

Relationship between spot and futures prices of Turmeric traded in NCDEX

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Abstract:

India has a long and rich history of futures trading in commodities. Spot and futures markets have an important role in price discovery in the Indian commodity market. In this paper, the authors examine the long run relationship between spot and futures prices of Turmeric traded in NCDEX in India. The period of the study is from 1st of January 2009 to 31st of December 2016. Descriptive statistics, Augmented Dickey-Fuller (ADF) test, Phillips Perron (PP) test, Johansen's Co-integration test and Granger Causality test were employed in the study. The results demonstrate that interaction between spot and futures prices clearly exist. Authors concluded that there is a long-run relationship and bidirectional causality relationship between the spot and futures prices of Turmeric traded in NCDEX India for the period from 2009 to 2016.

Keywords: Spot Price, futures price, Turmeric, co-integration

Introduction:

India has a long and rich history of futures trading in commodities. The origin of commodity derivative markets in India is as old as USA and UK. The commodity futures contracts were adopted to ensure the convergence between spot and futures prices at the contract expiration date.

The most problem that farmers faced is price variability. Along with price variability, agricultural producers are prone to several risks such as crop diseases, high input prices, adverse impact on farming community and weather conditions which would bring negative effect to their incomes. Primary commodity prices and their markets are known to behave differently from those of manufactured goods.

Turmeric is one of the oldest spices and had been used in India since ages. That is why it is said that this spice belongs to India and also called 'Indian saffron'. The world production of turmeric stands at around 800000 tons in which India hold a share of approximately 75-80%.

National Commodity and Derivative Exchange Ltd. (NCDEX):

NCDEX was incorporated as a public limited company under the company Act 1956 on April 23, 2003. NCDEX started its operations on 15th December 2003. NCDEX headquarter in Mumbai. NCDEX facilitates trading in precious metals, ferrous and non ferrous metals and agricultural commodities. NCDEX facilitates trading in 56 commodities currently through its members in 550 centers spread throughout India. NCDEX has emerged as India's 2nd largest commodity exchange.

Spot VS future Commodity market:

The market in which commodities are sold for ready cash and delivered immediately is known as spot market or cash market. A future contract can be defined as a type of financial contract wherein parties agree to exchange financial instruments like securities or physical commodities for future delivery at a particular price. Future contract is a standardized contract to buy at a future date at a certain price. Future market is full of risk because anything might go wrong at any stage and the transaction may become invalid or void. Trading in future market is not for the risk averse. It is only for those who trust others and their own luck. A very small percentage of future contracts turn to physical delivery.

The main objective of this study is to examine the long run relationship between spot and futures prices of Turmeric traded in NCDEX India.

Review of Literature:

In the relation between spot and future price, the question is that futures prices tend to influence spot prices or spot prices tend to lead futures prices or a bidirectional feedback relationship exists between spot and futures prices. By taking a position in the future market the producer can potentially offset losses in the spot market.

Minimol, (2018) tried to examine the relationship between the spot and futures prices of crude oil. The Johansen co-integration test and vector error correction model were applied in the study. Results demonstrated that there is a strong correlation between the variables and the variables are also found to be co-integrated. Authors concluded that there is a long run relationship between the spot and futures prices of crude oil in the period of the study.

Nirmala, and Swarna, (2017) analyzed the relationship between spot and futures prices of crude oil. The ADF test, Granger causality test and Co-integration test were applied in the study. The results indicated that spot prices are generally discovered in futures markets. Authors concluded that changes in futures prices lead changes in spot prices more often than the reverse.

Shanmugam, and Raghu, (2016) tested the market which reacts first in India by assessing the relationship between spot and future prices of agricultural commodities such as Soya bean, Chana, Maize, Jeera and Turmeric for the period from January 2010 to March 2015 traded in NCDEX. Authors found out that there were

long-run equilibrium relationships between futures and spot prices for all the 5 agricultural commodities that were taken for this study.

Chellasamy, and Anu, (2015) analyzed the relationship between spot and future prices of silver, crude oil, gold, copper and zinc in Indian commodity market from 1st of January 2014 to 28th of February 2015. Authors applied econometric methods such as Johansen co-integration test, ADF unit root test and Granger causality test to determine the relationship between spot price returns and future price returns of selected commodities in Multi Commodity Exchange India LTD. Authors concluded that the spot and future price returns of the selected commodities are co-integrated, and there is uni-directional causality between spot price return and future price return for commodities like gold and silver.

