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# Impact of Price Level Changes in Indian Commodity Market

**Dr. G. SELVALAKSHMI** — Assistant Professor, Department of Commerece,Trinity College for Women, Namakkal – 637002,Tamil Nadu.

**Dr.A.ARUMUGAM** — Professor, Department of Management Studies, Paavai Engineering College Namakkal – 637018,Tamil Nadu.

**ABSTRACT**

*The main purpose of this study would be to look into price level changes in Indian commodity market. The commodity market provides trading platform to trade commodities of varied types. This study evaluates the extent to which macroeconomic variables contribute to commodity price level change. This study uses daily commodity price index data for the period of five years from 2007-08 to 2011-12. The sample is selected in the Multi Commodity Index of India and data collected for the study period. This paper investigates the presence the stationary properties of variables and using ADF test, the relationship between dependent and explanatory variables in the long-run is computed through co-integration test. The impact of macroeconomic variables such as, storage of stock, supply and demand, economic performance, price of commodities, global trends, substitute commodity prices, savings and investment, agricultural output and monsoon in the commodity prices is analyzed through Granger causality test. The daily returns, day-of the week effect and volatility test are analyzed by using mean, median, standard deviation, kurtosis and skewness, the validity of the results are checked through Kruskal-Wallis Test. Barletts homogeneity is adopted to test the equally of variance in addition with Levenes Test. Percentage analysis is used to measure the price level changes in the commodity prices in MCX.*

**KEYWORDS : Commodity, Price changes, Commodity market, Econometric analysis, day-of the week effect.**

## 1. INTRODUCTION

The realization of econometric models has become progressively the latest thing in commodity market research. Economic growth and progress of countries have fundamentally relies on the existence of commodity market. Globally, the phenomenon of organized trading in commodity stuff progressed in the middle of the 19th century. Chicago had pioneered as a principal commercial centre with rail transports and telegraph lines connecting it with the international destinations, thereby attracting wheat producer from mid-west to sell their produce to the merchants. Lack of storage facility, weighing and grading system, transport and transparency in pricing of wheat created problems to the farmers and it paved the way to establish a common meeting place for both farmers and dealers to deals in spot grain to deliver wheat immediately and receive cash in return. Then this trading pattern developed in a new shape in which the farmer and merchants agreed to transact at a future date at an agreed price, this is what called as 'futures' trading (Baskara, M. 2007). A commodity exchange is a type of financial market where different groups of participants trade commodity-linked contract, with the underlying objective of transferring exposure uqto commodity-price risks. Futures market facilitates producers and traders of commodities to sell and buy commodity in advance to protect them against uncertain price fall or rise, with a view to safeguard their interest. Future market is an effective mechanism to hedge against adverse price conditions.

Commodity market essentially offers enormous potential to become a separate asset class for investors, speculators and arbitrageurs. Commodity markets transactions are easy to understand as far as fundamentals of demand and supply are concerned. Pricing in commodity futures has been less volatile compared with equity and currency market, thus providing an efficient portfolio diversification opportunity. In India, National Commodity and Derivative Exchange (NCDEX), Multi Commodity Derivative Exchange (MCX) and National Multi Commodity Exchange of India Limited (NCME) are providing electronic trading and settlement platform to transact spot and futures in various commodities. Future contract are standardized contracts and come with specific set of prices with a lot size and expiry or settlement date. Commodity exchanges in India are expected to contribute considerably in strengthening economy to face the challenges of globalization. Indian markets are balanced to bystander further developments in the areas of electronic warehouse receipts, which would facilitate seamless countrywide spot market for commodities. A developed and efficient commodity futures market assists counterbalancing the transactions without impacting on physical goods until the expiry of a contract. There is a large number of diverse market players share in buying and selling activities in the diversity commodity market. There are both domestic and global information like, demand and supply, price, climatic conditions and other market related information. All these factors put together result in the efficient price discovery as a result of large number of commodity producers and investors transacting in the futures market.

