THINK INDIA JOURNAL

ISSN: 0971-1260

Vol-22-Issue-14-December-2019

"*Price Discovery of Indian Sugar Futures Market*"

DR. M. SAMNA[1]

DR. A. R. SADAR[2]

Abstract

Sugar Cane is the majour crop in india. Lot of farmers and labour force are engaged in Sugar cultivation and contribute in industrial production of various by products. This paper dicuss the importance of Commodity derivatives market related to Sugar in india and its involvement in Sugar price discovery process. Specialy focusing on the led lag relationship in Spot and Future prices.

Key Words:- Commodity Derivatives, Sugar Futures market , Price discovery.

---

[1]Assistant Professor of Commerce,Iqbal College, Perigammala-695563, University of Kerala**.** samnasm@gmail.com. *Mob: +91-8547036940.*

[2]Founder & Managing Director, Finformation - Edification & Consulting Pvt. Ltd, Kerala. dr.sadar@finformation.org. *Mob: +91-7025687589.*

1. Introduction

Sugarcane is the main sugar-producing crop that contributes nearly 75% to the total sugar pool at the global level. Sugar is a commodity of mass consumption and the cheapest source of energy in India, supplying around 10% of the daily calorie intake. India is the second largest producer of sugar, falling marginally behind Brazil, and also the largest consumer of sugar in the world, with the demand nearly equaling the supply in most cases.

ISSN: 0971-1260

Vol-22-Issue-14-December-2019

The sugar industry is the largest agro based industry located in rural India. About 50 million sugarcane farmers, their dependents, and a large mass of agricultural labourers are involved in sugarcane cultivation, harvesting, and ancillary activities. They constitute about 7.8% of the rural population.

India is one of the largest sugar producing countries in the world, having a share of over 15% of the world's sugar production. India is also among the largest consumers of sugar in the world. There are over 480 installed sugar mills in India with a production capacity of over 20 million MT of sugar. The average per capita consumption of sugar in India is estimated to be 20kg/year. In the last few years the per capita consumption has been increasing at a steady 3.7% annually.

2. Objectives of the Study

The objective here is to build the price dynamics between NCDEX Sugar spot and futures prices. Specifically, to test whether the Sugar futures contract is in fact providing price discovery benefits to Sugar market participants in India, or whether the future market sometimes leads the spot market in price discovery.

i. To identify the price discovery function of NCDEX Sugar futures

ii. To identify the lead – lag relationship between spot and future Sugar Futures

iii. To identify whether the future market is efficient or not

3. Data used for analysis

The data used in this analysis consists of the daily closing of NCDEX Sugar futures contract prices from 01/2012 - 1/2015, and daily closing NCDEX

ISSN: 0971-1260

Vol-22-Issue-14-December-2019

Spot price on the same period. This gives a total of 952 data points for both series. Futures contracts on NCDEX Sugar Future are specified in trading units Rs./100Kg and Spot price trading in Rs./100Kg.

4. Methodology

As the secondary data is in the form of time series, time series analysis is the appropriate method for this analysis. Some important econometric models are used for the study. In order to test the price discovery and market efficiency of commodity future market, Augmented Dicky Fuller (ADF) test, Philip-Perron (PP) test, Johansen Co-integration test, Pair-wise Granger Causality test etc. are done separately for each commodity markets.

4.1 The Test of stationarity

The test of stationarity is known as Unit Root Test. Augmented Dicky Fuller (1981) and Philip and Perron (1988) tests are the most commonly used test for stationarit and are based on the fact that a non- stationary series is characterized by a Unit Root. The present study also used these two tests and result proves that the spot and future series are non- stationery at its level and become stationery in its first difference. These two series have a unit root. It can be concluded that the spot and futures follow I (1) process.

A series Yt is integrated of order one or contains a Unit root, if Yt is non-stationery, but ΔYt is stationery. Dicky and Fuller (1981) devised a procedure to formally test non-stationerity. According to them, testing for non-stationarity is

ISSN: 0971-1260

Vol-22-Issue-14-December-2019

equalent to testing for the existence of a Unit root. It is based on the simple AR (1) model. It needs to examine whether φ is equal to one. So the null hypothesis is H0= φ=1 and the alternate hypothesis is Ha= φ<1.

1. **Augmented Dicky Fuller Test:**

   The ADF equation can be written as

   $\Delta Yt\text{-}1 = ao + \gamma Yt\text{-}1 + \Sigma \text{ P al } \Delta Yt\text{-}1 + Ut$

   This test assumes that there is at most one unit root and the error term is a white noise. The null hypothesis is that unit root exists. If the test statistic is smaller than the corresponding critical values, the hypothesis may be rejected.

