International Journal of Advanced Research in Management and Social Sciences
ISSN: 2278-6236
Impact Factor: 6.943

# UNIT ROOT TEST OF SELECTED NON-AGRICULTURAL COMMODITIES AND MACRO ECONOMIC FACTORS IN MULTI COMMODITY EXCHANGE OF INDIA LIMITED

**G. Hudson Arul Vethamanikam,** UGC-MANF-Doctoral Research Scholar, Alagappa Institute of Management, Alagappa University, Karaikudi

**Dr. S. Rajamohan,** Professor and Dean-CDC, Alagappa Institute of Management, Alagappa University, Karaikudi

**Abstract:** *In every human being has a requirement the income/return for surviving the day-to-life in a smooth way. Many people are investing the money to bank in previous years, but still not much use because very low interest can able to giveby the banking sectors. It is not sufficient return so automatically diverted to the real-estate than followed by share market. The people are finally deciding the share market with much better than the real estate. Hence, people are interested to invest the money in the online market of share, bonds and so on. Those who are investing the money in online market is called as an investor. The investors are getting more boon in his life, such as online trading commodity market of agri and non-agri commodities. The Multi Commodity Exchange (MCX), National Commodity and Derivatives Exchange (NCDEX) and National Multi Commodity Market Exchange (NMCE) and so on. But MCX and NCDEX are majorly traded both agricultural and non-agricultural commodities. In addition to that this research paper concentrates only MCX because non-agricultural commodity traded more than the NCDEX. The selected macroeconomic factors are highly influenced on the selected non-agricultural commodities with provided by the adopted statistical tools like descriptive analysis, two methods of unit root test such as Augmented Dicky Fuller (ADF) test and Phillips - Perron test (PP) test is applied.*

***Keywords:*** *Commodity Market,Non-Agricultural Commodity, Macroeconomic Variables, Multi-Commodity Exchange*

**JEL classification:** G11, G15, E31, E44. Q02

## 1. INTRODUCTION

The commodities play major role in the field of online markets. There are two major markets, namely Multi Commodity Markets (MCX) and National Commodity and Derivatives

Exchange (NCDEX). The NCDEX deal commodities trade both agri and non-agri commodities, but agricultural commodity are traded more than the non-agricultural commodities[1]. But MCX trades more non-agricultural commodities than the agricultural commodities. In this study, the researcher has chosen only the non-agricultural commodities like Gold, Silver, Aluminium, Copper, Lead, Nickel, Zinc, Crude Oil and Natural Gas which are traded in MCX. There are number of variables influence the price of these non-agricultural commodities.

The impact of macroeconomic variables on selected non-agricultural commodities is studied in this chapter. The highly influenced macroeconomic factors such as inflation, interest rate, US Dollar (USD), money supply, Gross Domestic Product (GDP), international commodity price and world crude oil are identified and used in this study.

The data collected for this study are analyzed to understand the nature of the data by using descriptive statistics and tests for stationary. Descriptive statistics are used to describe the basic features of the data selected for the study. It provides simple summaries about the sample data and helps to present a quantitative description in a meaningful manner. To assess the distributional properties of the monthly return series of the selected non-agricultural commodities of MCX, the descriptive statistics are summarized in terms of mean, standard deviation, skewness and kurtosis. In order to understand the normality of the return series, Jarque - Bera test statistical tool is employed and to test the stationary of data both the Augmented Dickey Fuller test (ADF test) and Phillips - Perron test (PP test) are applied.

## 2. OBJECTIVES OF THE STUDY

1. To assess whether the data are stationary or not towards the selected non-agricultural commodities
2. To measure whether the data are stationary or not towards the selected macroeconomic factors

## 3. NATURE OF MONTHLY RETURN SERIES OF THE SELECTED COMMODITIES IN MCX

The researcher has collected the monthly data regarding non-agricultural commodities which are traded in the online commodity market index of MCX. All the selected commodities are converted into the natural logarithm values with return and run the

descriptive statistics[3]. The monthly series of selected commodities are gold, silver, aluminum, copper, lead, nickel, zinc, crude oil and natural gas. Table.1 denotes the nature of a return series of the selected commodities in MCX.

