MARKET EFFICIENCY AND TREND ANALYSIS OF SPOT AND FUTURES COMMODITY MARKET IN INDIA – AN ANALYTICAL STUDY

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ABSTRACT

The present paper explores the presence of association, trend and long term price efficiency between the Spot and Futures Commodity Derivatives Market in India. The study uses descriptive, correlation analysis to test the association, Augmented Dickey Fuller (ADF) test for stationarity, Mann-Kendall analysis for trend and Engel-Granger test for long term efficiency between Commodity Spot and Futures market. The analysis done by using the MCX four major Comdex, Agri, Metal and Energy Spot as well as Futures indices. It is concluded that trend exists between spot and future commodity indices and found efficient.

Keywords: *Commodity futures, growth, trend, derivatives, commodity exchange, Agriculture and Non-Agriculture Commodities.*

1. Introduction

In a liberalized, integrated and free market economy, by nature volatility and risk is an imperative concern for every individual investor, traders, producers and enterprises in stabilizing and protecting their value of wealth. The prices of commodities and securities generally determined by market forces like collective interaction of demand and supply determines the price. Hence, the speed, frequency and magnitude of price changes can increase the volatility in commodity and assets prices in general.

2. Review of Literature

Ahuja (2006) analyzed the Commodity Derivatives market in India. And found that the commodity futures market in India has recorded spectacular growth to reach a one trillion mark in 2006. However, several challenges have to be overcome for further stability and persistent growth and development of the market

Nath and Lingareddy (2008) concluded that futures trading in the selected commodities escort to increase volatile in case of Urad, in case of Gram and Wheat prices moderately rise in post futures period not proved statistically significant.

Brajesh and Pandey (2013) they investigated the short run and long run market efficiency of Indian commodity futures market. The result confirmed the long run efficiency of commodity futures prices and inefficiency of futures prices in short run.

Tarun Soni (2013) Nonlinearity in the Indian commodity markets: evidence from a battery of tests. the presence of nonlinearity in returns is considered as evidence against the efficiency of Indian commodity markets theory which characterizes data as random walk or more strictly a martingale

Masood and Chary (2015) examine efficiency of commodity futures and spot market and observes that the role of commodity futures is

very significant in price discovery, and improving efficiency of the market.

Masood and Chary (2016) investigated the Performance of Commodity Derivatives Market in India by using growth in volume and value of commodity derivatives market and found the linearity in growth trend.

3. Objective of the Study

1. To test the association between Spot and Futures Commodity Market
2. To test whether trend exists in Spot and Futures market
3. To analyze the efficiency of Commodity Markets with reference to select (MCX) National Commodities Market Indices.

4. Hypothesis of The Study

To test the performance, the following hypothesis were framed

1) To test the association between spot and futures indices of MCX

Ho_1: There is no correlation between Spot and Futures indices of MCX (Spot Indices of MCX ≠ Futures Indices of MCX)

Ha: There is a correlation between spot and futures indices of MCX (Spot Indices of MCX ═ Futures Indices of MCX)

2) To test the growth trend performance of spot and futures market by using the MCX indices

Ho_2: There is no trend in the MCX spot indices Comdex S, Agri Index S, Energy index S and Metal index S series.

Ha: There is trend in the MCX spot indices Comdex S, Agri Index S, Energy index S and Metal index S series.

Ho_3: There is no trend in the MCX Futures indices Comdex F, Agri Index F, Energy index F and Metal index F series.

Ha: There is trend in the MCX Futures indices Comdex F, Agri Index F, Energy index F and Metal index F series.

3) To test the market efficiency and long run equilibrium, Engle and Granger co integration

Ho_4: There is no co integration between MCX spot indices and MCX futures indices value in long run.

Ha: There is cointegration between MCX spot indices and MCX futures indices value in long run.

5. Data Collection and Methodology

The present study is an analytical and explorative in nature, it uses secondary data formed through reports of Forward Market Commission reports, UNCTAD reports, Ministry of Consumer Affairs, Government of India, published Annual reports, Research Works, Research papers, RBI and working papers, articles published in national and international journals, websites of government, stock broking organization, intermediary services organizations, newspapers, magazines and library sources. Further the Multi Commodity Exchange (MCX) Spot and Futures indices data collected as it available from 2005-06 to 2013-14.

Methodology

The study basically used the descriptive analysis, Mean, Minimum and Maximum values, skewness, kurtosis and correlation and further mainly employed time series techniques.

Augmented Dickey Fuller (ADF) test

This test is conducted on the variables in original price series (ADF regression including the intercept and trend) and first differences (ADF regression with only intercept as trend will be removed while differencing). The variables that are integrated of the same order may be cointegrated, while the unit root test finds out which variables are integrated of same order, for example; if integrated by order one then it is denoted as I(1). The following ADF regression equation is used for testing the stationarity,

$$\Delta Yt = \beta 1 + \beta 2t + \delta Yt - 1 + \alpha i \sum_{i=1}^{m} \Delta Yt - 1 + ut$$

Where Yt is a vector to be tested for cointegration, t time or trend value, ΔYt is the first order difference, ut is pure white noise term, The null hypothesis that, δ = 0; signifying unit root, states that the time series is non-stationary while, the alternative hypothesis, δ < 0 signifies that the time series is stationary, thereby rejecting the null hypothesis.

