Impact of Commodities Transaction Tax on Indian Commodity Futures

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Abstract

The Commodity Futures Market is an instrument to achieve price discovery of commodities. The Government of India introduced the Commodities Transaction Tax of 0.01 per cent payable on seller for derivative transactions on 1 July 2013. This tax in line with the earlier tax imposed on transactions in the Securities Market, the Securities Transaction Tax. The difference between the two taxes (STT and CTT) in India is that STT is imposed on both buyers and sellers whereas CTT is levied on non-farm commodity derivatives and the tax is payable by the seller. The aim of imposition of these taxes is to reduce the price volatility and increase tax revenue, whether it will actually be able to achieve the objectives is debatable. It is debatable since the levy of the tax adversely affects the traded volume of the contracts. Currently, the CTT is applicable to non-farm commodity derivatives traded in commodity exchanges of India. The current study uses bootstrap methodology to assess the impact of commodities transaction tax on the trading volume on commodity exchange (overall) and trading volume of chosen commodities. A first order autocorrelation model is also utilised to study the impact of the imposition of CTT on returns and volatility of commodity portfolios.

Keywords: Commodity Futures, tax, trading volume, portfolios

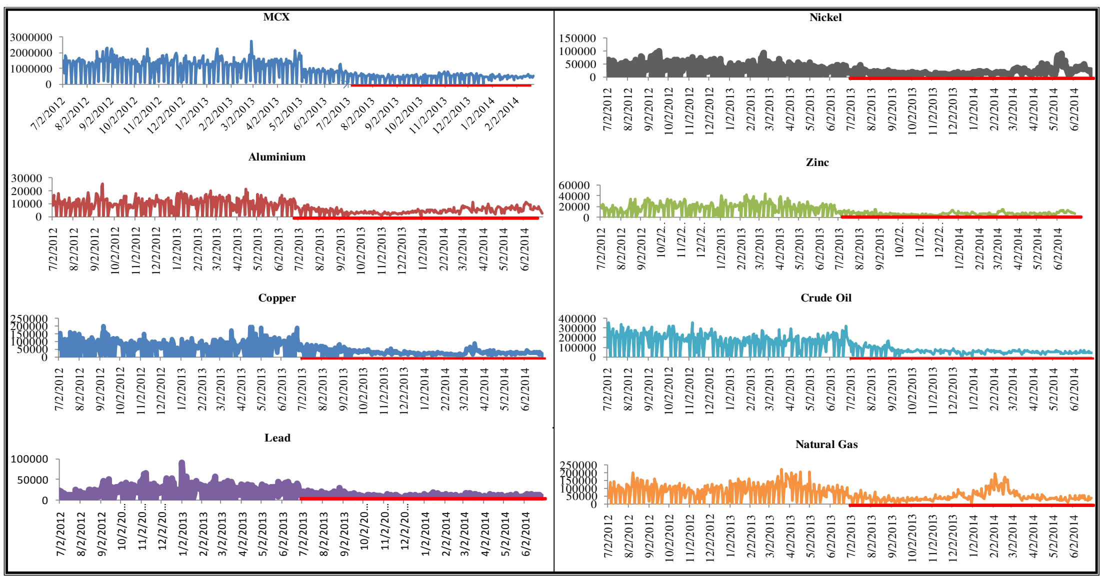
JEL Codes: Q02. F38, G12

1. Introduction

The commodities transaction tax is the tax levied on taxable commodity transactions traded on recognised commodity exchanges. A taxable commodities transaction means a sale of commodity derivatives. The Indian Union Budget, 2013-14, introduced the Commodities Transaction Tax and the tax is being imposed on commodity transactions at a rate of 0.01 per cent since 1 July 2013. Unlike the Securities Transaction tax in the capital market, which is levied on both buyers and sellers involved in equity transactions, Commodities Transaction tax is levied on non-farm commodity derivatives (the agricultural commodity derivatives, which are excluded are given in Annexure), and the tax is payable by the seller.

The current study tries to examine the impact of the imposition of Commodities Transaction Tax on non-farm commodity derivatives traded on Indian commodity exchanges as well as the impact of tax on the MCXENERGY Index (a composite index).

Figure 1: Trading Volume at MCX and seven commodities from 2012-14



Source: Authors Work; Compiled from Bloomberg

Figure 1 shows the trading volume on Multi Commodity Exchange of India as well as the trading volume of the seven non-farm commodity derivatives (Aluminium, Copper, Lead, Nickel, Zinc, crude oil and natural gas), traded on Multi-Commodity Exchange (India). The trading volume is studied before and after the imposition of the commodities transaction tax. A preliminary analysis of the graphs in Figure 1 indicates that there has been a plunge in the trading volume (in lots) after the tax was imposed on 1 July 2013 in India.

This paper is divided into five sections. While Section 1 introduces the Commodities Transaction Tax, Section 2 reviews the previous studies related to transaction tax. Section 3 discusses the data and the methodology used in the study. Section 4 reports the empirical findings and Section 5 concludes the chapter.

2 Literature Review

A number of studies have been conducted on the pros and cons of imposition of a transaction tax on various elements of the financial markets – including futures and options of stock markets, commodity markets and foreign exchange markets.

One of the earliest proponents of taxing financial sector transactions was Keynes (1936) who believes the introduction of a tax on transactions would mitigate the predominance of speculation over the enterprise in the United States. Keynes argues that STT will increase welfare and reduce wastage of resources, market volatility and asset pricing. In line with Keynes argument is Tobin (1978) who proposes a tax on all foreign exchange transactions to be levied multilaterally to decrease the speculative capital inflows. Summers and Summers (1989) examine the desirability and feasibility of implementation of a Securities Transfer Excise Tax in the US. They argue that imposition of such a tax would reduce speculation and raise revenues.

The imposition of a turnover tax can reduce price volatility. A tax on turnover is likely to lead to lower speculation in the stock market by discouraging noise traders and arbitrageurs (Stiglitz, 1989).The securities transaction taxes on financial markets have a negative effect on price discovery, volatility, liquidity and lead to a reduction in market efficiency (Habermier and Kirilenko, 2003).

There is a presence of a rise in volatility in response to the imposition of a transaction tax with a movement of traded volume of Swedish stocks to London (Umlauf, 1993). He studies the effect of transaction taxes on the behaviour of equity returns of Sweden for the period 1980-1987. He uses daily and weekly Swedish All-Share Equity Index returns and calculates variance ratios.

