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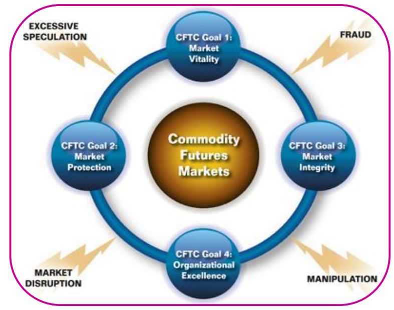
CAUSALITY IN INDIAN SPOT – FUTURES COMMODITY MARKET



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ABSTRACT:

This paper examines the causality relation between spot and futures markets through Johansen Cointegration and Vector Error Correction Model (VECM). The study uses Aluminium spot and futures prices of Multi Commodity Exchange of India (MCX) from Sep 2008 to Dec 2016. Johansen Cointegration test confirms the long run equilibrium between the variables. The VECM discloses that futures market plays a dominant role.

KEYWORDS : *Johansen Cointegration, VECM, Spot and Futures markets* **.**

INTRODUCTION

Background of Indian Futures market is for 1875 by Bombay Cotton Trade Association and it continued by Calcutta Hessian Exchange (CHE) and East India Jute Association (EIJA) in 1919 and 1927 respectively. Bullion Futures market established in Mumbai and also in Rajkot, Jaipur, Delhi, etc.

After Independence and introduction of economic reforms, again futures market was re-introduced by agricultural commodities and silver. The main task of futures market is a tool for risk management especially for agricultural products which are seasonal. Futures contracts used to minimize the risk and having stable prices for products too. Therefore, studying the relationship between spot and futures market is necessary for investors to make profit from their investment through a proper strategy and for farmers to secure from unexpected price changes. Hence, the role of futures market is influential for buyers and sellers in commodity market.

In this study, the spot and futures prices relationship is tested by econometric technique. Unfortunately, not many studies have been done in India related to spot and futures market especially in commodity market. Most of studies are related to developed countries like US.

REVIEW OF LITERATURE

There are varieties of studies regarding relationship between spot and futures prices but in commodity market in India are not abundant. P Srinivasan (2012) confirms long-term equilibrium between spot and futures prices of commodity market and spot markets of MCXCOMDEX, MCXAGRI, MCX ENERGY and MCXMETAL play a dominant role in price discovery. Sanjay et al (2013) confirmed a greater role for futures market in price discovery and volatility spill over in India commodity market. Foties and Nikolaos (2013) observed the introduction of futures contracts has decreased spot price volatility in French electricity market but not for German market Sang et al (2013) observed strong bi-directional causal relationship between spot and futures markets.

Therefore, it is important to know which market plays a dominant role and information is disseminated through that i.e. the direction of information and based on these investors can decide to invest in which market.

Mattos and Garcia (2004) found cointegration between spot and futures prices for some commodities. Karnade (2007) observed cointegration between Mumbai and Ahmedabad futures have long-run relationship and there is causality from futures to spot market. Iyer and Pillai (2010) confirmed futures prices play main role in price discovery. P Sakthivel and B Kamaiah (2010) observed long-run relationship between spot and futures market and also direction of information is from spot market to futures market.

DATA

Data was collected from the website of Multi Commodity Exchange (MCX) in India. The sample period is from 2005 to 2008. Weekly spot and futures prices are taken from the website.

METHODOLOGY

First of all, we start examining stationary and variables by applying Augmented Dickey – Fuller (ADF) test. This Test is used to check the existence of unit root for each variable.

$$\Delta Yt = \alpha + \beta t + (\rho - 1)Y\,t - 1 + \sum_{i=1}^{k-1} \theta i\,\Delta Y\,t - i + \alpha t$$

Where ΔY_t is differenced level of $Y_,$ Yt is a macroeconomic variable such as commodity spot and futures prices, and a_t is a white noise term. In the ADF test the null hypothesis is formulated based on the existence of unit root.

If unit root exist, then we have to take first difference and again re-check the stationary of variables. After that, the optimal lag selection will be done.

When the variables become stationary, the Johansen cointegration test will be employed to check long-run equilibrium.

$$\Delta yt = \mu + \Pi\,y\,t - 1 + \sum_{i=1}^{p=1} \Gamma i\,\Delta y\,t - 1 + \varepsilon t$$

Where $\mathbf{y_t}$ is an $n \times 1$ vector of variables that are integrated of order one and ε_t is an $n \times 1$ vector of innovations. If the coefficient matrix Π has reduced rank $r < n$, then there exist $n \times r$ matrices α and β each with rank r such that $\Pi = \alpha\beta$ and βy_t is stationary. r is the number of co-integrating relationships and each column of β is a co-integrating vector. Johansen suggests two different likelihood ratio tests of the reduced rank of the Π matrix: the Trace test and the Maximum Eigenvalue test.

If cointegration vector exist between the variables, Vector Error Correction Model (VECM) will be applied to check the Granger Causality.