Babu, and Srinivasan, (2014) analyzed the relationship between spot and futures prices in Indian Commodities market. Authors selected 10 commodities based on the total turnover during the period from January 2012 to December 2012. Authors applied Johansen Co-integration test to examine the co-integration of commodities in Multi Commodity Exchange India Ltd. Authors concluded that the spot prices of the selected sample commodities had no influence on their futures prices.

Viswanathan, and Sridharan, (2014) examined the causal relationship between the price of Pepper in the spot and future market. Authors used the daily closing price of spot and future price of Pepper in National Commodities and derivatives exchange for the period from 2005-06 to 2012-13. They applied Pairwise Granger Causality test to analyze the relationship between the two series, and descriptive statistical analysis for this study. Authors found bi-directional causality between the price of Pepper in the spot and futures market.

Wang, and Wu, (2013) analyzed the co-integration relationships between crude oil spot and futures prices. Authors collected weekly price data of West Texas Intermediate (WTI) crude oil spot and futures traded in NYMEX covering the period from January 1986 to February 2011. They found that crude oil spot and futures prices are co-integrated only when the price differentials are larger than the threshold value. Authors concluded that the relationships between spot and futures prices are different between in the short-term and in the long-term.

Mall, et al. (2012) tried to examine the lead-lag relationship between the Nifty index and Nifty based index futures (FUTIDX) prices at NSE of India. Authors used daily data for the period from June 2000 to May 2011. Authors used the Co-integration and error correction modeling technique in this study. Authors concluded that the S & P CNX Nifty based index futures market tends to lead the underlying stock index over a long period of time.

Botterud et al. (2010) examined spot and futures prices from the hydro-dominated Nord Pool electricity market for eleven years. Authors found that futures prices tend to be higher than spot prices. They concluded that the relationship between spot and futures prices is clearly linked to the physical state of the system.

Zapata et al. (2005) tested the relationship between eleven futures prices traded in New York and the World spot prices for exported sugar from January 1990 to January 1995. Authors found that the future market for sugar leads the cash market. They also found unidirectional causality from futures price to spot price. According to the results of co-integration between futures and spot prices, authors concluded that sugar future contract is a useful vehicle for reducing overall market price risk faced by spot market participants selling at the world price.

Mattos and Garcia (2004) analyzed the relationship between spot and futures prices in the Brazilian agricultural market for the period from 1995 to 2003. Authors applied the co-integration and error correction methods for the study. In general, results demonstrated that higher trading activity was linked to the presence of long-run relationships between spot and futures prices. Overall, authors concluded that the level of market activity necessary to develop interactive cash and futures markets is small.

Data Source and Methodology:

Data used

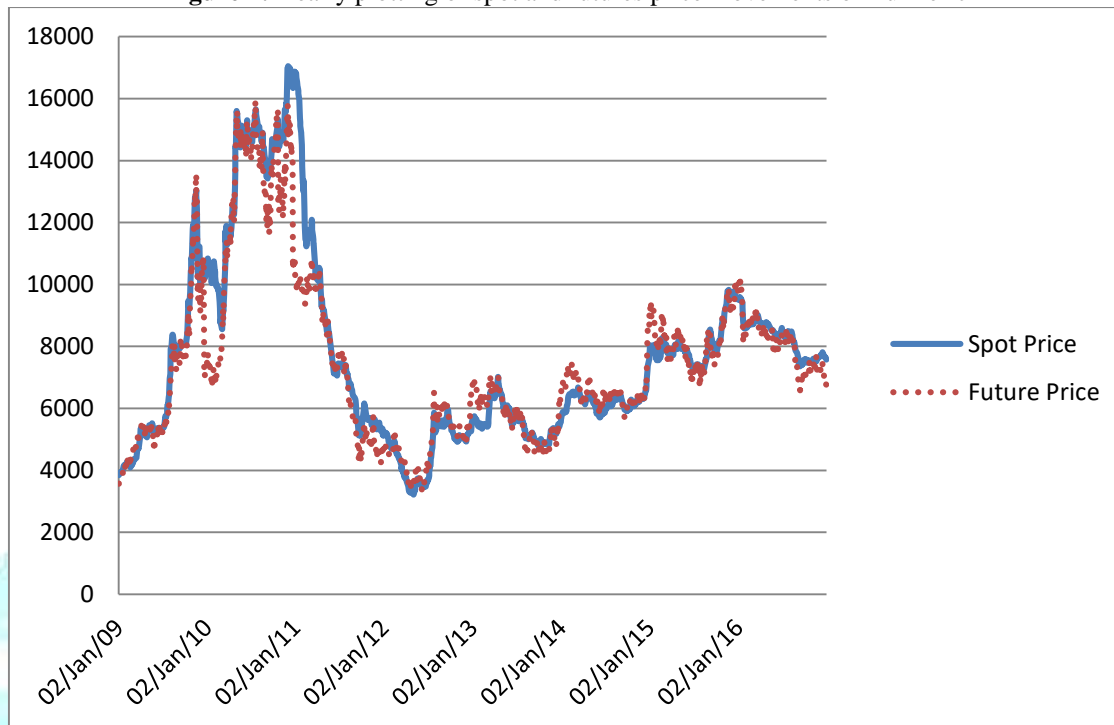
The study used daily data of spot and future price of Turmeric traded in National Commodity and Derivative Exchange (NCDEX) India, for the period from 1st of January 2009 to 31st of December 2016.