Due to imposition of transaction taxes, investors can change the location of trade, moving transactions off-exchange or abroad (Campbell and Froot, 1993). They study the international experience with Securities Transaction Taxes (STT) using the Swedish and British systems as case studies. They conclude that the impact of imposition of tax in Sweden is offshore trading and trading of untaxed local substitutes. In Britain, the authors observe that STT cannot be avoided; it can stimulate trading in untaxed securities and reduce total trading volume. Hayashida and Ono (2011) quantitatively examine the effect on the Tokyo stock market volume for the period from April 1995 to March 2003. The study concludes that the increased transaction cost due to imposition of tax significantly reduces the trading volume.

A study by (Baltagi et al., 2006) examines the impact of an increase in stamp tax rate on stock market behaviour in China. The authors use daily observations of Shanghai A Share Index and Shenzhen A Share Index over the period from 11 November 1996 to 10 November 1997. The study proves that trading volume changes significantly after the tax rate increases and also leads to lower market efficiency.

Transaction tax increases volatility during the bull periods and decreases volatility during bear periods (Phylaktis and Aristidou, 2007). The authors describe the effects of security transaction tax on volatility of stock market returns in the Athens Stock Exchange for All Share Index and large cap index FTSE/ASE 20 Index. The study uses different versions of GARCH-M/EGARCH-M models to investigate the relationship between transaction tax and the conditional mean and variance during bull, normal and bear periods of daily stock returns for the period from 24 September 1997 to 31 December 2003.

A transactions tax can impede the information efficiency of markets by discouraging the volume of information motivated trading (Kupiec, 1995). The author concludes that the tax is likely to cause risky assets to trade further from their underlying economic values. In another study, the STT when analysed in the context of a general equilibrium model, can reduce the volatility of risky assets price and a decline in the risky assets price can lead to rise in volatility of risky assets return (Kupiec, 1996).

Transaction taxes are inversely but insignificantly correlated with volatility across countries (Roll, 1989). The author examines the stock market volatility for twenty three countries for the period from January 1987 to March 1989. He studies the impact of transaction taxes, price limits and margin requirements on stock market volatility around the 1987 Wall Street Crash. He compares the experience of countries which had a transaction tax with those which didn't impose a transaction tax (Canada, Mexico, New Zealand and United States).

Stamp duty has no effect on volatility (Saporta and Kan, 1997). They discuss the effect of the UK stamp duty on the level and volatility of equity prices. The authors study the response of equity markets to changes in stamp duty rates and compare the prices of assets identical in all respects. This is done via comparing the prices of a sample of underlying shares of UK-listed companies (subjected to stamp duty) with the price of their US-listed ADRs. The authors perform the comparison empirically using univariate GARCH models. Froot and Perold (1995) discuss that a decrease in transaction costs does not hamper the dissemination of information leading to a fall in autocorrelation of index returns. It demonstrates the change in first order autocorrelation of 15 minute S&P 500 index returns for the period 1983-1989.

Hu (1998) attempts to study the effect of stock transaction tax on the stock market for a number of Asian Economies including - Hong Kong, Japan, Korea, and Taiwan during the period 1975-1984. He concludes that an increase in tax rate is detrimental to the return on market and does not find significant change in market volatility and turnover. He argues that stock transactions tax does not have the potential to reduce noise trading.

Lo et al. (2004) develop a model to examine the influence of transaction costs on the level of trading volume. They conclude that a one percent increase in the transactions cost decreases trading volume by only 0.25 percent.

A decrease in transaction tax has a positive impact on trading volume in the index futures market and reduces the bid ask spread (Chou and Wang, 2006). They study the impact of a reduction in transaction tax on the market quality of futures contracts of the Taiwan Stock Exchange in a structural equation framework. The authors measure the market quality by trading volume, bid-ask spread and price volatility. The time period chosen for the study is from May 1999 to April 2001. The authors do not find a significant relationship between transaction taxes and return volatility and argue that an increase or decrease in transaction tax does not result in the same percentage increase or decrease in the tax revenues.

An imposition of STT leads to wider bid ask spreads, lower volumes (Pomeranets and Weaver, 2011) but find no consistent relationship between tax and volatility. They examine the changes in New York State Securities Transaction Tax for the time period between 1932 and 1981. The study uses three measures of market quality including volatility, spread width and volume. Liu (2007) investigates the effect of transaction taxes on the efficiency of Tokyo Stock Exchange price discovery process. The author uses daily data from 1 April 1987 to 31 March 1991 and empirically checks the effects through switching the first order autocorrelation model. He suggests that tax event of 1989 results in lower STT related transaction costs and higher informational efficiency in the Tokyo Stock Exchange. The study also estimates the marginal impact on overall trading volume using a switching regression analysis and claims that the tax reform has a positive price impact on Japanese stocks without any effect on the prices for their respective ADRs. Thus, the study demonstrates that a reduction in transaction costs improves the efficiency of the price discovery process.

Su (2010) discusses the impact of a change in securities transaction tax on the local A shares in the Shanghai and Shenzhen markets over the period from April 1991 to August 2008. The author uses the Switching Generalized Autoregressive Conditional Heteroskedasticity methodology to test whether there are changes in market efficiency due to changes in STT. To examine the impact of STT changes on trading volume the author performs bootstrap testing and reports lower taxes can lead to increase in trading volume. The author concludes that a reduction in the level of STT rate increases return volatility and reduces market efficiency.

In an earlier study (Sinha and Mathur, 2012), conducted by us, we studied the effect an increase in the level of securities transaction tax on traded quantity of shares and time series behaviour of stock returns using data from two prominent national stock exchanges of India (BSE and NSE). The study assess the effect on return of indices (BSE SENSEX and NSE NIFTY using modified GARCH specification and employs bootstrap methodology for the effect on traded quantity of shares. The empirical analysis suggests that the effect of the increase in tax level from 0.1% to 0.125% leads to a fall in the traded volume of shares in the BSE and NSE Stock exchanges by more than twenty five percent and there is no change in return volatility in the stock market due to increase in tax level.

In another study (Sinha and Mathur, 2014) undertaken by us, we use S&P CNX 500 Index, the stocks in the Index are sorted and sub commodity portfolios are constructed. A switching regression analysis of the first order autocorrelation is employed to assess the impact of tax on traded shares and risk in the constructed commodity portfolios. The study also looks at the effect of tax on dually listed stocks (Stocks listed in India as well as United States, i.e., American Depository Receipts). The study finds that the host market dominates in the price discovery process for the dually listed stocks and an increase in the Securities Transaction Tax in India does not influence the return on ADRs which are dually listed in India and United States. For the stocks considered in the portfolios, the first order autocorrelation coefficient increases as firm size decreases; this implies that Small sized stocks are priced less efficiently compared to Medium and Large sized stocks. The study concludes that the volume of traded shares are influenced by the change in tax rate on equity transactions and returns on large and medium sized stocks are affected by risk after the increase in tax.

