RELATIVE ANALYSIS OF VOLATILITY OF BULLION COMMODITY DERIVATIVES WITH RESPET TO MCX METAL INDEX

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ABSTRACT

India, a commodity based economy where two-third of the one billion population depends on agricultural commodities, surprisingly has an under developed commodity market. Unlike the physical market, futures markets trades in commodity are largely used as risk management (hedging) mechanism on either physical commodity itself or open positions in commodity stock. Commodity markets like stock and foreign exchange markets are of great help not only for those who participates but also for economy as a whole. Commodity markets in India are still in their initial stage of development. Commodity market in India has a huge potential due to the fact that Indian economy is agriculture based economy. In this paper an attempt has been made to track the volatility analysis of some commodity derivatives on the basis of empirical finding of 3 years future prices of select commodities: - Gold, Silver, Copper. A volatility analysis of these three precious metal commodity have been carried out in this paper.

INTRODUCTION

Derivatives as a tool for managing risk first originated in the Commodities markets. They were then found useful as a hedging tool in financial markets as well. The basic concept of a derivative contract remains the same whether the underlying happens to be a commodity or a financial asset. However, there are some features, which are very peculiar to commodity derivative markets. In the case of financial derivatives, most of these contracts are cash settled. Even in the case of physical settlement, financial assets are not bulky and do not need special facility for storage. Due to the bulky nature of the underlying assets, physical settlement in commodity derivatives creates the need for warehousing. Similarly, the concept of varying quality of asset does not really exist as far as financial underlying are concerned. However in the case of commodities, the quality of the asset underlying a contract can vary largely. This becomes an important issue to be managed.

Evolution of Commodity Market in India

Bombay Cotton Trade Association Ltd., set up in 1875, was the first organized futures market. Bombay Cotton Exchange Ltd. was established in 1893 following the widespread discontent amongst leading cotton mill owners and merchants over functioning of Bombay Cotton Trade Association. The Futures trading in oilseeds started in 1900 with the establishment of the Gujarati Vyapari Mandali, which carried on futures trading in groundnut, castor seed and cotton. Futures' trading in wheat was existent at

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several places in Punjab and Uttar Pradesh. But the most notable futures exchange for wheat was chamber of commerce at Hapur set up in 1913. Futures trading in bullion began in Mumbai in 1920. Calcutta Hessian Exchange Ltd. was established in 1919 for futures trading in raw jute and jute goods. But organized futures trading in raw jute began only in 1927 with the establishment of East Indian Jute Association Ltd. These two associations amalgamated in 1945 to form the East India Jute & Hessian Ltd. to conduct organized trading in both Raw Jute and Jute goods. Forward Contracts (Regulation) Act was enacted in 1952 and the Forwards Markets Commission (FMC) was established in 1953 under the Ministry of Consumer Affairs and Public Distribution. In due course, several other exchanges were created in the country to trade in diverse commodities.

Table 1 : showing position of India in World Gold Industry

(Rounded Figures)	India (In Tons)	World (In Tons)	% Share
Total Stocks	13000	145000	9
Central Bank holding	400	28000	1.4
Annual Production	2	2600	0.08
Annual Recycling	100-300	1100-1200	13
Annual Demand	800	3700	22
Annual Imports	600	—-	—-
Annual Exports	60	—-	—-

Source: www.mcx.com (downloaded on 15-3-09)

India plays an important role in world gold industry. India has 9% share of world gold industry. India also have 1.4% share of central bank holding which is very good.

Objectives of study

The study has been planned with the following objectives:

- To study the growth of commodity derivatives in India during last three years (i.e. from 1st March 2006 to 28th Feb, 2009.
- To study and analyze the performance of commodity derivatives in selected commodities traded by different commodity exchanges in India.

