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An Empirical Examination of the Efficiency of Commodity Markets in India

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Abstract

India's growing economic clout within the emerging market club has resulted in a steady proliferation of innovative financial products entering the capital markets. With an expansive economy presenting enormous opportunities for businesses to earn superior rates of return on capital outlays, the inherent risks arising out of a volatile global economic climate driven by a slew of geo-political factors exert enormous pressure on the management of corporations to devise strategies that are effective in mitigating some of these risks. In recent years, India has been a witness to heightened interest being evinced by financial managers towards skilfully deploying financial instruments like Futures and Options in order to overcome the uncertainty arising out of fluctuations occurring in the prices of underlying assets[1]. In this context, the role of commodity markets assumes considerable significance. Emergence of organized and sophisticated commodity markets like NCDEX (National Commodities and Derivatives Exchange) and MCX (Multi-commodity Exchange) has enabled the participants of this specialized market to strategically hedge their positions in the backdrop of volatilities witnessed in prices of underlying commodities. An implied postulate necessary for the successful performance of the hedging function is the operation of market efficiency that serves as a necessary condition for organized functioning of the market, which becomes the basis for an efficient price-discovery mechanism. In this paper, we endeavour to examine the efficiency of commodity markets in India by resorting to a rigorous econometric model. By underscoring the need to establish a relationship between the Futures and Spot markets (given that they depict a time-series behaviour), the model is better poised to examine the empirical validation of market efficiency in comparison to alternative models (variance-ratio test, jarque-bera test, and runs test etc.) that have traditionally relied upon the observed behaviour of Spot prices alone to validate the enshrined objectives. A conspicuous absence of studies involving employment of statistically robust models like cointegration regression in respect of examination of efficiency of commodity markets in emerging economies like India presents a compelling reason to undertake the present study. We employ the popular cost-of-carry model to empirically examine the hypothesis involving efficiency of commodities market in India[2]. We reject the cost-of-carry model using both single-hypothesis and joint-hypothesis tests depicting a weak evidence of market efficiency.

***Key words:** - Commodity Markets; Market Efficiency; Cointegration Regression*
***JEL Codes:** - C58; G02; G14*

[1] In this paper, we examine the utility of derivatives products primarily from the standpoint of investors employing it as a hedging tool.
[2] We perform the cointegration regression using the popularly employed *E-Views 7* software program.

1. Introduction

Since the time commodities' trading was introduced in the Indian financial markets, the pace of growth has been phenomenal. From the year 2004 through 2013, the total traded contracts have witnessed a CAGR of 66.99% highlighting the tremendous growth potential existing in commodities markets (see Exhibit I). Until recently, commodities were predominantly restricted to physical trading with the buyers and sellers exchanging assets at a price discovered using an '*arms-length*' transaction. While the dominance of physical markets continues catering to buyers comprising of both wholesale and retail segments, the enormous opportunities that have been opened up subsequent to the launch of commodities futures market have led to trading in commodities a preferred investment vehicle for savvy investors, portfolio managers, and sophisticated institutional investors led by banks and financial institutions to earn superior rates of return by taking advantage of the price anomalies exhibited by the futures and spot markets. Notwithstanding the enormous potential that is available for futures traders to earn abnormal returns using speculative bets, the underlying risks arising out of an adverse price movement could be equally deterring with the possibility of a complete erosion of net worth. In keeping with the enormous risk exposition undertaken by investors in trading commodities without an adequate hedging cover, the recently promulgated banking licences policy places enormous restrictions on new licence holder banking units from investing in commodities for treasury purposes (DNA, 2012).

Another peculiarity surrounding the commodities' market is that unlike other futures markets (say, equity or forex) that are characterized by cash settlement, contracts either follow '*both option*', '*seller option'* or '*compulsory delivery*' model with the physical delivery entailing additional transaction costs that are incurred towards maintenance of inventory and warehouses[3]. This peculiarity has often led policy makers to view trading in commodities futures with considerable suspicion with the ramification that trading in specific category of commodities (particularly in agriculture) has been suspended in the past on fears that speculative considerations might lead to an 'artificial supply crunch' with the consequence of jacking up prices of the commodities in spot markets. In recent times, even trading in gold futures has attracted lot of attention to assess its ramifications on demand-supply equilibrium.