Only a few studies have addressed the aspect of taxing commodity derivative transactions. The proponents of the commodities transaction tax include Schulmeister (2009) and Nissanke (2011). Schulmeister (2009) suggests an imposition of financial transaction tax on commodities is likely to reduce short term price volatility of futures contracts due to increase in transaction costs. On similar lines, Nissanke (2011) proposes a multi-tier tax system to commodity derivatives in order to stabilise prices and curb excess price volatility.

While the opponents strongly feel that the imposition of transaction tax on commodity derivatives can be regressive for the development of the commodity futures market. Edwards (1993) examines speculative trading in futures markets, market volatility in futures and spot markets and monthly turnover for 16 commodities. The author finds that a transaction tax may reduce speculative trading in the futures markets, but may not be able to reduce price volatility in futures or spot markets. He concludes that the tax would place markets at a disadvantage vis a vis foreign markets leading to a shift to foreign markets.

In the Indian context, Pavaskar and Ghosh (2008) argue that the transaction tax is a burden on the operators in the commodity market. They believe that the imposition of tax can deter the hedgers from entering the market and will shift to illegal market channels including bucket shops and dabbas. The authors state that the derivative taxation violates the canons of taxation.

Sahoo and Kumar (2008) use a three equation structural model to examine the relationship between transaction cost, volatility and trading activity of commodity futures traded in India. The commodities studied include Gold, Copper, crude petroleum oil, soya oil and chana. The authors bring out the impact of the imposition of the commodities transaction tax by assuming a change in transaction cost. In the study, a levy of 0.017% of CTT leads to a rise in transaction cost of Rs 2.00 per lakh to Rs 19.25 per lakh and the transaction cost is proxied by increase in bid ask spread. The authors run simulations for three situations, i.e., imposition of tax by 0.0125%, 0.017% and 0.02%. The study concludes that an indirect relationship exists between transaction cost and trading volume and a direct relationship exists between transaction cost and volatility. Soya oil and chana are found to have the least impact of the levying of CTT, which is attributed to the commodities being traded domestically.

Using the same methodology of structural equations, a similar study has been performed to study the potential impact of transaction tax by Bjursell et al. (2012) for 11 futures contracts traded in the US. The authors conclude that transaction tax would increase transaction costs, reducing trading volume and may not be able to reduce volatility in prices of futures contracts. It may not even lead to rise in revenue.

3 Data and Methodology

3.1 Effect on Traded Quantity[1]

To examine the impact of imposition of Commodities Transaction Tax, daily traded quantities, in terms of lots at the Multi Commodity Exchange (MCX), have been used. Apart from looking at the impact of tax on the total quantity traded at MCX, we also study the total quantity traded (in lots) of seven commodity futures – Aluminium, Copper, Nickel, Lead, Zinc, crude oil and natural gas traded on MCX. All the seven commodities are consumption assets and non-

[1]In 2011-12, it was being speculated that there will be imposition of CTT in the commodity market. Hence, in order to study the effect of transaction tax (STT) on securities market, bootstrapping methodology was employed. For the analysis on STT, please refer to Sinha, P and Mathur, K. (2012). Evolution of Security Transaction Tax in India. *International Journal of Intelligent Technologies and Applied Statistics,5(4), 405-422.*

agricultural commodity futures. The data ranges for a period of one year before 1 July 2013 and one year after 1 July 2013, i.e., from 13 July 2012 to 30 June 2014. The data has been collected from the official website of MCX. The traded quantity data is measured in lots. The summary statistics of the data for traded quantity are given in Table 1.

Table 1: Summary Statistics of Traded Quantity (in lots)

Statistics	Pre Event (July 13, 2012 to June 28, 2013)	Post Event (July 1, 2013 to June 30, 2014)	Whole Sample (July 13, 2012 to June 30, 2014)
Multi Commodity Exchange (in lots)			
Number of observations	296	296	592
Maximum	2739577	1310653	2739577
Minimum	52669	6180	6180
Mean	1208664.71	509192.77	858928.74
Standard Deviation	571404.54	247215.92	562142.07
Aluminium traded on MCX			
Number of observations	263	263	526
Maximum	25582	11806	25582
Minimum	148	80	80
Mean	10468.18	4860.11	7664.14
Standard Deviation	5441.37	2258.03	5019.77
Copper traded on MCX			
Number of observations	263	263	526
Maximum	201185	89143	201185
Minimum	1537	977	977
Mean	81632.99	33874.90	57753.94
Standard Deviation	43008.35	16816.50	40441.56
Lead traded on MCX			
Number of observations	263	263	526

Maximum	90042	28768	90042
Minimum	266	314	266
Mean	26997.69	11089.05	19043.37
Standard Deviation	14813.54	4460.69	13521.58
Nickel traded on MCX			
Number of observations	263	263	526
Maximum	101678	91321	101678
Minimum	646	492	492
Mean	40475.29	20872.93	30674.11
Standard Deviation	22075.22	13545.11	20760.54
Zinc traded on MCX			
Number of observations	263	263	526
Maximum	44648	14679	44648
Minimum	328	162	162
Mean	19792.71	6957.89	13375.31
Standard Deviation	10560.04	2908.54	10056.56
Crude Oil traded on MCX			
Number of observations	263	263	526
Maximum	360207	177148	360207
Minimum	2367	1567	1567
Mean	171264.01	65634.27	118449.14
Standard Deviation	85713.07	28959.42	82943.46
Natural gas traded on MCX			
Number of observations	263	263	526
Maximum	227193	196961	227193
Minimum	1183	904	904

Mean	94538.52	49406.35	71972.44
Standard Deviation	48622.45	31346.98	46694.74

In terms of trading volume (in lots) it is found that, on an average, trading volume (in lots) has fallen from 12,08,664.7 to as low as 5,09,192.77 after the imposition of CTT. If we look at this table, commodity wise we find that the trading volume (in lots) is maximum in case of crude oil (maximum is 3,60,207 for the whole sample), whereas the least number of lots traded are in the case of Aluminium (minimum is 60 for the whole sample). Similarly, the maximum variation in lots is observed in case of crude oil (standard deviation is 82,943.46 for the whole sample), whereas least variation in trading lots is in Aluminium.

To study the impact of the imposition of transaction tax on the trading volume traded at MCX and the trading volume of commodities traded on MCX, the bootstrap method as discussed by Efron (1982) is used. A similar method was used by Baltagi et al. (2006) to study the impact of change in tax on two prominent Chinese Stock Exchanges (2006).

