Original Research Article

Efficacy Analysis of NCDEXSpot and Futures Trading in Spices

ABSTRACT

This research paper is an attempt to assess the efficacy of spot and futures trading in spices on NCDEX. Spot price and futures price relationship is prominent indicatorsof the commodity futures market to protect the interest of beneficiaries and to hedge sharpprice fluctuations in commodity markets. The study tested price patterns using data forFY2015 to FY2022 daily spot and futures price series of near month contracts. ADF test,Johansen's cointegration, Granger causalitywas computed to examines spot and futures prices for three selected spices,namely jeera (cumin), turmeric and coriander. The results revealed that Turmeric and Coriander had significant bidirectional relationship and Jeera had significant unidirectionalrelationship between futures and spot market prices.

Keywords: Spot Price, Futures Price, commodity Futures Trading, Relationship, Spices.

INTRODUCTION

The National Commodity and Derivatives Exchange Limited (NCDEX/ the Exchange) is a professionally managed on-line, multi commodity exchange focusing on revolutionising India's agricultural sector. It is India's largest agricultural derivatives exchange with a market share of 75 per cent in agricultural derivative contracts for the Financial Year ending March 2021. It's reason for existence is to serve as an efficient platform for Price Discovery and Price Risk Management and this has been consistently demonstrated over the past two decades. It also offers a range of diverse products such as commodity futures, options in goods and index futures that open an abundance opportunity to cater to the needs of various sets of participants in the agri value chain. NCDEX offers three spices commodities for trading viz., Jeera (Cumin), Turmeric and Coriander.

In India, cumin seed commonly known as 'Jeera' is the dried, white fruit with greyish brown colour of a small slender annual herb. Whereas, Turmeric is one of the most important spices as well as therapeutic agent and is grown during Kharif season and Coriander being the most widely used spices in India and around the world is one of those herbs whose all parts are edible. Keeping in view the above facts, an attempt is made to critically assess the reletionship of NCDEX futures and spot trading in spices with the following specific objective is to analyze the efficacy of agricultural commodity market through futures and spot market prices.

METHODOLOGY

To examine the main objectives of the study, secondary data on selected spices crops (i.e., Jeera, Turmeric, Coriander) were collected from the reports available on NCDEX website. The data set comprises of daily closing spot prices and near-month futures contract prices for each commodity. The historical price reports were collected for a period of seven years from 2015-16 to 2021-22 with 1777 observations. For the purpose of the study, selection of appropriate and sufficient data is significant to achieve the best possible outcomes. In this context, sampling is taken from the available data at NCDEX platform. For measures of central tendency, dispersion, skewness and kurtosis, a total of seven years data is taken. Since Covid 19 pandemic has highly impacted all sectors including agriculture. Post covid 19, commodity futures market dominates the prevailing market through digital platform wherein the buyers and sellers are able to fulfill their demand and supply efficiently. Because of this reason, the study data from FY 2019-20 to 2021-22 is considered as a sample.

The efficacy of agricultural commodity market is assessed through analyzing the relationship of futures and spot market price series. Firstly, the stationarity of the price series was tested with the help of unit root test procedure namely Augmented Dickey Fuller Test and possible cointegration between spot and future price series was checked using Johansen's Cointegration Analysis Test. Secondly, Granger causality test model was used to find out whether futures price causes effects on spot price or not and vice-versa with their direction of causation.

Analytical tools and statistical techniques:

Measures of Central Tendency

The measures of central tendency include mean which is the sum of the observed values of a set divided by the number of observations in the set, maximum and minimum of spot and futures price series for various commodities are assessed.