Mann-Kendall Analysis

The Mann-Kendall test is a non-parametric test for identifying trends in time series data. The test compares the relative magnitudes of sample data rather than the data values themselves (Gilbert, 1987). The data values are evaluated as an ordered time series. Each data value is compared to all subsequent data values. The initial value of the Mann-Kendall statistic, S, is assumed to be 0 (*e.g.*, no trend). If a data value from a later time period is higher than a data value from an earlier time period, Yt is incremented by 1. On the other hand, if the data value from a later time period is lower than a data value sampled earlier, Yt is decremented by 1. The net result of all such increments and decrements yields the final value of Yt.

Let 1 *x* , 2 *x* , … *n x* represent n data points where *j x* represents the data point at time j. Then the Mann-Kendall statistic (S) is given by

$$Yt = \sum_{k=1}^{n-1} \sum_{j=k+1}^{n} \text{sign } (Xj - Xk)$$

Where

Sign (Xj-Xk) = 1 if Xj - Xk > 0

Sign (Xj-Xk) = 0 if Xj – Xk = 0

Sign (Xj-Xk) = - 1 if Xj - Xk < 0

A very high positive value of Y_t is an indicator of an increasing trend, and a very low negative value indicates a decreasing trend. However, it is necessary to compute the probability associated with Y_t and the sample size, n, to statistically quantify the significance of the trend. The procedure to compute this probability will be described

Probability Associated with the Mann kendall's Statistic

Kendall (1975, p55) describes a normal-approximation test that could be used for datasets with *more than 10 values*, provided there are not many tied values within the data set. The test procedure is as follows:

Calculate the variance of Y_t, VAR (Y_t), by the following equation:

$$Var\ (Yt) = \frac{1}{18}\ [n(n-1)(2n+5) - \sum_{i=0}^{m} tp\ (tp-1)(2tp+5)]$$

Where n is the number of data points, m is the number of tied groups (a tied group is a set of sample data having the same value), and *p t* is the number of data points in the p[th] group. In the sequence {2, 3, non-detect, 3, non-detect, 3}, we have n=6, g =2, 1 *t* =2 for the non-detects, and 2 *t* =3 for the tied value 3.

Compute a normalized test statistic Z as follows:

$Z = \frac{Yt-1}{[Var\ (Yt)]1/2}$ if $Y_t > 0$

Z=0, if $Y_t = 0$

$Z = \frac{Yt+1}{[Var\ (Yt)]1/2}$ if $Y_t < 0$

Compute the probability associated with this normalized test statistic. The probability density function for a normal distribution with a mean of 0 and a standard deviation of 1 is given by the following equation:

$F(Z) = \frac{1}{\sqrt{2\pi}}\ e_2^{z2}$

The Engle and Granger Co integration approach

Generally one would find most of the economic variables to be non-stationary I(1) variables. Hence, any equilibrium theories that involve these variables require the existence of a combination of the variables to be stationary.

The components of a (kx1) vector, Yt, are said to be cointegrated of order i,j, denoted, Yt~CI (i,j), if (i) all the components of the vector yt are I(i), that is, they need d differences to induce stationarity, and (ii) there exists a vector β (≠0) so that Zt = β^1 Yt ~I (i-j) The vector β is called the Co integrating vector. Usually we

consider the case with i=j=1. This is an important result as any arbitrary linear combination of I(1) series will be I(1) (unless the series are cointegrated).

Co integrating combinations are "equilibrium". So it is important to be able to discover and model these relationships. An alternative approach to the analysis of "long-run" (equilibrium) relationship would be to analyse the relationships between the differences of the series, i.e. among I(0) series. However, this approach is only concerned with short-run movements, while it throws useful long-run information.

If a set of variables are cointegrated, then there exists a valid error correction representation of the data, and vice versa.

If y and x are both I(1) and have a long run relationship, there must be some force which pulls the equilibrium error back to zero.

As they recommend a two-step procedure for co integration analysis.

(i) Estimate the long-run (equilibrium) equation:

$$Yt = \delta o + \delta\, Xt + \varepsilon t$$

The OLS residuals from (5) are a measure of disequilibrium:

$$\varepsilon\hat{}t = Yt - \delta\hat{}o - \delta\hat{}1\, Xt +$$

A test of co integration is a test of whether $\varepsilon\hat{}t$ is stationary. This is determined by ADF tests on the residuals, with the MacKinnon (1991) critical values adjusted for the number of variables (which MacKinnon denotes as n).

If co integration holds, ordinary Least square the estimator of (5) is said to super be consistent be Implications: as $\underset{n\to\infty}{T}$ (i) there is no need to include I (0) variables in the co integration equation.

(ii) Second step: estimate the Error Correction Model

$$\Delta Yt = \phi o + \sum_{j=1} \phi j\, \Delta Yt - j + \sum_{h=0} \psi h\, \Delta Xt - h + \alpha u\hat{}1 - 1\, \varepsilon t$$

by OLS as this equation has only I(0) variables, standard hypothesis testing using t ratios and diagnostic testing of the error term is appropriate. The adjustment coefficient α must be negative.

Special case:

$$\Delta Yt = \phi o + \phi j\, \Delta Yt - 1 + \phi 1\, \Delta Xt - 1 + \alpha(Yt - 1 - \delta\hat{}o - \delta\hat{}1\, Xt - 1) + \varepsilon t$$

ECM describes how y and x behave in the short run consistent with a long run co integration relationship.