The quantity of lots traded are denoted by a = (a_1, a_2, $a_3 \ldots a_k$) for k trading days before the event (1 July 2013) and b = (b_1, b_2, $b_3 \ldots b_k$) for k trading days after the event (1 July 2013). The Test statistic to be calculated using G (c) where

$$G(c) = \frac{(\bar{a}-\bar{b})}{\sqrt{\left(\frac{\sigma a^2}{k}+\frac{\sigma b^2}{k}\right)}} \qquad \text{(Equation 1)}$$

The test statistic is valid when we assume that there are equal variances between a and b. Test statistic G was calculated for k =15, 20, 30, 50 and 75 to avoid arbitrariness.

Before choosing bootstrap samples, we performed transformations. $\breve{a}_i = a_i - \bar{a} - \bar{c}$ (where $\bar{a}$ and $\bar{c}$ means of k samples pre the event and total samples of both pre and post the event respectively) and $\breve{b}_i = b_i - \bar{b} - \bar{c}$ ($\bar{b}$ and $\bar{c}$ are means of k samples post the event and total samples of both pre and post the event respectively). Bootstrap samples were chosen from ($\breve{a}_1$, $\breve{a}_2$, $\breve{a}_3$, $\breve{a}_4 \ldots \breve{a}_k$) and ($\breve{b}_1$, $\breve{b}_2$, $\breve{b}_3$, $\breve{b}_4 \ldots \breve{b}_k$). We developed a MATLAB code (given at the end of chapter) to choose with replacement k items from pre event group (containing k values) and k items to choose from post event group (containing k values). Samples were chosen 10,000 times and G' statistic was calculated each of the times for k =15, 20, 30, 50 and 75.

$$G' = \frac{(\bar{a}' - \bar{b}')}{\sqrt{\{(\sigma a'^2/k) + (\sigma b'^2/k)\}}} \quad \text{(Equation 2)}$$

For each value of k, a bootstrap distribution of G', using the 10,000 values of G' statistic, were used to find out the critical values of the test statistic.

3.2 Effect on Return of Index

To study the effect of imposition of commodities transaction taxes, MCXENERGY Index is used for the current study.[2] The data in this study cover the period from July 13, 2012 to June 30, 2014 (equal observations before and after July 1, 2013). There are 592 observations for closing price of MCXENERGY. The data of daily closing price for the index was retrieved from MCX website. The daily returns were calculated based on the closing prices by Return, Rt = $\ln(P_{t+1}/P_t)$, where P_t represents the value of index at time t and P_{t+1} represents the value of index at time t+1. Table 2 gives the summary statistics of the daily returns of the index MCXENERGY.

Table 2: Summary Statistics of daily returns of MCXENERGY Index

Statistics	Pre Event	Post Event	Whole Sample
Number of observations	296	296	592
Maximum	0.0377	0.0667	0.0667
Minimum	-0.0429	-0.0502	-0.0502
Mean	0.0007	0.0004	0.0005
Standard Deviation	0.0101	0.0120	0.0111

2 MCXCOMDEX is a composite commodity index and consists of three indices MCXMETAL (40%), MCXENERGY (40%) and MCXAGRI (20%). MCXENERGY index is an index that reflects the energy commodities traded on MCX, the weightages of Crude oil and Natural Gas in the composite index are 35.41% and 4.59% respectively; MCXENERGY index is calculated, but is not a tradable index. We could not use MCXCOMDEX and MCXMETAL as those indices include gold and silver, which are investment assets and not consumption asset. Many commodities in MCXAGRI are not being taxed via CTT, so we could not include it.

In this we check whether the return on MCX ENERGY index changes due to the imposition of tax. Traditional homoskedastic models are not suitable when using the stock prices to calculate return due to the presence of conditional heteroskedasticity (Baillie and Bollerslev, 1990). The volatility of returns is not constant through time and exhibit clustering, which makes periods of relatively low volatility and periods of relatively high volatility grouped together. Thus, the returns can be characterised by Autoregressive Conditional Heteroskedasticity (ARCH), and its extension, Generalised Autoregressive Conditional Heteroskedasticity (GARCH) Model. Thus, we use the methodology developed by Engle (1982) to study the impact of increase in transaction tax on return[3]. The ARCH Model claims that the variance of residuals at time t is dependent on squared error terms from the past. (Engle, 1982).

The Standard GARCH model specification is:

Mean Equation: $h_t = j_0 + \varepsilon_t$;	$\varepsilon_t \sim N(0, \sigma_t^2)$(Equation 3)
Variance Equation: $var(\varepsilon_t \mid L_{t-1}) = \sigma_t^2 = s_0 + s_1 \varepsilon^2_{t-1} + s_2 \sigma^2_{t-1}$	(Equation 4)

In Equation 3 (mean equation of GARCH model), h_t represents the return of MCXENERGY Index, j_0 is the constant in the mean equation and ε_t is the error term. In variance equation of the model (Equation 4), σ_t^2 represent the volatility in MCXENERGY Index, ε^2_{t-1} and σ^2_{t-1} denote ARCH and GARCH terms respectively. $s_1$and s_2 represent the coefficients of ARCH and GARCH terms respectively.

To understand whether the imposition of CTT on 1 July 2013 on return and volatility, we include a dummy variable in the Standard GARCH Model resulting in a Modified version of GARCH. The impact of the change in tax will be observed if the dummy coefficients in the mean equation and variance equation will be significant. The model with dummy variable used in the study is

Mean Equation:$h_t = j_0 + j_1 D_t + \varepsilon_t$;	$\varepsilon_t \sim N(0, \sigma_t^2)$(Equation 5)
Variance Equation: $var(\varepsilon_t \mid L_{t-1}) = \sigma_t^2 = s_0 + s_1 \varepsilon^2_{t-1} + s_2 \sigma^2_{t-1} + s_3 D_t$	(Equation 6)

In Equation 5 (mean equation of GARCH model), $h_t$represents the return of MCXENERGY Index at time t, j_0 is the constant in the mean equation and ε_t is the error term. $D_t$is the dummy

[3] To check whether or not GARCH models can employed for the commodity daily return series, ARCH-LM tests were performed using the commodity daily return series.

variable term introduced in the mean equation, where D_t= 0 before the event (before July 1, 2013) and D_t= 1 after the event (after 1 July 2013). j_1 denotes the coefficient of the dummy variable term in the mean equation. In variance equation of the model (Equation 4.6), σ_t^2 represent the volatility in MCXENERGY Index, ε^2_{t-1} and σ^2_{t-1} denote ARCH and GARCH terms respectively. $s_1$and s_2 represent the coefficients of ARCH and GARCH terms, respectively. Dummy variable term has also been included in the variance equation (Equation 6), s_3 is the coefficient of dummy variable in the variance equation.

