Cointegrating Nexus Among Spot and Future Price of Crude Palm Oil

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———————————————————— **ABSTRACT** ————————————————————

This paper scrutinizes the cointegratingnexusamongspotandfuturerateofCrudePalmOil(CPO). This is because the study linked with spot and futures emporiums endures as a prominent field among researchers, practitioners and regulators. The study operates the daily data of spotandfutureclosingpriceofCPOon the MCX for the period 2013 to 2020 to determine the nexus. The 'Unit root test', the 'Johansen co integration test', the 'Vector error correction model', and the 'Granger causality test' are applied for this study. The outcome of the study specifies that there exists an elongatedtenure nexusamongthe future andspotrate ofCPO. Hence it is clear that these market are dexterous and future emporium was found to be driving the spot emporium.

Keywords : Unit Root; Cointegration; Error Correction; Granger Causality; Spot Price; Future Price.

Introduction

India is the second prevalent consumer of CPO and the globe's prevalent importer of CPO. Consumption inclinations in India are palpable not only by an upsurge in overall utilisation, but also by a vacillation in consumption configurations. At present, imported oils, habitually palm oil and soybean oil, bear the bulk of consumption growth. These non-conventional imported oils now make up more than half of the oil utilised in India, filling the gap shaped by budding demand and maintainable domestic oil production. Adverse weather circumstances for production, domestic oil production, rupee movement, import tariff policies and rivalry for alternative oil are the elements that persuade the rateof CPO. In this context, it is imperative to look into the viability of the CPO futures emporiumin India, especially to find the price. Therefore, this paper inspects the cointegrated connexion among the future and spot rates of CPO from MCX.

Table 1 :Fundamentals of CrudePalm Oil (000 tonnes)

Particular	2015-16	2016-17	2017-18	2018-19	2019-20
Global Scenario					
Beginning Stocks	10060	8281	8992	10989	11040
Production	58901	65267	70610	74080	72771
Imports	42839	45927	46451	50806	47389
Total Supply	111800	119475	126053	135875	131200
Exports	43837	48924	48569	52759	49107
Domestic Consumption	59682	61559	66495	72547	71409
Ending Stocks	8281	8992	10989	10569	10689
Exports	Major Producing Countries				
World	58901	65267	70610	74080	72771
Indonesia	32000	36000	39500	41500	42500
Malaysia	17700	18858	19683	21000	19000
Thailand	1804	2500	2780	2900	2800
Colombia	1268	1099	1633	1625	1529
Nigeria	955	61559	66495	72547	71409
Major Consuming Countries					
World	59682	61559	66495	72547	71409
Indonesia	9270	9160	11000	12625	13680
India	9100	9350	9270	9805	9060
Maropean Union	6600	6800	6900	7000	6770
China	4800	4750	5100	7012	6262
Malaysia	3000	2587	3233	3554	3275
Major Exporting Countries					
World	43837	48924	48569	52759	49107
Indonesia	22906	27633	26967	29200	27500
Malaysia	16667	16313	16472	18000	16700
Guatemala	614	718	800	812	810
Colombia	420	502	697	750	770
Papua New Guinea	580	664	635	640	565
Major Importing Countries					
World	42839	45927	46451	50806	47398
India	8860	9341	8608	9700	8550
European Union	6717	7219	7057	7150	6650
China	4689	4881	5320	6900	6400
Pakistan	2720	3075	3095	3500	3175
Bangladesh	1511	1347	1637	1650	1550

Review of Literature

Obtainable studies connected to these aspects are reviewed and presented over a period of time:-

Jackline & Deo (2011) inspected the connexion among the futures segment and the spot segment for Pork Belly and Lean Hogs products during the sample epoch from 2001 to 2010, and assessed sample futures price detection activity in connection to underlying segments. The 'Granger Causality Test' demonstrated a dual-causal association among sample segments. Therefore, it clinched that lucrative arbitrage does not happen in these sample segments and that they are in impeccable equilibrium.

Unlu & Ersoy (2012) explore the interface among spot and futures agreements dealt Derivatives Exchanges in Turkey. The outcomes specified that there is an elongatedpath steady connection among selected spot and futures segments. Likewise, there is a reciprocal causality among selected segments in the short and the long path.

Ilter&Alguner (2013) scrutinizes the price detection and leadlag connexion among Turkish stock index futures and stock index emporiums from 2006 to 2011. The proof vindicates that the Turkish futures segments are a beneficial price detection instrument.

Tripathi (2014) peruses the leadlag association among Indian spot and futures segments. The outcomes elucidate that the spot segments maintenances the rating mechanism and also leads the futures segments. This enquire clinches that the spot segments shows a comparatively robust prominent function in propagating information obtainable in the segments and is really effective than the futures segments.

