



## AN EMPIRICAL STUDY ON COMMODITY DERIVATIVES MARKET IN INDIA



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### ABSTRACT

*This study analyzes the relationship between spot and future prices of commodities namely Crude oil, Silver, Zinc, Gold and Copper in Indian Commodities Market. Econometric methods such as ADF unit root test, Johansen Co-integration Test and Granger causality test are used to ascertain the relationship between Spot Price Returns and Future price returns of Commodities in Multi Commodity Exchange India Ltd. The Study Period was from 01.01.2014 to 28.2.2015. It was found that all the variables exhibited stationary. The results of the study gave evidence that the Prices of the commodities during the study period were Independent.*

**KEYWORDS:** *Commodity Derivative, Co-Integration, Granger Causality, Guar Seed.*

**JEL classification code:** *C58*

### INTRODUCTION

The neoliberal economic policies initiated in India since 1991 have revolutionized the financial sector. Numerous financial instruments were introduced and one such new financial market initiative is the commodity market. India, a commodity based economy where two thirds of the one billion population depends on agricultural commodities, surprisingly has an underdeveloped commodity market. Thus, the Government of India's decision to charter national multilevel commodity exchanges that meet certain stringent criteria was the first step towards an organized commodity futures market development. Commodity derivative markets in India are emerging as a global hub. Commodities play a significant role in the economic growth

of the country. The Indian economy is witnessing a mini revolution in the commodity derivatives. Trading in futures contract is increasingly gaining importance in India. Liberalization of Indian economy in 1991, a series of steps were taken to liberalize the commodity futures markets and one of the steps was recognition granted for the set up of three national level multi commodity exchanges as per the recommendation of Forward Markets Commission, the govt of India, department of consumer affairs. Multi commodity Exchanges of India limited (MCX), Mumbai commenced in November 2003 and National commodity derivative Exchange Ltd (NCDEX) commenced in december2003 and national multi commodity exchange of India Ltd (NMCE) commenced in November 2002.



Commodity futures trading have come a long way ever since national online platforms began their operations, reducing entry barriers and enabling nation-wide participation. Indian commodity futures volume has increased exponentially from INR 1.29 lakh crore in 2003-04 to INR 101.44 lakh crore in FY 2013-14. MCX has emerged as the biggest commodity exchange with an annual turnover of about INR 86.5 lakh crore in FY 2013-14 garnering more than 85 per cent of the total market of the country. The Indian economy is witnessing a mini revolution in the commodity derivatives. Trading in futures contract is increasingly gaining importance in India. Liberalization of Indian economy in 1991, a series of steps were taken to liberalize the commodity futures markets and one of the steps was recognition granted for the set up of three national level multi commodity exchanges as per the recommendation of Forward Markets Commission, the govt of India, department of consumer affairs. Multi commodity Exchanges of India limited (MCX), Mumbai commenced in November 2003 and National commodity derivative Exchange Ltd (NCDEX) commenced in december2003 and national multi commodity exchange of India ltd (NMCE) commenced in November 2002.

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## **LITERATURE REVIEW**

**M.Babu, S.Srinivasan (2014)**, their study focused on analyzing relationship between spot and future prices in Indian Commodities Market using Johansen Co-Integration Test. The Study Period was from 01.01.2012 to 31.12.2012. A sample of 10 Commodities based on the total turnover during the study period was selected. The results of the study gave evidence that the Prices of the commodities during the study period were Independent.

**Tarun Soni (2013)** analyzed the market efficiency of Guar Seed futures contract traded at National Commodities and Derivative Exchange Ltd (NCDEX) using Co- Integration analysis and Error Correction model. The data for the study comprises of daily closing spot and futures prices from April 2004 till March 2012 The results of the study indicated that the future market for Guar Seed was inefficient in both short and long term.

**Ramachandran and raju deepa(2011)**,their study analyzed the impact of futures trading on spot price in Indian commodity markets for a period of five years from 2004-2005 to 2008-2009.correlation and regression analysis has been used and it was founded that FP of wheat has influenced the SP to a certain extent.

## **STATEMENT OF THE PROBLEM**

The peculiar characteristic of any market is Unlimited Loss and Unlimited Profit, and therefore the Investors should know the market conditions in order to earn more returns. The common laymen Investors prefer to invest their money only in Bank Deposits, Post Office savings Deposit etc. Despite of several advantages of these investments, Commodities Investment has attractive features such as diversification, weather derivatives, and Hedging against Price fluctuations which can help in managing the Investments. Commodities can be an important way for investors to diversify beyond traditional stocks and bonds, or to profit from a conviction about price movements. Indian commodities market is one of the developing markets which provide a platform for the investors and business planners to make investment in commodity futures as it can help them to protect their securities from systematic risks when they trade in spot market and the futures will direct the next price move in the spot market(Sibler and Gabrade). So proper planning of investments in these markets can help the investors in gaining better returns than in spot market. This induces the researcher to study about the stability, cause and effect relationship between returns in spot market and futures price returns of commodities.