6. MCX INDICES CONSTRUCTION AND MAINTANCE METHODOLOGY

The MCX maintains composite index of four major segments of spot indices and corresponding futures indices, namely MCX SPOT COMDEX, MCX FUTURES COMDEX, this spot and futures indices are composition of all Agricultural indices, Energy indices and Metal indices. This composition consists of highly liquid contracts, high trade volumes and value weights hence, they are considered as samples in the index. The indices are considered weighted average method for this index with base year 2001. The MCX has also applied such methodology for other group of indices, MCX SPOT AGRI, MCX FUTURES AGRI, MCX SPOT ENERGY, MCX FUTURES ENERGY, MCX SPOT METAL and MCX FUTURES METALs daily closing prices of spot for spot index and daily closing prices of futures contracts sample commodities weights are taken into the composition and the these group indices are computed based on geometric mean.

The methodology followed by MCX to select sample commodity in the indices is based on the eligibility criteria and weights as number of contracts traded on MCX in all variety of commodities in specified period liquidity and the weights are equally relying on factors such as endogenous to the futures market Liquidity and exogenous to the futures market as physical market and hence, size and index computation would be done by basing on near month active contract prices (see table1 for more details).

Table – 1 : The MCX Index Composition

MCX COMDEX	COMMODITY	WEIGHTS (%)	GROUP ADJUSTED WEIGHT (%)
MCX METAL INDEX	Gold	15.21	40
	Silver	9.66	
	Copper	7.13	
	Zinc	2	
	Aluminium	2	
	Lead	2	
MCX ENERGY INDEX	Crudeoil	35.41	40
	Natural gas	4.59	
MCX AGRI INDEX	Ref Soy oil	3.91	20
	Potato	4.76	
	Chana	4.14	
	Crude palm oil	3.19	
	khapakhalli	2	
	Mentha oil	2	

Source: MCX Directory

6.1 DESCRIPTIVE ANALYSIS

The descriptive analysis exhibited by table - 2 does assess the market performance through select indices of MCX, four spot and futures indices SPOT COMDEX (COMDEX S), FUTURES COMDEX (COMDEX F), AGRI SPOT INDEX (AGRIINDEX S) AGRI FUTURES INDEX (AGRI INDEX F) ENRGY SPOT INDEX (ENERGY INDEX S), ENERGY FUTURES INDEX (ENERGY F), METAL SPOT INDEX (METAL INDEX S) and METAL FUTURES INDEX (METAL INDEX F) with the help of Mean, Standard Deviation, Skewness and Kurtosis.

Table – 2 : Descriptive analysis of MCX Spot and Futures Indices

	N	Minimum	Maximum	Mean		Std. Dev	Skewness		Kurtosis	
		Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Std. Error	Statistic	Std. Error
SPOT COMDEX	96	1602	4562	2991.45	78.126	765.478	.163	.246	-1.393	.488
FUTURES COMDEX	96	1819	4509	2992.74	73.250	717.699	.147	.246	-1.413	.488
AGRI SPOT INDEX	96	1415	3851	2399.16	75.919	743.850	.267	.246	-1.407	.488
AGRI FUTURES INDEX	96	1392	3613	2177.76	54.452	533.517	.513	.246	-.389	.488
ENRGY SPOT INDEX	96	1494	4906	2991.33	74.595	730.878	.427	.246	-.338	.488
ENRGY FUTURES INDEX	96	1707	4946	3032.62	73.184	717.056	.492	.246	-.296	.488
METAL SPOT INDEX	96	1978	5364	3626.25	108.248	1060.609	.206	.246	-1.611	.488
METAL FUTURES INDEX	96	2162	5489	3663.58	108.809	1066.108	.223	.246	-1.614	.488

Results and Discussion

The analysis shows that the mean values of spot and futures Comdex were 2991.45 and 2992.74 respectively. But maximum spot Comdex value was higher than futures Comdex value and with a spot and futures standard deviation of 756 and 717 respectively. It implies that futures Comdex value is more consistence than spot Comdex. By comparing the symmetry of distribution of both spot and futures Comdex, it is found that there is a positive skewness that infers the mean value is greater than most frequently occurring Comdex value, whereas, the coefficient of kurtosis, both spot and futures Comdex value less than three implied a platykurtic curve, a curve flatter than normal. The spot and futures Agri index mean values were found at 2399 and 2177, but maximum spot Agri index value is higher than futures agri index with standard deviation of 743 and 535, it implies that futures Agri Index value is more consistence than spot Agri Index, comparing symmetry of distribution for both spot and futures Agri Index, it infers that mean value is greater than most frequently occurring indices value.

Energy spot and futures index mean values were found at 2991 and 3032 with standard deviation of 730 and 717 respectively, whereas maximum value of spot index is lower than futures index, it can be concluded that spot index value is more consistent than futures index value, the symmetric distribution of spot and futures index have positive skewness that infers as mean value is greater than most frequently occurring index values. On the other hand Metal spot and futures mean values are found at 3626 and 3663 with standard deviation of 1060 and 1066, it can be analyzed that the spot index value is more consistent than futures index value, whereas symmetric distribution of spot and futures index value have positive skewness, which states that mean value is greater than most frequently occurring index values. As the kurtosis of all spot and futures indices have fewer values than a platykurtic curve values, which is a curve more flatter than normal. On the whole it can be asserted that the mean value and volatility moved in the above cited segments in a passive manner accordingly the change in volume.