Review of literature

In order to formulate a problem and search the areas of research literature review on the existing work is significant. Till now many researchers have shown interest in field of derivatives, and the various aspects of commodity derivatives also. Their findings and suggestions are reviewed here. Though a lot of research work is available, the review of latest work has been presented here. To prepare the present synopsis, various journal articles, papers, conference proceedings and studies, various reports, theses and dissertation, internet and books have been reviewed as follows:

Thomas et al (2007), examined efficiency of the castor-seed futures markets in India. The examination included identifying: 1 The flow of information between futures and spot prices, as well as, 2 The behaviour of the basis and basis risk across two different

markets, one export-oriented and another production-oriented. They found that futures dominate spot prices, and that the export-oriented market prices dominate production-oriented market except in the harvest season when the relation was reverse. They observed that there are very low arbitrage opportunities in this market. They analyzed the basis for five commodities that trade on the national multi commodity exchanges. These are: 1 Guar seed: This is the commodity where there has been the longest period with significant liquidity. 2 Wheat: One of the essential commodities where the government maintains a minimum support price (MSP). 3 Pepper: Pepper futures has been traded on an international exchange in Cochin since the eighties. 4 Channa : A commodity that does have an MSP, but it is not a binding constraint in the price discovery process. 5 Jeera : This is one of the newest contracts on the electronic exchange in terms of it's liquidity buildup. Guar Seed shows the best signs of low arbitrage opportunities and good hedging prospects. Wheat and Channa show the worst signs of poor hedging prospects. Both Jeera and Pepper have a high but a low R2 which is endemic of poor liquidity. The data above would suggest that cash-settled contracts tend to be more amenable to no-arbitrage conditions than physically settled contracts.

Ahuja (2006), attempted to answer questions such as: how did India pull it off in such a short time since 2002? Is this progress sustainable and what are the obstacles that need urgent attention if the market is to realize its full potential? Why are commodity derivatives important and what could other emerging economies learn from the Indian mistakes and experience? He concluded that India is one of the top producers of a large number of commodities, and also has a long history of trading in commodities and related derivatives. The commodities derivatives market has seen ups and downs, but seem to have finally arrived now. The market has made enormous progress in terms of technology, transparency and the trading activity. Interestingly, this has happened only after the Government protection was removed from a number of commodities, and market forces were allowed to play their role. This should act as a major lesson for the policy makers in developing countries, that pricing and price risk management should be left to the market forces rather than trying to achieve these through administered price mechanisms. The management of price risk is going to assume even greater importance in future with the promotion of free trade and removal of trade barriers in the world. All this augurs well for the commodity derivatives markets.

Kent Horsager et. al.(2006) provided information on customized derivatives, their background and contemporary applications for natural gas procurement in the Netherlands' horticulture sector. The price of natural gas in the Netherlands has doubled in the past five years, making natural gas the number two input for green house producers and accounting for between 20% and 25% of all input costs. The combination of global pressure on the energy markets and the liberalization of the gas market in the Netherlands have also increased the volatility of natural gas prices causing increasing input cost risk and income instability. They observed horticulture sector in the Netherlands could find significant value by utilising natural gas price derivatives to manage the volatility risk and price risk of natural gas. The case study analysis for the period 2001-2005 revealed us that the cost of natural gas can be reduced through the

prudent use of derivatives when compared with a variable price procurement strategy. Furthermore, all natural gas derivative strategies considered here offer less procurement cost volatility in both the case study analysis and simulation analysis. Of course these results are no guarantee that the use of derivatives will realize similar savings for further periods.

Pennings & Meulenberg (1999) presented a new and integrative approach towards commodity derivatives management, which makes it easier to gain insight into the viability of new commodity derivatives before introduction, to assess and improve the viability of existing commodity derivatives and to provide the managers of the financial services industry with information about the tools they can use in the product development process of commodity derivatives. The proposed MF-approach towards commodity derivatives management provides: 1) insight into the factors which play a role in the success of a commodity derivative, divided into two aspects namely factors with a financial character and factors dealing with the decision-making process of entrepreneurs with respect to hedging , and 2) a methodology for organizing the product development process of commodity derivatives, through the integration of both technical and marketing factors. Because the MF Approach contains all the relevant aspects it is a powerful tool for drawing conclusions about the viability of a commodity derivative.

