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Risk Analysis in Trading with Castor Seeds Futures in India

Ravi Prakash Siddavatam[1, *], Appa Rao[2]

[1]School of Entrepreneurship & Management Studies, SRM University-AP, Vijayawada, India
[2]Avanthi PG College, Osmania University, Hyderabad, India

Email address:

raviprakashsiddavatam@gmail.com (R. P. Siddavatam), dr.s.apparao@gmail.com (A. Rao)
[*]Corresponding author

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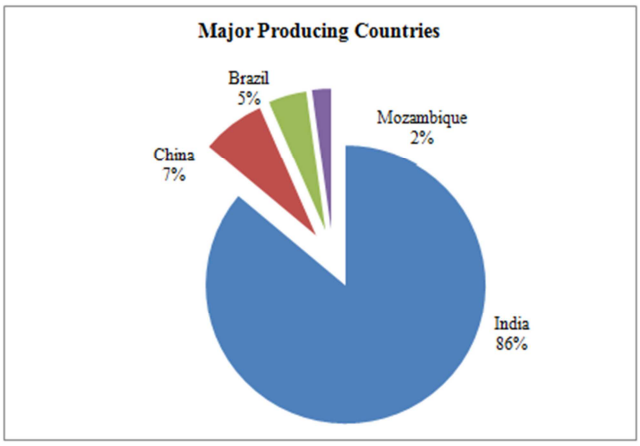
Abstract: India is the largest producer and exporter Castor seeds in the World. Castor seeds is traded in both Spot market and Futures market are well established in India. The present study is time series analysis on daily Futures closing prices of Castor Seeds Commodity of National Commodity and Derivatives Exchange (NCDEX) and the corresponding Spot market prices in Deesa of Banaskantha district in Gujarat State. Since the introduction of commodity derivatives markets in 2003 in India, there was a lot of political/social criticism/resistance that these derivative markets lead to only speculation and paying way for high inflation of commodities prices. Hence, the author initiated to test few commodities price data. The present study is on castor seeds. The main objective of the study whether Price discovery is happening due to introduction of Futures in castor seeds or not, and to analyze price risk. The Futures and Spot prices of Castor seeds commodity are studied for six years by using important econometric tools: Unit Root test, Cointegration test, Granger Test, VECM, Wald test & Variance Decomposition test with the help of Eviews software Version 10. Futures are unbiased predictor of spot and this is the hypothesis that has been tested by using above Econometric tools. The study reveals that the Castor seeds time series data is stationary at first difference and having atleast one cointegrated equation. There is long term and short term causality from Futures towards Spot variable. The speed of adjustment from Futures variable towards equilibrium of the market price is 5.1% for any news/shock that is related to Castor seeds market. Granger casualty test indicates that there is bi-direction relationship between the variables. Variance Decomposition test reveals that Futures role in price discovery of spot ranges between 19% to 74% from 1 to 10 periods. It has been concluded that market prices in Spot and Futures of Castor seeds commodity are integrated and appropriate price discovery is happening in Indian commodity Exchange (NCDEX). Introduction of Castor futures are useful to development and stability of the market.

Keywords: Futures, Spot, Price Discovery, Price Risk, Stationarity, VECM, Integration, Decomposition

1. Introduction

The commodity derivatives markets introduced in India in 2003. National Commodities and Derivatives Exchange (NCDEX) and Multi Commodity Exchange (MCX) started its operation during 2003. Since then there was lot of noise from political parties and social group that these derivatives market leads to price hike and cause for high inflation in the India. Several times the Government came under huge pressure and suspended trading in some selected commodities. Green Gram, Black gram, Wheat etc. Strong Scientific research evidences required to take decision to take such crucial decisions. On other side, the stakeholders in these commodities find great difficult as there is no appropriate hedge mechanism. Hence, there is real need to test price data of commodities from time to time to know that whether purpose of introduction of derivatives is happening or not. i.e. Price discovery. The author has conducted such study on several commodities which have high trade volume on Exchange platform. The present paper is one among them. i.e. Castor Seeds.

India is the largest producer of Castor seeds in the world and accounting for 86%. China, Brazil and Mozambiqe are in the 2nd, 3rd and 4th places in castor seeds production accounting for 7%, 5% and 2% respectively. In India, it is usually cultivated as a kharif crop though cultivated as a rabi crop in Orissa, Madhya Pradesh and Uttar Pradesh. [17]



Source: FAOSTAT

Figure 1. *Major producing countries of Castor seeds [17].*

Castor is an important non-edible oil grown in arid and non-arid region. Castor is scientifically known as Ricinus communus. Castor crop duration varies between 145 and 280 days depending upon the variety. It has lot of commercial applications. Castor oil used as lubricants in high speed engines. Hydrogenated castor oil is used in polishes, ointments, waxes, soaps etc. [17]

National Commodities and Derivatives Exchanges (NCDEX) is the popular Commodity Exchange in India. 'Nkrish' is the Agriculture commodity index scientifically designed by NCDEX. It is more than one-decade old index. Earlier, it was known as 'Dhaanya'.