3.3 Effect on Commodity Portfolios[4]

This section of the study uses daily data of commodities traded on Multi Commodity Exchange of India. The sample period extends from 3 July 2012 to 30 June 2014 (one year before and one year after) for the tax event occurred on 1 July 2013. We use daily closing price and daily traded data (trading volume) for only seven commodities traded on MCX, since these are the most actively traded commodities. The seven commodities are categorised into three commodity portfolios. For the commodity portfolios, seven commodities are sorted by size – size is measured by trading value (in Rs. lakhs) – as of 28 June 2013, the trading day prior to the imposition of CTT. COMMALL (this is an equally weighted portfolio covering all seven commodities) and is categorised into three sub commodity portfolios as per trading value (Rs. lakhs). These are COMMLARGE (crude oil and Copper), COMMMEDIUM (Natural Gas and Lead), and COMMSMALL (Zinc, Nickel and Aluminium). Table 3 gives the trading value of commodities as on 28 June 2013 (day prior to imposition of CTT) along with the portfolio that the commodity has been categorised into on the basis of trading value. The impact of the commodities transaction tax on each of the commodity portfolios has been examined by studying their return from closing price, shares traded and risk.

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[4] In 2011-12, it was being speculated that there will be imposition of CTT in the commodity market. Hence, in order to study the effect of transaction tax (STT) on securities market, switching first order autocorrelation model was employed. For the analysis on STT, please refer to *Sinha, P. and Mathur, K. (2014). Securities Transaction Tax and the Stock Market: An Indian Experience, Finance India, Vol. 28, No. 2, pp. 441-452.*

Table 3: Trading Value (in Rs. Lakh) of commodities as on June 28, 2013

Commodities	Trading Value (in Rs. lakhs)	Commodity belongs to Portfolio
Crude Oil	1120385.69	COMMALL and COMMLARGE
Copper	254514.18	
Natural Gas	185454.21	COMMALL and COMMMEDIUM
Lead	132571.67	
Zinc	132571.67	COMALL AND COMMSMALL
Nickel	61331.6	
Aluminium	49897.39	

Source: MCX

3.3.1 Effect on Commodity Portfolios - Returns

This section of the study uses the closing prices of the seven commodities in the commodity portfolios to calculate the daily returns of commodity portfolios (log difference of closing price). Besides return of commodity portfolios, risk is calculated for each of the four commodity portfolios using the standard deviation of return for each day over the two year sample period respectively. Table 4 contains summary statistics for the returns on commodity portfolios.

Table4: Summary Statistics for daily returns on commodity portfolios

Portfolio	Number of commodities	Mean	Median	Minimum	Maximum
COMMALL	7	0.0004	0.0003	-0.0482	0.0494
COMMLARGE	2	0.0003	0.0004	-0.0524	0.0555
COMMMEDIUM	2	0.0007	0.0009	-0.0724	0.0680
COMMSMALL	3	0.0003	0.0002	-0.0495	0.0414

To investigate the efficiency effects of the imposition of CTT on July 01, 2013, we use the following switching first order autocorrelation model.

$$R_t = c + \beta R_{t-1} + \mu D_t * R_{t-1} + \varepsilon_t \quad \text{(Equation 7)}$$

Where R_t is the return on a portfolio (COMMALL, COMMLARGE, COMMEDIUM, and COMMSMALL) on a day t, R_{t-1} is the lagged return on a portfolio respectively and D_t is the dummy variable, which takes the value of 0 for dates ranging between 3 July 2012 and 28 June 2013 and it takes the value of 1 for dates ranging between 1 July 2013 till 30 June 2014. β is the coefficient of lagged return whereas μ is the coefficient of interaction term ($D_t * R_{t-1}$). We run the model as specified in Equation 7 separately for each of the four commodity portfolios.

3.3.2 Effect on Commodity Portfolios – Risk

Using the returns of commodities, standard deviations of returns are calculated for the four commodity portfolios. Table 5 contains summary statistics for risk (standard deviation of returns) for commodity portfolios.

Table 5: Summary Statistics for risk (standard deviation) for commodity portfolios

Portfolio	Number of commodities	Mean	Median	Minimum	Maximum
COMMALL	7	0.0106	0.0097	0.0004	0.0532
COMMLARGE	2	0.0074	0.0056	0.0000	0.0463
COMMMEDIUM	2	0.0134	0.0107	0.0000	0.0982
COMMSMALL	3	0.0056	0.0048	0.0001	0.0405

We use two model specifications in Risk I and Risk II to study the impact of CTT on risk of commodity portfolios.

Risk I

The first model specification studies the relationship between return of a portfolio, commodities transaction tax and risk in the portfolio.

$$R_t = k+\tau R_{t-1} + \varphi D_t * R_{t-1} + \chi(SD_t) + \varepsilon_t \quad \text{(Equation 8)}$$

In Equation 8, R_t is the return on a commodity portfolio (COMMALL, COMMLARGE, COMMMEDIUM, and COMMSMALL) on a day t, R_{t-1} is the lagged return on a portfolio and D_t is the dummy variable, which takes the value of 0 for dates ranging between 3 July 2012 and 28 June 2013 and it takes the value of 1 for dates ranging between 1 July 2013 till 30 June 2014.

SD_t is the standard deviation of the return of a portfolio (COMMALL, COMMLARGE, COMMMEDIUM, and COMMSMALL) on a day t. k represents the constant, τ is the coefficient of lagged return while φ is the coefficient of interaction term ($D_t * R_{t-1}$) and χ is the coefficient of standard deviation in the respective commodity portfolios.

Risk II

Another model that this study uses is to examine the relationship between volatility and imposition of CTT as mentioned in specification of Equation 9 below.

$$SD_t^2 = g + \nu D_t*(SD_{t-1})^2 + \varepsilon_t \quad \text{(Equation 9)}$$

In Equation 9, SD_t^2 is the square of the standard deviation of the return of a portfolio (COMMALL, COMMLARGE, COMMMEDIUM, and COMMSMALL) on a day t (measures volatility), SD_{t-1}^2 is the lagged square of standard deviation of the return for the four commodity portfolios and $D_t$is the dummy variable, which takes the value of 0 for dates ranging between 3 July 2012 and 28 June 2013 and it takes the value of 1 for dates ranging between 1 July 2013 till 30 June 2014. g and ν represent constant and coefficient of interaction term $D_t*(SD_{t-1})^2$ respectively in the Equation 9.