Research methodology

In view of the above objectives the following methodology has been adopted:

i) Research design

The proposed work is based on empirical study and the research is descriptive and explanatory in nature.

ii) Data collection

The secondary data has been collected from authentic websites of mcx. The closing future price of the commodity under observation has been taken.

iii) Method to compute volatility

Since the study is based on secondary resources of information and data relating closing future price of metal for the last three years, the following mathematical and statistical tools have been applied to calculate volatility of metal derivatives.

Terminology used

To understand the calculation of volatility, the definition of some terms is required as follows:

VOLATILITY: Volatility is one of the most important factors when pricing options — when volatility is high, options premiums are relatively expensive; when volatility is low, options premiums are relatively cheap. Volatility is a measure of the amount and speed of price changes, regardless of directions.

HISTORICAL VOLATILITY: This is a measure of how volatile the underlying futures contracts has been for the 20 trading days prior to each observation date in the data

series. It is an annualized standard deviation of price changes expressed as a percentage. The formula is as follows:

$TP = (T_t / Pn) * 262$

TP is the total number of trading periods per year.

T_t is the total trading time in a day.

Pn is the length of the period.

262 is the number of weekdays per year.

For instance, the S&P 500 trades from 8:30 a.m. to 15:15 or 3:15 p.m. That

is a total trading time of 6 hours and 45 minutes. On a variable chart using 5 minute bars, the number of periods for the day is 81 as demonstrated:

- 6 hours @ 60 minutes = 360 minutes
- Total minutes of trading = 360 minutes + 45 minutes = 405 minutes
- 405 / 5 minute bars = 81 trading periods per day

To calculate the trading periods per day, we must calculate the number of periods for the year. Since historical volatility considers every weekday of the year when calculating total periods for the year, the multiplier is 262:

TP = (405)/5) * 262

TP = 81* 262

TP = 21,222

Now that you have the total number of periods per year, continue with the calculation of the Historic Volatility.

Next calculate the logarithm of the price change for each price in the specified time span of n periods. The formula is:

- LOGSi = LOG(Pi / Pi-1)
- LOG is the logarithm function.
- Pi is the current price
- Pi-1 is the previous price

Now take the logarithms of the price changes, calculate the total logarithms for the time span you are reviewing. To calculate the total of the logarithms, use the following formula:

$$Tlogs = \sum_{i=1}^{n} (LOGSi)$$

- Tlogs is the total of the logarithm price ratio for the time span.
- S indicates to sum all n logarithms.
- LOGSi is the logarithm of the price change for period i.
- n is the number of periods for the specified time span. The next step is to calculate the average of the logs by dividing the total logarithm by the number of periods as shown below:
- ALOGS = Tlogs / n
- ALOGS is the average of the logarithms.
- Tlogs is the total of the logarithm for the time span.
- n is the number of periods for the specified time span.

The last calculation is to sum the squares of the difference between the individual logarithms for each period and the average logarithm. This is accomplished in the following formula:

$$SSD = \sum_{i=1}^{n} (LOGSi - ALOGS)^2$$

- SSD is the sum of the squared differences.
- S indicates to total the squares of all n differences.
- LOGSi is the logarithm of the price change for period i.
- ALOGS is the average of the logarithms.

Now that the elements of the final formula are complete, the following formula calculates the historical volatility for a given period over a specified time span.

$$HV = \sqrt{\frac{SSD}{n-1}} * \sqrt{TP}$$

- SSD is the sum of the squared differences.
- n is the number of periods for the specified time span.
- TP is the total number of trading periods for the year.

Due to the complexity of the formula, it is preferable to use MSEXCEL while calculating the Historic Volatility of a futures instrument.

Steps used in calculation of volatility

After thorough study of volatility and historical volatility we derived some steps to calculate the volatility of future index. These steps are:

Calculations: Historical Volatility (20-Day):

STEP1: For the past 20 days, calculate today's close / previous close (requires 21 days of data)

STEP2: Calculate the natural log of the results calculated in STEP 1.

STEP3: Calculate the sum of the natural logs over the past 20 days. Calculate the sum of the squares of the natural logs over the past 20 days.