## 2. STATEMENT OF THE PROBLEM

Price changes and its instability in commodities inflict overheads on both the producers and consumers at large. If the price of a commodity cataracts below the cost of production, it is incredibly destructive to the producer of commodities, if the price surpass a certain level; it is detrimental to the consumers. Low price can be beneficial to consumers and induce them to buy more and high price goes up producers gain. A sudden fall or increase in the commodity prices can create serious problems to the economy. The variations in price movements have rigorous consequences, unlikely afford chance for speculators, lead for formation of flawed policy on pricing and so on (Anil Sharma et al. 2001). Government pricing policy involves a variety of policy instruments, including tariffs, subsidies, and price floors. Government set price floors mean that the price distribution is censored at the price support level. This is typically implemented by a nodal agency set to purchase an unrestricted quantity of targeted commodity at the price floor (Chavas et al. 2005).

Since the inception of commodity derivatives, there has been an unremitting deliberate on pricing of commodities. Especially, the producers facing alleged influence of price during surplus supplies on one side, and the consumers whimpered about their frustrating influence on rising prices under shortage of supply of commodities on other side. Ahuja, N. L., (2006) it is imperative to understand why commodity futures are required and its role in risk management. It is common acquaintance that prices of commodities, metals, shares and currencies fluctuate over time. The possibility of adverse price changes in future creates risk for businesses. Derivatives are used to reduce or eliminate price risk arising from unforeseen price changes. Sen et al. (2010) debated that forward and future trading can be advantageous by ensuring efficient pricing in the market centre on a process known as 'price discovery'. The latter, subject to competitive markets and full information is supposed to provide a direction to price formation via the future market. Sushismita Bose (2008) examined that there is noticeable restrictions to the benefits from commodity futures. It provides protection against price risk, and price risk instruments address only a portion of the underlying problem of income protection. For instance, in the case of metals or energy commodities, where shocks typically originate on the demand

side through the industrial business cycle, production can be planned and from the producer's point of view volatile prices explain most revenue volatility.

## 3. SIGNIFICANCE OF THE STUDY

MCX is one the premier commodity exchange and started operations in November 2003 and holds a market share of over 85% till date in Indian commodity market. MCX offers more than 40 commodities across various segments like, bullions, plantations, metals, energy, weather, oil and oil seeds, cereals, fiber, spices and pulses on its trading platform. It provides standardized commodity futures on its platform and creates better trading environment for ideal price discovery. Furthermore, for globally-traded commodities, its platform enables to the domestic participants to trade Indian currency. The clearing and settlement process are done quickly to meet the investor's demands and ensures transparency to its stakeholders.

## 4. OBJECTIVES OF THE STUDY

This study is started with the view of analyzing price level changes in Indian commodity market, the objectives are as follows:

1. To test the impact of macroeconomic variables in price level changes in Indian commodity prices.
2. To establish the life of long-run price equilibrium relationship among the different macroeconomic variables.
3. To determine the daily returns patterns in the market, day-of the week effect and volatility of commodity returns.
4. To find the annual growth performance of commodity index in MCX.

## 5. REVIEW OF LITERATURE

This study is equipped with comprehensive reviews on commodity, commodity futures, price distribution in the commodity market both in India and across the world. Kumar, R (2000) examined the relationship between prices of rice in Indian market with global major rice market by adopting the co-integration approach. The results showed that all the price series were stationary and were not integrated in the long-run. Naik et al. (2001) analyzed that on assessing the competence of major commodity futures markets in India using co-integration theory and they accomplished that a major reason for the poor performance of Indian market could be the lack participation of hedgers in commodity trading activities. The exchange authorities and the forward markets commission have to find ways to attract hedger in order to improve the performance of these markets. Dasgupta (2004) stressed that the future price stretch of production has always been greater or equal to one and increasing profit by increasing price is not attainable. It also showed that the future price change of inventory was adversely related with the carrying cost. Applying a co-integration model Gervais et al. (2010) report similar results, a 1% increase of global gross domestic product generates a peak response of 15% in the price of oil and 4% increase in non-energy commodity prices.