Castor seeds is one of the highly traded agricultural commodities in NCDEX. It finds regular berth in NKrish Index of NCDEX. Its weightage in NKrishi index is 10.84% as on Q2, 2019. The Castor Seeds Futures contract issued by NCDEX is for the period of 5 months. It starts on 21st of the launching month and ends on 20th settlement month. Usually, Futures contracts are highly liquid during its last one month of the expiration period. Hence, we took Futures prices of nearest expiring month for the present analysis.

Table 1. *Important terms of Castor Seeds Futures Contract in NCDEX.*

Contract Specification	Castor seeds
Ticker symbol	CASTOR
Basis of price of the contract	Ex-warehouse Deesa, Gujarat.
Unit of trading	5 Metric Tons
Delivery unit	5 Metric Tons
Maximum Order Size	500 Metric Tons
Quotation/base value	Rupees. Per one Quintal
Tick size of trading system	Rupees. 2/-
Delivery Centre of commodity	Deesa
Delivery Logic follows for contract	Compulsory delivery
Initial Margin	4%

Authorized Delivery center for Castor seeds is Deesa of Banaskantha district in Gujarat, India. The corresponding Spot market closing prices are obtained from the Delivery center. 1352 days' price data pertaining to 64 months and its corresponding daily spot data used for the study.

Table 2. *Details of Futures and sport Price of Castor Seeds.*

Type of Trade	Ticker Symbol	Period for testing	Number of settlement months	Number of observations
Futures	CASTOR	22.12.2012 to 20.12.2018	64	1352
Spot	---		---	1352

2. Review of Literature

Iyer and Pillai (2010) have examined whether Futures market plan a dominant role in the process discovery process. They used Threshold vector auto regression for six commodities. They found that commodity futures prices play sheet anchor role in the price discovery process. They observed that for copper, gold and silver, the rate of convergence is almost instantaneous during the settlement week of contract. Futures acts as an effective hedging tool. The convergence worsens during the expiration week for Chickpeas, nickel and rubber indicating the non-usability of futures contract for hedging. [1]

Kushankur Dey, Debasis Maitra, & Shiladiya Roy (2011) in their study "Market Efficiency and Volatility on Indian Pepper Futures Markets". They tried to model volatility spill over in Indian Pepper futures and spot markets employing Johansen's co-integration test, VECM, Granger Causality and Variance Decomposition test. They had drawn inference from the study that unidirectional causality has been observed in case of pepper futures market. The adjustment of innovation or shocks in future market is relatively faster than that of spot markets. For volatility modelling, they have employed models with their specifications, namely EGARCH (2,2), EGARCH (3,3), MGARCH (diagonal VESH & BEKK) for spot and futures prices series of Pepper. The study concluded that unidirectional spillover had been observed under EGARCH (2,2) model and results obtained through EGARCH (3,3) model were not impressive. News impact curve shows the steeper movement on the logarithmic conditional variance of futures and spot return series, which was due positive shocks rather than that of negative shocks. Conditional correlation seems to be dynamic in nature and the correlation between pepper spot and futures has been observed the temporal changes. [2].

V. Jayagurunathan, P. S. Velmurugan, P. Palanichamy, (2010) in their Research article ''An empirical analysis of price discovery inn gold Spot-Futures market: Evidence from Multi commodity Exchange of India Ltd" used co-integration, VECM to examine the price discovery in gold. They observed that spot market is informally more efficient than the underlying future market. Spot market leads the future market for price discovery. The leading role of future market weaken around the firm specific announcement. Futures market is not in immature stage, which has been started from 2003. Still many traders and investors are confused about their new market. Derivatives are complex. New traders and

investors are still facing difficulty to entry in the futures market. Hence, spot market leads futures market. [3]

Jabir Ali, Kriti Bardhan Gupta, (2011) studied the long term relationship between futures and spot prices of Agri-Commodities like Soy bean, Castor seeds, chickpea, Pepper, Maize, Balck Lintil, Maize and found that there is co-integration between Futures and Spot prices of these commodities trade. There was short term relationship between them and the futures market had ability to predict the spot prices for chickpea, castor seeds, soybean and sugar. There was Bidirectional relation in the short run among the Maize, Black Lentil and pepper. [4]

Srinivasan (2012) examined the price discovery process and volatility spillover of Indian futures-spot commodity market through Johansen co-integration test, VECM, and bi-Variate EARCH model. He observed that the commodity spot markets of MCX Comdex, MCX AGRI, MCX ENERGY and MCX METAL serve as effective price discovery vehicle. Further, the volatility spillover from spot to futures market are dominant in case all MCX commodities. [5]

Kushankur Dey, Debasis Maitra (2012) conducted studies on Pepper commodity to examine price discovery process by using econometric tools like Granger Causality, Co-integration, Error correction model. They observed unidirectional causality from Futures to Spot in paper trade. [6]

Nazlioglu et al (2012) examined whether volatility in oil prices has any explanatory impact on the volatility in agricultural commodity prices. The study investigated volatility spillover between oil and selected agri commodities (Wheat, Corn, Soybean and Sugar) that are key agricultural products for biofuel and for food in the world. They observed that risk transmission between oil and agricultural commodity markets in the pre-crisis period, but the oil market volatility spills on the agricultural market in the post post-crisis period (exemption of Sugar). The study reveals that local measures to suppress price uncertainty in agricultural markets may not be effective in short run. [7]