STEP4: Divide the sum of the natural logs by 20 Divide the sum of the squares of the natural logs by 20 Calculate: RESULT 2 - the square of RESULT 1 Calculate the (square root of RESULT 3) x (sq. root of 252) x 100 This is the 20-day historic volatility for today.

v) Scope of the study

There are various indices of commodity are available like NYMEX MCX COMDEX , MCX METAL MCX rainfall etc. for better comparison and analysis only MCXMETAL have been taken in the analysis. i.e. 2006-2009only for three years. There are many types of prices are also available under commodity derivatives like forward, future, option and swap many other, but focus of this research is on the future commodity prices. A number of commodities are there which traded in category of future commodity derivatives like Agro-based Commodities, Soft Commodities, Live Stock, Energy, Precious Metals etc. but for making a analysis of bullion commodity the following three metal commodities have been selected.

Name of selected commodities: GOLD, SILVER, COPPER

ANALYSIS AND INTERPRETATION

A study of volatility of future prices of selected metals has been carried out as per the result shown in following tables.

Table 2: present composition of commodities and their weights in the MCXMETAL :

No.	Commodity MCX-METAL	Weight (New)
1	Gold	12.54%
2	Silver	9.26%
3	Copper	9.85%

Source:www.mcx.com

From the table 2 this is clear that gold has more weight in mcx metal in comparison of silver and copper. So gold is more important metal than silver and copper in mcxmetal index.

Table 3 showing three year volatility of MCXMETAL index on the basis of three years data i.e.1-3-2006 to 1-3-2009

MCX METAL	2006-2009
Voltality of index	24.71

Source: Based on calculation from MSEXCEL

Table 3 shows that the volatility of MCXmetal index data from 1-3-2006 to 28-2-09, is 24.71 which is good.

Table4 showing yearly volatility of MCXMETAL index on the basis of three years data i.e.1-3-2006 to 1-3-2009

Year	Volatility
2006-07	33.13
2007-08	14.95
2008-09	24.25

Source: Based on calculation from MSEXCEL

Table 5 showing yearly volatility of selected bullion commodities future price

Name of commodity	Contract 1	Contract2	Contract 3
Gold	13.26(6-Aug-07 5-Feb-08)	23-69 (6-June-09 6-Oct-08)	26.80(6-Oct-08 13-Mar-09)
silver	24.16(6-Sep-07 5-May-08)	32.08(7-Jul-08 5-Dec-08)	31.79(6-Dec-08 13-Mar-09)
copper	23.89(1-May-07 30-Nov-07)	33.98(1-Jan-08 26-Nov-08)	42.01(1-Nov-08 13-Mar-09)

Source: Based on calculation from MSEXCEL

From the analysis of table 3 and 4 it is clear that the volatility of all three metal i.e. GOLD, SILVER & COPPER understudy has been higher than the benchmark index MCXMETAL for two years i.e. 2007-2008 & 2008 2009, but the volatility in the year 2006 2007 has been lower than the volatility of MCXMETAL index in 2007.

One more conclusion have been carried out from table 5 that the gold is less volatile in all three contract in comparison of silver and copper. Copper is more volatile in comparison of gold and silver.

Table 6: showing six monthly volatility MCXMETAL index on the basis of three years data i.e.1-3-2006 to 1-3-2009

Time-period	Volatility
1-3-06 to31-8-06	39.5059455
1-9-06 to 30-2-07	19.60387367
1-3-07 to31-8-07	13.47519781
1-9-07 to 30-2-08	15.40067145
1-3-08 to31-8-08	22.51426453
1-9-08 to 30-2-09	27.62771288

Also from table 6 it is evident that the volatility of benchmark MCXMETAL index has been quite higher from six month period of 1-3-06 to 31-8-06 i.e. almost 40%. Then it has shown declining trend in 2007. After that up to 2009 it has shown increasing trend. In the conclusion we can say that after 2007 the benchmark is more volatile and the volatile behavior of metal has beaten the benchmark.

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