larger response to one standard deviation shocks to the future price than the future responses to spot vicissitude. Initially spot price fluctuated for 4 days when there is shock to future prices. It remain constant from 4 to 10th day Relatively, the response of spot price is greater than the response of future prices. From above analysis we can say that future price leads more as compared to spot price.

Panel A of Table II shows the forecast error variance decomposition of spot return. Initially a high percentage (62.33%) of its total forecast error variance is explained by itself. After that it decreased to 44.03% in 2nd period. Later on it decreased but at a very slow pace. However, in the first period of the forecasting horizon, 37.66% variation in the forecast error of spot market is explained by the futures market. After that it increased to 55.96 % in 2nd period and later on increased at decreasing rate. This indicates that percentage of the forecast error variance in spot price is due to futures prices is more. In other words, the futures prices lead to spot prices. Similarly, Panel B of Table II reports the forecast error variance decomposition of futures returns. Throughout the forecast period, it explains a high level of forecast error variance of itself. Initially, it explains 100% variation in its forecast error, but after that it shows a decreasing trend. Only a small percentage changes in forecast error of futures market is by the spot market, though over the period of time it shows an escalating trend, but the rate of increase is very low. This indicates that futures prices lead the spot prices in Chana . The shape of the impulse response graphs discloses that spot market has a larger response to one standard deviation shocks to the future price than the future responses to spot innovations .Initially the response of spot price to shocks to futures prices declined till 4th day The response of spot price is higher than the response of future prices comparatively. Thus, it can be concluded from the analysis that future price leads in **Soyabean**.

Table - III : Variance Decomposition of Soyabean

Panel A: Variance Decomposition of LSPOT:			Panel B:Variance Decomposition of LFUTURE:		
Period	LFUTURE	LSPOT	Period	LFUTURE	LSPOT
1	23.93362	76.06638	1	100	0
10	31.82939	68.17061	10	99.07571	0.924289

Panel A of Table III shows the forecast error variance decomposition of spot return. Initially a high percentage (76.07%) of its total forecast error variance is explained by itself in spot price. After that it decreased and then remained constant. However, in the first period of the forecasting horizon 23.93 % variation in the forecast error of spot market is explained by the futures market. Panel B of Table III reports the forecast error variance decomposition of futures returns. Throughout the forecast period, it explains a high level of forecast error variance of itself. At the initial period, it explains 100% variation in its forecast error, but after that it shows a decreasing trend. However, only a small percentage changes in forecast error of futures market is explained by the spot market,

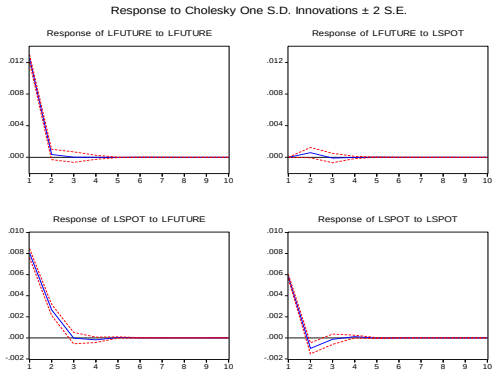

Fig. III. Impulse Response Function of Soyaoil

It is evident from the shape of the impulse response graphs that spot market has a larger response to one standard deviation shocks to the future price than the future responses to spot innovations . Initially the response of spot price to shocks to futures prices declined till 3rd day .It remain almost constant from 3 to 10th day . On the other hand, response of futures price to shocks to spot prices increased a bit initially declined till 4th period and then remained constant. The response of spot price is higher than the response of future prices comparatively. Thus, it can be concluded from the analysis that future price leads in Soya Oil.

Table - V : Variance Decomposition of Soya Oil

Panel A: Variance Decomposition of LSPOT:			Panel B:Variance Decomposition of LFUTURE:		
Period	LFUTURE	LSPOT	Period	LFUTURE	LSPOT
1	65.69934	34.30066	1	100	0
10	67.35762	32.64238	10	99.77947	0.220533

Initially a low percentage (34.30%) of its total forecast error variance is explained by itself in case of Soyaoil. After that it decreased to 32.63 % and then remained constant . However, in the first period of the forecasting horizon 65.69% variation in the forecast error of spot market is explained by the futures market. In other words, the futures prices lead to spot prices. Similarly, Panel B of Table V reports the forecast error variance decomposition of futures returns. it shows an increasing trend, but the rate of increase is very low. This indicates that in Soyaoil futures prices lead the spot prices.