6.2 CORRELATION ANALYSIS TO TEST THE ASSOCIATION BETWEEN MCX SPOT AND FUTURES COMMODITY INDICES

Person coefficient of correlation is applied for the analysis of select MCX spot and futures indices of different segments, namely, SPOT COMDEX, FUTURES COMDEX, AGRI SPOT INDEX, AGRI FUTURES INDEX, ENRGY SPOT INDEX , ENERGY FUTURES INDEX, METAL SPOT INDEX and METAL FUTURES INDEX (See table 3 for analysis and results).

Table – 3: Correlations analysis of MCX Commodity Indices

Indices	COMDEX S	COMDEX F	AGRIINDEX S	AGRIINDEX F	ENRGYINDEX S	ENRGYINDEX F	METALINDEX S	METALINDEX F
COMDEX S	1	.996**	.911**	.763**	.852**	.862**	.972**	.968**
COMDEX F		1	.908**	.791**	.844**	.857**	.972**	.970**
AGRIINDEX S			1	.887**	.579**	.595**	.959**	.961**
AGRIINDEX F				1	.415**	.430**	.834**	.838**
ENRGYINDEX S					1	.996**	.711**	.701**
ENRGYINDEX F						1	.726**	.718**
METALINDEX S							1	.999**
METALINDEX F								1

**. Correlation is significant at the 0.01 level (2-tailed).

Table – 4: Test of significance of Correlations between MCX Commodity Indices

Test	r	D.f	Significance	Result	Critical Value	Decision
t	0.996	3	5%	15.764	2.132	Reject

Results and Discussion

Table 4 presents the analysis of correlation between the Spot Indices and Futures Indices of MCX. The analysis clearly depicts that Comdex S is possessing a high positive correlation with all other spot as well as futures indices. The Agri index S and F possesses low degree of positive correlation coefficient with Energy index S and F, whereas correlation coefficient between Metal indices S and F and Energy indices S and F are positive, but it is lower than other indices comparatively, hence it can be concluded from the analysis that all the select indices are moving in same direction and having reciprocal impact on each and every opponent indices. Hence, the correlation coefficient between commodity derivative market indices Spot and Futures is very significant as t value is 15.764 against critical value of t at 5% significant level is 2.132.

6.3 TREND ANALYSIS OF SELECT MCX SPOT AND FUTURES INDICES

The Mann-Kendal's trend analysis test used to test the trend in the MCX spot and futures indices. (See table 5 for details)

Table 5: Mann-Kendall trend test of MCX INDICES

Summary statistics:								
	COMDEX(S)	COMDEX (F)	AGRIINDEX (S)	AGRIINDEX (F)	METALINDEX (S)	METALINDEX (F)	ENRGYINDEX (S)	ENRGYINDEX (F)
Kendall's tau	0.722	0.701	0.708	0.592	0.701	0.690	0.550	0.556
S	3292.000	3197.000	3228.000	2701.000	3196.000	3146.000	2510.000	2536.000
Var(S)	99813.333	99812.333	99813.333	99812.333	99813.333	99813.333	99813.333	99813.333
p-value (Two-tailed)	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
alpha	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Observations	96							
Std. deviation	765.478	717.699	743.850	533.517	1060.609	1066.108	730.878	717.056
The continuity correction has been applied.								

Results and Discussion

Table 5 vividly presents the trend analysis and significance of result of MCX Spot and Futures indices. The trend was tested as null hypothesis that there is no trend exists in the MCX spot indices, namely Spot Comdex, Agri Spot Index, Energy Spot index and Metal Spot Index series as well as Futures indices. Hypothesis are rejected as the calculated P value is less than Alpha Value, it means that alternative hypothesis is accepted, hence there is a trend exists in all above mentioned MCX spot and Futures indices, whereas the Mann-Kendall test (S) value for MCX spot and futures indices shows a high positive value. So there is an increasing trend and the Kendall's tau Statistical Value shows a positive correlation of coefficient, it states that the future values are dependent on past values of the series.

To understand well the trend of the MCX Spot and Futures prices month wise graphical presentation has been made through Figure 1 to 8.