Prashant Atma, Venu Gopala Rao (2013) conducted a study on Commodity derivatives in India: A Study of COMDEX. They used the Vector Error Correction Model & Granger causality test and concluded that the average future prices are greater than the average spot prices due the fact that the Comdex is a combination of both perishable and non-perishable commodities. The futures showed leadership in the markets. [8]

Dr. S. Nirmala, & K. Deepthy (2016), in their article "Price discovery in commodity markets: a study of precious Metals market in Multi Commodity Exchange" analyzed the price discovery of Gold and Silver market of MCX during 2014 to 2016 by using co-integration vector, VECM. They observed that Gold has unidirectional causality relationship from futures to spot market in long run, whereas there is a bidirectional relationship in short run. In case of Silver, there is a bidirectional causal relationship between spot and futures in long run, and unidirectional relationship from futures to spot in short run. [9]

Tanushree Sharma (2016) conducted a study on "the impact of Future trading on Volatility in Agriculture Commodity: A Case of Pepper". She studied the pepper prices from 2004 to 2013 from NCDEX by ARCH & GARCH model. The results show that residual the volatility in spot showed positive and significant relationship with unexpected open interest. Volatility in spot price is explained by open interest and trade volume. When there is sudden change unexpected open interest, it leads to a rise in volatility of physical market prices and is destabilizing. [10]

Arora and Chander (2016) in their studies made an endevor to assess the futures trading impact on India market regarding Agricultural Commodities. The daily prices of Spot and Futures markets for a period of 5 years from 2011 to 2015 for Castor seeds, chana, Kapas and Turmeric, were integrated in to various econometric models to study the price efficiency in cash market and the effects of unpredictability spillover in agricultural commodities market in India with the help of Johansen co-integration test, VECM and Bivariate model of EGARCH (1,1) on NCDEX. The study observed that futures market of NCDEX is more proficient in terms of price efficiency and the information dissemination as compared to the spot market. Further, the study observed that the spillover information occurs from futures to spot market. Thus the futures market entails potential to explain underlying price in the cash market. [11]

Arora and Chander (2017) further, in another study made an effort to assess the futures trading impact on Indian market regarding agricultural commodities (Castor seeds, Mustard seed, crude palm oil and refined soy oil) for the period 2013-16. The empirical study findings reconfirmed that futures market of agricultural commodities is more proficient in terms of price efficiency and information disseminations as compared to the spot market. [12]

Dhandayuthapani and Pavitra (2017) examined the relationship of spot and futures prices in Crude oil and natural gas using ADF Test, PP test & Johansen co-integration test. The results implied the existence of relationship between spot and futures prices of commodity trade at Multi commodity exchange. [13]

Shilpa Lodha (2017) in their "A co-integration and Causation study of Gold prices, Crude oil prices and Exchange rate" used the tools ADF test, Johansen co-integration test and VAR model. It has been concluded in the study that a bidirectional causality exists between crude oil and exchange rate, whereas unidirectional Granger causality was found from crude oil to gold. Causation from crude oil to exchange rate and gold implies changes in the gold price may be monitored by movement in the oil price. The causation has been attributed to the logic to the logic that high oil prices is bad for the economy, which adversely affects growth and hence pushes down the stock prices. Investors look for gold as one of the alternative assets, due to the inflation and negative impact on economy, there is negative impact on the exchange rate also. [14]

Karamjeet Kaur (2019) conducted a study on "Causality Relationship between spot and Futures Markets: Evidence

from India." She has used Unit Root test, co-integration Test, Granger causality test to find out causal relationship between spot and futures market of Bombay Stock Exchange. The result indicates that the existence of long-run stable relationship between spot index and futures contract index of Indian stock market. Granger causality test result suggested that the direction of causality is unidirectional running from spot prices lead to futures prices. The futures market does not play a role of price discovery vehicle for stock market. [15]

3. Objectives of the Study

To find out whether any co-integration relation is happening between i). Daily Castor Seeds Futures closing prices at NCDEX and ii). Daily Castor Seeds Spot prices at Deesa of Banaskantha (Authorised Delivery Centre).

1. To find out the lead-lag relationship between Castor Seeds Futures trading price in NCDEX and Spot prices in Deesa (Delivery center).
2. To find how price discovery is happening in commodity markets during the Study period and in which market reflects the price information first.
3. To find how the Variance Decomposition is happening between the two markets prices of Castor Seeds.

4. Research Methodology

EViews Version-10 is used for the analysis. Author is licensed user of EViews software.

There are only two variables in the data.

1. Daily closing price of Futures market of NCDEX.
2. Daily closing prices of Spot market of Deliver center.

Trend: Long-run characteristics in economic and financial data are usually associated with non-stationary in time series are called trends.

Cycles: Short term fluctuations are stationary times series are called Cycles.

Economic and financial times series can be viewed as combination of both trends and cycles. A shock/impact to stationary time series would have an effect which would gradually disappear, leaving no permanent impact on the time series in the long period. A shock/impact to non-stationary time series would permanently change the path of the time series or would permanently move the activity to a different level. It would be either higher or a lower level.

