Nexus between Spot & Futures Price of Cardamom

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ABSTRACT

The purpose of this study is to investigate whether there exists any kind of relationship between the spot and future prices of cardamom traded in MCX from February 2006 to March 2012. For this purpose, ADF test and PP test are used in testing the stationarity whereas Johansen Co-integration test is used in testing the long-run relationship which exhibits that there exists a long-run relationship. Moreover, the result of Granger Causality supports the fact that there exists a bi-directional relationship which helps the players to gain from the derivative market.

KEY WORDS: ADF test, PP test, Stationarity, Johansen Co-integration, Granger Causality

JEL Classification: G13, G14

INTRODUCTION

The Price discovery is the process of determining the price of a commodity based on supply and demand factors. The Futures markets play an important role in the price discovery of agricultural commodities. Futures contracts are originally developed as new financial instruments for price discovery and risk transfer. The Price Discovery function is the existence and development of futures market foundation and the market participants can use futures market price discovery function to make relevant decisions in order to improve their ability to adapt to the market.

The movements of spot market price have been largely influenced by the speculation, hedging and arbitrage activity of futures markets. The influence of futures market on the spot market and the vice-versa makes price discovery become increasingly important. It provides an idea about the market efficiency, volatility, hedging effectiveness and arbitrage opportunities if any. Both markets contribute to the discovery of a unique price which is the efficient price. The essence of price discovery function hinges on whether new information is reflected first in changes of future prices or changes of spot prices. In reality, the existence of market frictions and non-synchronous trading effects may induce lead-lag relationship between the futures contract and its underlying spot market. It implies that futures and spot market prices are inter-related and can be traced under different market frictions through price discovery mechanism.

This Present study aims at investigating the price relationships both short-term and long-term between the futures and spot market of cardamom along with examining the lead-lag direction between changes in the price of futures contracts and changes in spot prices. Owing to the increasing demand for spices at global market trading in spices futures has also grown, especially cardamom the queen of spices adding a zing to the commodity portfolio as only those products that have great demand and large supply, a long shelf life and whose prices are fluctuating, serving as an excellent hedging tool.
REVIEW OF LITERATURE

Gardbade and Silber (1983) used daily spot and futures prices to understand the price discovery process in four storable agricultural commodities (wheat, corn, oats and orange juice) and found that the futures markets dominate the spot markets for wheat, corn and orange juice, but for oats the results were not clear enough.

Kumar and Sunil (2004) investigated the price discovery in six Indian commodity exchanges for five commodities along with analysing the efficiency of spot and future markets and found the inability of future market to fully incorporate information and confirmed in efficiency of future market. However concluded that the Indian agricultural commodities future markets are not yet mature and efficient.

Mattos & Garcia (2004) analyzed the lead-lag relationship between spot and futures prices in the Brazilian agricultural markets for coffee (Arabica), corn, cotton, live cattle, soybeans and sugar and found mixed results. It was found that the futures and the spot prices were co-integrated in the case of live cattle and the coffee markets. Besides, the analysis revealed that there was no co-integrating relationship in the thinly trade markets like corn, cotton, soybeans.

Gupta and Belwinder (2006) examined the price discovery mechanism in the NSE spot and future market using the daily closing values of index future S&P CNX Nifty, from June 2002 to February 2005 and found that there existed stronger casual relation from Nifty futures to Nifty index as compared to the vice-versa along with bilateral causality between the Nifty index and futures.

Praveen and Sudhakara (2006) attempted to study a comparison of price discover between stock market and the commodity future market taking Nifty future traded on National Stock Exchange (NSE) and gold future on Multi Commodity of India (MCX). The result empirically showed that the one month Nifty future did not have any influence on the spot Nifty, but influenced by future Nifty itself. The casual relationship showed that gold future price influenced the spot gold price, but not the contrary implying that information is first disseminated in the future market and then later reflected in the spot market. The study on spot prices of gold during the period of April 2002 to June 2005 showed that the Indian gold prices volatility is relatively higher than global market and Indian stock market has declined during the period of study.