Volatility of prices is conceivably the most pressing concern facing producers of primary commodities. The low prices for basic commodities limit the income farmers can receive for their products and the high unpredictability of these prices constructs it very complicated for them to optimize the use of their revenue (Morgan, 2000). Kellard, et al. (1999) observed the efficiency of numerous extensively traded commodities in different markets, the outcomes demonstrate that the long-run equilibrium condition holds in commodities, but again there was evidence of short-run inefficiency for most of the markets inspected. Gallant et al. (1992) specify that more can be learned about the market by studying the joint dynamics of price and trading volume. Moreover the trading volume reflects information about changes in investor's expectation. A strong relationship between price and volume provides support to technical analysis.

Ciner (2002) examined the relationship between volume and price in commodity futures market in Tokyo. The information about gold, platinum and rubber futures has been examined for the direction and magnitude of the price and volume. It was accomplished that based on linear Granger causality test; do not advocate that volume contains information to predict return. Puri et al. (2008) have examined the volume-return relationship in the interest rate currency futures traded on LIFFE. They have found that interest and currency futures exhibit a volume return relationship which is asymmetric and characterized by larger volume associated with negative returns than with non-negative return.

Franses et al. (2001) surveyed on quantitative models for revealed preference data in application of econometric tools. The main reason for considering econometric models is that in many cases the number of data points and the number of variables is rather large, and hence plainly performing a range of bivariate analyses appeared unreasonable. Cooper (1993) and Bronnenberg et al.(2000) significant features of attraction models are that they duly assume that market shares sum to unity and that the market shares of individual brands are in between 0 and 1. Normally, an attraction model can be written as a system of equations concerning all market shares, and the parameters can be estimated using standard methods.

## 6. RESEARCH METHODOLOGY

### Sample and Data

The commodity futures investment now recognized as a financial instrument equivalent to the equity futures. Future contracts are taking place through screen based trading on these exchanges giving rise to timely and efficient distribution of information on price of commodities. The data for the study is collected from MCX commodity exchange of India for the period 2008-2012 to determine the daily returns, day-of the week effect and volatility of commodity returns. Studying longer period of data can make apparent results to investment decisions. However use of long-term data that summarize antiquated data that transmits to periods of long-term performance of commodity market. As a result of these benefits in applying long-term data, this study focus on more recent trends in price level changes in commodity market. In this study, econometric model has been utilized to investigate the process of market price determination of commodities. Under market equilibrium situation, the interaction between supply and demand determines commodity prices. In carrying this study, time series data sourced from MCX covers various commodities including metal, serial, and other commodities. This study covers Storage of Stock (SS), Supply and Demand (SD), Economic Performance (EP), Price of Commodities (PC), Global Trends (GT), Substitute Commodity Prices (SCP), Savings and Investment (SI) Agricultural Output (AO) and Monsoon (MON) between 2008 and 2012. Eventually, these factors make fluctuations in prices and when unexpected, they price uncertainty. Conversely, in the existence of negative movement, there is an inducement to grasp stock in response to changes in prices. The Average Commodity Price (ACP) of different commodities in India straddling through precious metals, industrial metals, energy, oil and oil seeds, fibres, spices, pulses and cereals.

### Testing Methods

Unit test has been conducted to test the stationary properties of the variable and it was performed using Augmented Dickey – Fuller (ADF) test. In order to check the existing of a long-run stable relationship between dependent and explanatory variables, co-integration test conducted. The basic empirical difficulty is whether macroeconomic variables significantly affect commodity market prices in India. This model utilizes Granger Causality Test to find the direction of causality between commodity prices and macroeconomic prices.

The daily returns of each commodities was calculated and to establish the nature of volatility of the returns, the distributions of daily returns are analyzed using measures like mean, median, standard deviations, kurtosis and skewness. In order to validate the results obtained in the above, parametric and non-parametric tools employed. The result obtained in the normality test specifies that the distributions are non-normal, hence Kruskall-Wallis applied to test the equality on mean returns. The equality of variance across the trading days of the week, Bartletts homogeneity test. It is also limited to a particular extent, it failed to encounter homogeneity of variance, the use of Levenes test attempted to test equality of variance. In order to find the progress of commodity prices, the closing index values are taken to find the annual trends in commodity market movements.

