

An Analytical Study on Bi-Directional Relationship Between crude Oil future and Spot Prices of Multi Commodity Exchange

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ABSTRACT

In today's scenario commodity market becomes very burning issue for the research because in global competitive environment there are various determinants which have great impact on the movement of the commodity market. Commodity market deals in spot market as well as in future market. So, there is a need to know the trend in the future and spot commodity market before knowing other factors relationship with the commodity market. Purpose of the study is to know the causal relation between the future and spot prices movement in the energy sector commodity market. For the purpose of this study crude oil prices are taken into consideration as the sample size of the study. Daily basis data related for the duration of the five years based on financial year 2015 to 2020 has been taken for the analysis purpose. To find out the association between the prices of the commodities ARDL Model with bound testing has been applied for the analysis purpose. Findings of the study conclude that there is existence of the relationship between the future and spot prices of the crude oil.

Keywords: Crude Oil, Future Price, Spot Price, Commodity Market, Auto Regressive Distributed Lag Model (ARDL).

I. INTRODUCTION

Crude oil plays an important role in the global economy because it is one of the most important sources of energy, which is vital to the new global economy. There are several different kinds of markets that deal with various commodities. In the Indian context, three stock exchanges are considered to be important. Bombay Stock Exchange, National Stock Exchange, and Multi- Commodity Exchange (MCX) are some of these exchanges. The stock exchanges BSE and

NSE trade in shares, while the Multi Commodity Exchange, or MCX, deals in a wide range of soft and hard commodities. The commodity market is a place where investors can buy and sell products at different prices. MCX was established in 2003, and headquarter is located in Mumbai. It's the largest commodity derivatives exchange in India. The Securities and Exchange Board of India (SEBI) has been in charge of MCX since September 28, 2015. MCX was previously governed by the Forward Markets Commission (FMC), which merged with SEBI on September 28, 2015. MCX is a stock exchange that trades in a variety of sectors, including agriculture, metals, and energy. Each sector deals in its own commodities, such as cardamom, black pepper, castor seed, and so on, while the metal sector deals in gold, silver, lead, nickel, and so on. Aside from these, there is one more important sector, the energy sector, which deals in crude oil and natural gas. For market dealing, every product has two prices. The commodity's future and spot prices are also available.

The rates at which the futures contract trades in the future market are known as future prices of the commodity. Future contracts are standardised contracts that are traded on an exchange, while spot prices are the prices at which the underlying asset trades in the future and spot markets. Currently, crude oil prices have a major effect on every economy. Brent crude oil, West Texas Intermediate (WTI) crude oil, and Middle East countries crude oil prices are all included in the global crude oil prices. These global crude oil prices have also impacted the MCX crude oil future contract.

*The **Symbol** - MCX CRUDEOIL Crude Oil Futures (100 BBL), **contract** - European Call & Put Options, **Expiration Day**- (Last Trading Day) Two business days before the underlying futures

contract expires. **Trading hours** are 9.00 a.m. to 11.30 / 11.55 p.m. Monday through Friday, **Underlying Quotation/ Base Value-** Rs. per barrel.

*Source: MCX website.

II. REVIEW OF LITERATURES

2.1. Kim HyeonSeon & Shin Hoon Dong (2020) they studied the causal relationship between spot price and futures price of crude oil with the agricultural Products. Seven linear relationships have been discovered with the causes and established 27 associations between crude oil and six agricultural products, indicating a clear causal relationship. The spot price of oil having a higher causality on agricultural product prices than the futures price of oil. Finally, analysis of each cycle reveals that a financial crisis may reinforce the connection between agriculture and energy markets.

2.2. Bakare, Ibrahim A. O., Quadry, Mahmud O., Chowdhury & Mohammad Abdul-Matin (2018) - There is relativity in the pace of change among such countries' stock market indexes as Mauritius, whose economic backbone is tourism, which reacted faster than other 'equity markets, according to research. Kenya's stock market index outperformed Morocco and Nigeria, while South Africa's equity market, in contrast to other equity markets, reacted slowly. The slow adjustment of Morocco's and Nigeria's stock markets to the shock of the crude oil price crisis was attributed to the governments of both countries' heavy reliance on crude oil revenues to fund their economic activities. The research demonstrates that crude oil, crude palm oil, and futures prices on stock markets have a long-term relationship. To investigate the relationship and effect of these factors, the VECM Granger causality test was used. The findings show that crude oil spot and futures prices have an effect on the equity markets of Mauritius, Kenya, and Morocco, while crude oil futures prices have an impact on the equity markets of Nigeria and South Africa.