Measures of Dispersion, Skewness and Kurtosis

The dispersion such as standard deviation and coefficient of variation for spot and futures prices for various commodities are assessed. The positive square root of the variance is called standard deviation. It explains the average amount of variation on either side of the mean. The coefficient of variation (CV) is the percentage of the standard deviation around/ about the mean. The higher the coefficient of variation, the greater the level of dispersion around the mean. Skewness can be defined as departure from symmetry or lack of symmetry of frequency distribution. If the skewness is less than -1 or greater than +1, the distribution is highly skewed. If the skewness is between -1 to -0.5 or between +0.5 and +1, the distribution is moderately skewed. If skewness is between -0.5 and +0.5 the distribution is fairly symmetric.

The Kurtosis is a measure of the "tailedness" of the probability distribution. A standard normal distribution has kurtosis of 3 and is recognized as mesokurtic. An increased kurtosis (>3) can be visualized as a thin "bell" with a high peak whereas a decreased kurtosis corresponds to a broadening of the peak and "thickening" of the tails. Kurtosis >3 is recognized as leptokurtic and <3 as platykurtic (lepto=thin; platy=broad).

One-way Analysis of Variance (ANOVA)

One-way Analysis of Variance (ANOVA) was performed to test the equality of means of spot price and futures price for each commodity. The values of *F*-statistic along with corresponding *p*-values are also included.

Augmented Dickey Fuller Test

Stationary series are the precondition for cointegration and causality analysis. Therefore, a unit root test is performed using an autoregressive model to check whether a time-series variable is non-stationary or not. A series is stationary if the mean and autocovariances of the series do not depend on time. Unit root tests based on Augmented Dickey-Fuller (ADF) test approach was used in this study to examine the stationarity of all the futures and spot price series.

The test of stationarity of futures and spot prices were carried out by estimating the following regression equation:

$$\Delta X_t = b_0 X_{t-1} + \sum_{i=1}^{T} b_i \Delta X_{t-i} + \varepsilon_t$$

Where, *Xt*represents the base level or the first difference of the variables. The null hypothesis of non-stationarity is *b*0 = 0. If the null hypothesis is not rejected at the base level of the series, *b0* rejected at the first difference of the series, then the series is taken as stationary at the first difference level, and it is denoted by I (1). The above tests have been performed using a constant intercept and lag length has been determined though Schwarz information criterion.

Johansen's co-integration model

The Johansen cointegration test is employed on log prices of the three commodities using two methods: (1) Johansen trace test and (2) Johansen maximum eigen test. As this test is sensitive to lag selection, Vector autoregression (VAR) is applied to determine the appropriate lag length as per the Akaike information criterion (AIC). The purpose of the cointegration test is to determine whether a group of non-stationary series are cointegrated or not, and explores the long-run equilibrium relationship among the variables. The Johansen likelihood ratio test statistic, λtrace, and the maximal Eigen value, λmax for the null hypothesis that there are at most r cointegrating vectors are given by:

$$\lambda_{\mathrm{tr}\,ace} = -T \sum_{i=r+1}^{k} \ln\left(1 - \hat{\lambda}_i\right)$$

$$\lambda_{\max} = -T \ln\left(1 - \hat{\lambda}_{r+1}\right)$$

Ganger CausalityTest

Granger causality test has been used to analyze the direction and causal relations between futures and spot prices of major agricultural commodities. The Granger (1969) approach predicts how much of the current value of one variable can be explained by past values of other variable and then tries to see whether adding lagged values of prior variable can improve the explanation. For instance, Y is said to be Granger-caused by X, if X helps in the prediction of Y, or equivalently if the coefficients on the lagged X is statistically significant. Specifically, Y_t is causing X_t if some coefficient, a_i, is non-zero. The test for causality is based on an *F*-statistics, which tests whether

lagged information on a variable Y provides any statistically significant information about a variable X in the presence of lagged X. The F-statistic is given by:

$$F_1 = \frac{SSEo - SSE1/p}{SSE1/(T - 2p - 1)}$$

Where, SSE_0 and SSE_1 are the sum of squares of residuals, p is the number of lags and T is the number of observations. It is important to note that the statement "X Granger causes Y" does not imply that Y is the effect or the result of X. This implies that the Granger causality measures precedence and information content but does not by itself indicate causality in the true sense.