## 7. DISCUSSION OF RESULTS

### ADF Unit Root Analysis

The unit root test used in this study investigates the following factors and its stationary level along with its order of integration, such as, storage of stock, supply and demand, economic performance, price of commodities, global trends, substitute commodity prices, savings and investment, agricultural output and monsoon. Results for the unit root test for the different variables are presented in the table 1.

**Table – 1: ADF Unit Root Test Results**

| Variables | ADF Test | ADF lag | 95% Confidence | Order of Integration | Stationary Level @ 5% |
|---|---|---|---|---|---|
| Storage of Stock | -7.346 | 1 | -3.4542 | I (1) | Good |
| Supply and Demand | -12.534 | 1 | -3.4534 | I (1) | Good |
| Economic Performance | -14.615 | 1 | -3.4534 | I (1) | Good |
| Price of Commodities | -6.693 | 1 | -3.4542 | I (1) | Good |
| Global Trends | -7.897 | 1 | -3.4534 | I (1) | Good |
| Substitute Commodity Price | -7.825 | 1 | -3.4534 | I (1) | Good |
| Savings and Investment | -7.204 | 1 | -3.4542 | I (1) | Good |
| Agricultural Output | -13.692 | 1 | -3.4542 | I (1) | Good |
| Monsoon | -7.894 | 1 | -3.4542 | I (1) | Good |

**Source: Market Data**

In order to confirm the stationary of the macroeconomic variables in price level changes in commodity market Augmented Dickey Fuller (ADF) test was performed on the series and the results show that of all variable are equally have stationary level. The results obtained from the above table shows that all the variable are integrated of order one, which means, all variables are I(1) variables at the 5% level of significance. All other variable are found to contain unit root, these results are consistent with similar results in the literature that most macroeconomic variables and commodity are stationary. Thus, the price of commodities has different stationary process. The remaining factors are equally posses the stationary level at 5% significance is good. It is clear from the above analysis, these variables are completely rely on the concept of price level changes is equally disturbed from time to time as per the uniqueness of the problem. While applying this test, the results are ranging from -6.693 to -14.615 for all the variables and significant at 5%.

**Co-integration Test**

In order to establish the subsistence of long-run price equilibrium relationship among these variables, this is nothing but, a test of stationary of the residual of the OLS equation of all macroeconomic variables. As per the view point of Engle and Granger (1987) co-integration among time series data, advocate that series may perform in a different way in the short-term period but that will come together towards a common behavior in the long-term time period. The different sets of variables are co-integrated when their residual is stationary. The co-integration test have been applied for the study to bring the results, the following table-2 presents its results.

**Table – 2: Co-integration Test Results**

| Variables | ADF Test | ADF lag | 95% Confidence | Order of Integration | Stationary Level @ 5% |
|---|---|---|---|---|---|
| Residuals | -4.359 | 1 | -4.135 | I (1) | Good |

It is evident from the table-2; the ADF unit root test statistics is superior in absolute terms than the 95% confidence level. The result is an indicator to the fact that the residuals are stationary in this analysis. This brings the fact that both the dependent and independent variables are co-integrated properly. It is confirmed that during the period between 2007-08 and 2011-12, there were a long-term stable relationship among the variables storage of stock, supply and demand, economic performance, price of commodities, global trends, substitute commodity prices, savings and investment, agricultural output and monsoon in India such that converge position in long-term. It denotes that price level changes in Indian commodity market are largely governed by the above variable in no uncertainty.

**Granger Causality Test**

Granger causality test is conducted to assess the impact of macroeconomic variable in the price changes in commodity market. It ascertains the direction of causality between Average commodity price and macroeconomic variable in Indian commodity market between 2007-08 and 2011-12. The following variables, such as, Storage of Stock (SS), Supply and Demand (SD), Economic Performance (EP), Price of Commodities (PC), Global Trends (GT), Substitute Commodity Prices (SCP), Savings and Investment (SI) Agricultural Output (AO) and Monsoon (MON) have been adopted to this study.