Figure 1: SPOT COMDEX SERIES

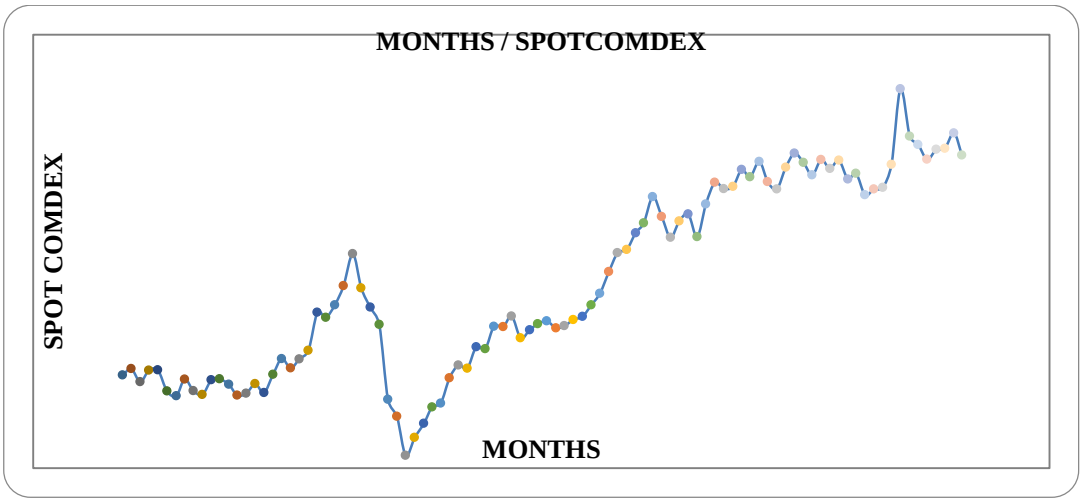


Figure 2: FUTURES COMDEX SERIES

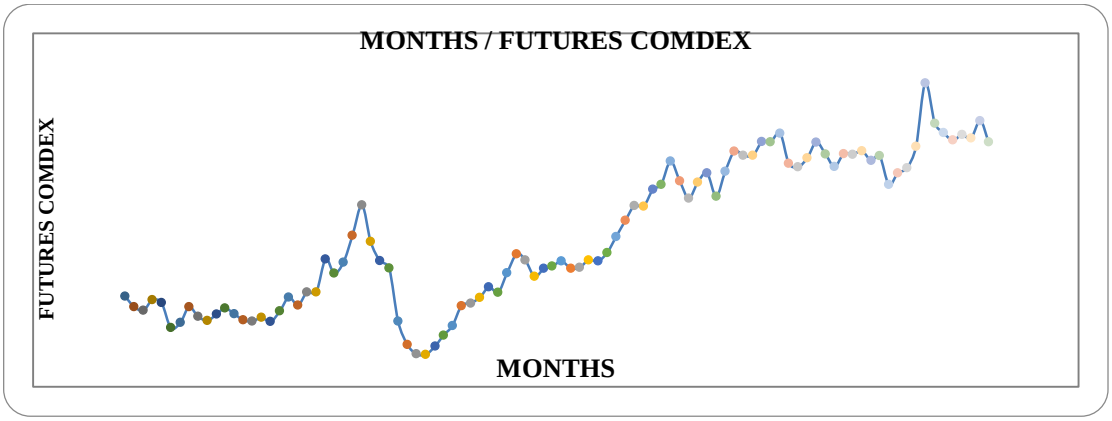


Figure 3: AGRI SPOT INDEX SERIES

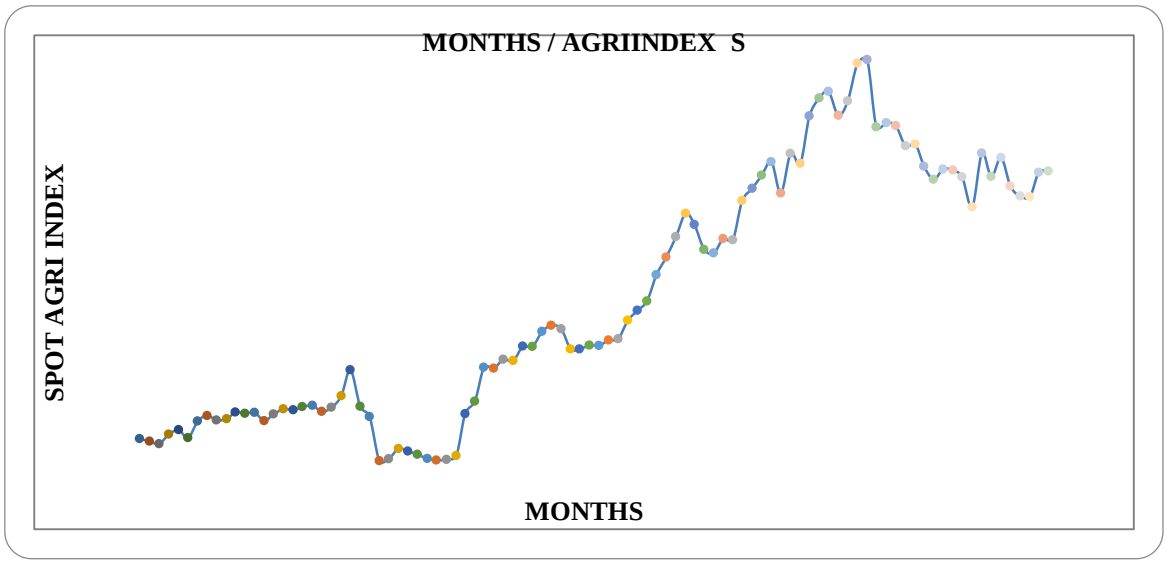


Figure 4: AGRI FUTURES INDEX SERIES

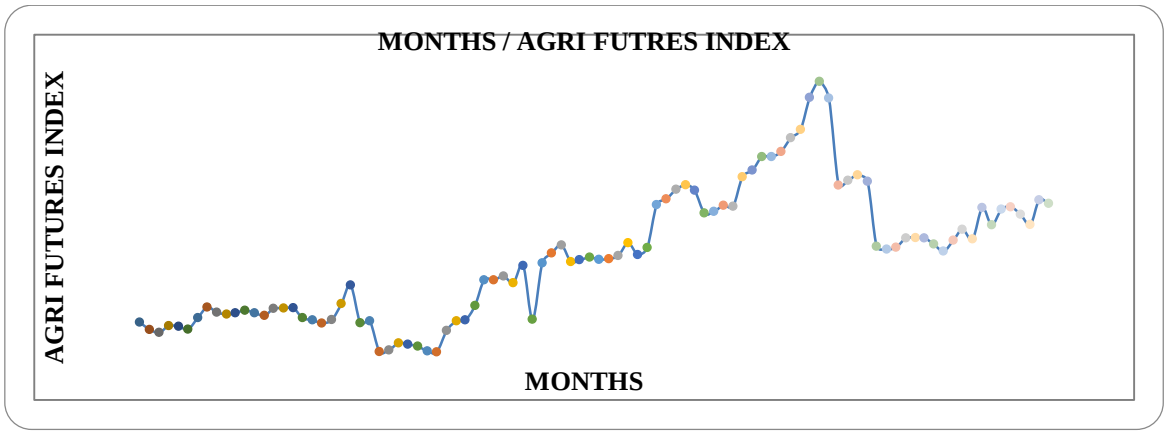