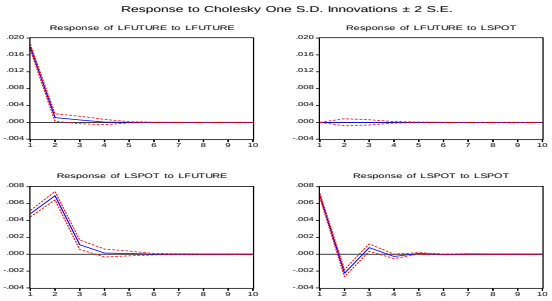

Fig. IV. Impulse Response Function of Pepper

It is evident from the shape of the impulse response graphs that spot market has a larger response to one standard deviation shocks to the future price than the future responses to spot innovations .Initially the response of spot price to shocks to futures prices increased till 2nd period .From 2nd to 3rd period it decreased sharply. It further declined till 4th day .It remain almost constant from 4 to 10th day . On the other hand, response of futures price to shocks to spot prices increased a bit initially declined till 4th period and then remained constant. The response of spot price is higher than the response of future prices comparatively. Thus, it can be concluded from the analysis that future price leads in Pepper.

Table -VI: Variance Decomposition of Pepper

Panel A: Variance Decomposition of LSPOT:			Panel B:Variance Decomposition of LFUTURE:		
Period	LFUTURE	LSPOT	Period	LFUTURE	LSPOT
1	32.22369	67.77631	1	100	0
10	57.15507	42.84493	10	99.99993	7.32E-05

Panel A of Table V shows the forecast error variance decomposition of spot return. Initially a high percentage (67.77%) of its total forecast error variance is explained by itself. After that it decreased to 42.96% and then remained constant . In the first period of the forecasting horizon 32.22 % variation in the forecast error of spot market is explained by the futures market then it increased to 57.03% afterwards it remained constant. Similarly, Panel B of Table VI reports the forecast error variance decomposition of futures returns. Throughout the forecast period, future price explains a high level of forecast error variance of itself. Initially, it explains 100% variation in its forecast error by itself, but after that it stablized at 99.99%. Hence we can say that in case of **pepper** future price leads spot price.

V. EMPIRICAL RESULTS AND DISCUSSIONS

The Government noticed price rise in six certain agricultural commodities (chana, soyabean, soyarefined and Pepper). (2012,Business Line).There are price rise and heavy fluctuations in these commodities future prices. These commodities were selected for the study and an analysis of cointegration and price discovery being conducted on these commodity. Johansen's Cointegration technique followed by the impulse response and variance decomposition was applied in selected Agricultural commodity to investigate the price discovery between spot and futures market . The empirical analysis was conducted for the daily data for near future market from November 2006 to April 2016. Using Augmented Dickey-Fuller test, we found enough evidence for the presence of a unit root for all 6 commodities spot and future prices initially. After first difference prices future and spot prices were stationary.We have also used the theory of cointegration to examine the long-run causal effect between spot and future markets of selected agricultural commodities. We found presence of single cointegration vector between the daily spot and one-month near futures commodity prices of chana,soyabean,soya oil,pepper, We could not not find any cointegration in Guar gum and Potato Future and spot prices.This is consistent with market efficiency. Finally, impulse response and variance decomposition test are used to measure impact of shocks in four commodities (chana, soyabean, soya oil, pepper) .The evidence shows that future leads to spot in case of soya oil and soyabean.
Impulse response and variance decomposition , points out that futures leads to spot market and therefore futures prices can be used for pricing spot market transactions in Chana, Soyaoil, Soyabean and Pepper. Overall, we find evidence of price discovery taking place in these selected futures market, but efficient arbitrage is missing due to which error correction process is slow. Instead of suspending trading for these selected agricultural commodities. Steps need to be taken to make market more transparent and efficient.

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