A MODEL TO DETERMINE THE COMMODITY DERIVATIVE TURNOVER IN COMMODITY EXCHANGES IN INDIA

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ABSTRACT

Commodity derivatives are contracts used as price risk management tool. Commodity derivative trading turnover in Indian commodity exchanges is having systematic variation caused by relevant influencing forces to explain its determination. The Indian commodity derivative market turnover is determined by interest rate in Indian call money market, general level of prices and weather condition in India. The interest rate and weather exert positive influence and price level create negative influence. The influence of weather is the largest.

Keywords: Commodity Derivatives, Futures Trading, Commodity Exchanges, Whether, Interest Rate

Cite this Article: M.A. Raja Mohamed and A.Hidhayathulla, A Model to Determine the Commodity Derivative Turnover in Commodity Exchanges in India, *International Journal of Management* 11(12), 2020, pp 1315-1322.

<http://iaeme.com/Home/issue/IJM?Volume=11&Issue=12>

1. INTRODUCTION

Commodity derivatives are contracts used as price risk management tool. Who are the beneficiaries really needing the tool? The ultimate consumers are not the buying parties needing commodity derivative contracts, because, they buy small quantities of commodities in retail markets for family consumption. Similarly, retail sellers of the commodities are not the parties of derivative contracts as their market and turnover is small. They buy at the current market prices, add a margin and sell the commodities to the ultimate retail consumers. Large producers and high quantity buyers are in need of subscribing to derivative contracts to manage the price risk. It is economically viable for them to bear the cost associated with entering into commodity

derivative contracts. Since invention time of the tool it underwent remarkable changes. It acquired too many new features responding to changing economic conditions. Many commodities were brought into the contract process. It also attracted many new types of contracts and speculative investors. Subsequently, the volume of commodity derivative trading has grown phenomenally. The research works on commodity financialisation has heavily focused on few dimensions such as futures contract pricing, macroeconomic effects, returns yielded by the futures etc. Research works did not sufficiently explain the determinants of rapidly growing total volume of commodity derivative market trading. All these led to the question that what determines the total volume of commodities contract traded in India.

2. OBJECTIVE

- To explain the determination of commodity derivative trading turnover in India by suitable independent variables

2.1. Hypothesis

Commodity derivative trading turnover in Indian commodity exchanges is not having any systematic variation caused by relevant influencing forces to explain its determination

2.2. Data and Methods

The data values of commodity derivative turnover in three leading exchanges were collected from the annual reports of MCX, NCDEX and NMCE. The three values were summed up to arrive at the annual gross turnover of commodity derivative trading in India. The data on call money rate was collected from column 2 of Table 67: Structure of Interest Rates in Handbook of Statistics on Indian Economy [1]. The consumer price index numbers data were collected from Table 38: Consumer Price Index - Annual Average in Handbook of Statistics on Indian Economy. The rainfall data has been collected from All India Area Weighted Monthly, Seasonal and Annual Rainfall (in mm) [2]. India receives around 75 percent of rainfall during the months from June to September every year. Therefore, rainfall India received during these months has been used as rainfall of India.

3. REGRESSION MODEL

Annual gross commodity futures turnover, Interest rate (call money rate), Annual average of mean of consumer price index of three groups namely industrial workers (non-food), industrial workers (food) and agricultural workers and Annual rainfall of India are the variables found to be stationary at its levels. The model equation to explain the annual gross commodity futures turnover in leading two commodity exchanges is specified as follows.

$$F_t = b_0 + b_1 I_t + b_2 \sum_1^3 (CPI/3)_t + b_3 \sum_1^{365} R f_t + e_i - (1) \text{ for } t = 2010-17$$

Where F_t = annual gross commodity futures turnover,

I_t = Interest rate (call money rate)

$\sum_1^3 (CPI/3)_t$ = Annual average of mean of consumer price index of three groups namely industrial workers (non-food), industrial workers (food) and agricultural workers

$\sum_1^{365} R f_t$ = Annual rainfall of India

e_i = Stochastic disturbance term to represent randomly affecting influences in the relationship explained by systematic component of the (1)