Figure 5: METAL SPOT INDEX SERIES

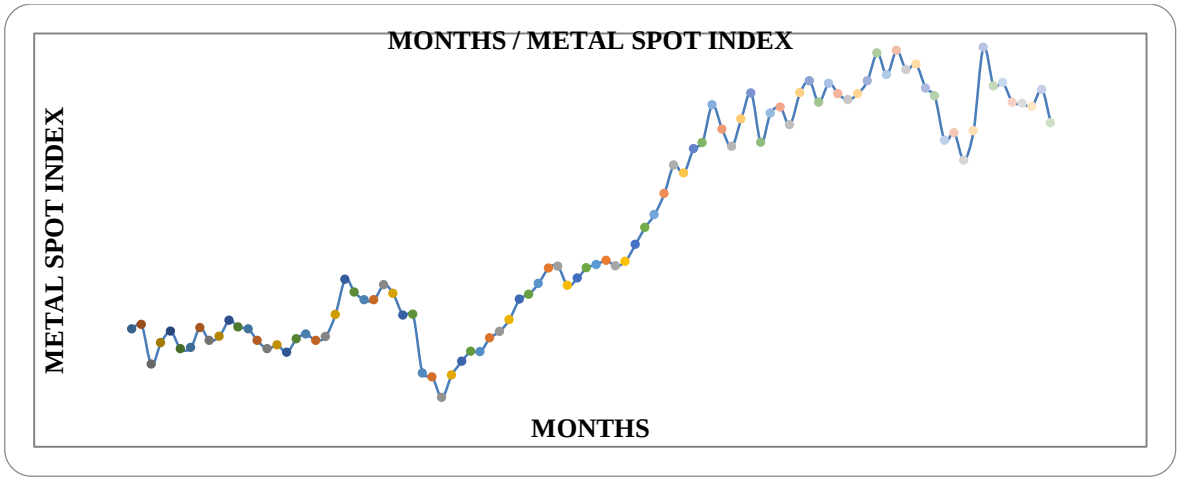


Figure 6: METAL FUTURES INDEX SERIES

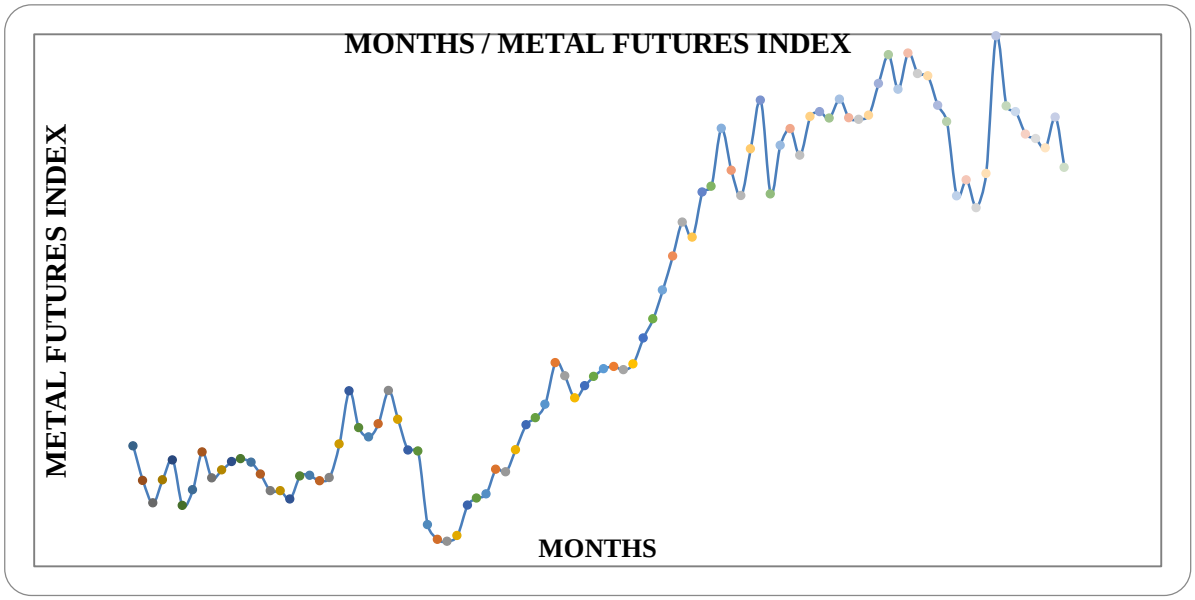


Figure 7: NRGY SPOT INDEX SERIES

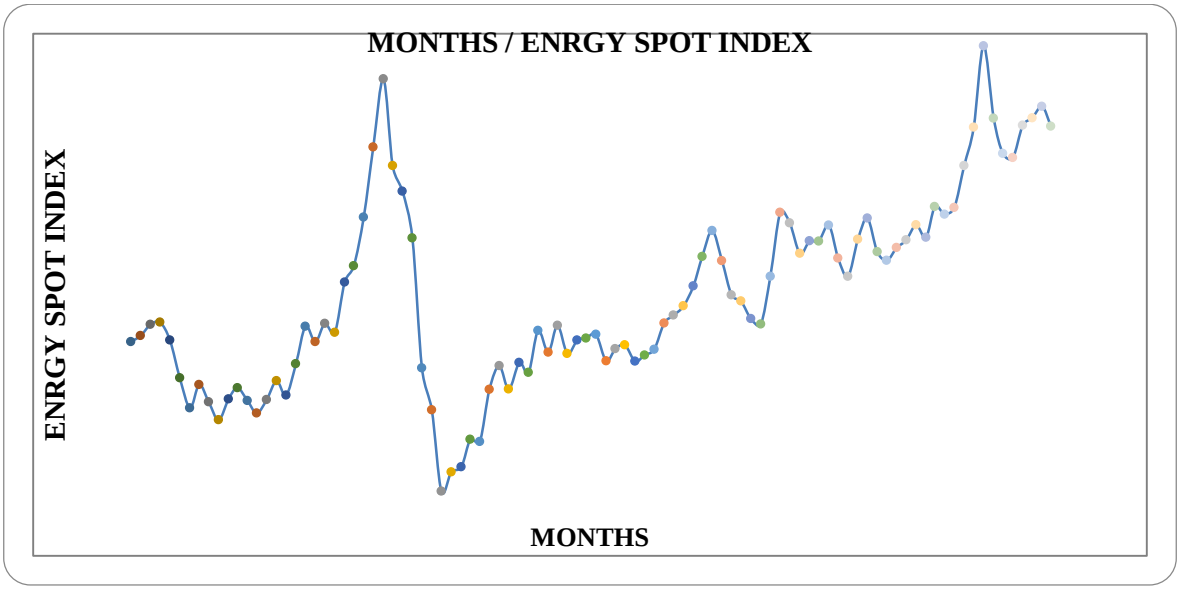
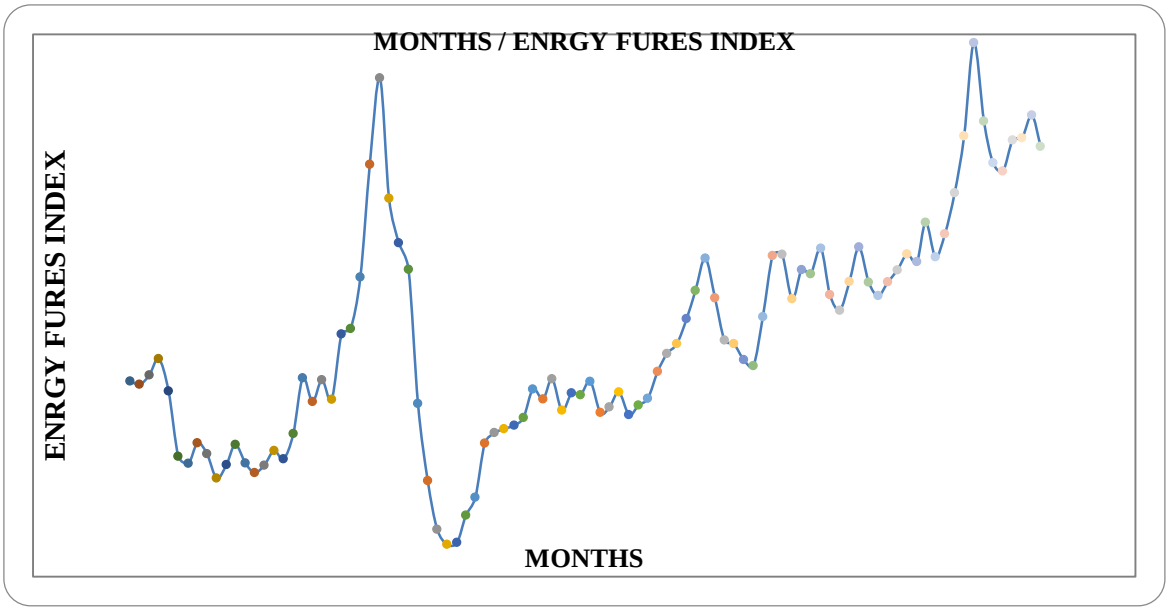


Figure 8: ENRGY FURES INDEX SERIES



6.4 EMPIRICAL ANALYSIS ON TEST OF STATIONARITY

In order to determine the order of integration of each indices value or price series, in analysis first tested whether MCX spot and futures indices are stationarity or not. (See table 5 for more details).