**Table – 1 Nature of Monthly Return Series of the Selected Commodities in MCX**

| S. No. | Name of the Commodity | Mean Return | Standard Deviation | Skewness | Kurtosis | JarqueBera | *P* Values |
|---|---|---|---|---|---|---|---|
| 1 | Gold | -0.00152 | 0.258956 | 0.334744 | 4.476975 | 13.03877 | 0.0014 |
| 2 | Silver | -0.00072 | 0.219218 | -0.187782 | 2.796265 | 0.905175 | 0.0000 |
| 3 | Aluminium | 0.021651 | 0.382682 | 0.412594 | 6.207793 | 54.39724 | 0.0000 |
| 4 | Copper | 0.001224 | 0.208993 | 0.808688 | 6.166838 | 62.69697 | 0.0000 |
| 5 | Lead | 0.080581 | 0.749141 | 5.453543 | 40.24686 | 7468.704 | 0.0000 |
| 6 | Nickel | 0.015762 | 0.266059 | 0.260166 | 3.520203 | 2.684226 | 0.0000 |
| 7 | Zinc | 0.009078 | 0.232016 | 0.090481 | 2.947310 | 0.176138 | 0.0000 |
| 8 | Crude Oil | 0.010929 | 0.185009 | -0.065613 | 3.155455 | 0.205209 | 0.0000 |
| 9 | Natural Gas | 0.019763 | 0.350655 | -0.421333 | 4.023773 | 8.717715 | 0.0127 |

Table 1 reveals the nature of monthly series on selected commodities in MCX. The mean return for all the commodities are positive values except the gold (-0.00152) and silver (-0.00072). It indicates the fact that the price of these commodities are not constant in trend during the study period.

Standard deviation is necessary to find the deviation from the standard value of the selected nine commodities. Out of nine commodities, the highest value is Lead (0.749141) followed by Aluminium (0.382682) which indicates that these commodities have more volatility. The lowest value is Crude Oil (0.185009) and Copper (0.208993) which has a less deviation from the standard values. Which reveals that these commodities have less volatility.

The measurement of Pearson skewness is to find the curve, whether it is positive or negative in the field of selected nine commodities. Three are negative skewed namely Natural Gas (-0.421333), Silver (-0.187782) and Crude Oil (-0.065613) and another six are positively skewed among the nine commodities.

The Pearson kurtosis values are measured the distribution curves, whether medium or peak curves. The Silver (2.796265) and Zinc (2.947310) are less than the three (<3) among the selected nine commodities which is called as Platykuttic Distributions (Flat curve). Other than these two commodities are Leptokurtic Distributions (Pecked Curve) because whose

values are more than the three (>3). These nine commodities are not following the normally distribution rules and proved by the p values of JarqueBera test statistics whose are less than the 0.05 ($p<0.05$).