2. **Philips-Perron Test**:

   The test of regression for the Philip-Perron test is AR (1) process.

   $\Delta Yt\text{-}1 = a0 + \beta Yt + 1 + et$

   PP test makes a correction to the t static of the coefficient γ from the AR (1) regression to account for the serial correlation in et. In this test also the null hypothesis is that unit root exists. The null hypothesis may be rejected, only when the test statics is smaller than the corresponding critical values.

4.2 Co-integration Test:

If both the future price and spot price series are I (1) process, Johansen's Co-integration tests can be conducted in order to check the co-integration. Before testing for co-integration, each individual series should be examined for I (1) first. Unit root tests such as ADF and PP test are done for both series. ADF test

ISSN: 0971-1260

Vol-22-Issue-14-December-2019

construct a parameter correction for higher- order correlation by assuming that the series follows an AR (P) process and adding lagged difference terms of the dependent variable to the right hand side of the regression.

$$\Delta Yt = a + \beta t + (P-1)Yt-1+\theta 1\Delta Yt-1+ \theta 2\Delta Yt-2+.....+\theta k-1\Delta Yt-k+1+wt$$

Where 'Δ' is the first difference,'t' a time trend variable, wt a white noise and 'k' the lagged number.

Johansen (1988) suggested two test statistics to test the null hypothesis that there is at most 'r' co-integrating vectors. The two test statistics are based on trace and maximum Eigen values, respectively.

In present test for efficiency of future market, Yt = (Ft, St), n=2, and the null hypothesis should be tested for r = 0 and r = 1.

If r =0 cannot be rejected, we will conclude that there is no co-integration. Otherwise, if r = 0 is rejected, and r = 1 cannot be rejected, we will conclude that there is a co-integration relationship.

If the future pre and spot price are not co-integrated, it n be concluded that there is inefficiency. Co-integration is a necessary condition for market-efficiency.

4.3 Pair-wise Granger Causality Test: -

Correlation does not necessarily imply causation. The econometric graveyard is full of magnificent correlations, which are simply spurious or meaningless. The Granger (1969) approach to the question of whether x causes y is to see how much of the current y can be explained by past values y of and then

ISSN: 0971-1260

Vol-22-Issue-14-December-2019

to see whether adding lagged values x of can improve the explanation. 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's are statistically significant.

Note that two-way causation is frequently the case; x Granger causes y and y Granger causes x. 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. Granger causality measures precedence and information content but does not by itself indicate causality in the more common use of the term.

5. Analysis and Interpretations

This study analyses the NCDEX spot price and NCDEX future prices of sugar for selected period. The result and interpretations are given below.

Each of the logarithmic price series were examined for I (1). The Augmented Dicky Fuller Test and Philip Perron Test were performed to test the stationary of the data. The results of both the test with intercept, with trend & intercept, without trend & intercept etc are done and given in the Table 1.1 & Table 1.2 Both the test suggests the existence of unit root in each of the price series. The test result also revealed that all price series data are stationery in their first difference.

Table 1.1
The statistics of Augmented Dicky Fuller Unit Root Test

	Intercept	Trend & Intercept	Without trend & Intercept

ISSN: 0971-1260

Vol-22-Issue-14-December-2019

St	-0.911615	-0.980105	0.938725
ΔSt	-30.17101	-30.17120	-30.15361
Critical value at 1%	-3.433157	-3.962105	-2.565068
Ft	-1.025145	-1.691215	0.607260
ΔFt	- 48.45801	- 48.44729	- 48.45761
Critical value at 1%	-3.433174	-3.962281	-2.566025

Table 1.2
Test Statistics of Philip Perron Unit Root Test

	Intercept	Trend & Intercept	Without Trend & Intercept
St	-0.878076	-0.979213	0.948181
ΔSt	- 47.10273	- 47.09621	- 47.12138
Critical value at 1%	-3.433174	-3.962201	-2.565025
Ft	-0.968756	-1.692215	0.653852
ΔFt	- 48.49565	- 48.46576	- 48.42452
Critical value at 1%	-3.433084	- 3.961301	-2.565835

In all the above cases the test statistics are smaller than the corresponding critical value. So we can reject the null hypothesis. The test result also revealed that all the price series data become stationery after the first order difference.

ISSN: 0971-1260

Vol-22-Issue-14-December-2019

There for it can be concluded that each of the logarithmic price series is I (1) in NCDEX spot and future market.