[3]Commodities like Arecanut, Black Pepper, Cardamom, Chana, and Coffee (Robusta) are covered under compulsory delivery model. For a complete discussion on commodity delivery models see MCX India (2002).

While certainly there is merit in understanding the exact nuances for the above delineated phenomenon, certain sections of the scholarly community has not been prevented from making an assertion on the plausibility of futures dictating spot prices[4].

Even a cursory glance at the above points should prompt researchers to pose a fundamental question – are commodity markets in India really efficient? A satisfactory response would certainly aid a wide spectrum of audience comprising of policy makers, commodity traders, and the academic community in general to develop strategies and frameworks that will facilitate a meaningful expansion of commodities market with the intended benefit of serving the legitimate needs of all interested parties.

More specifically, our collective understanding of the factors contributing to price-disequilibrium in commodities market should get enriched empowering the decision makers to formulate effective responses to challenges posed by markets operating below the optimum level of efficiency[5].

The recent episodes of excesses of speculation compounded with complete breakdown of market fundamentals at the disgraced National Spot Exchange should sensitize all the participants about the consequences of participating in markets that do not exhibit even the basic traits of efficiency (Frontline, 2013).

In the present study, we therefore seek to evaluate the efficiency of commodity markets in India by resorting to an empirical validation derived from a rigorous model with an objective to significantly enrich the growing expanse of academic studies carried towards examining the market efficiency of commodity markets in India.

2. Review of Significant Literature

Plethora of studies have been undertaken to examine the efficiency of commodities market, which have predominantly been undertaken in the context of developed markets. With the establishment and expansion of specialized commodity bourses in India, the scope of research has significantly expanded. However, given the evolving scope of the subject in India, there is certainly a merit in expanding the literature by presenting a compelling case in the light of heightened interest evinced by participants of financial markets in commodities.

It is also noteworthy to observe that, traditionally, studies on market efficiency have been undertaken by observing the behaviour of commodities' prices in the spot markets alone. Given that the futures markets have become virtually indispensable in the orderly

[4] This is understandable because of the inextricable link existing between prices of commodities and inflation.

[5] Here, one might argue that an existence of inefficiency would lead the arbitrageurs to exploit the inefficiencies by selling futures and buying spot and vice-versa depending on the price-trend exhibited by spot and futures prices with the intended consequence of ultimately leading to an equilibrium level. However, persistent episodes of inefficiency, while giving the arbitrageur an upper hand would discourage the genuine traders from benefitting fully from an organized functioning of the market.

development of capital markets in India, we opine that studies pertaining to examination of market efficiency are incomplete without tracing the underlying relationship between futures and spot prices of assets. Consequently, in this study, we employ a robust econometric tool represented by Cointegration Regression model to derive inferences on market efficiency (Crowder & Phengpis, 2005).

In the following section, we present a chronological summary of significant studies undertaken in respect of examination of efficiency of commodity markets aimed at mapping the findings of similar studies carried out in India and elsewhere.

Serletis & Scowcroft (1991) use a combination of six commodities comprising of Wheat, Corn, Oats, Soybean, Soybean oil, and Soybean meal to derive inferences on market efficiency. The study employs the cointegration approach with the results finding strong evidence of cointegration between daily spot and one-month futures commodity prices. With the study concluding that the observed results are consistent with market efficiency seems to contradict, to an extent, on the inferences derived by studies subsequently that have highlighted the plausibility of market inefficiency.

Beck (1994) uses a combination of six commodities comprising of Cattle, Orange Juice, Hogs, Corn, Copper, Cocoa, and Soybeans to test the market efficiency. Here again, the study employs the contested approach of using futures market to predict spot prices to derive inferences on market efficiency. The study does not seem to present a strong case of either accepting or rejecting the condition of market efficiency with the results pointing out that the commodity markets were not always inefficient but only sometimes inefficient.