3.3.3 Effect on Commodity Portfolios – Traded Volume (in lots)

For the four commodity portfolios, we calculate the average daily traded volume from the trading volume of its constituent commodities (Details of commodity portfolios/sub-portfolios were explained in Table 3). Table 6 contains summary statistics for traded volume (in lots) for commodity portfolios.

Table 6: Summary Statistics for daily traded volume (in lots) for commodity portfolios

Portfolio	Number of commodities	Mean	Median	Minimum	Maximum
COMMALL	7	46900.26	37346.86	729.14	106962.57
COMMLARGE	2	92188.79	73837.75	1395.00	258511.00
COMMMEDIUM	2	45737.40	43074.50	606.00	129956.50
COMMSMALL	3	17483.15	14879.33	256.6667	51900.00

The effect of imposition of CTT on traded volume (in lots) using the switching first order autocorrelation model.

$$TV_t = \gamma + \gamma' TV_{t-1} + \gamma'' D_t * TV_{t-1} + \varepsilon_t \qquad \text{(Equation 10)}$$

In Equation 10, TV_t is the average number of traded volume (in lots) of a portfolio (COMMALL, COMMLARGE, COMMMEDIUM, and COMMSMALL) on a day t, TV_{t-1} is the lagged value of average number of traded volume (in lots) of a portfolio and D_t is the dummy variable, which takes the value of 0 for dates ranging between July 3, 2012 and June 28, 2013 and it takes the value of 1 for dates ranging between July 1, 2013 till June 30, 2014. In the Equation 10, γ is the constant, γ' represents the coefficient of lagged traded volume and γ'' is the coefficient of interaction term (D_t* TV_{t-1}).

4 Empirical Results

4.1 Effect on Traded Quantity

We test whether the total quantity of traded volume (in lots) at MCX and the traded volume of seven commodities changed after the imposition of tax. The results are given in Table 7. The sample length indicates the length of trading used in the calculation of the G(c) statistic. The ratio is the ratio of Mean value after the event (July 1, 2013) to the mean value before the event. The formula used to calculate G(c) has been discussed at length in Section 3.1. The significance level was assessed using the confidence interval obtained from the bootstrapping distributions using code developed on MATLAB. The critical values derived are given in Annexure of paper.

The test statistics (G(c)) for MCX and six of the commodities are found to be significant at 5% level for the five sample lengths (k=15, 20, 30, 50 and 75). Thus, suggesting the traded quantity significantly changed due to imposition of tax on seller of commodities on July 1, 2013 for MCX and the six commodity futures contracts. Whereas, the test statistic for Nickel is not found to be significant for four sample lengths (k=15, 20, 30, 50), the G statistic is found to lie within the region.

Table 7: Results of Impact of Tax on Traded Quantity in commodities (Bootstrapping methodology)

Values of k	**±15**	**±20**	**±30**	**±50**	**±75**
MCX					
Mean before the event	1261938	1238991.35	1210301.93	1197267.10	1217350.51
Mean after the event	722953.93	705217.65	710718.73	714221.60	661414.81
Ratio (mean value after the event/before the event)	0.5729	0.5692	0.5872	0.5965	0.5433
G (c)	**2.8960**	**3.4020**	**4.1425**	**5.4025**	**7.4300**
Aluminium					
Mean before the event	10162.67	10449.35	10084.27	10008.92	10199.39
Mean after the event	6198.67	5969.2	5730.67	5248.94	4515.69
Ratio (mean value after the event/before the event)	0.6099	0.5713	0.5683	0.5244	0.4427
G (c)	**2.8823**	**3.5541**	**4.6167**	**6.2912**	**8.8582**
Copper					
Mean before the event	99743.13	94596.35	95653.17	93406.74	93853.29
Mean after the event	56902.80	52982.90	53478.50	50819.50	46899.63
Ratio (mean value after the event/before the event)	0.5705	0.5601	0.5591	0.5441	0.4997
G (c)	**2.8507**	**3.3250**	**4.6301**	**5.7088**	**7.6751**
Lead					
Mean before the event	27314.07	28519.05	29319.43	26451.08	25621.59
Mean after the event	15416.27	14841.45	14229.60	14292.98	13283.76
Ratio (mean value after the event/before the event)	0.5644	0.5204	0.4853	0.5404	0.5185
G (c)	**3.2997**	**4.0545**	**5.8361**	**6.0836**	**7.6789**

Coefficients marked in bold are significant at 5% significance level

Table 7: (contd.): Results of Impact of Tax on Traded Quantity in commodities (Bootstrapping methodology)

Values of k	±15	±20	±30	±50	±75
Nickel					
Mean before the event	32426.80	31405.30	30999.43	31584.74	32195.91
Mean after the event	23854.33	23132.05	21557.4	19513.34	17463.96
Ratio (mean value after the event/before the event)	0.7356	0.7366	0.6954	0.6178	0.5424
G (c)	1.6754	1.9016	2.9557	4.8396	**7.0554**
Zinc					
Mean before the event	16879.67	17217.65	16875.67	17014.54	18084.87
Mean after the event	9292.2667	8805.80	8367.3667	8289.84	7338
Ratio (mean value after the event/before the event)	0.5505	0.5114	0.4958	0.4872	0.4058
G (c)	**3.2622**	**4.0336**	**5.4624**	**6.9534**	**9.2531**
Crude Oil					
Mean before the event	197082.47	192578.15	194596.57	177906.36	165702.19
Mean after the event	107439.33	101685.35	103253.47	98566.10	87418.33
Ratio (mean value after the event/before the event)	0.5451	0.5280	0.5306	0.5540	0.5276
G (c)	**3.3530**	**3.9332**	**5.4323**	**6.2579**	**7.3851**
Natural Gas					
Mean before the event	75303.87	73210.70	77190.03	82260.82	96221.40
Mean after the event	43137.60	43937.70	42681.43	38521.90	34642.12
Ratio (mean value after the event/before the event)	0.5728	0.6002	0.5529	0.4683	0.3600
G (c)	**3.1278**	**3.1401**	**5.0018**	**7.0629**	**9.8712**

Coefficients marked in bold are significant at 5% significance level

As can be seen from Table 7, the volume of commodities traded fell by 40% in MCX. Thus clearly showing with an imposition of tax there has been a fall in quantity of volume traded on MCX. This indicates that the market responded to the imposition in CTT by a large reduction in trading volume. This is in line with the basic principle of public finance which states that, as tax rate increases, the tax base shrinks.