Kharbanda& Singh (2017) checks the leadlag connexion among Indian futures and spot foreign exchange segments to comprehend the price detection pattern. The evidence discovered that there is a long path connexion among the selected segments and the futures segments has developed as the prominent segments for the selected currencies in this investigation.

The role of futures markets in offering an effective pricing mechanism is a field of extensive empirical exploration in the financial emporiums. Several studies have dealt with the lead-lag connexion among spot and futures prices in financial derivatives with a view to scrutinising the delinquent of emporium efficacy. Very meagre research has been done on the cointegrating nexus of the commodity derivative emporium in India. Hence the current study inspecting the cointegratinglink among the future and spot rates of crudepalm oil from MCX.

Theoretical Framework

Efficient Market Hypothesis emphasizes that "in an efficient market, prices fully reflect all available information". In an effective emporium with a robust combination of spot and futures prices. Because "in an efficient market, the spot and futures prices are based on the same information, rationally processed by agents on the market. Thus the prices will be cointegrated if the market is efficient" (Bekiros&Diks, 2008). This is because the Cointegration among spot and futures prices occurs when there is an elongatedtenure equilibrium connexion among these variables. As previously revealed, cointegration among spot and futures values in an emporium is a pointer to emporium effectiveness. This exploration will inspect the effectiveness of crudepalm oil futures segments from MCX, along with scrutinise futures and spot rates and attempt to combine the two.

Objective

The core objective of this research paper is to check the cointegrating nexus between the spot and the future rates of crudepalm oil.

Hypothesises

H0: The spot and the future prices of crudepalm oil has a "unit root".

H0: The spot and the future prices of crudepalm oil are not cointegrated.

Methodology

This study runs daily data on the spot and future closing price of crudepalm oil on the MCX for the period 2013 to 2020 to determine the association. The trading unit of crude palm oil at MCX is 10 MT. The 'unit root test'; the 'Johansen co-integration test'; the 'Vector error correction model'; and the 'Granger causality test' are all applicable to this inspection.

In this empirical processes, an inspection predominantly demeanour through the succeeding methods. Initial step is to check the 'stationarity' of elements with 'ADF tests'. 'Johansen's linear cointegration model' was then opted to observe whether the cointegrating connexion subsists or not. Further, the 'Vector error correction model', and the 'Granger causality test' were verified.

Discussion

MCX is the number one exchange in India in terms of trade turnover across the Indian commodity derivatives emporium. Crude palm oil is the highest commodity futures agreement in MCX in terms of trade volume of agricultural products traded on MCX. The time series plot of the future and spot rates of the crudepalm oil is presented in graph-1.

Graph 1: Time Series Plot of Spot and Future Price of Crude Palm Oil
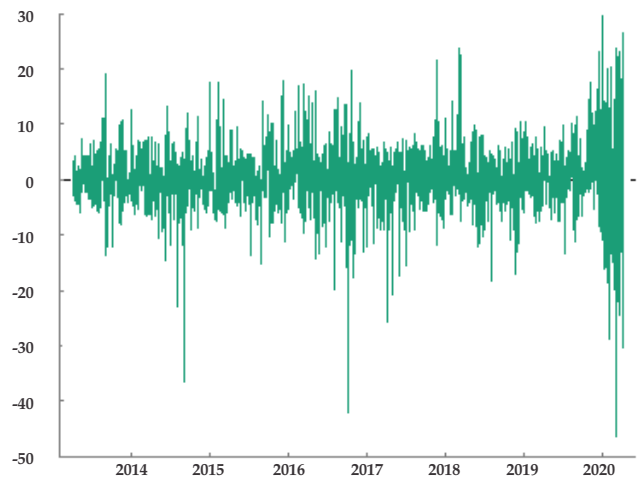
A. Spot Price

B. Differenced Spot Price

C. Future Price

D. Differenced Future Price

Source: Authors' Estimation.

A swifter examination of these variables specifies that these variables are 'nonstationary'. (But to scrutinize these characteristics of the variables, this paper operated the ADF test.)

Table 2 : Unit Root Test Results for Crude Palm Oil

Series	Levels			1st Difference			
	t - Statistic	Critical Value	p - Value	t-Statistic	Critical Value	p-Value	Order of Integration
Crude Palm Oil Spot Price	- 1.680198	- 2.862911	0.4412	-24.32997	- 2.862911	0.0000	I (1)
Crude Palm Oil Futures Price	- 1.551725	- 2.862900	0.5072	-39.80099	- 2.862900	0.0000	I (1)

Source : Authors' Estimation

The ADF t-statistics of both variables (-1.680198 and -1.551725) are bigger than the critical values (-2.862911 and -2.862900). The Pvalues (0.4412 and 0.5072) of both variables are bigger than the level of significant. Here dual components have "unit root". The nullhypothesis of unit root is accepted at its level. But the nullhypothesis of unit root is rejected at its first difference. In this context the ADF t-statistics of dual components (-24.32997 and -39.80099) are lesser than the critical values (-2.862911 and -2.862900). The Pvalues of dual

components of crudepalm oil are combined in the identical order.