Using a combination of commodities comprising of Brent crude, Gasoil, Soybeans, Live-hogs, Live-cattle, and Dm/$, Kellard, et al., (1999) examine market efficiency by employing the Cointegration approach. While the results point to presence of a long-run efficiency, however, in the short-run market efficiency does not seem to hold good. The study employs a contested methodology of testing the ability of futures market to predict subsequent spot prices, which is seen as an unbiased predictor of market efficiency. The primary limitation associated with using futures as an unbiased predictor of future spot prices arises from the fact that results on market efficiency remain inconclusive with some finding evidence of efficiency while others finding inefficiency (Heaney, 2002). The apparent dichotomy also arises partly from the different time periods and methods chosen for testing.

Four commodities comprising of Live cattle, Hogs, Corn, and Soybean meal are used by McKenzie & Holt (2002) to examine the market efficiency of commodities. This study also employs the contested approach of using futures markets to predict spot prices, which is believed to be an unbiased indicator of market efficiency. The results point to existence of long-range cointegration while exhibiting short-run inefficiencies and pricing biases.

Yaganti & Kamaiah (2012) use a combination of commodities comprising of spices and base metals to examine the hedging efficiency of commodity futures markets in India. While the study does not appear to directly confront the issue of market efficiency, it does however seek to address the issue indirectly as it is generally understood that a weak form of hedging efficiency posits market inefficiency. The results interestingly point out that futures price is considered as a reference point for spot market players like farmers, traders, and other participants in the commodity markets. Clearly, such an observation is inconsistent with market efficiency as it enables the participants to profit from the underlying spot transactions due to the existence of pricing bias. The study employs the contested approach of building a cointegration regression involving futures markets as a predictor of spot prices to derive inferences. Moreover, the fact that results surrounding unit-root tests involving ADF have been accepted at a reduced statistical power with a significance of 10% does not augur well.

As opposed to the studies reflected above which invariably employ testing the unbiasedness hypothesis, also referred to as simple efficiency (Hansen & Hodrick, 1980), we employ the more plausible cost-of-carry model to investigate the hypothesis surrounding efficiency of commodity markets.

The cost-of-carry model is considered as the best-known model for pricing futures, which expresses futures price as a function of the spot price compounded continuously over a given rate of interest (usually risk-free rate) and time (Hemler & Longstaff, 1991).

3. The Empirical Model

Mathematically, under the cost-of-carry model[6], futures price is expressed as a function of the underlying spot price as given below.

$$F_{t,T} = S_t e^{r_t (T-t)} \qquad \text{Eq. 1}$$

where

F = futures price

S = spot price of the underlying asset

r = risk-free rate of interest

T = time to maturity

t = time at the start of the contract

Given the time-series nature of the variables represented in the equation above, we would expect the variables to have unit-roots, i.e. non-stationary or $I(1)$. In such a scenario, application of conventional regression would be rendered spurious lending the results unreliable (Gujarati, et al., 2009)

[6] For an excellent discussion on cost-of-carry model see, Hull (2014)

We therefore express the above relationship as a cointegration regression equation by transforming the variables into a logarithmic function.

Taking the natural logarithms, Eq. 1 may be expressed as given below.

$$f_t = s_t + r(T - t) + \mu_t \quad \text{(Joyeux \& Milunovich, 2010)} \qquad \text{Eq. 2}$$

where

$f_t \equiv \log F_t$

$s_t \equiv \log S_t$

and, μ_t is a white noise error term with mean 0 and variance σ^2 determined by market imperfections.

The term in the brackets of the above equation represents a reverse time trend that starts at T time duration to contract maturity, and ends at zero as t approaches T.

Empirically, the above equation may be re-specified as follows.

$$f_t = \alpha s_t + \beta r(T - t) + \mu_t \qquad \text{Eq. 3}$$

Provided that μ_t is stationary, we perform the following single and joint-hypothesis tests:

1) H_0: $\alpha = 1$
2) H_0: $\beta = 1$
3) H_0: $\alpha = \beta = 1$

The above are the restrictions applied by the cost-of-carry model.