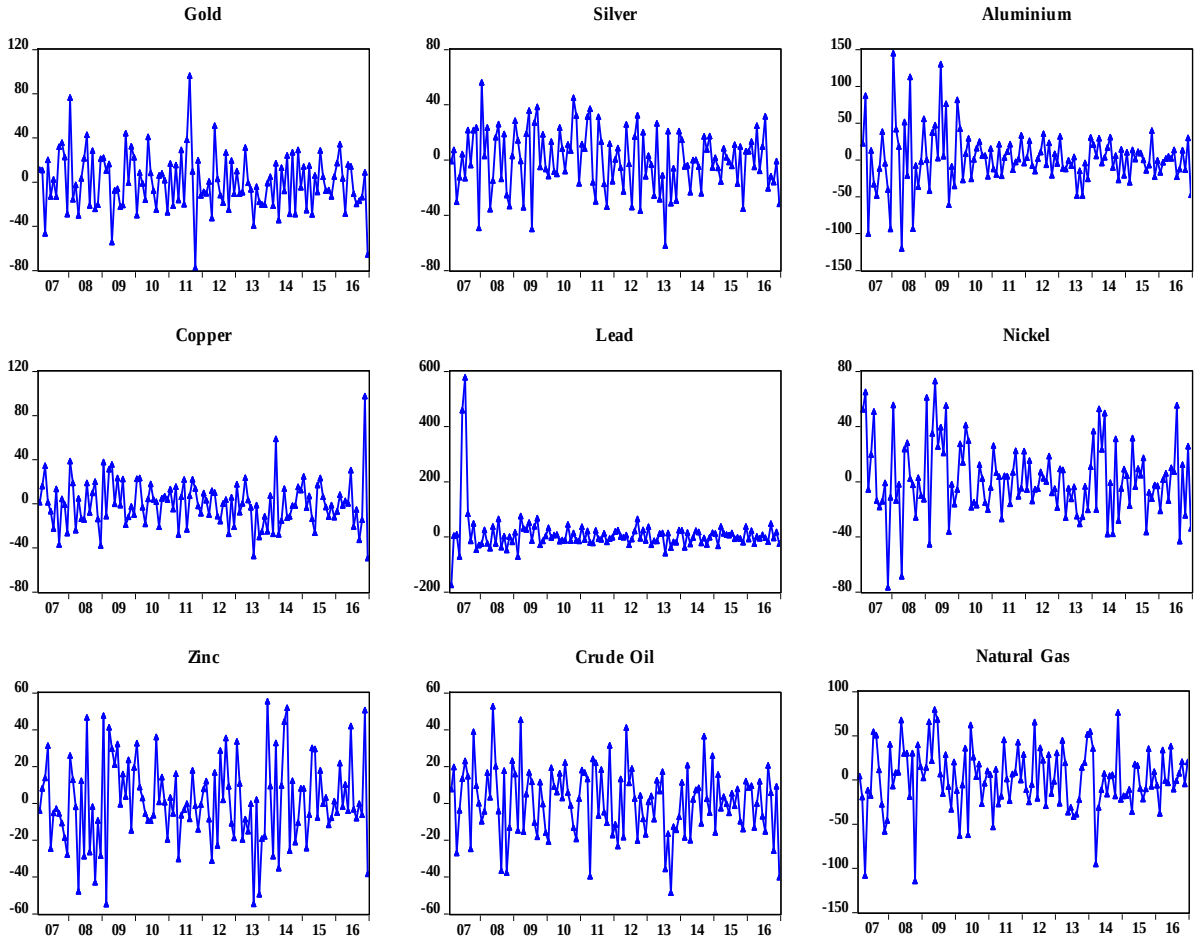


**Chart - 1 Nature of Monthly Return Series of the Selected Commodities in MCX**

## 4. NATURE OF MONTHLY MOVEMENT SERIES OF THE SELECTED MACROECONOMIC VARIABLES

There are two kinds of economic variables which are highly influenced the commodity market in India such as micro and macroeconomic variables. The microeconomic variables are control lesser than the macroeconomic variables[6]. Hence, the researcher has chosen the macroeconomic variables such as inflation, interest rate, US Dollar, money supply, GDP, international commodity price and world crude oil. In order to understand the nature of the data the descriptive statistical tools like mean, standard deviation, skewnees, kurtosis along with the JarqueBera test are applied and the result obtained are presented in the Table 2.

**Table – 2 Nature of Monthly Movement Series of the Selected Macroeconomic Variables**

| S. No. | Name of the Factors | Mean Return | Standard Deviation | Skewness | Kurtosis | JarqueBera | *P* Values |
|---|---|---|---|---|---|---|---|
| 1 | Inflation | -0.0093 | 0.126186 | 0.110775 | 4.07685 | 5.99309 | 0.0499 |
| 2 | Interest Rate | -0.0191 | 0.461853 | 0.261591 | 7.26809 | 91.68114 | 0.0000 |
| 3 | US Dollar | 0.00358 | 0.021065 | 0.537198 | 3.86179 | 9.40599 | 0.0091 |
| 4 | Money Supply | 0.01146 | 0.008389 | -0.239743 | 7.06783 | 83.18669 | 0.0000 |
| 5 | GDP | 0.00957 | 0.007405 | -5.247580 | 41.12910 | 7754.719 | 0.0000 |
| 6 | International Commodity Price | 9.82E-05 | 0.057416 | -1.251600 | 5.48483 | 61.68368 | 0.0000 |
| 7 | World Crude Oil | 0.00528 | 0.101424 | 0.470642 | 8.87486 | 175.52520 | 0.0000 |

Table 2 exhibits the descriptive statistics values of the selected macroeconomic variables. The mean return for all macroeconomic variables are positive values except inflation and interest rate, which indicates that the values of these factors are not constantly increase over the period of 2007 to 2016. The mean values are comparatively high for international commodity price (9.82) followed by money supply (0.01146) and the lowest value is for interest rate/treasure bills (-0.0191).

Standard deviation is used to find out the deviation from the standard values with comparatively low in the case of GDP (0.007405) followed by money supply (0.008389). These are the variables closely associated with standard values other than two variables are more deviations from the standard values such as interest rate (0.461853) and inflation (0.126186).