4.2 Effect on Returns of Index

In this section, we examine the impact on return of index due to an imposition of CTT by modified version of GARCH Model. Both the Standard GARCH(1,1) model defined in the Equation (3) and Equation (4) and the modified GARCH in the Equation (5) and Equation (6) are estimated for the index. Table 8 provides the results of the GARCH Model and the Modified version of GARCH.

Table 8: Results of Standard GARCH and Modified Version of GARCH for MCXENERGY INDEX (Equation 3, Equation 4 and Equation 5, Equation 6)

Mean Equation		**Variance Equation**				
Coefficient of Constant j_o	**Coefficient of Dummy j_1**	**Coefficient of Constant s_0**	**Coefficient of ARCH s_1**	**Coefficient of GARCH s_2**	**Coefficient of D_t s_3**	**L**
Standard GARCH (Equation 4.3 and Equation 4.4)						
0.0006 (0.1444)	-	1.73E-06 (0.0659)	0.0726 (0.0000)	0.9159 (0.0000)	-	1856.96
Modified GARCH (Equation 4.5 and Equation 4.6)						
0.0007 (0.2147)	-0.0002 (0.8276)	1.62E-06 (0.069)	0.0708 (0.0000)	0.9170 (0.0000)	3.11E-07 (0.7282)	1857.027

Coefficients marked in bold are significant at 5% significance level, p value is indicated in parenthesis

As we can observe from Table 8, for MCXENERGY index, the coefficient of the dummy variable (j_1) in the mean equation of Modified GARCH (Equation 5) is negative though the coefficient is not significant. Thus, indicating that an imposition of CTT has had a negative impact on the rate of return on MCXENERGY index. The coefficient of the dummy variable (s_3) in the variance equation (Equation 6) is positive and insignificant. Thus, we do not find a significant relationship between imposition of CTT and return volatility of the MCXENERGY index as was expected by the imposition of transaction tax by the proponents of transaction tax.

4.3 Effect on Commodity Portfolios

4.3.1 Effect on Commodity Portfolios – Returns

The results of the estimated model as specified in Equation 7 for each of the four commodity portfolios are reported in Table 9.

Table 9: Summary of Switching First Order Autocorrelation Model (Equation 7)

Model	Portfolio\ Coefficients	Coefficient of Constant, c	Coefficient of R_{t-1}, B	Coefficient of $R_{t-1}*D_t$,μ	Adjusted R^2	F statistic for significance of the model
I	**COMMALL**	0.00044 (0.2859)	0.0332 (0.6379)	-0.0583 (0.5086)	-0.0028	0.2232
II	**COMMLARGE**	0.0002 (0.5228)	0.0446 (0.5124)	-0.1125 (0.1958)	0.0000	1.0037
III	**COMMMEDIUM**	0.0007 (0.2649)	-0.0084 (0.8973)	0.1006 (0.2405)	0.0013	1.3609
IV	**COMMSMALL**	0.0003 (0.4749)	0.0066 (0.9186)	-0.0865 (0.3127)	0.0000	1.0072

Coefficients marked in bold are significant at 5% significance level, p value is indicated in parenthesis

The coefficient of R_{t-1}, β, is the first order autocorrelation coefficients for all the commodity portfolios respectively. For COMMALL, COMMLARGE, COMMMEDIUM, COMMSMALL, the coefficient of R_{t-1}, that is β, is not found to be significant at 5% level of significance. The coefficient of (DUMMY* R_{t-1}), μ, is not significant at 5% level of significance for any of the commodity portfolios. Thus, the commodity portfolios (COMMALL, COMMLARGE, COMMMEDIUM, COMMSMALL) do not experience a statistically significant change around 1 July 2013 when the CTT was imposed. Proponents of the imposition of transaction tax were of the view that the imposition of transaction tax would increase the efficiency of the underlying asset. Whereas in the case of commodity portfolios, efficiency measured by the first order autocorrelation, remains unaffected by the imposition of the transaction tax on the commodity portfolios chosen.

4.3.2 Effect on Commodity Portfolios – Risk

Risk I

The results of model as specified in Equation 8 for each of the four commodity portfolios are reported in Table 10.

Table 10: Summary of Switching Order Autocorrelation model with a risk component (Equation 8)

Model	Portfolio\ Coefficients	Coefficient of Constant,K	Coefficient of R_{t-1},T	Coefficient of D_t*R_{t-1},Φ	Coefficient of SD, χ	Adjusted R^2	F statistic for significance of the model
I	**COMMALL**	0.0004 (0.6208)	0.0331 (0.6385)	-0.0582 (0.5107)	0.0027 (0.9640)	-0.0046	0.1492
II	**COMMLARGE**	0.0001 (0.8164)	0.0494 (0.4691)	-0.1149 (0.1870)	0.0522 (0.3823)	-0.0004	0.9237
III	**COMMMEDIUM**	7.91E-06 (0.9927)	-0.0136 (0.8338)	0.1108 (0.1989)	0.0483 (0.3079)	0.0014	1.2545
IV	**COMMSMALL**	-0.0003 (0.6167)	0.0080 (0.9010)	-0.0859 (0.3154)	0.1158 (0.2324)	0.0008	1.1485

Coefficients marked in bold are significant at 5% significance level, p value is indicated in parenthesis

The associated p values of the coefficients of the model are given in parentheses. It is observed that coefficient of risk (χ) and coefficient of interaction term, Φ (lagged return, R_{t-1} and dummy) are not significant for all the commodity portfolios. This indicates that the returns remain unaffected by risk inherent in the portfolio as well as the imposition of tax.

Risk - II

The results of the model as specified in Equation 9 for each of the four commodity portfolios are reported in Table 11.

Table 11: Summary of results for risk (Specification in Equation 9)

Model	Portfolio\ Coefficients	Coefficient of Constant g	Coefficient of D_t*(SD_{t-1})	Adjusted R^2	F statistic for significance of the model
A	**COMMALL**	**0.0001** (0.0000)	**0.2494** (0.0000)	0.0321	19.4271
B	**COMMLARGE**	**9.73E-05** (0.0000)	0.0026 (0.9606)	-0.0018	0.0024
C	**COMMMEDIUM**	**0.0003** (0.0000)	**0.2459** (0.0001)	0.0241	14.7384
D	**COMMSMALL**	**4.06-05** (0.0000)	**0.3108** (0.0000)	0.0930	58.0194

Coefficients marked in bold are significant at 5% significance level, p value is indicated in parenthesis

It is seen that the coefficient of interaction term of dummy and lagged square of standard deviation of the return (ν) is significant for three (COMMALL, COMMMEDIUM, COMMSMALL) out of the four commodity portfolios. Thus one can argue that, imposition of CTT affects the risk of return for the three commodity portfolios. In other words, we conclude that tax affects the volatility of return on commodity portfolios. This argument is consistent with the opponents of transaction tax who believe that imposition of transaction tax would lead to increase in volatility of returns rather than reducing volatility in the stock market (Umlauf, 1993).