RESULTS AND DISCUSSION

To analyse the efficacy of agricultural commodity markets, it is vital to understand the basic behaviour of spot and futures price series taken from NCDEX daily price data by assessing the central tendency, dispersion, skewness, kurtosis and ANOVA F-test. The outcomes are presented in Table 1.

One-way Analysis of Variance (ANOVA)

It depicted significant values at 5 per cent level of significance of F-statistic in jeera and coriander i.e., 24.61 and 5.43 respectively. Whereas, the F-statistics for turmeric is 0.57 which is not significant at 5 per cent level of significance. This indicates that there is no difference among group means with respect to jeera and coriander but with respect to turmeric the difference exists.

Unit Root Test Outcomes

The unit root test on spot and futures prices of selected spices is presented in Table 2. The t-statistics at level revealed that for spot prices of jeera, turmeric and coriander is 2.42, -0.66 and -1.13 respectively and for futures prices the t-statistics value for jeera, turmeric and coriander is 0.47, -2.60 and -0.79 respectively. All these values are not statistically significant at 5 per cent level of significance which means that the data is not stationary. Whereas, the t-statistics at first difference are statistically significant at 5 per cent level which means that the data is stationary.

Cointegration Test Outcomes

The Johansen's cointegration tests statistics for selected spices is presented in Table 3. In the case of zero cointegrating vector ($r = 0$), the trace value and maximum eigen value for jeera in spot and futures market is 67.24 and 66.70 respectively, for turmeric it is 39.42 and 39.09 and for

coriander it is 36.21 and 35.96 respectively. All these values are significant at 1 per cent level of significance which means that the data has cointegration between spot and futures price series. On the other hand, in the case of one cointegrating vector ($r = 1$), all the values are not significant at 5 per cent level of significance and which means that the data has no cointegration between spot and futures price series.

Causality Test Outcomes

Granger causality test is employed to measure the short-run lead–lag relationship between futures and spot price returns after the series are checked for stationarity and cointegration. Here returns denote the logarithmic differences of prices. The results of test reported in Table 4. In the case of the null hypothesis (Ho), the F-statistics for jeera is 0.05, for turmeric it is 4.88 and for coriander it is 21.61. Likewise, in the case of the null hypothesis (Ho), the F-statistics for jeera is 70.14, for turmeric it is 14.02 and for coriander it is 67.58. All these values are significant at 1 per cent level of significance (except one) and hence, the null hypothesis (Ho) is rejected which means FR granger cause SR and vice versa except in first case (i.e., SR does not granger cause FR) of jeera where F-statistics is not significant at 1 and 5 per cent level of significance and hence, the null hypothesis (Ho) is not rejected.

The ADF test was applied to examine the stationarity of the spot and future prices, which reveals that both spot and futures prices of all these commodities at first difference are stationary. On the other hand, at level, these prices are non-stationary. Hence, for further analysis it is important to take non stationary data rather than differenced series. After testing for unit root, long-run relationship between spot and futures prices is estimated using cointegration tests. As per results obtaind in cointigration, including both the phase it is accepted that the log of spot and futures prices is cointegrated with one-to-one and have long-run relationship in the case of all the three commodities. These results suggest market efficacy of Indian agricultural commodity markets. The result is in line with Manogna and Mishra (2020). According to Granger causality test results, however, future prices in jeera and coriander with high F-statistics reflects dominance of Futures market. These designate that the futures market is leading and hence price discovery function occurs in these markets. On the other hand, in the case of turmeric, the F-statistics for both spot and futures prices are almost equal which reflects that both markets are equally important for price discovery. The results for Jeera and Coriander are similar to Manogna and Mishra (2020).