5. Data Analysis & Interpretation of Castor Seeds Futures & Spot Prices

5.1. Unit Root Test

ADF Test and PP test have been conducted to test the stationarity of the variables (Futures & Spot) of Castor Seeds. E-views automatically takes the lag suitable for the data.

Table 3. *Hypothesis Details.*

Null Hypothesis H_0	**Data is not stationary or got Unit Root**
Alternate Hypothesis H_1	Data is stationary

Table 4 shows the value of Test Statistic and its corresponding p-values of the variables (Futures and Spot prices) for Level data and First difference data of ADF Test and PP test separately. It is mentioned in three phases. 1. Constant, 2. Constant & Linear trend & 3. None.

5.1.1. Level Data

This has been observed that all p-value are more than 0.05 (>5%) for level data, which indicates that the variables fail to reject null hypothesis (accepted the null hypothesis). Hence, this can be concluded that variables (Futures & Spot prices) are non-stationary at level (Raw data).

5.1.2. First Difference Data

Further, the data has been converted to first difference and then ADF Test & PP Test were repeated with three phases. Table 4 results under first difference shows that the p-vales are less than 0.05 (<5%) in all three phases of ADF test and PP Test. This indicates that the Null hypothesis has been rejected and alternate hypothesis has been accepted. Hence, this can be concluded that both the variables (Futures and Spot prices) are stationary at 1st difference as per probability values.

Table 4. *Result of Unit Root Test with p-values of Castor Seeds Commodity.*

Type of Test	**ADF Test**			**Philips Perron Test**		
Phase type / Data type	**None**	**With Intercept**	**With trend & intercept**	**None**	**With intercept**	**with trend & intercept**
I. Variable: Spot Closing price of Castor Seeds commodity A. Level data:						
T- Statistic (Probability)	0.233584 (0.7539)	-2.269387 (0.1822)	-3.178490 (0.0892)	0.206770 (0.7462)	-2.237261 (0.1932)	-3.231949 (0.0786)
Conclusion	*Non-Stationary*	*Non-Stationary*	*Non-Stationary*	*Non-Stationary*	*Non-Stationary*	*Non-Stationary*
B. First difference data:						
T-Statistic (Probability)	-34.37192 (0.0000)	-34.36515 (0.0000)	-34.35825 (0.0000)	-34.30247 (0.0000)	-34.29515 (0.0000)	-34.28778 (0.0000)
Conclusion	Stationary	Stationary	Stationary	Stationary	Stationary	Stationary
II. Variable: Futures Closing prices of Castor Seeds commodity						
A. Level Data						
T-statistic (Probability)	0.537733 (0.8321)	-1.352377 (0.6068)	-2.595157 (0.2826)	0.529236 (0.8301)	-1.390046 (0.5885)	-2.706201 (0.2342)
Conclusion	Non-stationary	Non-stationary	Non-stationary	Non-stationary	Non-stationary	Non-stationary

Type of Test	ADF Test			Philips Perron Test		
Phase type / Data type	**None**	**With Intercept**	**With trend & intercept**	**None**	**With intercept**	**with trend & intercept**
B. First difference data:						
T-statistic (Probability)	-34.34713 (0.0000)	-34.34583 (0.0000)	-34.35146 (0.0000)	-34.28746 (0.0000)	-34.31431 (0.0000)	-34.31983 (0.0000)
Conclusion	Stationary	Stationary	Stationary	Stationary	Stationary	Stationary

Source: Author's Estimation. [16]

5.2. Lag Selection Criterion

The lag 7 is being finalized based on the Final Prediction error (FPE) test and Akaike information criterion (AIC). The other three methods collectively did not suggest any particular single lag. Hence, Lag 7 will be appropriate for the purpose of calculating Cointegration, VECM test etc.

Table 5. *Lag selection by 5 methods.*

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-18509.45	NA	3.42e+09	27.62903	27.63679	27.63194
1	-14532.19	7936.714	9093202	21.69879	21.72208	21.70752
2	-14457.90	148.0229	8187583	21.59388	21.63269*	21.60842
3	-14445.55	24.57779	8086137	21.58142	21.63575	21.60177*
4	-14441.49	8.067069	8085405	21.58132	21.65118	21.60750
5	-14435.89	11.09380	8066209	21.57895	21.66433	21.61093
6	-14424.63	22.31726*	7979186	21.56810	21.66900	21.60590
7	-14420.43	8.307140	7976802 *	21.56780*	21.68423	21.61142
8	-14419.08	2.650210	8008516	21.57177	21.70372	21.62120
9	-14416.98	4.151077	8031203	21.57460	21.72207	21.62984
10	-14413.67	6.504800	8039558	21.57563	21.73863	21.63670
11	-14413.36	0.622889	8083888	21.58113	21.75965	21.64801
12	-14412.48	1.729181	8121623	21.58579	21.77983	21.65848

Source: Author's Estimation.
* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

5.3. Johansen's Co-Integration Test

For examining Johansen's Cointegration test, it is mandatory that variables (Futures and Spot price data) are non-stationary at level and stationary at 1st differentiation. This has been confirmed from the Unit Root. [16]

Table 6 shows the result of Johansen Cointegration test results for Trace test and Max Eigen Value test separately.