4.3.3 Effect on Commodity Portfolios – Traded Volume (in lots)

The results of the estimated model as specified in Equation (10) for each of the four commodity portfolios are reported in Table 12.

Table 12: Summary of Switching First Order Autocorrelation using Traded Volume (in lots)

Model	**Portfolio\ Coefficients**	**Coefficient of Constant, Γ**	**Coefficient of TV_{t-1}, γ'**	**Coefficient of D_t*TV_{t-1}, γ''**	**Adjusted R^2**	**F statistic for significance of the model**
I	**COMMALL**	**44261.54** (0.0000)	**0.2717** (0.0000)	**-0.7818** (0.0000)	0.3933	181.1926
II	**COMMLARGE**	**69826.90** (0.0000)	**0.4129** (0.0000)	**-0.6767** (0.0000)	0.4147	197.9746
III	**COMMMEDIUM**	**31667.47** (0.0000)	**0.3919** (0.0000)	**-0.2710** (0.0000)	0.2107	75.2191
IV	**COMMSMALL**	**14061.58** (0.0000)	**0.3176** (0.0000)	**-0.4196** (0.0000)	0.1994	70.2649

Coefficients marked in bold are significant at 5% significance level, p value is indicated in parenthesis

The first order autocorrelation coefficient (γ') of all the four commodity portfolios is significant at 5% level of significance. The fourth column of the Table 12 indicates that that the first order autocorrelation coefficient (with interaction term with dummy variable) which takes the tax imposition into account (γ'') is significant for the four commodity portfolios at 5% level of significance. The coefficient (γ'') is negative for the four commodity portfolios, one can assert that traded volume of the commodity portfolios decline with an imposition of CTT.

5 Concluding Remarks

The Commodity Futures Market is an instrument to achieve price discovery of commodities. The Government of India introduced the Commodities Transaction Tax of 0.01 per cent payable on seller for derivative transactions on 1 July 2013. This tax in line with the earlier tax imposed on transactions in the Securities Market, the Securities Transaction Tax. The difference between the two taxes (STT and CTT) in India is that STT is imposed on both buyers and sellers whereas CTT is levied on non-farm commodity derivatives and the tax is payable by the seller. The aim of imposition of these taxes is to reduce the price volatility and increase tax revenue, whether it will actually be able to achieve the objectives is debatable. It is debatable since the levy of the tax adversely affects the traded volume of the contracts. Currently, the CTT is applicable to non-farm commodity derivatives traded in commodity exchanges of India.

This study examines the impact of levying the tax on non-farm commodity derivative markets. Through bootstrap methodology, one can conclude that the trading volume significantly changed due to imposition of tax on seller of commodities on July 1, 2013 for MCX and the six commodity futures contracts (Aluminium, Copper, Zinc, Lead, Crude Oil and Natural Gas). The fall in trading volume has been approximately 40% across commodities.

Analysing the effect of the tax on MCX Energy Index using a modified GARCH model it was found that an imposition of CTT has had a negative impact on the rate of return on index, whereas there is an absence of a significant relationship between imposition of CTT and return volatility of the index as was expected by the imposition of transaction tax by the proponents of STT.

On categorising commodities into an aggregate commodity portfolio (COMALL), and sub-commodity portfolios (COMMLARGE, COMMMEDIUM, COMMSMALL), it is found that the efficiency of the commodity portfolios remains unaffected by the imposition of the transaction tax on the commodities chosen. It is also found that the portfolio returns remain unaffected by risk inherent in the portfolio as well as the imposition of tax. Another interesting result is that Commodities Transaction Tax affects the volatility of return of commodity portfolios. This argument is consistent with the opponents of transaction tax who believe that imposition of transaction tax would lead to increase in volatility of returns rather than reducing volatility in the (Umlauf, 1993). Apart from the above results, the study is also able to conclude with the switching autoregression model is that the traded volume (in lots) of the four commodity portfolios declines with an imposition of CTT.

Thus, the current study asserts that imposition of CTT is not desirable for the Indian Commodity Futures, as it still is in the nascent stage of growth. The tax has turned out to be counterproductive, since it has not been able to generate the much desired revenue for the government due to lack of trading. Further, due to lack of trading, the basic function of commodity markets, i.e., of price discovery is also not being achieved.

Annexure

Commodity derivatives exempted from levy of CTT

1. Almond	13. Kapas
2. Barley	14. Maize Feed
3. Cardamom	15. Pepper
4. Castor Seed	16. Potato
5. Channa /Gram	17. Rape/Mustard Seed
6. Copra	18. Raw Jute
7. Coriander	19. Red Chilli
8. Cotton	20. Soya bean/seed
9. Cotton seed oilcake	21. Soymeal
10. Guar seed	22. Turmeric
11. Isabgul seed	23. Wheat
12. Jeera	

Critical Values (derived from Bootstrapping)

		k=15	k=20	k=30	k=50	k=75
MCX	**Lower**	-3.7647	-3.4221	-4.5931	-4.0987	-3.3266
	Upper	0.5047	0.7363	-0.7313	0.1548	0.9065
Aluminium	**Lower**	-3.8148	-4.8864	-2.886	-2.7946	-1.9456
	Upper	0.9844	-0.0012	1.7891	1.5516	2.1321
Copper	**Lower**	-3.8627	-4.1075	-3.105	-3.2121	-3.5769
	Upper	0.335	0.2639	1.3504	1.0046	0.6328
Lead	**Lower**	-9.7711	-10.6542	-6.5575	-5.6726	-3.8734
	Upper	-3.6998	-4.5701	-1.5526	-1.6401	0.2729
Nickel	**Lower**	-1.9325	-2.2587	-0.5374	0.6682	2.0101
	Upper	2.9862	2.4503	4.52	5.4698	6.7839
Zinc	**Lower**	-4.5419	-5.5631	-3.4242	-3.4447	-1.5104
	Upper	0.5191	-0.3451	1.0357	0.6455	2.6683
Crude Oil	**Lower**	-2.956	-1.9784	-2.1694	-1.6374	-1.1234
	Upper	1.405	2.8648	2.2726	2.4694	2.8521
Natural Gas	**Lower**	-0.8128	-0.4251	-0.1791	0.0156	0.4503
	Upper	4.6215	4.8149	4.7546	4.6307	4.7516

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