The Pearson's moment coefficient of skewness is a measure of the asymmetry of the probability distribution of a real-valued random variable about its mean. The skewness value can be classified into two variables such as positive and negative skewed. The four values are positively skewed namely inflation (0.110775), interest rate (0.261591) US Dollar (0.537198) and world crude oil (0.470642) and others are negatively skewed in the selected macroeconomic factors.

The measurement of Pearson kurtosis values is measuring the distribution curve on the independent variables. It is basically three types such as Platykuttic, Mesokuttic and Leptokurtic. All the independent variables are more than three (> 3) which means the highest peak values on the distribution curve. Hence, these variables are not normally

distributed. The seven macroeconomic variables are not normally distributed and evidenced by JarqueBera test statistics of p values which are less than the 0.05 (P<0.05).

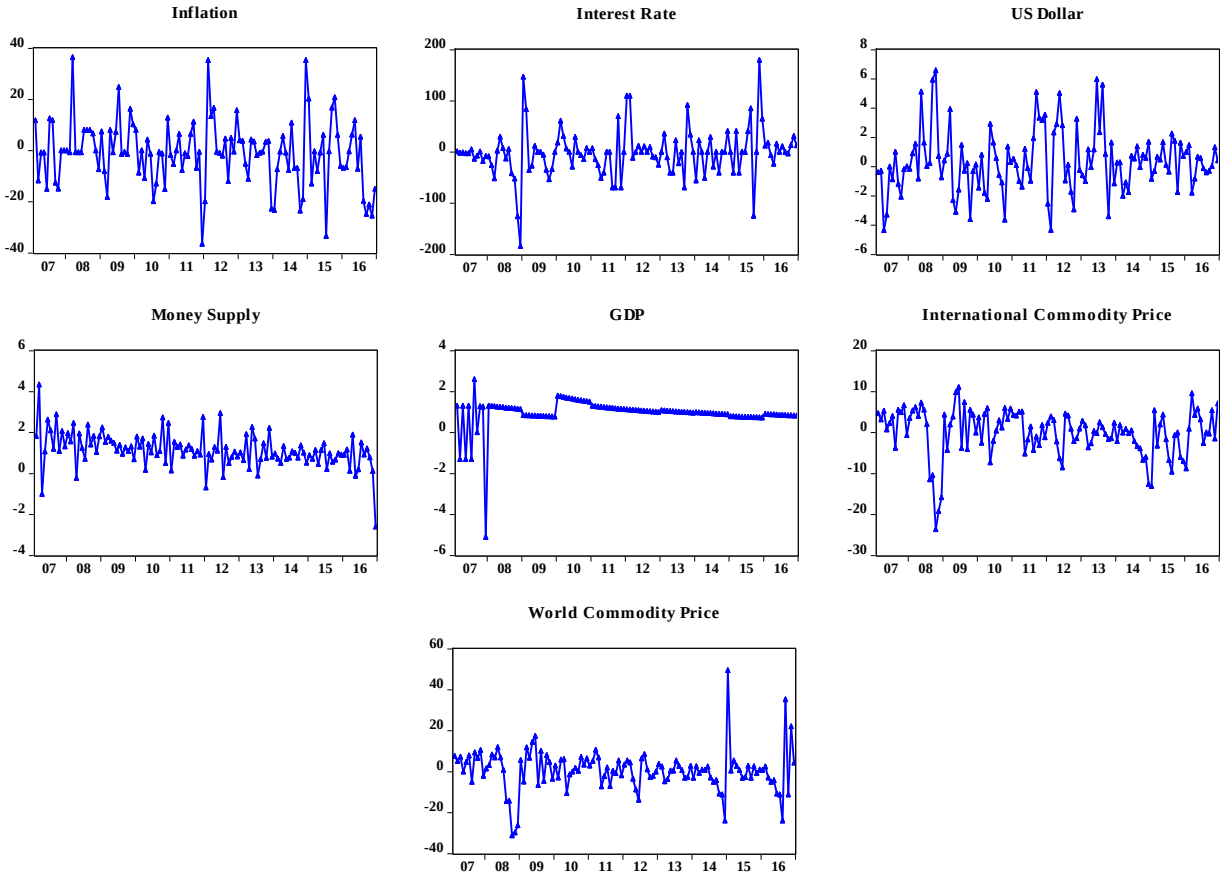


**Chart – 2 Nature of Monthly Movement Series of the Selected Macroeconomic Factors**

## 5. UNIT ROOT TEST ON SELECTED NON-AGRICULTURAL COMMODITIES

The nine non-agricultural commodities are being traded regularly without fails except the government holidays. Commodities price are naturally volatile in the field of online markets in MCX index. In order to test whether the unit root problem exists or not in the non-agricultural commodities of MCX, both Augmented Dicky Fuller (ADF) test and Phillips - Perron test (PP) test are applied.