5.3.1. Trace Test Result

Trace test (Table 6, Part A) result shows that the p-value is less than 0.05 (<5%) for zero cointegration equations. Thus, the null hypothesis is rejected. Further, the test has been conducted for at most 1 cointegrating equations. The result shows that the p-value is more than 0.05 (>5%) for atmost 1 Cointegration equation. The null hypothesis has been accepted. Therefore, this has been concluded that there is atmost one cointegrating equation between the variables.

5.3.2. Max Eigen Test Result

Max Eigen value test results (Table 6, Part B) also shows that p-value of null hypothesis for "None" has been rejected. P-value for 'atmost 1 cointegrating equation is more that 0.05 (5%). The alternate hypothesis is accepted. Hence, this can be concluded that there is at most one cointegrating equation is available between the variables.

5.3.3. Eviews Inference

Further, Eviews Report (Table 6, Part C) Itself Indicates That There is Atmost 1 Cointegrating Equations Is Available

5.4. Granger Causality Test

This test examines the lag-lead relationship between the variables at 0.05 level of significance using F test. It is a statistical proposition test for determining whether one time series is helpful in forecasting another one. It gives us the direction of Causality relationship between the variables.

5.4.1. Spot Does Not Granger Cause Futures

Granger causality test result (Table 7, Part. A) shows that p-value is more than 0.05 (>5%) and hence the null hypothesis is accepted, which shows that 'Spot Does not granger cause Futures'.

5.4.2. Futures Does Not Granger Cause Spot

Granger causality test result (Table 7, Part. B) shows that p-value is less than 0.05 (<5%) and the null hypothesis is rejected. Hence, it can be concluded that 'Futures does granger cause Spot'. Therefore, the direction causal relationship is from Futures to spot.

Table 6. *Johansen's Co-Integration Test.*

Cointegration between Daily Spot prices and Daily futures prices of Castor Seeds						
Lag length selected	**Cointegration test used**	**No. of cointegrating equations (CES)**	**Eigen Value**	**Trace Statistic**	**Critical value at 5%**	**Probability ****
1 to 7	A. Trace test	H_0: r=0 (None) *	0.027554	41.33128	15.49471	0.0000
		H_1: r<=1 (At most 1)	0.002807	3.778540	3.841465	0.0519
	B. Max-Eigen value test	H_0: r=0 (None) *	0.027554	37.55274	14.26460	0.0000
		H_1: r<=1 (At most 1)	0.002807	3.778540	3.841465	0.0519

Author's Test result

C) Eviews inference: Trace Test indicates 1 cointegrating equations at the 0.05 level

Max-Eigenvalue test indicates that 1 cointegrating equations at the 0.05 level.

In the above table one star (*) indicates: Rejection of the hypothesis at the 0.05 leveln the above table one star (*) indicates: Rejection of the hypothesis at the 0.05 level

Two Stars (**) indicates: MacKinnon-Haug-Michelis (1999) p-values".

Table 7. *Pair wise Granger causality tests.*

Hypothesis details	Observations	F statistics	probability	Inference	Direction of causality
A) SPOT does not Granger Cause FUTURES	1345	1.36164	0.2177	Accepted	F→S
B) FUTURES does not Granger Cause SPOT	1345	47.6429	2.E-60	Rejected	

Author's Test result.

5.5. Vector Error Correction Model (VECM)

5.5.1. Test of Long-term Association

If the Cointegration criterion is validated, then it enables the error correction model. This model is used to identify whether price discovery occurs in the market. The Error Correction Model is constructed by means of the equilibrium relationship among the non-stationary variables.

The lag length of 7 is applied in the test which was suggested by leg selection criterion.

A. VECM with Futures as Dependent variables:

The VECM results (Table 8, Part A) shows that the coefficient of error correction term C(1) is negative and not significant as p-value is more than 0.05 (>5%), when Futures is a dependent variable and Spot is an independent variable. Hence, this can be concluded that there is no long run causality from Spot to Futures prices in Castor seeds trade during the test period.

B. VECM with Spot as Dependent variables:

From the VECM Test results (Table 8, Part B) shows that the coefficient of error correction term C(1) is negative and significant as the p-value is less than 0.05 (<5%). Hence, this can be concluded that there is exists unidirectional long run causal relationship from Futures variable to Spot variable in castor seeds trading during the test period. [16]

C(1) is the coefficient of Cointegrating model. It is also called Error Correction term or Speed of adjustment towards equilibrium. Here, C(1)=-0.050905. The speed of adjustment from futures market towards equilibrium is 5.1% in long run when there is any information/shock arises in the commodity markets.