4. GROSS TURN OVER IN COMMODITY DERIVATIVE EXCHANGES IN INDIA

Futures trading in commodities started formally in India with the setting up of the Bombay Cotton Trade Association in 1875. After independence the Government of India enacted the Forward Contracts (Regulation) Act, 1952. According to the provisions of the act, Forwards Markets Commission (FMC) was set up. However, futures market was banned in 1960's in most commodities for many years following the food shortages in the country. 'The Government of India, in April 1999, finally lifted bans on futures trading, leading to the setting up of, demutualized, national level, multi commodity exchanges by end of 2003. At that time, there were 21 regional commodity exchanges trading in a single or few commodities. Most of these regional exchanges were practicing the "open-outcry" system. National level multi commodity exchanges were established during 2002-2003' [3].

The post LPG commodity derivative trading has started in November 2003. Number of commodities and quantity of trading has grown phenomenally since then.

Table 1. Volume of Commodity Derivative Turn Over in Major Commodity Exchanges in India during 2010-11 to 2016-17

Year	Total Turn Over	Percent Change
2010-11	11470516	
2011-12	17675650	54.09639038
2012-13	16656617	-5.765180825
2013-14	9910596	-40.50054683
2014-15	6123810	-38.20946841
2015-16	6683150	9.133857244
2016-17	6490955	-2.875820141

Source: MCX, NCDEX and NMCE

Table 2. Volume of Commodity Derivative Turn Over in MCX during 2010-11 to 2016-17

Year	MCX Turn Over	Percent Change
2010-11	9841502.44	
2011-12	15597095.50	58.48287
2012-13	14881057.10	-4.59084
2013-14	8611449.06	-42.1315
2014-15	5183707.46	-39.8045
2015-16	5634194.22	8.690436
2016-17	5865661.22	4.108254

Source: MCX, NCDEX and NMCE

Table 3. Stationarity Results

Sr. No.	Variable	Auto-regressive Coefficient Value	Null Hypothesis	Result
1	Total Turnover in Commodity Derivative Exchanges	0.684	Non-stationary	H ₀ rejected, stationary
2	GDP at Current Prices	1.049	Non-stationary	H ₀ accepted, autoregressive non-stationary series
3	GDP at Constant Prices	1.116	Non-stationary	H ₀ accepted, non-stationary explosive series
4	Money Supply	0.533	Non-stationary	H ₀ rejected, stationary series
5	Interest Rate	0.097	Non-stationary	H ₀ rejected, stationary series
6	WPI Average of Three groups	0.925	Non-stationary	H ₀ rejected, stationary series
7	Rainfall	-0.205	Non-stationary	H ₀ rejected, stationary series

Source: Computed

5. MODEL RESULTS

This study has raised a research question that what determines the total volume of commodities contract traded in India after examining the situations which are cited to be the need for commodity price management tool. Thus this study attempts to explain the forces determining the changes in the volume of turnover in commodity exchanges in India. Hence, volume of turnover in commodity exchanges in India became the dependent variable. The GDP at Current Prices, GDP at Constant Prices, Money Supply, Interest Rate, WPI Average of Three groups and Rainfall were considered for explaining the variations in the volume of turnover in commodity exchanges in India. The GDP at Current Prices and GDP at Constant Prices were dropped as these two variables are non-stationary series. Money supply was also dropped to avoid the problem of multicollinearity as it is closely correlated with interest rate. The following model was finally formulated.

$$F_t = b_0 + b_1 I_t + b_2 \sum_1^3 (CPI/3)_t + b_3 \sum_1^{365} R f_t + U_i \quad (1) \text{ for } t = 2010-17$$

Where F_t = annual gross commodity futures turnover,

I_t = Interest rate (call money rate)

$\sum_1^3 (CPI/3)_t$ = Annual average of mean of consumer price index of three groups namely industrial workers (non-food), industrial workers (food) and agricultural workers

$\sum_1^{365} R$ f_t = Annual rainfall of India

Table 4. Estimated Results

DV	IV	R ²	Adj.R ²	SE OF Estimates	F	Sig. Level	b ₀	b ₁	b ₂	b ₃
F _t	Interest Rate, CPI, Rainfall,,	0.916	0.832	1981240	10.901	0.04	-24590	30100	47053.854	37682859
	SE						20410	962242	13111	15558.74
	T						-1.205	3.128	-3.589	2.422
	Sig. Level						0.315	0.052	0.037	0.094

Source: Computed

$$F_t = -24590 + 30100 I_t - 47053.854 \sum_1^3 (CPI/3)_t + 37682859 \sum_1^{365} Rf_t + e_i$$

The above equation estimates the relationship between commodity derivative exchanges turn over and three explanatory variables namely rainfall, interest rate and general price level (average of consumer price index of three groups namely industrial workers (non-food), industrial workers (food) and agricultural workers).