**Table -3: Granger Causality Test results**

| VARs | ACP | SS | SD | EP | PC | GT | SCP | SI | AO | MON |
|---|---|---|---|---|---|---|---|---|---|---|
| ACP | - | # | # | # | # | # | # | # | # | # |
| SS | # | - | # | 10% | # | # | # | 5% | # | # |
| SD | 1&5% | # | - | # | # | 1&5% | # | # | # | # |
| EP | # | # | # | - | 5% | # | # | 10% | # | # |
| PC | # | # | 1&5% | # | - | # | 1&5% | # | # | 10% |
| GT | # | 10% | # | # | 1&5% | - | # | # | # | # |
| SCP | # | # | # | # | # | # | - | # | 1&5% | # |
| SI | # | # | # | 1&5% | # | # | # | - | # | # |
| AO | 1&5% | # | # | # | 5% | # | # | # | - | # |
| MON | # | # | # | 1&5% | # | # | # | # | 5% | - |

# - indicates that the variable in row does not Granger cause variable in column.

% - indicates how big the variables in row Granger cause the variable in column.

Table-3 illustrates the causality between the average commodity price (here both agricultural and non-agricultural commodity average has been calculated and utilized) and macroeconomic performance in India, Granger Causality test on commodity average with nine important macroeconomic variables. This is applied to examine the lead and lag relationship between average commodity price and macroeconomic variables. During this study period, the result in the above table indicates that average commodity price have Granger cause with supply and demand, and agriculture output. Similarly, storage of stock has causality with economic performance and savings and investment. Supply and demand posses the causality with global trend also, economic performance is correlated with price of commodities and savings and investment. Likewise, this study possess causality between global trend and storage of stock, global trend and price commodities, substitute commodity price was having causality with agriculture output, agriculture output and price of commodity, monsoon posses causality with economic performance and agriculture output.

**Basic Statistics on Commodity Returns**

The closing values of MCXCOMDEX index for the sample period to determine the daily returns, day-of the week effect and volatility of commodity returns. Hence mean median, standard deviation, kurtosis, skewness computed along with average minimum and maximum returns for the all the days in the week. The price level changes in daily mode have been computed with the help of above descriptive statistics tools and presented in the table-4.

**Table – 4: Descriptive Statistics of Daily Returns of the Commodities**

| Descriptive Statistics | Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| Mean | 3496.58 | 3536.09 | 3512.26 | 3523.63 | 3518.57 |
| Median | 2735.84 | 2773.78 | 2753.21 | 2743.31 | 2739.94 |
| Standard Deviation | 2392.03 | 2424.24 | 2431.53 | 2408.28 | 2399.43 |
| Kurtosis | -1.3312 | -1.3241 | -1.3222 | -1.3189 | -1.3293 |
| Skewness | 0.23985 | 0.24425 | 0.23951 | 0.23975 | 0.24562 |
| Count | 198 | 197 | 196 | 198 | 199 |
| Average Minimum Return | -0.71 | -0.32 | -0.42 | -0.53 | -0.46 |

| | | | | | |
|---|---|---|---|---|---|
| Average Maximum Return | 0.41 | 0.59 | 0.35 | 0.63 | 0.46 |
| Std. Deviation for Returns | 3.97% | 2.83% | 3.15% | 4.26% | 4.11% |

**Source: Market Data**

It is evident from the table-4; mean score values found for the commodities on Monday, Tuesday, Wednesday, Thursday and Friday are 3496.58, 3536.09, 3512.26, 3523.63 and 3518.57 respectively. Similarly, median values are found from 2735.84 to 2773.78 for the five days. Standard deviation ranges from 2392.03 to 2431.53 in the trading days of the week. Symmetrical measure, such as, skewness found that is a greater than 0.00. The normal distribution mark for the skewness is equal to zero (0). Hence it can be interpreted that this distribution is not-symmetric. Kurtosis is the measure of peak of data and the fat-tails that associate with less density in the middle. The normal distribution standard for kurtosis is 3.0 or more. In this study, the value of kurtosis is below the mark of 3.0, hence it is not symmetric distribution. The average minimum return shows that -0.71 on Monday with standard deviation of 3.97% and average maximum return shows that 0.63 on Thursday with standard deviation of 4.26%.