Cointegration Equation:

$$C(1)* (SPOT (-1) - 0.995757901318*FUTURES (-1) + 11.4036760531)$$

System Equation Model:

1) VECM Equation (when Futures is a dependent variable)

$$D(FUTURE)=C(1)*(FUTURE(-1) - 1.00426017075*SPOT(-1) - 11.4522576602) + C(2)*D(FUTURE(-1)) + C(3)*D(FUTURE(-2)) + C(4)*D(FUTURE(-3)) + C(5)*D(FUTURE(-4)) + C(6)*D(FUTURE(-5)) + C(7)*D(FUTURE(-6)) + C(8)*D(FUTURE(-7)) + C(9)*D(SPOT(-1)) + C(10)*D(SPOT(-2)) + C(11)*D(SPOT(-3)) + C(12)*D(SPOT(-4)) + C(13)*D(SPOT(-5)) + C(14)*D(SPOT(-6)) + C(15)*D(SPOT(-7)) + C(16)$$

2) VECM Equation (when Spot is a dependent variable)

$$D(SPOT)=C(1)*(SPOT(-1) - 0.995757901318*FUTURE(-1) + 11.4036760531) + C(2)*D(SPOT(-1)) + C(3)*D(SPOT(-2)) + C(4)*D(SPOT(-3)) + C(5)*D(SPOT(-4)) + C(6)*D(SPOT(-5)) + C(7)*D(SPOT(-6)) + C(8)*D(SPOT(-7)) + C(9)*D(FUTURE(-1)) + C(10)*D(FUTURE(-2)) + C(11)*D(FUTURE(-3)) + C(12)*D(FUTURE(-4)) + C(13)*D(FUTURE(-5)) + C(14)*D(FUTURE(-6)) + C(15)*D(FUTURE(-7) + c(16)$$

Table 8. *VECM Results.*

Castor Seed: Dependent variable		Coefficient	Standard Error	t-statistic	Probability	Inference
A) Futures	C(1)	-0.031057	0.017149	-1.810957	0.0704	No long run causality
B) Spot	C(1)	-0.050905	0.011445	-4.447806	0.0000	F→S

Source: Author's Estimation. [16]

5.5.2. Test of Short-term Association: Wald Test (Week Exogenous Test)

Wald test is test of short run causality between the variables. C(9) to C(16) of VECM equation are the coefficients of short-term equation.

Table 9. *Discerption of Hypothesis.*

Null Hypothesis H_0	C(9)=C(10)=C(11)=C(12)=C(13)=C(14)=C(15)=C(16)=0
Alternate Hypothesis H_1	C(9)=C(10)=C(11)=C(12)=C(13)=C(14)=C(15)=C(16) ≠ 0

A. when the Futures is dependent variable and Spot is independent variable:

The result (Table 10, Part A) shows that the p-value is more than 0.05 (>5%). Hence, the null hypothesis has been accepted. i.e. coefficient of variables is equal to zero. Therefore, there is no short run causality from Spot to Futures.

B. When Spot is a dependent variable and Futures is an independent variable:

The result (Table 10, Part B) shows that the p-value is less than 0.05 (<5%). Hence, the null hypothesis has been rejected and alternate hypothesis is accepted. i.e coefficient of variables is not equal to zero. Therefore, this can be concluded that there exist short run causality running from Futures to Spot.

The coefficients C(9) to C(16) jointly influence spot variable and hence we can conclude that there is short run causality running from Futures to spot variable.

Table 10. *Results of Wald Test (Week exogenous test).*

Castor Seeds Dependent Variable	Test statistic	Value	Df	Probability	Inference
A) Futures	F-statistic	1.000911	(7, 1328)	0.4288	No short run causality
	Chi-Square	7.006374	7	0.4282	
B) Spot	F-statistic	23.68390	(8, 1328)	0.0000	F→S
	Chi-Square	189.4712	8	0.0000	

Source: Author's Estimation.

5.6. Residual Diagnostic Tests

5.6.1. Jarque Bera Test

It is a Histogram Normality Test.

Test Hypothesis: H_0: Normal Distribution; H_1: Not normally Distribution

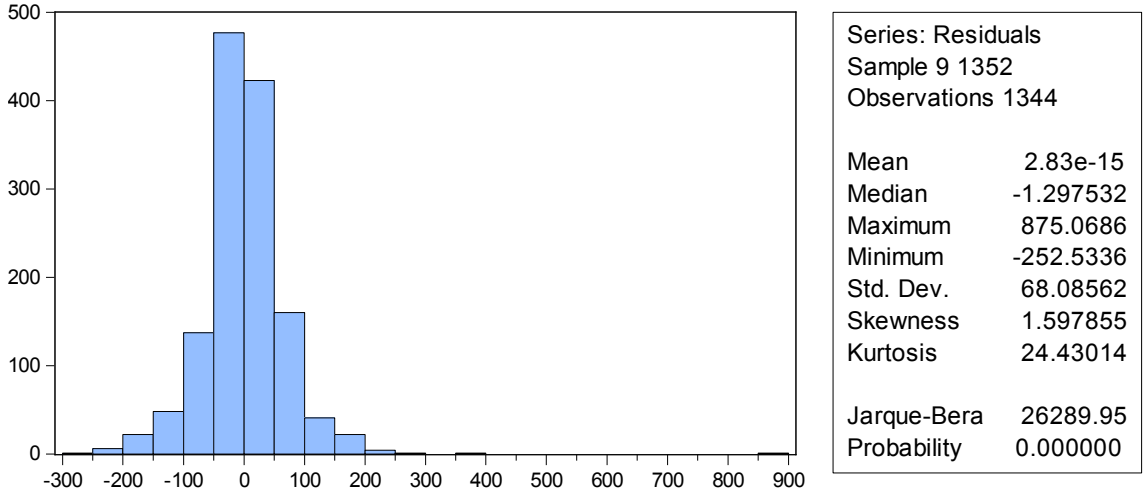


Figure 2. *Jarque Bera test results.*

5.6.2. Breusch-Godfrey Serial Correlation LM Test

p-value is more than 0.05 (>5%), hence the Null Hypothesis is accepted. Thus, there is no serial correlation in the model.