Table – 6

Analysis of Stationarity through ADF of MCX Commodity Indices

MCX INDICES SERIES	estimated value of (a - 1)	ADF (t stats)	Critical values 5%	Lag Order
SPOT COMDEX	-0.931478	-8.92781	-3.03	2
FUTURES COMDEX	-0.954603	-9.16723	-3.03	2

AGRI SPOT INDEX	-1.41522	-15.0022	-3.03	2
AGRI FUTURES INDEX	-1.03459	-9.97984	-3.03	2
ENRGY SPOT INDEX	-0.786044	-7.74618	-3.03	2
ENERGY FUTURES INDEX	-0.748929	-7.43406	-3.03	2
METAL SPOT INDEX	-0.89164	-4.28573	-3.03	2
METAL FUTURES INDEX	-0.709684	-4.0448	-3.03	2

Results and Discussion

It is very clear from table 6 that all MCX spot and futures indices value series were non stationary, but attains stationarity at first difference I (1) of indices at 5% significance. The stationarity tests conducted for the spot and futures indices series sets of time series shows that attain the stability at first difference and now amenable for cointegration analysis. It makes possible to investigate the existences of long run relation between series.

6.5 EMPIRICAL ANALYSIS OF COINTEGRATION TEST TO TEST THE LONG RUN MARKET EFFICIENCY

The co-integration test can be used to test the market efficiency in futures commodity markets. The market is called efficient, if there is a co-integration between the futures indices with spot indices and vice-versa.

Table – 7: ENGLE- GRANGER Co-Integration Analysis of MCX Commodity Indices

MCX INDICES Co integrating equation	coefficient	std. error	t-ratio	p-value	lags
const	-189.399	28.6454	-6.612	2.28e-09 ***	12
SPOT COMDEX	1.06284	0.00931162	114.1	1.28e-102 ***	12
const	837.243	97.8015	8.561	2.10e-013 ***	12
AGRI SPOT INDEX,	0.553938	0.0383946	14.43	1.44e-025 ***	12
const	103.468	27.9862	3.697	0.0004 ***	12
ENERGY SPOT INDEX,	0.978936	0.00909104	107.7	2.93e-100 ***	12
const	136.978	56.4877	2.425	0.0172 **	12
METAL SPOT INDEX,	0.968181	0.0148640	65.14	5.12e-080 ***	12

(OLS, using observations 2006:04-2014:03 (T = 96))

Results and Discussion

The Engle-granger test results presents through the table 7 and 8, that the test statistics of MCX spot and futures Comdex, MCX spot and futures Agri index, MCX spot and futures Energy index and MCX spot and futures Metal indices presents through value compare with p value and the coefficient value of all indices were more than zero. It can be concluding that the reject the null hypothesis that there is no cointegration between MCX spot and futures indices and accept the alternate hypothesis as there is cointegration between MCX spot and futures indices. Whereas table 8 exhibits the lag length criterion based on Akaike Information criterion (AIK), Schwarz (SIC) and Maximum Likelihood criterion and Durban-Watson test statistics. It shows the values higher than zero, which means the non-stationarity of the series at individual level and the linearity between the series is co-integrated. Hence, it can conclude that Indian commodity futures market is considerably efficient.

Table – 8: ENGLE- GRANGER Cointegration Coefficients of MCX Commodity Indices

	SPOT COMDEX& FUTURES COMDEX	AGRI SPOT INDEX& AGRI FUTURES INDEX	ENERGY SPOT INDEX& ENERGY FUTURES INDEX	METAL SPOT INDEX& METAL FUTURES INDEX
Mean dependent var	2990.979	2177.760	3031.781	3663.646
S.D. dependent var	765.4720	533.4744	718.4514	1066.141
Sum squared resid	398748.3	8411100	394328.9	2340574
S.E. of regression	65.13067	299.1317	64.76873	157.7965
R-squared	0.992837	0.688899	0.991958	0.978324
Adjusted R-squared	0.992760	0.685589	0.991873	0.978094
Log-likelihood	-536.1415	-682.4924	-535.6065	-621.0929
Akaike criterion	1076.283	1368.985	1075.213	1246.186
Schwarz criterion	1081.412	1374.113	1080.342	1251.315
Hannan-Quinn	1078.356	1371.058	1077.286	1248.259
rho	0.472862	0.737995	0.067314	0.493412
Durbin-Watson	1.024635	0.523628	1.850308	1.009237

(OLS, using observations 2006:04-2014:03 (T = 96))

7. Summary and Conclusion

The Following conclusion were found from the analysis and discussions

The association between the Spot indices and Futures indices of MCX, depicts that Comdex S high positive correlation with all other spot as well as futures indices, the Agri index S and F were positive correlation coefficient with Energy index S and F, whereas correlation coefficient between Metal indices S and F and Energy indices S and F positive, but comparatively lower than other indices, hence it can be concludes from the analysis that all the select indices moving in same direction and reciprocal impact on each other indices.

The MCX Spot and Futures indices trend was tested and found trend exists in all the time series of MCX spot and Futures indices, whereas, the Mann-Kendall test (S) value for MCX spot and futures indices shown a high positive value as it concludes as there is a increasing trend, at the end the Kendall's tau Statistical Value also shown the positive correlation coefficient, as future values are depended on past values of the series.

The stationarity analysis (ADF test) confirms that all MCX spot and futures indices value attain the stability at first difference and it makes possible to investigate the existences of long run relation between series.

The Engle-granger test results found that the test statistics shown (MCX spot and futures comdex, MCX spot and futures Agri index, MCX spot and futures Energy index and MCX spot and futures Metal indices) linearity between the series is co integrated. Hence it can conclude that Indian commodity futures market is efficient.

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