5.1. Explanatory Power of the Model

Estimated value of coefficient of multiple-determination (R²) is 0.916 and that of adjusted coefficient of multiple-determination is 0.832. These values show that more than 80 percent of derivative market turnover in Indian commodity exchange is determined by rainfall, interest rate and general price levels in India.

5.2. Prediction Power of the Model

Standard error of the estimate shows the average wrong that the estimated value of response value could be. The standard error of the estimate of the model is 1981240. It shows approximately 95% of the commodity market turnover in Indian commodity exchanges fall within plus or minus 2 x 1981240 MT. The difference between observed commodity market turnover and predicted turnover would lie between +3962480 and -3962480.

5.3. Statistical Significance of Overall Relationship Estimated in the Model

The null hypothesis regarding the overall dependence of commodity market turnover in India on rainfall, interest rate and general price level in India is that commodity market turnover in India is independent of rainfall, interest rate and general price level in India. The calculated F statistic is 10.901. The table F_(0.05, 3, 3) = 9.2766. The null hypothesis that commodity market turnover in India is independent of rainfall, interest rate and general price level in India is rejected since calculated F is greater than table F statistic. Therefore, the overall relationship estimated in the model is statistically significant. The commodity market turnover in India is dependent on rainfall, interest rate and general price level in India.

5.4. Direction and Magnitude of Relationship

As rainfall, interest rate and general price level would never become zero the intercept (b₀) need not be considered for interpretation. The signs of estimated regression coefficients show that rainfall and general price level have direct proportional relationship in determining the commodity market turnover in India during the study period, while the interest rate negatively influences commodity derivative market turnover.

5.5. Commodity Derivative Market Turnover and Call Money Rate

The call money (or broker loan) market intermediates renewable overnight loans between lenders and brokers to fund operations in financial markets, often speculative trading using margin purchases (Caroline Fohlin)[4]. Call money rate is the short term interest rate charged on short term borrowing. Speculative investors often resort to short term borrowing for margin

purposes. Futures margin is a good-faith deposit or an amount of capital one needs to post or deposit to control a futures contract (Chuck Kowalski) [5]. It is the collateral that the holder of a financial instrument has to deposit with a counterparty to cover some or all of the credit risk the holder poses for the counterparty. The counterparty for speculative investors is broker and for brokers is exchange. It is deposited in cash. Investors and brokers borrow often in call money market. The interest rate in call money market has been used as a proxy to represent the influence of call money market on commodity derivative market turnover. Empirical works have not investigated the link between call money market and derivative trading turnover. The works so far carried out investigated the link between money market and derivative market returns.

Commodity derivative trading turnover positively responded to call money rates during the study period. The data used in model estimation is the call money rate prevailed at the end March of every year. The estimated regression coefficient is 30100. It indicates that 30100 MT worth of commodity derivative contracts turnover undergoes change for every one point change in the call money rate in Indian money market. We can understand from this finding that availability of short term fund to meet the margin needs determines commodity derivative contract trading turnover.

5.6. Commodity Derivative Market Turnover and General Price Level

Almost all the empirical research studies on commodity derivatives investigated the influence of commodity derivative trading volume on commodity prices. The prices have not been studied as a determinant of commodity derivative market trading volume. Demand and supply uncertainties create the necessity for price risk management tools and thus it became the basis for functioning of derivative markets. Demand and supply uncertainties manifest in the form of general price level fluctuations. The price fluctuations of the commodities are taken up as cues for taking suitable positions in buying and selling contracts. Therefore, average of price indices of three broad groups is treated as proxy for general price level. The second regression coefficient of the regression model to analyse the determinants of commodity market turnover in India is interpreted here to investigate the magnitude of influence of general price level on commodity market turnover in India.