Table 11. *Breusch-Godfrey Serial Correlation LM Test.*

Null Hypothesis: No serial Correlation up to 7 lags			
Alternate Hypothesis: There is serial Correlation			
F- Statistic	0.707346	Prob F (7,1321)	0.6659
Observed R-Square	5.018823	Prob. Chi-square (7)	0.6659

Source: Author's Estimation.

5.6.3. ARCH Test

P-value is more than.05 (>5%), hence the Null Hypothesis is accepted. Therefore, there is no heteroskedasticity in the model.

Table 12. *Heteroskedasticity Test: ARCH.*

Null Hypothesis: No ARCH effect			
Alternate Hypothesis: ARCH effect			
F-statistics	0.734514	Prob F (97,1217)	0.6427
Obs R-square	5.152612	Prob. Chi-square (7)	0.6413

Source: Author's Estimation.

There is no Arch effect and there is no Heteroskedasticity in the model. But residuals are not normally distributed. However, it is acceptable for econometricians.

5.7. Variance Decomposition Test

Variance Decomposition describes the percentage of forecasting error that can be elucidated with the support of variance in its previous behavior as well as the behavior of other series. Daily data is used for analysis and hence, one period is equal to one day. For explanation purpose, 3rd period a Short run and 10th period is treated as Long run.

Forecast Error Variance Decompositio for Castor Seeds:

5.7.1. Variance Decomposition of Spot

The results of variance decomposition of Spot (Table 13) shows that a shock to Spot account for 46.54% of the fluctuation in spot (own shock) in short run. A shock to Futures can cause 53.46% fluctuation to Spot in short run.

A shock to Spot can cause 25.45% fluctuation to Spot (own shock) in long run, whereas a shock to Futures can cause 74.55% on spot. This can be concluded from the result that the response of own shock of spot is decreases and the response of shock on Futures to Spot is increasing to dominant proportion over the period of 10 days.

Table 13. *Variance Decomposition of Spot (%).*

Period/Variable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Spot	80.34	57.76	46.54	40.59	36.24	32.06	29.40	27.83	26.59	25.45
Futures	19.66	42.24	53.46	59.41	63.76	67.94	70.60	72.17	73.41	74.55

Source: Author's Estimation.

5.7.2. Variance Decomposition of Futures

The results of variance decomposition of Futures (Table 14) shows that a shock to futures account for 100% of fluctuation in futures (own shock) in short run. A shock to Spot cannot cause any fluctuation to futures in short run.

Further, a shock to futures can cause 99.72% fluctuation to Futures (own shock) on period.10, whereas a shock to Spot can cause only 0.28% on Futures. It can be concluded from the results that the response of own shock of Futures is very high all though the period. Hence, there is greater impact of futures on its own as well as on spot prices.

Table 14. *Variance Decomposition of Futures (%).*

Period/Variable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Futures	100	99.98	99.98	99.93	99.91	99.91	99.82	99.77	99.74	99.72
Spot	0.00	0.02	0.02	0.07	0.09	0.09	0.18	0.23	0.26	0.28

Source: Author's Estimation.

6. Conclusion

Several Econometric tests have been conducted for the Futures closing Price data of Castor seeds commodity for 1352 days pertaining to 64 settlement months in NCDEX and the corresponding Spot market prices from Deesa (delivery center) of Banaskant district in Rajasthan in India during the period. The Unit Root test (ADF Test and PP Test) infers that the price data is non-stationary at level and is stationary at first difference. Hence, the price data is fit for Econometric analysis. Johnsen cointegration indicates that there is atmost one Cointegrating equation between the data sets. This is a confirmation to stakeholders that both markets prices

(Futures & Spot) of castor Seeds are cointegrated.

VECM test confirms that there exist long run causation available between Futures and Spot variables in Castor seeds markets during the test period. The speed of adjustment is 5.01% from Futures towards equilibrium for any imbalance/ shock that occurs in the market. Further, Wald Test concluded that there exists short run causality. Granger causality test confirms that the direction of causality from Futures to spot. (F→S). This concludes that any price related information is first reflected in Futures price and then passed to Spot. Hence, we can conclude from the above three test that Futures market price leads in short and long run causation. Futures market leads in price discovery of Castor seeds market. This information is crucial in making trade related decisions.