Kailash Chandra Pradhan & K. Sham Bhat (2009) investigated price discovery, information and forecasting in Nifty futures Markets and found that the spot market leads the futures market and spot prices tend to discover new information more rapidly than futures prices showing clearly the importance of taking into account the long-run relationship between the futures and the spot prices in forecasting future spot prices.

Mantu Kumar Mahalik, Debashis Acharya & Suresh Babu M (2009) examined the price discovery and volatility spillovers in Indian spot-futures commodity markets and used four futures and spot indices of Multi-Commodity Exchange (MCX), from June 2005 to December 2008. The results indicated that commodity futures markets like agriculture future price index (LAGRIFP), energy future price index (LENERGYFP), and aggregate commodity index (LCOMDEXFP) effectively serves the price discovery function in the spot market implying that there is a flow of information from future to spot commodity markets but the reverse causality does not exist while there is no co-integrating relationship between metal future price index (LMETALFP) and metal spot price index (LMETALSP). Besides the results also indicates that although the innovations in one market can predict the volatility in another market, the volatility spillovers from future to the spot market are dominant in the case of LENERGY and LCOMDEX index while LAGRISP acts as a source of volatility towards the agri-futures.

Yajie Wang, Xiaofeng Hui, Yan Liu (2009) examined the dynamic relationship between the price of spot and futures of soybeans traded in Dalian Commodity Exchange along with analyzing quantitatively the magnitude of the role of futures market in price discovery and found that the spot and futures prices are co-integrated over the long term, and though they interact strongly, spot prices impact futures prices more heavily, showing unidirectional feedback.
Iyer.V & Pillai.A (2010) examined the role of futures market in the price discovery process using a two-regime threshold vector auto-regression (TVAR) and a two-regime threshold auto-regression for six commodities. The findings revealed that the rate of convergence of information is slow, particularly in the non-expiration weeks and also finds evidence for price discovery process happening in the futures market in five out of six commodities.

Manuel Hernandez and Maximo Torero (2010) examined the dynamic relationship between the spot prices and futures prices of agricultural commodities corn, wheat and soybeans and found that changes in futures prices lead changes in spot prices more often than the reverse.

Biswas.S & Rajib.P (2011) analyzed two competing models in price volume relationships in Indian commodity futures market. The findings exhibited contemporaneous correlation between volume and price change in some of the cases, but in general on the basis of the presence of Granger causality it followed that SIH is supported.

Prem Shah (2013) investigated the relationship between the spot and future prices of cocoa, coffee, crude oil, gold, natural gas and silver, and found that there exists a long-run relationship for all except crude oil. The reason behind the absence of long-run relationship might be the dramatic price movement in the recent period since crude oil is the worldwide traded energy commodity, and a bi-directional causal relationship also exists between the spot and futures prices of all commodities except natural gas and silver.

OBJECTIVES OF THE STUDY

• To identify the long-run equilibrium relationship between the spot and futures prices of MCX Cardamom
• To ascertain the Lead-Lag relationship between the spot and futures prices of MCX Cardamom

HYPOTHESES

• H01=There is no significant relationship between the spot and futures prices of cardamom in the long-run.
• H02 = There is no lead-lag relationship between the spot and futures prices of cardamom.

DATA & METHODOLOGY

The study is based on secondary data. The data for establishing price discovery and relationship between spot and futures prices of cardamom were collected from Multi-Commodity Exchange. MCX has launched cardamom futures on February 2006. The spot and futures prices from February 2006 to March 2012 released by MCX Ltd., are utilized for the study. The data relating to price series have been taken from their website www.mcxindia.com.

Johansen’s Co-integration approach and Granger causality have been employed to investigate the price discovery process in spot and futures market of cardamom in MCX. It is necessary to test the stationary of the series before doing co-integration analysis. The Augmented Dickey-Fuller (1979) test was employed to infer the stationary of the series. If the series are non-stationary in levels and stationary at differences, then there is a chance of co-integration relationship between them which reveals the long-run relationship between the series. Johansen’s co-integration test has been employed to investigate the presence or absence of long-run relationship between spot and futures price of cardamom. The co-integration statistics is based on comparing the number of co-integrating vectors under the null and alternative hypotheses. The empirical results presented in this paper were calculated by using a simple Granger-causality test so as to find out whether futures prices” Granger cause” spot prices and vice versa.