2.3 Roman Monika, Gorecka Aleksandra & Domagala Joanna (2020) The Augmented Dickey-Fuller test, Granger causality test, co-integration test, vector auto-regression model, and vector error correction model were used to analyze the price transmission between crude oil and five different food groups in their research article. The time frame covered by the data series is from January 1990 to September 2020. According to the paper's analytical findings, there are long-term relationships between crude oil and meat prices. In

the short term, crude oil prices were linked to food, cereal, and oil prices.

2.4 Zavadskaja Miroslava, Morales Lucia & Coughlan Joseph (2018) The study, titled "The Lead-Lag Relationship between Oil Futures and Spot Prices—A Literature Review," looked at the behavior of oil spot and future prices, as well as their determinants, during times of market turmoil, particularly during economic and financial crises. The study sheds light on a major debate in the literature about whether spot or futures prices are the most important crude oil price predictor. According to the literature review, the lead-lag relationship is dynamic, especially during periods of prolonged uncertainty, which leads to significant disagreements and inconsistencies among researchers about the price that is the most important factor.

2.5 Minimol M. C. (2018) - The subject of 'Relationship between Spot and Future Prices of Crude Oil: A Cointegration Study' was investigated, and the relationship between the spot and future price of crude oil was discovered, which will aid in calculating crude oil prices. When constructing a portfolio, high asset correlation cannot be used as a reliable indicator of long-term diversification payoffs. There is a critical need to improve conventional risk-return modelling methodologies by taking into account typical long-term asset price patterns. In light of this urgent need, the current paper aims to investigate the long- and short-term relationships between spot and future crude oil prices.

III. OBJECTIVE OF THE STUDY

3.1 The sole objective of this study is to find out the relation between crude oil spot prices and crude oil future prices and whether both the series are short run effective or long run effective.

IV. RESEARCH METHODOLOGY

4.1 Data Type: The study is based on secondary data.

4.2 Duration: The duration of the study is 5 years (i.e. 2015 to 2020 financial years). The study is based on daily data.

4.3 Variables of the study: The study is based on two variables, namely crude oil spot prices and crude oil future prices. Both the series are retrieved from MCX website.

4.4 Data Sources: The data is collected from official websites of commodity market.

4.5 Tools for data Analysis: Various statistics and econometrics tools like ADF for examine the

stationarity of data and ARDL test for scrutinise the causal relation between variables has been applied to achieve the objective of the study.

H0: The crude oil future and spot prices has no association between their prices.

H1: The crude oil future and spot prices has association between their prices.

V. ANALYSIS AND INTERPRETATION

TABLE 1 DESCRIPTIVE ANALYSIS

Particulars	Crude Oil Spot Prices	Crude Oil future prices
Mean	3518.783	577742.3
Median	3374.000	566092.9
Maximum	5580.000	1303059.
Minimum	1783.000	22878.16
Standard Deviation	725.1878	167030.1
Skewness	0.443817	0.305775
Kurtosis	2.883725	3.974058
Jarque-Bera	34.99510	57.76141
P-Value	0.000000	0.000000
Observations	1048	1048

5.1 INTERPRETATION- The basic statistics shows about the basic features of the data. Mean value describe the average with in the series of the data. Standard deviation describes the variation in the series. The Jarque-Bera test and its related P-values depicts that the both the variables are normally distributed.