4. Sample for the Study

In keeping with the objective to empirically examine the hypothesis surrounding efficiency of commodity markets in India, we use the daily values of futures and spot variables comprising of Metal and Energy indices over a continuous 90-day (equivalent of a 3-month contract) trading period ending on October 23, 2014. The futures and spot data were retrieved from http://www.mcxindia.com.

There are two points that merit explanation. Firstly, as against studying the behaviour of individual commodities, we choose a broader representation by selecting a specific Index, which captures the weighted average performance of all the commodities represented thereunder. Secondly, out of an available set of four different indices represented by COMDEX, AGRI, METAL, and ENERGY, we choose to study only the last two as the underlying relationship between the values of futures and spot is better reflected evidenced by statistically significant regression parameters (R^2, standard error, F-statistic), (See Appendix I). The rationale behind depiction of poor statistical relationship between futures and spot values in other indices is beyond the scope of this study and is thus reserved for discussion elsewhere.

As ultimately, a semi-strong EMH postulates an instantaneous adjustment to all the publicly available information by security prices, a marginal investor must not be endowed with the opportunity of earning superior rates of return by engaging in investing activity over a shorter-horizon. Selection of a sample comprising of 90-days to test the market efficiency hypothesis therefore look justified. In order to establish the veracity of the results, we compare the findings with equity stock markets represented by Sensex futures and Sensex (underlying) over a three-month futures contract expiring on October 30, 2014[7].

5. Analysis of data and interpretation

Having hypothesized that the variables represented in Eq. 2 are $I(1)$, we perform the unit root tests for which the results are indicated below in the tables numbering from I to III.

Table 1: Unit root test for variables underlying Metal Index

Null: Variables have unit roots			
Variable	**t-statistic values**	**modular test critical values at 5%**	**p-values**
L(Futures)	0.6916	2.8943	0.8428
L(Spot)	0.3845	2.8943	0.9063
Interest Rate	2.4670	2.8943	0.1270

(Source: *eviews* analysis)

Table 2: Unit root test for variables underlying Energy Index

Null: Variables have unit roots			
Variable	**t-statistic values**	**modular test critical values at 5%**	**p-values**
L(Futures)	0.3758	2.8943	0.9809
L(Spot)	0.0743	2.8943	0.9482
Interest Rate	2.4670	2.8943	0.1270

(Source: *eviews* analysis)

Table 3: Unit root test for variables underlying Sensex

Null: Variables have unit roots			
Variable	**modular t-stat values**	**modular critical values at 5%**	**p-values**
L(Futures)	1.8732	2.9199	0.3420
L(Spot)	1.7809	2.9199	0.3856
Interest Rate	1.4956	2.9199	0.9999

(Source: *eviews* analysis)

From the above table, it is clear that we are unable to reject the null involving presence of unit roots implying that the variables represented by futures, spot and interest rate have unit roots and are therefore non-stationery, i.e., $I(1)$.

Whilst we know that,

$$Y_t = Y_{t-1} + \mu_t \qquad \text{Eq. 4}$$

is non-stationery and therefore $I(1)$. However, when the same equation is expressed as;

$$\mu_t = Y_t - Y_{t-1} = \Delta Y_t \qquad \text{Eq. 5}$$

[7] The data for equity stock markets was retrieved from http://www.bseindia.com

the series becomes stationary and therefore *I*(0). Hence, we convert the variables into first-differences and test for the presence of unit roots. The results are depicted in tables IV to VI below.