Tools used

This study, employed Descriptive statistics, Augmented Dickey Fuller (ADF) test, Phillips Perron (PP) test and Johansen Co-integration test. Augmented Dickey-Fuller (ADF) test and Phillips Perron (PP) test are employed to check whether the data series are stationary at level and first difference. Johansen's Co-integration test is employed to examine long-run relationship between spot and futures prices of Turmeric after they are integrated in an identical order.

Results and Discussion:

Figure 1, plots the yearly spot and future price movement of Turmeric for the period from 1st of January 2009 to 31st of December 2016. While observing these graphs, it has been concluded that the futures price of this commodity and the underlying spot market are moving into same direction. So there may be a chance to have an influence by the price of futures on the commodity spot market.

Figure 1: Yearly plotting of spot and futures price movements of Turmeric

Source: Survey Data

Descriptive Statistics

Table 1 present descriptive statistics for Turmeric traded in NCDEX in India from 1st of January 2009 to 31st of December 2016. The mean spot prices and futures prices of Turmeric are Rs7764.664 and Rs. 7513.509, respectively. The mean spot price of Turmeric is more than its mean future prices. Standard deviation, which is a tool for measuring volatility shows that the spot price of Turmeric is more volatile compared to its futures price. High standard deviation is observed in case of Turmeric prices indicating wide fluctuation in the prices. Normality is tested using Jarque- Bera test, where it is found that time series data is not distributed normally. Finally, regarding the asymmetry of the distribution of the series around their mean, authors found positive skewness for both spot price and futures price of Turmeric during the period of study.

Table1: Descriptive statistics of Turmeric

	SPOT_PRICE	FUTURES_PRICE
Mean	7764.664	7513.509
Median	7129.275	6996

Maximum	17047.05	15934
Minimum	3215.55	3374
Std. Dev.	3186.089	2770.461
Skewness	1.213161	1.185101
Kurtosis	3.754069	3.978337
Jarque-Bera	442.2125	450.3877
Probability	0	0
Sum	12765108	12352208
Sum Sq. Dev.	1.67E+10	1.26E+10

Source: Survey Data

Unit Root Test

In order to test the long run relationship between spot and futures prices of the turmeric, at first the authors examine the level of integration in the given commodity price series. This can be done by examining the unit root properties in Turmeric price series. In this paper, the authors use the augmented Dickey-Fuller (ADF) test and Phillips Perron (PP) test to examine whether the sample commodity price series are stationary or not. ADF test and PP test are based on the null hypothesis that the level series data of Turmeric is non-stationary.

Table 2 and 3 presents the results of ADF test and PP test for spot and future price of Turmeric traded in NCDEX India, from 1st of January 2009 to 31st of December 2016 in level series and in first difference series, respectively.

Table 2: ADF test result (in level series and first difference series)

Augmented Dickey-Fuller Test Statistics (ADF)												
market	Level						1 st Difference					
	Intercept		With Intercept & Trend		Without Intercept & Trend		Intercept		With Intercept & Trend		Without Intercept & Trend	
	t-Statistic	Prob. *	t-Statistic	Prob. *	t-Statistic	Prob. *	t-Statistic	Prob. *	t-Statistic	Prob. *	t-Statistic	Prob. *
Spot	-1.7743	0.3936	-1.913	0.6472	0.6521	0.8569	-29.259	0.0000	-29.28	0.0000	-29.254	0.0000
Futures	-2.3812	0.1473	-2.4342	0.3615	0.4196	0.8039	-38.482	0.0000	-38.492	0.0000	-38.489	0.0000

Source: Survey Data

*MacKinnon (1996) one-sided p-values.