The commodity derivative trading has a tendency to fall by 47053.854 MTs for one point rise in the price index and when the prices fall the turn over rises. The trend behaviour of the commodity derivative turn over resembles relationship explained by law of demand. The commodity derivative contract trading volume, thus, can be considered to make addition to total demand for commodities. Therefore, any commodity that is brought under futures trading in commodity exchanges is having two components of demand namely real demand and speculative demand. It is worth to note here the findings of ShaikMasood and T Satyanarayana Chary [6] that the trading in commodity derivatives is about three times more than in physical market (in India), whereas, it is more than ten times in advanced economies. The speculative demand is larger than real demand for commodities. Investors often fear that consequent to commodity price rise the government may ban futures trading in the particular commodity. Therefore, they downsize the trading volume. This may be the cause for inverse relation between general price level and commodity derivative turn over.

5.7. Commodity Derivative Market Turnover and Weather

Weather is an exogenous non-policy variable exerting a strong influence on commodity derivative trading turn over. It works by causing commodity supply shocks says the Report of a CEPS-ECMI Task Force authored by D. Valiante [7]. This research work has used rainfall as a proxy to represent weather condition in India. Good weather sends a positive signal to the speculative investors. They take it as an indication of market pessimism. A bad weather sends a red signal to the investors. They behave cautiously and take trading positions accordingly.

Therefore, rainfall is supposed to have direct proportional influence on commodity derivative turnover.

The third coefficient of the regression model formulated to study the determinants of commodity derivative turnover in India estimates a positive value. It is estimated to be 37682859. It conveys that everyone mm of rainfall boosts 37682859 MT worth of turnover in commodity derivative market.

5.8. Testing of Hypothesis

H_0 : Commodity derivative trading turnover in Indian commodity exchanges is not having any systematic variation caused by relevant influencing forces to explain its determination.

The decision rule formulated in research design for rejecting the null hypothesis is that larger the regression coefficient size should be sufficiently larger with accepted levels of goodness of fit and levels of significance measures.

The estimated regression model is

$$F_t = -24590 + 30100 I_t - 47053.854 \sum_1^3 (CPI/3)_t + 37682859 \sum_1^{365} Rf_t + e_i$$

The size of estimated coefficient of the first regressor interest rate is 30100, the second regressor general price level is - 47053.854 and the third regressor rain fall is 37682859. All the coefficients of the three explanatory variables are sufficiently larger. Rainfall, that is, weather condition in India is the largest determinant of commodity derivative market turnover in India followed by general price level and interest rate in call money market.

Table 5. Testing of Hypotheses of Individual Coefficients

Explanatory Variable	Null Hypothesis	Calculated t value	Table value for 90% significance level (One sided 7-4 df)	Result
Interest Rate	Not determining commodity derivative turnover ($b_1=0$)	3.128	1.64	Rejected
General Price Level	Not determining commodity derivative turnover ($b_2=0$)	-3.589	1.64	Rejected
Rainfall	Not determining commodity derivative turnover ($b_3=0$)	2.422	1.64	Rejected

Source: Computed

Table 6. Testing of Hypotheses of Overall Model Relationship

Dependent Variable	Explanatory Variables	Null Hypothesis	Calculated F value	Table value for 0.10significance level (One sided 3-3df)	Result
Commodity Derivative Market Turnover	Interest Rate, General Price Level, Rainfall	Interest Rate, General Price Level, Rainfall are not determining commodity derivative turnover ($b_1= b_2= b_3=0$)	10.901	5.39077	Rejected

Source: Computed

Since the calculated t values are greater than table values and F value is greater than table F value the rejection of the null hypotheses individual coefficients and overall relationship that interest rate, general price level and rainfall are not determining commodity derivative turnover is statistically significant. The research hypothesis that commodity derivative trading turnover in Indian commodity exchanges is not having any systematic variation caused by relevant influencing forces to explain its determination is rejected.

6. CONCLUSION

Commodity derivative trading turnover in Indian commodity exchanges is having systematic variation caused by relevant influencing forces to explain its determination. The Indian commodity derivative market turnover is determined by interest rate in Indian call money market, general level of prices and weather condition in India. The interest rate and weather exert positive influence and price level create negative influence. The influence of weather is the largest.

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