'Trace statistics and max-eigen statistics' of selected components of crude palm oil are not accepted in the context of the nullhypothesis of "there is no cointegration (None)". Therefore, in the case of "At most one" the 'trace statistics and max-eigen statistics' of the selected components of crudepalm oil are fewer than the critical value. So it is accepted. The reason is that there is an

Table 3 : Johansen Cointegration Test Results for Crude Palm Oil

Unrestricted Cointegration Rank Test (Trace)			
Hypothesized No. of Cointegration Equations	**Trace Statistic**	**Critical Value**	**p-Value**
None	90.85336	15.49471	0.0000
At most 1	3.130471	3.841465	0.0768
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)			
Hypothesized No. of Cointegration Equations	**Max - Eigen Statistic**	**Critical Value**	**p-Value**
None	87.72289	14.26460	0.0000
At most 1	3.130471	3.841465	0.0768

Source : Authors' Estimation

components are lesser than the level of significant. So dual components of crudepalm oil have 'no unit root'.

Johansen Cointegration Test

The Johansen Cointegration Test was applied to examine the elongated-tenure connexion among selected variables of crudepalm oil. This is because according to the ADF output, the selected

elongated tenure balance connexion among the selected components of crudepalm oil.

Vector Error Correction Model

VECM can be seen as an adjustment processes by which the aberration from the equilibrium connexion of the erstwhile epoch, called et-1, directed to the adjustment in Yt. The term ECT reverberates the magnitude of the aberration from the elongated tenure equilibrium.

Co-integrating equation of crude palm oil :-

$$ECT\,t - 1 = 1.000000SP\,t - 1 - 1.014269FP\,t - 1 - 0.088212$$

The ECT spotlight that the connexion among spot and futures of crude palm oil coincides with its elongated tenure equilibrium level.

ECT in VEC Model of crude palm oil :-

$$\Delta LSP\,t = -0.100374\,ECT\,t - 1 - 0.065323\,\Delta LSP\,t - 1 + 0.037956\,\Delta LSP\,t - 2 \\ + 0.281945\,\Delta LFP\,t - 1 + 0.081639\,\Delta LFP\,t - 2 + 0.000113$$

$$\Delta LFP\,t = -0.047197\,ECT\,t - 1 - 0.157141\,\Delta LSP\,t - 1 + 0.084645\,\Delta LSP\,t - 2 \\ + 0.018717\,\Delta LFP\,t - 1 - 0.02125\,\Delta LFP\,t - 2 + 0.000143$$

The ECT in this formula demonstrates the quickness arrangement to the elongated tenure equilibrium time trajectory of the short tenure change of crude palm oil.In the case of VECM approximation procedure, a bunch of components are found to have single or further assimilating vectors, which modifies to short tenure vicissitudes in components.

The test shows that "there is a bidirectional causality among spot and future of crude palm oil". The p value is less than 5%, and so reject the nullhypothesis of "spot doesn't granger cause futures" and "futures doesn't granger cause spot". But the futures emporium was found to be driving the spot emporium.

All this econometric evidence from the paper universally acknowledges the validity of this efficient market theory in the Indian commodity derivatives emporium, especially in the case of crude palm oil, the underlying asset of MCX.

Conclusion

"Recently the Indian commodity derivatives market has attained good flexibility and dynamism on the one side also faced a lot of interventional issues warranting discourses on the other side" (Ranjith& K., 2019). The empirical findings point out that selected variables in the study are 'nonstationary at level and stationary at first difference'. Hence these components are integrated to order one. There is an elongated

Table 4: Granger Causality Test Results for Crude Palm Oil

Null hypothesis	F statistic	P-Value	Decision	Nature of Relation
Future Prices of Crude Palm Oil does not Granger Cause Spot Prices of Crude Palm Oil.	158.823	2.E-64	Reject	Bidirectional F ⇔ S
Spot Prices of Crude Palm Oil does not Granger Cause Future Prices of Crude Palm Oil.	15.7566	2.E-07	Reject	

Source: Authors' Estimation.

tenure steadiness connexion among the selected components of crude palm oil. There is a 'bidirectional causality' among spot and future of crude palm oil. But the futures emporium was found to be driving the spot emporium. Therefore the future emporium for crude palm oil is dexterous.

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