Table 3: PP test result (in level series and first difference series)

market	Phillips-Perron Test Statistics (PP)											
	Level						1 st Difference					
	Intercept		With Intercept & Trend		Without Intercept & Trend		Intercept		With Intercept & Trend		Without Intercept & Trend	
	t-Statistic	Prob. *	t-Statistic	Prob. *	t-Statistic	Prob. *	t-Statistic	Prob. *	t-Statistic	Prob. *	t-Statistic	Prob. *
Spot	-1.9505	0.3092	-2.0623	0.5659	0.5313	0.8306	-31.497	0.0000	-31.476	0.0000	-31.512	0.0000
Futures	-2.5106	0.1131	-2.5554	0.3012	0.3756	0.7926	-38.551	0.0000	-38.556	0.0000	-38.558	0.0000

Source: Survey Data

*MacKinnon (1996) one-sided p-values.

Results of table 2 show the non-rejection of the null hypothesis of the ADF test for Turmeric price series indicating that all the commodity price series under study are non stationary at level series, but it is clear that the null hypothesis of no unit roots for time series are rejected at their first differences since the ADF test P-values are less than 0.05 at 5% level of significances according to table 2. Also results of table 3 show the non-rejection of the null hypothesis of the PP test for Turmeric price series indicating that all the commodity price series under study are non stationary at level series, but it is clear that the null hypothesis of no unit roots for time series are rejected at their first differences since the PP test P-values are less than 0.05 at 5% level of significances according to table 3. All the commodity price series become stationary by using first difference method in %5 level of significant. Then, can go forward to test the co integration among them using Johansen co-integration test.

Johansen Co-integration Test

After testing the non-stationary and stationary of time series, the authors applied Johansen Co-integration Test to test the co-integration between the stationary variables to determine the existence of a long-run relationship between the spot and futures prices of Turmeric traded in NCDEX. The result of Johansen Co-integration Test for spot and futures prices of Turmeric is displayed in Table 4.

Table 4: Johansen co-integration test results

Hypothesis	Trace Test			Maximum Eigen value Test		
	Trace Statistics	5% Critical Value	P-Value**	Max-Eigen Statistics	5% Critical Value	P-Value**
None*	41.82147	20.26184	0.0000	37.51471	15.89210	0.0000
At most 1	4.306758	9.164546	0.3683	4.306758	9.164546	0.3683

Source: Survey Data

* denotes rejection of the hypothesis at the 0.05 level

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

The results of table 4 show that there is evidence of co-integrating vector(s) according to the Trace statistic for Turmeric. That is between Turmeric spot price and futures price. The co-integration results demonstrate that the null hypothesis of no co-integration equation (none) between the spot price and futures price of Turmeric can be rejected using the 5% critical value. This implies that the Turmeric spot and futures prices are co-integrated with one co-integrating vector. The existence of co-integration between the spot and futures prices corroborates the first an important necessary condition for long-run market relationship. Based on the Johansen Co-integration Test, authors detect that there is a long-run relationship between spot and futures prices of Turmeric traded in NCDEX India for the period from 2009 to 2016.

Granger Causality Test

The causal relationship between the spot and future prices for Turmeric traded in NCDEX India from 1st of January 2009 to 31st of December 2016 is presented in table 5.

Table 5: Granger Causality test results

Null Hypothesis	F-Statistic	Prob.	Result
Spot does not Granger Cause Future	5.60863	0.0037	Bi-directional Causality
Future does not Granger Cause Spot	36.7351	2.00E-16	

Source: Survey Data

The results of table 5 show that there is a bi-directional causality relationship between the spot and futures prices of Turmeric traded in NCDEX India from 1st of January 2009 to 31st of December 2016. It indicates that future prices influence spot prices and vice versa. So the hypothesis that future prices cause spot prices and vice-versa is accepted.

Conclusion:

The present study examined the long-run relationship between spot and futures prices of Turmeric traded in NCDEX India for the period from 2009 to 2016 in order to ascertain which series provides an indication of the other in the future. Augmented Dickey Fuller (ADF) and Phillips Perron tests were applied on the daily spot and futures data series demonstrate that both the spot and futures data series are non-stationary at level but are stationary at first difference, which is the necessary condition for testing co-integration and causality. According to the results of Johansen Co-integration test and Granger Causality test, authors concluded that there is a long-run relationship and bidirectional causality relationship between the spot and futures prices of Turmeric traded in NCDEX India for the period from 2009 to 2016.

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