Table 4: Unit root test for differenced variables underlying Metal Index

Null: Differenced variables have unit roots			
Variable	**modular t-stat values**	**modular critical values at 5%**	**p-values**
L(Futures)	10.9673	2.8947	0.0000
L(Spot)	9.1124	2.8947	0.0000
Interest Rate[8]	10.5686	2.8952	0.0000

(Source: *eviews* analysis)

Table 5: Unit root test for differenced variables underlying Energy Index

Null: Differenced variables have unit roots			
Variable	**modular t-stat values**	**modular critical values at 5%**	**p-values**
L(Futures)	8.9951	2.8947	0.0000
L(Spot)	10.8234	2.8947	0.0000
Interest Rate	10.5686	2.8952	0.0000

(Source: *eviews* analysis)

Table 6: Unit root test for differenced variables underlying Sensex

Null: Differenced variables have unit roots			
Variable	**modular t-stat values**	**modular critical values at 5%**	**p-values**
L(Futures)	6.5453	2.9212	0.0000
L(Spot)	6.6293	2.9212	0.0000
Interest Rate[9]	13.60031	2.9225	0.0000

(Source: *eviews* analysis)

As it is evident, we are conveniently able to reject the null hypothesizing presence of unit roots and conclude that the transformed first-differenced variables exhibit stationarity i.e. *I*(0).

We now proceed with the Johansen cointegration test with the underlying null hypothesis that there are none or zero cointegrating vectors (Johansen, 1991). The results underlying by the two commodities indices – Metal and Energy and equity index – Sensex are delineated below in tables VI to VIII. Clearly, the results indicate that we are able to reject the null underlying no-cointegration at a significance level of 1%. Further we find the evidence that in all the three indices led by Metal, Energy, and Sensex, there at most two cointegrating vectors at 5% level of significance.

We therefore conclude that futures, spot, and interest rate are cointegrated.

[8]The first-differenced values were also observed to be significant under the ERS (Elliott-Rothenberg-Stock) Point-Optimal unit root test (Elliott, et al., 1996). The reported P-Statistic value was observed to be 4622.378 with the critical value at 5% being 2.9728, thereby rejecting the null of unit-roots. The first-differenced series is therefore stationary, i.e., *I*(0).

[9] The first-differenced values were also observed to be significant under the ERS (Elliott-Rothenberg-Stock) Point-Optimal unit root test (Elliott, et al., 1996). The reported P-Statistic value was observed to be 19.7696 with the critical value at 5% being 3.0792, thereby rejecting the null of unit-roots. The first-differenced series is therefore stationary, i.e., *I*(0).

Table 6: Metal Index: Johansen Cointegration Test

Hypothesized number of cointegrating vectors	**modular trace statistic**	**modular critical values at 5%**	**p-values**
0	107.8731	29.7971	0.0000
At most 1	19.0884	15.4947	0.0137
At most 2	0.0086	3.8415	0.9225

(Source: *eviews* analysis)

Table 7: Energy Index: Johansen Cointegration Test

Hypothesized number of cointegrating vectors	**modular trace statistic**	**modular critical values at 5%**	**p-values**
0	66.1480	29.7971	0.0000
At most 1	4.6902	15.4947	0.8408
At most 2	0.6027	3.8415	0.4375

(Source: *eviews* analysis)

Table 8: Sensex: Johansen Cointegration Test

Hypothesized number of cointegrating vectors	**modular trace statistic**	**modular critical values at 5%**	**p-values**
0	38.4195	29.7971	0.0040
At most 1	5.9269	15.4947	0.7042
At most 2	0.3175	3.8415	0.5731

(Source: *eviews* analysis)

Having established that in all the indices the series represented by futures, spot and interest rate are cointegrated, we present the cointegration regression statistic depicting the coefficient values of the variables along with their respective p-values in tables IX to XI.

Table 9: Metal Index: Cointegration Regression Statistic

Variable	**Coefficient**	**Modular t-statistic**	**p-value**
L(Spot)	1.0388	35.8638	0.0000
Rate	-0.0043	3.012	0.0034

(Source: *eviews* analysis)

Table 10: Energy Index: Cointegration Regression Statistic

Variable	**Coefficient**	**Modular t-statistic**	**p-value**
L(Spot)	0.9097	15.5094	0.0000
Rate	0.0083	1.3086	0.1942

(Source: *eviews* analysis)

Table 11: Sensex: Cointegration Regression Statistic

Variable	**Coefficient**	**Modular t-statistic**	**p-value**
L(Spot)	0.9841	46.6941	0.0000
Rate	0.0166	14.6601	0.0000

(Source: *eviews* analysis)

We observe from the above tables that across all the three indices, the coefficient values of L(Spot) are close to unity and statistically significant at 1%. However, the coefficient values of rate appear to be close to zero and statistically significant in all scenarios with the exception of energy index.