The following two equations were used to specify Granger causality:

\[
X_t = \alpha_0 + \sum_{k=1}^{\infty} \beta_{kj} y_{t-j} + \mu_t \quad \text{----------------- (1)}
\]

\[
y_t = \alpha_0 + \sum_{k=1}^{\infty} \beta_{kj} x_{t-j} + \mu_t \quad \text{------------------ (2)}
\]

Here \(k\) is the suitably chosen integer, \(y_j\) and \(B_j, j=0, 1, \ldots, k\) parameters, \(\alpha\) is a constant whereas \(\mu_t\) is an error term with zero means and finite variance. The null hypothesis that \(Y_t\) doesn’t granger
cause $X_t$ is not accepted if $\beta_j \neq 0$ as in equation 1, are jointly different from zero using a standard test. Similarly, $X_t$ Granger causes $Y_t$, if $y_j \neq 0$, coefficients in equation 2 are jointly different from zero.

**EMPIRICAL ANALYSIS & RESULTS**

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Futures Price</th>
<th>Cardamom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>763.5821</td>
<td>721.7685</td>
</tr>
<tr>
<td>Median</td>
<td>689.7500</td>
<td>645.7000</td>
</tr>
<tr>
<td>Maximum</td>
<td>2038.200</td>
<td>1770.000</td>
</tr>
<tr>
<td>Minimum</td>
<td>218.9000</td>
<td>229.4000</td>
</tr>
<tr>
<td>Std.Dev.</td>
<td>352.9841</td>
<td>338.5025</td>
</tr>
<tr>
<td>Skewness</td>
<td>1.012676</td>
<td>1.056481</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>3.746582</td>
<td>3.726639</td>
</tr>
<tr>
<td>Jarque-Bera</td>
<td>353.1466</td>
<td>378.3982</td>
</tr>
<tr>
<td>Probability</td>
<td>0.000000</td>
<td>0.000000</td>
</tr>
</tbody>
</table>

**Source:** Computed Secondary Data

The table 1 presents summary statistics of futures and spot prices of cardamom. Skewness and Kurtosis are the estimated centralized third and fourth moments of the data. The skewness of a symmetric distribution should be 0 and the kurtosis should be around 3. Jarque-Bera reports that the null hypothesis is that the series follow a normal distribution. As a rule of thumb the 5% critical value is around 6. For values greater than 6 $H_0$ can be rejected. It also confirms this finding, rejecting the null hypothesis of normality at 1% level.

Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests have been used to test the stationarity of the data series. The ADF test uses the existence of a unit root. The distribution theory supporting the ADF assumes that the errors are statistically independent and have a constant variance. PP test allows the disturbances to be weekly dependent and heterogeneously distributed.

<table>
<thead>
<tr>
<th>Variable</th>
<th>ADF Test At Levels</th>
<th>1st Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Futures Cardamom</td>
<td>-1.754549</td>
<td>-42.15810*</td>
</tr>
<tr>
<td>(p value)</td>
<td>0.4035</td>
<td>0.0000*</td>
</tr>
<tr>
<td>Spot Cardamom</td>
<td>-1.627686</td>
<td>-17.89182*</td>
</tr>
<tr>
<td>(p value)</td>
<td>0.4681</td>
<td>0.0000*</td>
</tr>
</tbody>
</table>

**Source:** Computed Secondary Data  *

The table 2 gives the estimates of the ADF & to double check the robustness of the results, PP test has also been applied for the prices at the levels and difference of the series. The ADF Statistics at level for Cardamom (-1.754549), spot(-1.627686) and the PP Statistics for Cardamom futures (-1.688247), spot(-1.531474) indicates that the computed value of statistics are all insignificant at the 5% significance level for both ADF and PP tests. The results fail to reject the null hypothesis of unit roots in their level form. Thus, implying that there is no possibility of the series to be stationary around a constant mean or around deterministic linear trend. Therefore the first difference of all series is tested for stationary of the series. The results revealed that the value of statistics for cardamom is significant at the 1% level indicating the rejection of null hypothesis of the existence of a unit root for each of the price series in their first difference. Thus all the prices series need to be differenced once in order to achieve stationarity and they are confirmed to be integrated of order one.