## **OBJECTIVES OF THE STUDY**

1. To examine the stationary of Spot and Futures price returns of Indian commodity Market.
2. To determine the relationship between Spot and Futures price returns of commodity market.
3. To examine the cause and effect relationship between Spot and Futures prices returns of commodity market

## **HYPOTHESES OF THE STUDY**

The hypotheses framed for the study are:

**H<sub>01</sub>**: Spot price return of commodities has no co integration with its future price returns

**H<sub>02</sub>**: Spot price return of commodities and future price returns of commodities have no bidirectional impact among themselves.

**METHODOLOGY**

The study is empirical in nature. The data is secondary and sourced from MCX website (www.mcxindia). For the purpose of this study, spot and futures price of top five commodities namely Crude Oil, Copper, Gold, Silver and Zinc which are more actively traded in Multi Commodity Exchange (MCX) has been selected. The study analyzed daily spot price and future prices of commodities from January 2014 to February 2015.

In the present study, to test the stability of spot price return and future price return of Indian commodities, the ADF unit root test were applied. Johansen Cointegration was performed to detect whether there is a Cointegration in these series and granger causality test is used to examine the cause and effect relationship between the variables.

**Unit root test:** testing for the presence of a unit root in a time series has become a standard practice in empirical research using time series data. Unit root tests

can be used to determine if trending data should be first differenced or regressed on deterministic functions of time to render the data stationary. In this study the ADF tests were used for the analysis.

**Johansen Cointegration:** It has been recognized in recent literature that if a linear combination of integrated variables is stationary then such variables are said to be co-integrated. Although Engle and Granger (1987) was the first to introduce the co-integration test, the tests propounded by Stock & Watson (1988), Johansen (1991) and Johansen & Juselius (1990) are more useful in testing the long run equilibrium relationships in multivariate setting.

There are two types of Johansen test, either with trace or with Eigen value, and the inferences might be a little bit different. The null hypothesis for the trace test is the number of co-integration vectors  $r = d$ ?, the null hypothesis for the Eigen value test is  $r = ?$ . For a general VAR ( $p$ ) model:

$$X_t = \mu + \Phi D_t + \Pi_p X_{t-p} + \dots + \Pi_1 X_{t-1} + e_t, \quad t = 1, \dots, T_1$$

<sup>1</sup>Søren Johansen

**Granger causality test:** Granger (1969) causality test is employed to test for the causal relationship between two variables. This test states that, if past values of a variable  $y$  significantly contribute to forecast the future value of another variable  $x$  then  $y$  is said to granger cause  $x$  and if past values of  $x$  statistically improve the prediction of  $y$ , then it can be concluded that  $x$  granger cause  $y$ .

The absence of Granger causality is tested by estimating the following VAR model:

$$Y_t = a_0 + a_1 Y_{t-1} + \dots + a_p Y_{t-p} + b_1 X_{t-1} + \dots + b_p X_{t-p} + U_t \dots \dots (1)^2$$

$$X_t = c_0 + c_1 X_{t-1} + \dots + c_p X_{t-p} + d_1 Y_{t-1} + \dots + d_p Y_{t-p} + V_t \dots \dots (2)^3$$

<sup>2</sup>Olushina Olawale Awe

<sup>3</sup>Olushina Olawale Awe, "On Pairwise Granger causality Modeling and Econometric Analysis of Selected Economic Indicators"

Where  $Y_t$  and  $X_t$  are the two variables,  $U_t$  and  $V_t$  are mutually uncorrelated error terms,  $t$  denotes the time period and  $p$  and  $1$  are the number of lags.

$H_0: b_1 = b_2 = \dots = b_p = 0$  against  $H_1: \text{Not } H_0$  is a test that denotes  $X_t$  does not Granger-cause  $Y_t$ .

Similarly, testing  $H_0: d_1 = d_2 = \dots = d_p = 0$  against  $H_1: \text{Not } H_0$  is a test that signifies  $Y_t$  does not Granger cause  $X_t$ . In each case, a rejection of the null hypothesis implies that there is Granger causality between the variables.