CONCLUSION

In comparison to the spot market, the futures market is better at accurately reflecting new information to prices. Therefore, it is concluded that the futures market is crucial to the process of determining prices for the three commodities we chose, making it valuable for both buyers and sellers of the commodities in the spot and futures markets.

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Table 1. Summary statistics of future and spot prices of the commodities

qt) FY-2015-2022	Turmeric(₹ /qt) FY-2015-22			Coriander (₹ /qt) FY-2015-22		
Futures		**Spot**	**Futures**		**Spot**	**Futures**
1377	1777	1377	1377	1777	1377	1377
16598.7	-	7208.51	7180.9	-	7245.03	7115.4
12535	-	5117.2	5214	-	4582.45	4196
23120	-	9823.8	10834	-	12530	13044
2223.91	-	1085.94	1131.3	-	1858.45	1957.7
0.34	-	0.18	0.66	-	1.00	1.04
2.48	-	2.54	3.17	-	3.35	3.51
13.39	-	15.06	15.75	-	25.65	27.51
	0.57			5.43*		
	0.4482			0.0198		

Note:Significantat: 0.05level

SD indicates standard deviation, CV indicates coefficient of variation

Source(s): Authorscalculations based on NCDEX data

Commodity		
Price		**Spot**
Observations	1777	1377
Mean	-	16868.9
Minimum	-	12957.9
Maximum	-	22340
SD	-	2129.18
Skewness	-	0.04
Kurtosis	-	2.19
CV (%)	-	12.62
***F*-value**	24.61*	
***p*-value**	0	

Table 2: Unit root test on spot and futures prices of selectedprices

Sl. No.	Commodity	Prices	Observations	Augmented Dickey-Fuller (ADF) test			
				Level		1st difference	
				t-statistics	Probability	t-statistics	Probability
1	Jeera	Spot	612	2.42	1.00	-21.73**	0.00
		Futures	751	0.47	1.00	-27.43**	0.00
2	Turmeric	Spot	547	-0.66	0.97	-16.11**	0.00
		Futures	751	-2.60	0.28	-34.01**	0.00
3	Coriander	Spot	633	-1.13	1.00	-22.74**	0.00
		Futures	751	-0.79	0.97	-26.60**	0.00
Note(s): significance at 1% level of confidence is indicated as **							

Table 3: Johannsen's cointegration tests statistics for selected spices

Sl. No.	Commodity	Observations	Leg length	Trend	Cointegrating vector		Hypothesized No. of CE(s) (no. of cointegrating vector) (r)	Johansen's cointegration analysis	
					Beta of spot	Beta of Futures		Trace value	Max-eigen value
1	Jeera	598	1	No-deterministic	-0.99	1	*r* = 0	67.24**	66.70**
							r = 1	0.54	
2	Turmeric	547	1	No-deterministic	-1.02	1	*r* = 0	39.42**	39.09**
							r = 1	0.33	
3	Coriander	621	1	Quadratic deterministic	-1.01	1	*r* = 0	36.21**	35.96**
							r = 1	0.25	

Note: significance at 1% level of confidence is indicated as **

Table 4: Granger causality tests statistics for selected spices

Sl. No.	Commodity	Observations	Granger causality test				
			Null Hypothesis	F-statistics	Probability	Relationship	
						Direction	Lead- lag result
1	Jeera	598	SR does not granger cause FR	0.05	0.95	-	Unidirectional
			FR does not granger cause SR	70.14**	0.00	FR ➔SR	
2	Turmeric	547	SR does not granger cause FR	14.98**	0.00	SR➔ FR	Bidirectional
			FR does not granger cause SR	14.02**	0.00	FR ➔SR	
3	Coriander	621	SR does not granger cause FR	21.61**	0.00	SR➔FR	Bidirectional
			FR does not granger cause SR	67.58**	0.00	FR➔SR	

Note(s): * and ^{NS}indicates significance at, 1% level of confidence, respectively. SR stands for Spot Price Returns and FR for Futures Price Returns