All the results of the Dickey & Fuller and Phillips Perron unit root tests of the price series for cardamom showed that both the spot and futures price series are not stationary at their initial levels but...
became stationary at the first difference. Once the series are integrated in an identical order, co-integration test should be employed to investigate the long-run relationship between spot and futures prices.

Table 3: Long Term Relationship between Futures and Spot Price of Cardamom

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Hypothesis</th>
<th>Trace Statistics</th>
<th>Max-Eigen Statistics</th>
<th>Cointegration/Non-Cointegration</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCX-Cardamom</td>
<td>$H_0: r = 0$</td>
<td>Trace: 88.01299* p-value: 0.0000*</td>
<td>$\lambda_{max}$: 82.78384* p-value: 0.0001*</td>
<td>Co-integrated</td>
</tr>
<tr>
<td></td>
<td>$H_0: r \leq 0$</td>
<td>Trace: 5.229150 p-value: 0.7840</td>
<td>$\lambda_{max}$: 5.162733 p-value: 0.7211</td>
<td></td>
</tr>
</tbody>
</table>

Source: Computed Secondary Data
*- denotes significance level at 1%

The table 3 gives the results of co-integration tests. The results of the Johansen trace and max indicate that the null hypothesis of non-co-integration($r=0$) is rejected at the one percent significant level for cardamom stating that there are co-integrations between the spot and futures prices in case of cardamom with the existence of long-term market efficiency and indicates that the futures prices efficiently predict subsequent spot prices or the futures prices provide enough information about the movement of the spot prices. Although co-integration method helps to illustrate the relationship between the futures and spot prices of pepper, they do not imply causation. Granger Causality is used to provide information about causal relations, (i.e.) whether spot influences futures of vice-versa.

Table 4: Lead-Lag Relationship between Futures and Spot Price of Pepper

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Null Hypothesis</th>
<th>F-statistic</th>
<th>Probability</th>
<th>Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCX-Cardamom</td>
<td>F→ S</td>
<td>86.25833*</td>
<td>0.0000*</td>
<td>Bi-directional</td>
</tr>
<tr>
<td></td>
<td>S→ F</td>
<td>21.58673*</td>
<td>0.0000*</td>
<td></td>
</tr>
</tbody>
</table>

Source: Computed Secondary Data

The table 4 shows the results of Granger causality test for spot and futures prices of cardamom. The upper row of the f-statistic column for each commodity states the null hypothesis that futures price does not Granger-cause spot price, the lower row reports the f-statistic for the null hypothesis that spot price does not Granger-cause futures price. The Granger causality test results show bi-directional flow of information in case of cardamom. It implies that future prices Granger cause spot prices. This shows both the spot and futures markets are equally responsible for the price discovery process implying that the futures markets help discover prices in the spot markets and that the markets are efficient. The causality results also suggested that information flow from futures market to spot markets were increased over the years. This apparent increase in information flows could be attributed to the increase in the relative importance of electronic trading of futures contracts in recent years, which results in more transparent and widely accessible prices.

CONCLUSION

The futures markets and spot markets are having close relationship. The fast information transmission between two markets influences the volatility in one markets cause the leading changes in another. This paper empirically analyzed the long-term relationship between spot and futures prices of cardamom from MCX. The results revealed that there is a co-integrating relation between, which means that a necessary condition for market efficiency is satisfied. The causality tests performed indicate that price changes in futures markets lead price changes in spot markets and vice-versa., especially when examining returns. These findings support the price discovery role of futures markets and suggested that the information flow from futures to spot markets has been probably due to the increase in the relative importance of electronic trading of futures contracts over open auction trading, which results in more transparent and widely accessible prices thereby stating that futures trade can be continued in case of cardamom as the introduction of cardamom futures has created great consciousness to cultivate graded variety as well as provide greater information regarding current and futures prices of cardamom.
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