Variance Decomposition model explain the forecasting behaviour of variables for period of 10 days. A shock/impulse to Futures can cause 53% and 75% influence in short and long run respectively in determining the spot prices. Castor seeds Futures variable is more exogenous in nature whereas the Spot prices are influenced by lagged behaviour of Futures prices. Thus, it indicates that the factors that effects the Futures prices (like increase/decrease the trading margins, trading limits, taxes, cess etc.) will have more impact on Spot market prices. This model is more useful for traders in Castor seed (both Spot and Futures markets) that that any impulse on Futures prices will impact in short run as well as long run. Accordingly, the traders can design their trading strategies,

Castor seeds Futures variable is more exogenous in nature whereas the Spot prices are influenced by lagged behavior of Futures prices. Thus, this can be concluded that Castor Seed Futures leads in price discovery in the market. The Futures market impact is high on spot market, when the castor commodity related news shocks/impacts the market, and it will influence the Spot till equilibrium level arrived. The research information is useful for stakeholders in their decision making process and designing trading strategies. Hence, Futures trading is useful in Price Risk management. Introduction of Castor seeds Futures market in NCDEX in India has really achieved its targeted purposes.

References

[1] Iyer, V. and Pillai, A., 2010, Price discovery and convergence in Indian market, Indian Growth and Development Review, 3, No. 1, pp. 53-61.

[2] Dey Kushankur, Roy Shiladitya, (2011) Price Discovery, Market Efficiency and Volatility: Indian Pepper Futures Markets. Society of Interdisciplinary Business Research (SIBR), conference on interdisciplinary Research available at http://ssrn.com/abstract=1867850.2.

[3] Jayagurunathan, V., Velmurugan, PS., Palanichamy, P., (2010), An Empirical Analysis of price discovery in gold spot-futures market: Evidence from Multi Commodity Exchange of India Ltd., Indian Commodity Market (Derivatives and Risk Management), Serial Publication, PP. 1-32.

[4] Ali Jabir, Gupta Kriti Bardhan (2011), Efficiency in Agricultural Commodity Futures Market in India: Evidence from Co-integration and Causality Tests, Agricultural Finance Review, Vol. 71, No. 2, Issue: 2, pp. 162-178.

[5] Srinivasan. P (2012), Price Discovery ad Volatility Spillover in Indian Spot–Futures Commodity Market, The IUP Journal of Behavioural Finance, 9, pp-70-85.

[6] Kushankur Dey, Debases Maitra (2012), Price Discovery in Indian Commodity Futures Market: An Empirical exercise, International Journal of Trade and Global Markets, Vol. 5, No. 1, pp. 68-87.

[7] Nazlioglu Saban E, Cumhur S and Ugur (2012), Volatility Spillover Between Oil and Agriculture Commodity Markets, Energy Economics, Vol, 36, No. C, pp-1-28. http:// dx.doi.org/10.1016/j.eneco.2012.11.009.

[8] Prashanta Athma, Venu Gopal Rao K. P (2013), Commodity Derivatives in India: A Study of MCX Comdex, International Journal of Marketing, Financial Service & Management Research, Vol. 2, No. 6, PP: 26-41.

[9] Dr. Nirmala. S, & Deepthy K (2016), Price Discovery in Commodity Markets: A Study of Precious Metals Market in Multi Commodity Exchange, International Journal of Multidisciplinary Research and Modern Education (IJMRE), ISSN (Online): 2454-6119, (www.rdmodernresearch.com), Vol II, Issue II, 2016.

[10] Dr. Tanusree Sharma (2016), An Empirical analysis on Commodity Futures Market in India, International Journal of Engineering Technology, Management and Applied sciences (IJETMAS),(www.ijetmas.com), March 2015, Volume 3, Special Issue, ISSN. 2349-4476.

[11] Arora Mehak and Chander Ramesh (2016), Price efficiency and Volatility in Agri Commodities Market in India: An Empirical investigation, Amity Journal of Finance, Vol. 1, No2, pp. 83-99.

[12] Arora Mehak and Chander Ramesh (2017), Does Derivatives Trade Facilitate Price Discovery and Risk Management?, The IUP Journal of Applied Finance, Vol. 23, NO. 4 2017, pp 18-29.

[13] Dr. S. P. Dhandayuthapani and R. Pavitra (2017), A Study on Energy Performance Commodity Trading in India, International Journal for Scientific Research & Development (IJSRD), Vol. 5, Issue 01, 2017, ISSN (online) 2321-0613.

[14] Shilpa Lodha (2017), A Cointegration and Causation Study of Gold Prices, Crude Oil Prices and Exchange rate, The IUP Journal of Financial Risk Management, Vol. 14, No. 1, pp. 55-66.

[15] Kaur Karamjee, 2019, Causality Relationship between Spot and Futures Markets: Evidence from India, The IUP journal of Financial Risk Management, Vol. 16, No1, pp-50-57.

[16] Siddavatam, Ravi Prakash, and S. Appa Rao, 2021. "Price risk management of turmeric commodity futures (NCDEX) and spot Market." *Asian Journal of Multidimensional Research* 10, no. 11 (2021): 814-834.

[17] Rajendra Daga, 2017, Commodities control-Castor, Retrived 10 January 2022, From www.commoditiescontrol.com/eagritrader/commodityknowledge/ castor/castor1.htm.