In order to test the single and joint hypotheses surrounding the cost-of-carry model, we perform the Wald statistic (asymptomatically distributed as χ^2 i.e. *Chi-square*) of coefficient restrictions. The Wald statistic is computed using the following equation.

$$\text{Wald Statistic (W)} = \frac{(n-k)(\text{RRSS}-\text{URSS})}{\text{URSS}} \approx \chi^2 \qquad \text{Eq. 6}$$

where

n = number of observations

k = number of regressors in the unrestricted regression

RRSS = restricted residual sum of squares

URSS = unrestricted residual sum of squares

It is useful to note that in scenarios where a regression function involves finite samples with the testable hypotheses being linear (as in H_0: β_1=1), the *F-statistic* and *Chi-square* yield exactly similar values[10]. By imposing a coefficient constraint in an unrestricted regression, we seek to observe if the residual sum of squares would increase considerably. If indeed this is the case, it would be concluded that the restrictions were not supported by the data leading to rejection of the null hypothesis (Brooks, 2014). The W results are depicted in tables XII to XIV.

Table 12: Metal Index: Wald test for Coefficient Restriction

Restriction	**Chi-square value**	**p-values**
C(α) = 1	1.7914	0.1808
C(β) = 1	495842.7	0.0000
C(α) = 1, C(β) = 1	1406496	0.0000

(Source: *eviews* analysis)

Table 13: Energy Index: Wald test for Coefficient Restriction

Restriction	**Chi-square value**	**p-values**
C(α) = 1	2.3673	0.1239
C(β) = 1	24517.70	0.0000
C(α) = 1, C(β) = 1	189810.6	0.0000

(Source: *eviews* analysis)

Table 14: Sensex: Wald test for Coefficient Restriction

Restriction	**Chi-square value**	**p-values**
C(α) = 1	0.5722	0.4494
C(β) = 1	754045.6	0.0000
C(α) = 1, C(β) = 1	842789.0	0.0000

(Source: *eviews* analysis)

From the above tables, we observe that while in all the cases the null hypothesis surrounding α = 1 cannot be rejected, we are able to reject β = 1 in all the cases at a significance level of 1%. . Accordingly, under the single hypothesis tests, we are able to reject the cost-of-carry model. The joint hypothesis underlying α = β = 1 is rejected in all the three cases at a significance level of 1%. We therefore reject the cost-of-carry model for all three markets inferring that the commodities market represented by Metals and Energy fail to exhibit the characteristics of efficiency and at the same time the equity capital markets

[10] For linear regression models, with or without normal errors, there is of course no need to look at LM, W and LR at all, sine no information is gained from doing so over and above what is already contained in F (Davidson & MacKinnon, 1993)

represented by Sensex also fails to conform to the market efficiency postulate. The results are consistent with those observed by Joyeux & Milunovich (2010).

The above results reinforce the results derived from the many empirical studies that fail to convincingly defend the existence of market efficiency across different categories of markets. As evidence, it is often observed that participants in the financial markets often exploit the advantage of price differential observed over the futures and spot securities. In the absence of market efficiency, we would fail to encounter a scenario where arbitrage is perfect with the consequence that the trader would invariably end up either earning abnormal profits or incur abnormal losses.

6. Summary, Conclusions, and Scope for further research

In this paper, we investigate the postulate surrounding market efficiency surrounding commodity markets using an empirical model represented by the cost-of-carry. In order to support the veracity of the phenomena, we also apply the cost-of-carry model to the equity markets. Both single hypothesis and joint hypothesis tests reject the cost-of-carry model implying that in the absence of market efficiency, arbitrageurs should be in a position to exploit the price differentials existing across futures and spot prices in both commodity as well as equity markets in order to earn abnormal returns.