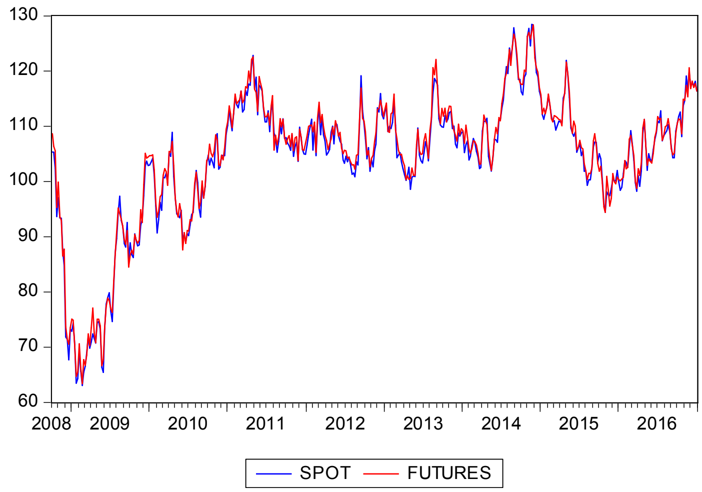
$$\Delta Yt = \alpha 0 + \delta 1\,(Yt - 1 - \gamma Xt - 1) + \sum_{i=1}^{k} \alpha 1i\,\Delta Yt - i + \sum_{i=1}^{k} \alpha 2i\,\Delta Xt - i + \varepsilon 1t$$

$$\Delta Xt = \beta 0 + \delta 2\,(Yt - 1 - \gamma Xt - 1) + \sum_{i=1}^{k} \beta 1i\,\Delta Yt - i + \sum_{i=1}^{k} \beta 2i\,\Delta Xt - i + \varepsilon 2t$$

In this model $\delta 1$ and $\delta 2$ denote speeds of adjustment. According to Engle and Granger (1987), the existence of the cointegration implies causality among the set of variables as shown by $|\delta 1| + |\delta 2| > 0$. Failing to reject the $H0$: $\alpha 21 = \alpha 22 = \ldots \alpha 2k = 0$ *and* $\delta 1 = 0$ implies that second variable does not Granger cause of first variable while failing to reject $H0$: $\beta 11 = \beta 12 = \ldots = \beta 1k = 0$ *and* $\delta 2 = 0$ indicates first variable does not Granger cause of second variable.

EMPIRICAL RESULTS AND DISCUSSION

Figure 1. Spot & Futures prices



The above graph shows the co-movement of spot and futures prices during the sample period. As can be seen, they almost move together.

Table 1. Descriptive Statistics

	Spot Prices	Futures Prices
Mean	103.9747	104.5593
Median	106.1000	106.7500
Maximum	128.4500	128.3500
Minimum	63.05000	63.40000
Std. Dev.	12.29991	12.21186
Skewness	-1.292345	-1.305855
Kurtosis	4.957948	4.890594
Observations	431	431

The descriptive statistics show that the futures prices have greater mean than spot prices with less volatility in sample period.

Table 2. Augmented Dickey-Fuller Test

Variables	**Critical Value**	**Original Level**		**First Difference**	
		t-statistics	**P-value**	**t-statistics**	**P-value**
Spot prices	-2.8680	-2.4466	0.1296	**-20.5725***	**0.0000**
Futures Prices	-2.8680	-2.3897	0.1452	**-20.5542***	**0.0000**
Note: * indicates significance at 1% level.					

It is clear that from Table 2 the data are not stationary at the level and by taking first difference they become stationary.

Table 3. VAR – Lag order selection method, SC criterion

Variables	Optimal Lag (weeks) 2008-2016
Spot prices & Futures prices	**1**

From Table 3, the optimal lag for Aluminum spot and futures prices during 2008-2016 based on SIC is 1 week. Now, by using optimal lag, the johansen cointegration test could be applied.

Table 4. Results of Johansen Cointegration

Hypothesized No. of CE(s)	(Trace Test)			(Maximum Eigenvalue Test)		
	Trace Statistic	0.05 Critical Value	P-Value	Max-Eigen Statistic	0.05 Critical Value	P-Value
None	152.0838	**15.4947***	**0.0001**	146.2957	**14.2646***	**0.0001**
Note: * indicates significance at 1% level.						

The results disclose that the variables are cointegrated and have long-run relationship with each other. Therefore, the VECM can employed to find out the direction of Granger causality.

Table 5. Results of Granger Causality test

Model	Dependent Variable	Independent Variable	Chi-square Coefficient	Chi-square Probability
VECM	Spot	Futures	**-0.671143***	**0.0000**
	Futures	Spot	0.153352	0.3507
Note: * indicates significance at 1% level.				

The results of Table 5 reveal that the futures market is Granger cause of spot market and direction of information is from futures market to spot market.

CONCLUSION

A change in price is an important point for investors and producers in every market. To reduce the associated risk the futures market was introduced and could stable the prices in futures time.

In this study, an attempt has been made to causality of spot and futures prices. First ADF test was employed to check the stationary of spot and futures prices and by selection of optimal lag, Johansen cointegration test was used to check the long-run relationship of the variables. Then by applying VECM, the Granger causality was tested and result confirms futures prices are Granger cause of spot prices. As can be shown direction of information is from futures market to spot market. The error correction term shows that there is short-run causality between the variables from futures to spot market and can be concluded that the futures market dominate the spot market for Aluminium during Sep 2008 to Dec 2016.

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