The confirmation that each series is I (1) allows us to proceed to Johansen Co-Integration test. With the help of ADF and PP test, it can be identify that both the series have long run relationship and co-integration was tested using Johansen Co-integration test. Based on this co-integration test, Vector Error Correction Model was used to determine the effects of shocks in the short run and long run equilibrium.

As there are only two series involved, the number of co-integrating can be at most one for each series. The null hypothesis of the Johansen test is that there are at most ($0 \leq r \leq k$) co-integrating vectors. The Eigen Values, trace statistics, max eigen value, and critical values are the test statistics of co-integration test which was provided.

Table 1.3
Test Statistics of Johansen Co integration Test

		Eigen Value	Trace stat	Critical value at 5%	Max Eigen value	Critical value at 5 %
Intercept	Ho:r = 0	0.025501	56.33188	1.49471	55.62639	17.14768
	Ho:r = 1	0.000326	0.705476	3.841466	0.705474	3.841465
Intercept & trend	Ho:r = 0	0.033534	74.39098	18.39771	73.44364	17.14768
	Ho:r = 1	0.000437	0.947319	3.841466	0.947317	3.841465
Without trend & Intercept	Ho:r = 0	0.021741	48.23619	12.32090	47.33179	11.22478
	Ho:r = 1	0.000418	0.094394	4.129906	0.904391	4.129902

ISSN: 0971-1260

Vol-22-Issue-14-December-2019

The results of Johansen's Co-integrating vector (r=0) can be rejected for Sugar futures as the trace- statistics and max- eigen values are higher than the critical value at 5 percent level.

In case of sugar futures trace test and max-eigen value test indicates there is one-integrating equation at 5 percent level, while analyzing the co-integration test with trend and intercept, without trend & intercept and intercept. This empirical result is clear evidence for co-integrating relationship in NCDEX sugar futures and NCDEX sugar spot market. It means that there is price discovery process in two market (NCDEX spot market and NCDEX future market), as the co-integration of these two market is a necessary condition for price discovery.

Only after determining the co-integrating relation between NCDEX future and spot market, the parameters of a bivariate co-integrating Vector Error Correction Model (VECM) was estimated, to determine the number of co-integrating vector. The variables are included in two lag form for NCDEX spot prices and future prices. The results of the estimated models are presented in the Table 1.4.

The VECM allows for the short run shocks and estimates the degree of convergence towards the long run relationship. The results indicates that the co-efficient of at least one error correction term was significant for spot and future prices of sugar in NCDEX. Thus it confirming the presence of co-integration between the spot and future prices of sugar in NCDEX.

Table 1.4
Vector Error Correction Model

ISSN: 0971-1260

Vol-22-Issue-14-December-2019

Variables	Δ Spot Price (NCDEX)		Δ Future Price (NCDEX)	
	Co-efficient	T-Value	Co-efficient	T-Value
Equilibrium Error	- 0.026357	- 4.98447	0.045373	5.54261
ΔSpot Price (-1)	- 0.037183	- 1.72207	- 0.039729	- 1.18852
ΔSpot Price (-2)	0.086409	4.05339t	0.052089	1.57834
ΔFuture Price (-1)	0.083459	5.83463	- 0.015896	- 0.71782
ΔFuture Price (-2)	0.057137	3.98484	- 0.023528	- 1.05993
Constant	7.15E-05	0.88466	8.20605	0.65561

The co-efficient of the error correction term was negative and significant in case of NCDEX spot price equation. This means that NCDEX spot price of sugar is stable in the long run and any deviation in their prices due to external shocks, occurred in short run was well adjusted the market forces overtime. The coefficient of error equilibrium was -0.026357 in spot price of sugar in NCDEX, which indicates that when the average Sugar price in NCDEX was too high, it immediately falls back towards Future prices of sugar in NCDEX. That means the Sugar spot price corrects to its previous periods dis-equilibrium by 2.6 percent. This result indicates that there exists long run relationship between Spot prices and future prices of sugar in NCDEX, and the adjustment towards equilibrium is made by Spot prices. It also provides that unidirectional lead-lag relationship existing here. In case of short run causality, changes in sugar spot prices with respect to lagged changes in sugar future price seems to be unidirectional. This results imply that price discovery of sugar price occurred in Future market, from there the information flows to the Spot market of sugar.

Pair-Wise GRANGER CAUSALITY Test Result: This analysis mainly focus on the relationship between spot and future price and also to examine the

ISSN: 0971-1260

Vol-22-Issue-14-December-2019

causality relationship between the future market price and future market price of sugar. Results of the test is given in the table 1.5.