TABLE -2 UNIT ROOT TEST

Variables	At Level		At 1 Difference		Decision
	t-Statistic	P-Value	T-Statistic	P-Value	
LNCRUDEFUTURE					
Constant	-3.478411	0.0088**	-11.66125	0.0000	I (0)
Trend And Constant	-3.720238	0.0214**	-11.67371	0.0000	
LNCRUDESPOT					
Constant	-1.511618	0.5275	-10.4361	0.0000**	I (1)
Trend and Constant	-2.604503	0.2784	-10.4489	0.0000**	

** Indicates significance at 5% level.

5.2 INTERPRETATION - Unit Root test talks about the stationary of the data. The mean, variance and co-variance is constant then a time series is called as stationary. ADF has been applied to check the stationarity of data. The findings of the ADF (Augmented Dickey Fuller) test shows that the crude oil future prices are stationary at level having

P-value 0.0088 and 0.0214 while the crude oil future prices are stationary at first difference having P-value lower than 0.05. The results of ADF indicate to apply ARDL model to find out short and long term relation between the selected variables of the study.

TABLE -3 ARDL Model

Variable	Co-efficient	Std. Err.	t-Stat.	Prob.*
LNCRDFUT(-1)	0.305344	0.030480	10.01801	0.0000
LNCRDFUT(-2)	0.110994	0.031892	3.480306	0.0005
LNCRDFUT(-3)	0.031787	0.032074	0.991063	0.3219
LNCRDFUT(-4)	0.077001	0.031899	2.413887	0.0160
LNCRDFUT(-5)	0.195051	0.030583	6.377840	0.0000
LNCRDFUT	0.035122	0.045837	0.766226	0.4437
C	3.412881	0.581795	5.866118	0.0000

PARAMETERS	VALUES
R-squared	0.279593
Adjusted R-squared	0.275420
Durbin-Watson stat	2.005486
Akaike info criterion	0.458148
Prob(F-statistic)	0.000000

Estimation Equation: LNCRDFUT = C(1)*LNCRDFUT(-1) + C(2)*LNCRDFUT(-2) + C(3)*LNCRDFUT(-3) + C(4)*LNCRDFUT(-4) + C(5)*DLNCRDSPOT + C(6)

Substituted Coefficients:

LNCRDFUT = 0.333895956944*LNCRDFUT(-1) + 0.123011365172*LNCRDFUT(-2) + 0.0562618235473*LNCRDFUT(-3) + 0.142770291872*LNCRDFUT(-4) - 0.138061419136*DLNCRDSPOT + 4.54772292406

Cointegrating Equation:

D(LNCRDFUT) = 4.547722924060 - 0.344060562465*LNCRDFUT(-1) - 0.138061419136*DLNCRDSPOT** - 0.322043480591*D(LNCRDFUT(-1)) - 0.199032115419*(LNCRDFUT(-2) - 0.40127069*DLNCRDSPOT(-1) + 13.21779774) - 0.142770291872*D(LNCRDFUT(-3))

5.3 INTERPRETATION –For the application of ARDL model first assumption is series has relation in terms of stationarity means integration at level and integrating at first order. Log Crude Oil Future

data series are stationary at level whereas Log Crude oil Spot data series are stationary at 1st difference. It fulfils the ARDL basic assumption. While ARDL model shows the short run relationship among the variables. The Data which has p value less than 0.05 are significant values in terms of lag and these are at lag-1, at lag-2, at lag-4 and at lag-5 values. Coefficient values denote the correlation between the dependent and independent data series. R² value is 27% which shows low positive relations among the lagged series. Based on low AIC criteria this model is best fit model. Durbin Watson test indicates the autocorrelation among the series. In the above parameter table DW test is 2 which mean there is no autocorrelation among the series. P value is less than 0.05 which indicates that null hypothesis is rejected or depict that there is short term relationship among the series. For model verification some diagnostic test are also applied. Log crude future prices are dependent variable. The selection of lag criteria is important for applying the ARDL model. Akaike information criterion (AIC) used through VAR, lag order selection criteria suggest lag 5 as most appropriate lag length for the model.