While arbitrageurs dealing in equities would be required to strictly operate within the rules enshrined by the capital markets regulator (SEBI), the scope of scrutiny is by-far restricted to a greater degree in commodities. Even while the commodity markets like MCX are governed by Forward Markets Commission (FMC), in the absence of enactment of long pending Forward Contract Regulation Act (FCRA) Amendment Bill, the regulator lacks the requisite powers to exercise effective supervision over the operations surrounding commodity markets[11].

In the wake of the recently unfolded scam in National Spot Exchange, regulators; particularly in the commodity markets, should be mindful to a greater degree of scrutiny on trading practices and put robust control systems in place in order to prevent occurrence of market excesses in the future.

In this study, our inferences have been derived based on a shorter sample horizon. An interesting extension would be to observe the feasibility of market efficiency over a longer-horizon. Further, we have employed the cost-of-carry model to empirically examine the market efficiency hypothesis. It would be meaningful to observe the impact of other popular empirical models on results of market efficiency.

[11] In recent times, policy makers within the Finance Ministry, Gov. of India have been evaluating the proposal involving either according greater power to FMC through FCRA or alternatively scrap the FCRA and seek merger of FMC with SEBI (Sinha, 2014).

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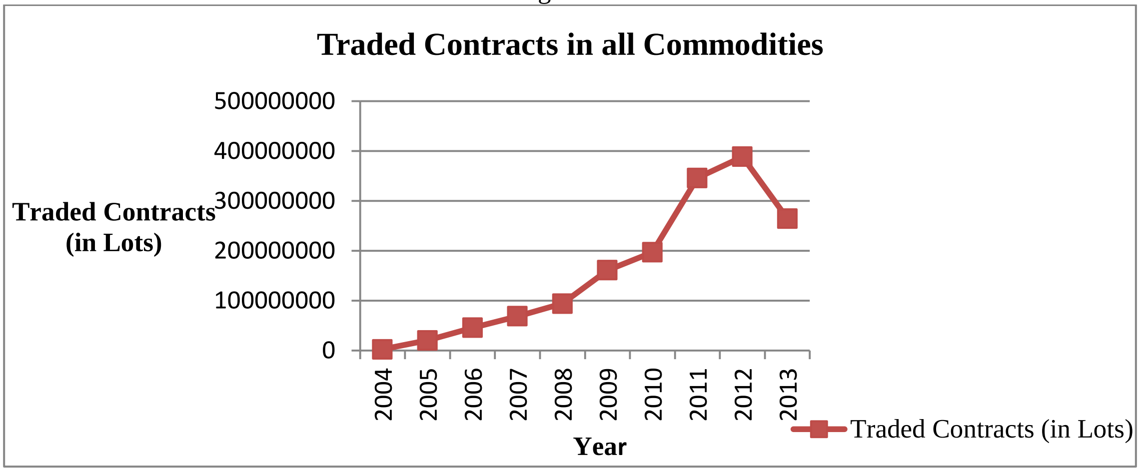
Exhibit 1: Volume of growth in all commodities



(Source: http://www.mcxindia.com)

Appendix I: Regression parameters observed over Metal, Energy, and Sensex indices

Regression Statistics underlying Metal Index Futures & Metal Index Spot

Regression Statistics *Dependent variable*: Metal Index Futures	
Adjusted R^2 value	0.9653
Standard error	23.7486
F-statistic	2474.3021* (0.00000)

*Significant at 1%

Regression Statistics underlying Energy Index Futures & Energy Index Spot

Regression Statistics *Dependent variable*: Energy Index Futures	
Adjusted R^2 value	0.9724
Standard error	40.9061
F-statistic	3138.5033* (0.00000)

*Significant at 1%

Regression Statistics underlying Sensex Futures & Sensex Spot

Regression Statistics *Dependent variable*: Sensex Futures	
Adjusted R^2 value	0.8939
Standard error	143.3937
F-statistic	431.0239* (0.00000)

*Significant at 1%