Table 1.5
Pair-Wise GrangerCausality Test Result

Commodity	Null Hypotheses	Observation	lags	F-statistics	Probability
Sugar	NCDEX spot price does not granger cause NCDEX future price	947	5	6.51884	5.E-06
	NCDEX future price does not granger cause NCDEX spot price	947	5	19.6018	4.E-19

Table 1.5 shows the test result of Granger causality test, that high F- Value (6.51884) and corresponding low P-Value (5.E-06) is against the null hypothesis. Thus changes in spot price causes changes in future price of sugar. Similarly, high F-value (19.6018) and corresponding low P-Value (4.E-19) is also the evidence against the null hypothesis. Thus changes in future price causes changes in spot price of sugar. Thus there is two-way causality.

6. Findings and Conclusions

The unit root tests such as ADF and PP test result shows that price series data become stationary in their first difference. The confirmation that each series is I (1) allows us to proceed to Johansen co-integration test. The trace test and eigen value test indicates there is one co-integrating equation at 5 percent level, while analysing the co-integration test with intercept & trend, without intercept & trend. It reveals that there is co-integrating relationship between NCDEX sugar

ISSN: 0971-1260

Vol-22-Issue-14-December-2019

futures and NCDEX sugar spot markets. It means that there is price discovery process in two market, as the co-integration of these two market is a necessary condition for price discovery.

After the determination of the co-integrating relation between spot and future markets of sugar, the parameters of a bivariate co-integrating Vector Error Correction Model (VECM) was estimated to determine the number of co-integrating vector. The results indicates that the co-efficient of at least one error correction term was significant for sugar spot and futures in NCDEX. It confirms the presence of co-integration between sugar spot market and future market. The co-efficient of error correction term was significant for sugar spot price in NCDEX. It means that sugar spot prices are stable in long run and any deviation in their prices due to external shocks, occurred in short run was well adjusted the market forces over time. It indicates that when the average sugar spot price was too high, it immediately falls back towards sugar future price. That means the spot price of sugar corrects to its previous periods dis-equilibrium by 2.6 percent. This result implies that price discovery of sugar occurred at future market and the information flows to the spot market. Pair-wise granger causality test shows the causality relationship between sugar spot market and future market. Result shows two way causality, means that changes in spot market price causes changes in future market price and vice versa.

7. References

ISSN: 0971-1260

Vol-22-Issue-14-December-2019

1. Ardeni, P G. “Does the Law of One Price Really Hold for Commodity Prices?” American Jour- nal of Agricultural Economics 71(1989):661– 669.
2. Baillie, R.T. and R.J. Myers. “Bivariate Garth Es- timation of the Optimal Commodity Futures Hedge.” Journal of Applied Econometrics 6(1991):109–124.
3. Bessler, D.A. “An Analysis of Dynamic Economic Relationship: An Application to the U.S. Hog Market. ” Canadian Journal of Agricultural Economics 32(1984): 109–1 24.
4. Bessler, D.A. and T. Covey. “Cointegration: Some Results on U.S. Cattle Prices. ” Journal of Fu- tures Markets 11(199 1):46 1–474.
5. Bessler, D.A. and S.W. Fuller. “Cointegration be- tween U.S. Wheat Markets. ” Journal of Re- gional Science 33(1993):481–501.
6. Bessler, D.A. and E.W.l? Peterson. “Cotton l%ices in the U.S. and Northern Europe: Government Policies Affect Cointegration. ” Working paper, 1996.
7. Brenner, R.J. and K.17 Kroner. “Arbitrage, Cointe- gration, and Testing the UnbiasednessHypoth- esis in Financial Markets. ” Journal of Financial and Quantitative Analysis, 30(1995):23–42.
8. Chalmin, I? (cd.). International Commodity Markets Handbook 1992. Woodhead-Faulkner Limited, England, 1992.
9. Chowdhury, A.R. “Futures Market Efficiency: Ev- idence from Cointegration Tests. ” Journal of Futures Markets 11(1991):577–589.

ISSN: 0971-1260

Vol-22-Issue-14-December-2019

10. Covey, T. and D.A. Bessler. “Asset Storability and the Information Content of IntertemporalPric- es. ” Journal of Empirical Finance 2(1995): 103–15.
11. Crain, S.J. and J.H. Lee. “Volatility in Wheat Spot and Futures Markets, 1950–1 993: Government Farm Programs, Seasonality, and Causality.” Journal of Finance 5 1(1996):325–343.
12. Dickey, D.A. and W.A. Fuller. “Distribution of the Estimators for Autoregressive Time Series with a Unit Root. ” Journal of the American Statis- tical Association 74(1979):427–43 1.