DIAGNOSTIC TESTS

TABLE 4 RESIDUAL DIAGNOSTIC

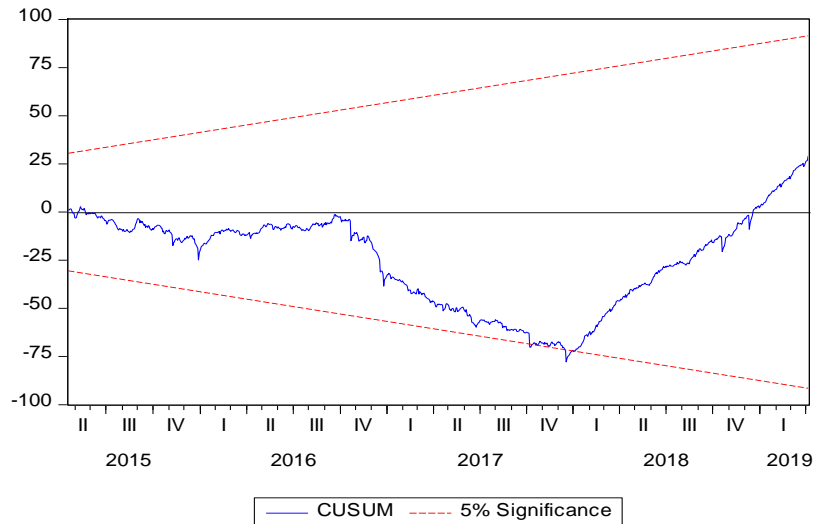
BGSC LM Test:			
F-stat.	0.447331	Probability F(2,1034)	0.6395
R-squared	0.901670	Prob. Chi-Square(2)	0.6371

5.4 INTERPRETATION- BGS test has p value 0.63 which is more than 0.05%. Here we accept H0. This means having is no serial connection in the test. It is a residual diagnostic test. Breusch-

Godfrey Serial Correlation (BGSC) LM Test is also tells that there is no serial correlation in the model because the Chi-Square (2) P-value is 0.6371 (Table 4).

GRAPH-1

STABILITY DIAGNOSTIC
 CUSUM TEST



5.5 INTERPRETATION - CUSUM TEST (cumulative sum control chart) is stability diagnostic test. It is control chart of auto regression series. Red line shows the lower and upper bound of the data series and blue line shows the significant area of the series lies. This is helpful in determining long run relationship as well as with

the model stability. The Goodness of fit of the model was checked through CUSUM test for its residuals. Above graph shows the error term at 5% level of significance and inference the small shifts in the series.

TABLE-5 COEFFICIENT DIAGNOSTIC
 ARDL LONG RUN RELATION AND BOUNDS TEST

Null Hypothesis: No levels relationship

Dependent variables	F-statistic	P-value Outcome	Outcome
Log crude oil future	17.98261	0.4392	Co-integration
Level of Significance		10 Percent	5 Percent
Lower bound value, I(0)		3.02	3.62
Upper bound value, I(1)		3.51	4.16

$$EC = \text{LNCRDFUT} - (0.1255 * \text{LNCRDSPOT} + 12.1966)$$

5.6 INTERPRETATION- ARDL model shows the short term relationship whereas **bound test** describe the long run relationship. F value of bound test is more than i.e.17.98 of lower bound of I(0) and upper bound of I(1) at 5% level of significance. Here, the relationship between crude oil future prices and crude oil spot prices are significant in nature means that there is exist long run relationship as well as short term relationship among the series. The regression equation in error correction term indicates as $0.1255 * \text{LNCRDSPOT} + 12.1966$.

VI. CONCLUSION

This paper deals with the analysis of the future and spot prices of the crude oil. Crude oil is the most important aspect of any economy. Crude oil prices are the valuable prices in the energy sector. Future prices are based on date whereas spot prices denote the cash market. Above research found that the dynamic association between the crude oil future and crude oil spot prices. Both series are converted into natural log term to convert the series on same basis. The ARDL (autoregressive distributed lag model) has been applied to establish the association between the series. This model was given by Pesaran et

al.(2001). This model depicts that model can be framed upto lag 5 and the values having lower than 0.05 are the significant values in lag term. For calculating time series each series has its own structure. This study defined that there is long term as well as short term relationship between the prices of the crude oil. Both prices are positively correlated with each other. Crude oil prices are also affected through various determinants like-economy rules and regulations, Foreign Exchange rates, natural gas prices, and other commodity sector prices. This paper focused on that other factors are fixed and not considered here. Further research can be improved by using those determinants, considering more duration for the data and also considering the policy aspects. Commodity dealing increasing day by day and some special category commodity create impact on the whole economy. Crude oil prices are one of the prices which affect investor to consumer. So, everyone should know about the trend of the prices and how these prices moved.

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