Time series data should be stationary in nature for further meaningful analysis. The financial time series data relating to monthly returns of the selected nine non-agricultural commodities of MCX are tested by using ADF which is an augmented version of ADF used for a larger and more complicated set of time series models and PP test to understand whether the data set is stationary or not. The results obtained from applying these two techniques are presented in this section[5].

The widely used tests for unit root are the ADF developed in the year of 1979 and PP tested in the year of 1988. The ADF test suffers from loss of significant information and assumes a stringent homoscedastic error terms, but the PP test corrects any serial correlation and heteroscedastic in the error terms by directly modifying the t statistics. The null hypothesis is that there is no stationary in the return series of the selected nine non-agricultural commodities of MCX. The results of these commodities are mentioned in Table 3.

**Table – 3 Test for Unit Root Problem in Selected Commodities**

| S. No. | Name of the Commodities | Augmented Dickey Fuller Test | | | Philips Perron Test | | |
|---|---|---|---|---|---|---|---|
| | | Intercept | Trend and Intercept | None | Intercept | Trend and Intercept | None |
| 1 | Gold | -12.85575 | -13.01002 | -12.91356 | -12.8591 | -13.22597 | -12.917 |
| 2 | Silver | -13.00026 | -13.12143 | -13.05683 | -13.08999 | -13.3476 | -13.149 |
| 3 | Aluminium | -8.941065 | -8.981153 | -8.878455 | -14.01829 | -14.09216 | -13.997 |
| 4 | Copper | -13.11605 | -13.1267 | -13.17299 | -13.4562 | -13.57124 | -13.524 |
| 5 | Lead | -7.473069 | -7.697878 | -7.402664 | -7.464933 | -7.697878 | -7.3868 |
| 6 | Nickel | -11.17262 | -11.23653 | -11.19322 | -11.16539 | -11.23653 | -11.193 |
| 7 | Zinc | -12.62105 | -12.57786 | -12.64517 | -12.62105 | -12.57786 | -12.645 |
| 8 | Crude Oil | -11.8206 | -12.1711 | -11.81614 | -11.8206 | -12.1711 | -11.816 |
| 9 | Natural Gas | -10.48346 | -10.44591 | -10.40057 | -10.48346 | -10.44591 | -10.401 |

(Testcritical values @ 5% level is ***-2.886074*** is for ***Intercept;*** @ 5% level is ***-3.448348*** is for ***Trend and Intercept;*** @ 5% level is ***-1.94354***is for ***None,*** p values for all the above observations are < 0.05)

The results of the stationary test for all the three test equations of both ADF and PP Test of the return series of selected non-agricultural commodities of MCX are shown in Table. 3. All the absolute test statistics values for both ADF and PP Test are compared with the absolute test critical values and found that the absolute test statistics values are greater than the absolute test critical values at 5 percent level which is a basic requirement for rejecting the null hypothesis of unit root problem in the return series. Since the computed values of both ADF and PP test for all the selected nine commodities are greater than test of “tau” statistics or critical values, the null hypothesis of a non-stationary in return series can be convincingly rejected and confirms that the return series are stationary in nature.

## 6. UNIT ROOT TEST ON SELECTED MACROECONOMIC VARIABLES

The economic variables are basically of two kind micro and macro variables. The macroeconomic variables are highly impact on the online commodity trading index of MCX which are greater than the microeconomic variables. In order to examine whether the

macroeconomic variables are free from unit root problem or not, it is necessary to conduct some stationary testing techniques like ADF test and PP test. The null hypothesis is that there is no stationary in the return series of the selected macroeconomic variables. The result obtained from both ADF and PP test are mentioned in Table 4.