**MODEL RESULTS AND DISCUSSION**

To determine the order of integration of the variables considered, Augmented Dickey Fuller (ADF) tests were used and the results are depicted in the table 1

**Table 1: UNIT ROOT TEST STATISTIC FOR SELECT VARIABLES**

Commodities	Variables	ADF Test	
		Level	First Difference
Crude oil	Spot price	-20.86767*	
	Future price	-16.52844*	
Zinc	Spot price	-18.54596*	
	Future price	-0.664618	-3.997095*
Copper	Spot price	-17.49125*	
	Future price	--18.44207*	
Gold	Spot price	-17.01768*	
	Future price	-18.91116*	
Silver	Spot price	-17.41347*	
	Future price	-18.74038*	

Note: \* is significant at 1%

From table 1, the results indicate that spot price return for all the select commodities are stationary at levels i.e. I (0). Future price returns of crude oil, copper, gold and silver is stationary at level whereas for Zinc it

is stationary at first difference i.e. I (1) with trend and intercept.

Ho1: Spot price return of commodities has no co integration with its future price returns

**Table 2: Johansen Co integration analysis of Spot Price Return and Future Price Return**

	Hypothesized No. of CEs	Trace Statistic	0.05 critical value	Max.Eigen Value	0.05 critical value
Crude oil	None *	147.8524	25.87211	111.2474	19.38704
	At most 1 *	36.60500	12.51798	36.60500	12.51798
Zinc	None *	65.62044	25.87211	62.46113	19.38704
	At most 1 *	3.159315	12.51798	3.159315	12.51798
Copper	None *	188.0575	25.87211	140.5129	19.38704
	At most 1 *	47.54464	12.51798	47.54464	12.51798
Gold	None *	222.6674	25.87211	156.4666	19.38704
	At most 1 *	66.20081	12.51798	66.20081	12.51798
Silver	None *	199.4975	25.87211	156.9574	19.38704
	At most 1 *	42.54010	12.51798	42.54010	12.51798

\*denotes rejection of the hypothesis at the 0.05 level

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

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level

Source: Compiled and calculated from mexindia.com

Table 2 depicts the results of Johansen Co Integration Test which is used to check the long run equilibrium relationship between Spot and Future Price Returns of the select sample commodities. The Co Integration between Spot and Future Price Returns was tested with unrestricted Co-Integration Trace Statistic and Max -Eigen Value. It can be revealed from the table that

the Trace Value and Max-Eigen Values are greater than the Critical Values at five percent level of significance for all the select sample commodities. Hence, the null hypothesis is rejected and concluded that there is co-integration between spot and future price returns of select commodities.

**Granger Causality Results:-**

The results of granger causality test between spot price return and future price return are given in table 3.

**Table: 3 Pair wise Granger Causality Test Results for the Select Variables**

	Pair wise Hypothesis:	Obs	F-Statistic	Prob.	Decision	Type for Causality
Crude oil	FP does not Granger Cause SP	283	215.348	3.E-57	DNR H0	No causality
	SP does not Granger Cause FP		1.28699	0.2777	DNR H0	
Zinc	SP does not Granger Cause DFP	297	0.54456	0.5807	DNR H0	No causality
	DFP does not Granger Cause SP		0.83447	0.4351	DNR H0	
Copper	SP does not Granger Cause FP	280	2.03005	0.0747	DNR H0	No causality
	FP does not Granger Cause SPOT		119.915	2.E-66	DNR H0	
Gold	FP does not Granger Cause SP	303	23.1660	4.E-10	DNR H0	Uni-directional causality
	SP does not Granger Cause FP		8.56778	0.0002	Reject H0	
Silver	FP does not Granger Cause SP	298	86.1381	4.E-30	DNR H0	Uni-directional causality
	SP does not Granger Cause FP		4.37056	0.0135	Reject H0	

Note: DNR Ho- Do not reject Ho

The results of granger causality test indicate that there exists a relationship between spot price return and future price returns of commodities. However, it can be observed from the table that, No causality exists between spot price return (SP) and future price return (FP) for the commodities crude oil, Zinc and Copper. For gold and silver the result shows that there is uni-directional causality between spot price return and future price return.

**MAJOR FINDINGS OF THE STUDY**

1. The results of Augmented Dickey Fuller Test imply that all the select sample commodities attained Stationary at the level itself except future price return of Zinc.
2. Johansen Co-Integration Test results reveal that the Spot and Future Price returns of the select sample commodities are co-integrated.
3. There is uni-directional impact among spot price return and future price return of Gold and Silver which is proved by Granger causality test.

**CONCLUSION**

Commodity derivative markets in India are emerging as a global hub. Commodities play a significant role in the economic growth of the country. The paper attempts to study the stability of spot price and future price of commodities in India. The co-intergration methodology was used to investigate the long run efficiency of the selected market. The results of co-intergration test indicated that the spot and futures prices are co-integrated. The presence of co-intergration results

indicates that the futures prices provide some useful information to the spot market for commodities. Further the empirical findings reveal that there is uni-directional causality between spot price return and future price return for the commodity gold and Silver.

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