### The day-of the week effect

With a view to test the validity of results obtained in the descriptive statistics, Kruskal-Wallis test has been applied to test the day-of the week effect with the following hypothesis to place the price level changes. Commodity returns are calculated to test the significance changes in commodity prices during the sample period.

$H_0$: There is no change in the returns (prices) of commodity across the days-of the week;

$H_1$: There is a change in the returns (prices) of commodity across the days-of the week.

In the rejection of null hypothesis leads for acceptance of alternative hypothesis in the market, this means that there is a change in the returns (prices) of commodity across the days-of the week.

**Table-5: Test of Normality, Equality of Means (Variances)**

| Variable | Kruskal-Wallis | | Levene's Test | | Bartlett's Test | |
|---|---|---|---|---|---|---|
| | $X^2$ | P Value | Statistics | P Value | Statistics | P Value |
| MCX Index | 0.793* | 0.854 | 0.726 | 0.314 | 753.30 | 0.00 |

***Not-significant at 5% level, null hypothesis rejected.**

As shown on Table-5, the values of chi-square statistics not significant at the 5% level for market. These results do not hold up the survival of the day-of the week effect on the commodity return in MCX. The equality of the standard deviations across of the day-of the week contains that 0.726 and failed to accompany. It brought another connotation that any seasonal volatility and investing on low return days not necessarily mean that it possesses low risk, Levene's test countered. The equality of variance across the days of the week also reveals the same message about the price level changes over a period of time.

### Annual Closing Values of Index

The price level changes in commodity prices can be checked by using the price differential between two years and divided the same by the price at the beginning. The annual closing values of index provide the movement of commodity prices in India.

**Table – 6: Price Level Changes in Commodity Prices**

| % Change | Year | | | | |
|---|---|---|---|---|---|
| | 2007-08 | 2008-09 | 2009-10 | 2010-11 | 2011-12 |
| MCXCOMDEX | 12% | 25% | 45% | 34% | 35% |

**Source: Market Data**

It is found in the table-6 that the percentage changes in the annual return over a period from 2007-08 to 2011-12 in MCX commodity market. In 2007-08 its growth was 12% when compared with its corresponding previous year. In the year 2008-09 it was grown by 25%, then in the year 2009-10 it was increased to 45%, again in the year 2010-11 it shows another increase up to 34%. During the year 2011-12, the commodity price increased to 35% than the corresponding previous year. The price level changes indicate high volatility trend in the commodity market.

## 8. CONCLUSION

This study examined the price level changes in Indian commodity market, the ADF test revealed that the entire nine macroeconomic variables are equally possess stationary level with the commodity market. This study considers the following economic variables like, storage of stock, supply and demand, economic performance, price of commodities, global trends, substitute commodity prices, savings and investment, agricultural output and monsoon. The variables are integrated of order one and significant at 5% level. The co-integration test brings the fact about dependent and independent variables and co-integrates properly. Granger causality test ascertains the causality between average commodity price and macroeconomic variables in lead and lag format. Granger result shows that Granger cause with supply and demand and agriculture output. Granger cause had happened between several macroeconomic variables like storage of stock and economic performance, storage of stock and agriculture output, supply& demand and global trend, economic performance and price of commodities, economic performance and savings of the investors and more.

The average daily returns, day-of the week effect and market volatility have been computed using mean, median, standard deviation, kurtosis, skewness. The mean, median values divulge that satisfactory results skewness has symmetrical distribution with greater than zero and kurtosis has the value of less than 3.0 hence it is not symmetric distribution. The average minimum return shows -0.71 on Monday and maximum return shows that 0.63 on Thursday. The change in commodity prices are tested by using Levene's test with the returns calculated. The null hypothesis framed with there is no change in the returns of commodity across the days-of the week. The result of the study leads the existence of the day-of the week effect on the commodities return in MCX. Percentage analysis shows that the progress of commodity market, the trend shows progressive movement of commodity prices.

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