**TABLE – 4 Test for Unit Root Problem in Macroeconomic Factors**

| S. No. | Name of the Factors | Augmented Dickey Fuller Test | | | Philips Perron Test | | |
|---|---|---|---|---|---|---|---|
| | | Intercept | Trend and Intercept | None | Intercept | Trend and Intercept | None |
| 1 | Inflation | -8.74655 | -8.89021 | -8.73149 | -8.55748 | -8.82119 | -8.54474 |
| 2 | Interest Rate | -9.37773 | -9.71598 | -9.3907 | -9.49197 | -9.71531 | -9.60496 |
| 3 | US Dollar | -7.99590 | -7.98499 | -7.84709 | -7.87103 | -7.86284 | -7.84013 |
| 4 | Money Supply | -11.66602 | -14.8287 | -1.41931 | -12.00667 | -18.23438 | -5.82493 |
| 5 | GDP | -11.74405 | -11.72661 | -5.50362 | -11.84797 | -11.83784 | -6.34536 |
| 6 | International Commodity Price | -6.19323 | -6.19374 | -6.22001 | -6.19323 | -6.19374 | -6.22001 |
| 7 | World Crude Oil | -5.35564 | -5.31777 | -5.36599 | -9.67841 | -9.65378 | -9.70166 |

(Testcritical values @ 5% level is ***-2.886074*** is for ***Intercept;*** @ 5% level is ***-3.448348*** is for ***Trend and Intercept;*** @ 5% level is ***-1.943563*** is for ***None,*** p values for all the above observations are < 0.05)

Table 4 exhibits the results of ADF Test and PP Test for all the three Test equations of Intercept, Trend and Intercept and None. It is visible from the table that all the calculated absolute test statistic values are greater than the test critical values at 5 percent level (-2.886074 for Intercept, -3.448348 for Intercept and Trend and -1.943563 for None) which is a necessary condition to reject the null hypothesis stating that the return series are not stationary. Since the values are fulfilling the requirements of the decision rule, it can be convincingly interpreted that the return series of all the selected nine non-agricultural commodities are stationary at 5 per cent level and do not require any further differentiation.

## 7. CONCLUSION

The distributional properties of the return series of the selected non-agricultural commodities indices of MCX are analysed in this research paper by applying appropriate statistical tools like mean, standard deviation, skewness, kurtosis and Jarque-Bera test. The calculated values of skewness and kurtosis exhibit the nature of the selected return series.

Jarque - Bera values have clearly revealed that the selected series are not normally distributed. But the findings of the stationary tests like ADF test and PP test show that the selected financial time series are stationary in nature which is a compulsory phenomenon for the applications of further statistical tools to understand the objective of estimating the volatility of these series.The investor before investing the money in commodity market, knowing what happen in the commodity market. Technical analysis is authentically helping to invest money and also one more basic evidence of current news regarding any announcement from the Forward Market Commission (FMC). In addition to that some of the impact on the commodity market and macroeconomic factors also influenced the commodity market in MCX. If considered these variable and easy to get more return from commodity market of non-agricultural commodity market in MCX.

## ACKNOWLEDGEMENTS

The author Mr. Hudson Arul Vethamanikam and Prof. Dr. S. Rajamohan thanks the University Grants Commission, New Delhi, India, for financial assistance under the Maulana Azad National Fellowship for Minority Students (UGC-MANF) Project Grants Code: F1-17.1/2013-14/MANF-2013-14-CHR-TAM-26811/ (SA-III/Website) dated: 06.02.2014. We sincerely acknowledge the University Grants Commission, New Delhi, India for the financial support of my research work.

## REFERENCES

1. Brajesh Kumar and Ajay Pandey, “Market efficiency in Indian Commodity Futures Markets”, Journal of Indian Business Research, Vol. 5 Issue.2, February 2013, p.101.

   Retrieved from: http://dx.doi.org/10.1108/17554191311320773
2. Julien Chevallier Florian Ielpo, “Time series momentum in commodity markets”, Managerial Finance, Vol. 40 Issue.7, February 2014, p.663.

   Retrieved from: http://dx.doi.org/10.1108/MF-11-2013-0322
3. Rajamohan. S. and Hudson Arul Vethamanikam. G “Commodity Futures Market in India”, International Journal of Advanced Research in Management and Social Sciences, Vol.3, Issue.10, October 2014, p.54.
4. Bollerslev. T, “Generalized Autoregressive Conditional Heteroskedasticity”, Journal of Econometrics, March 2011, Vol.17, Issue.7, p.305.
5. Rajamohan. S. and Hudson Arul Vethamanikam. G, op.cit. p. 59.