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Volatility of Agricultural Products Using Value At Risk with Special Reference to Multi Commodity Exchange (MCX)

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Abstract

Value at risk models are relevant for commodity traders who have short and long trading positions in the commodity markets. These models are used to quantify risk and return profile of the active market participants such as traders or asset mangers. Commodity futures market (especially agricultural commodities) gives either unlimited loss or unlimited profit, and therefore investors should know the market condition in order to earn more returns.

1.0 INTRODUCTION

India's agricultural production has improved significantly since independence. India is now a major producer of many agricultural commodities, fruits, and vegetables. According to the Ministry of Agriculture annual report, India ranks within top two global producers of rice, wheat, sugarcane, cashew nut, pepper, cotton, jute, spices, potato, tomato, and tea. Agriculture contributes to the Indian economy in many significant ways. It provides employment to around 51 percent of the total population. Data provided by the Planning Commission of India indicates that in 2013, agriculture contributed 14 percent of the total GDP, and agricultural exports accounted for 11 percent of the total exports from India.

1.1 NEED OF THE STUDY

Commodity futures market (especially agricultural commodities) gives either unlimited loss or unlimited profit, and therefore investors should know the market condition in order to earn more returns. Hence, there arises a need to test the volatility in commodity prices and the risk involved in the commodity exchange in India. The present study is an attempt to analyse the volatility of agricultural products in derivative commodity market and to evaluate the risk arising out of it.

1.2 SCOPE OF THE STUDY

The present study gives an overview on investing in agricultural products (Cardamom, Cotton, Crude palm oil, Mentha oil and Kapas) using hedging and evaluate the risk at the time of investment using Value at Risk (VaR) models. The area of study is confined to MCX. The period of the study is confined from 01 Jan 2020 to 31 Dec 2021.

1.3 OBJECTIVES OF THE STUDY

The objectives of the study are:

1. to record the futures contract price of the agricultural products.
2. to analyze the price changes in the agricultural products.
3. to describe the Value at Risk (VaR) of the agricultural products.

4. to make possible suggestions to the investors.

1.4 HYPOTHESES OF THE STUDY

The following are the null hypothesis of the study.

(H_o) There is no significant difference of price changes between the agricultural products.

(H_o) There is no significant risk relation between the agricultural products.

(H_o) There is no significant difference in estimating value at risk by using historical simulation method and variance-covariance method.

1.5 METHODOLOGY OF THE STUDY

The following are the methodology of the study.

- **Universe**
  All the agricultural products listed and traded in MCX limited are taken as universe.
- **Sample of the study**
  The sample of the study are the five products like Cardamom, Cotton, Crude palm oil, Mentha oil, Kapas out of the agricultural products which are listed in the Multi Commodity Exchange of India (MCX).
- **Sources of the study**
  The secondary data are collected from the website www.mcxindia.com
- **Period of the study**
  The daily prices of the agricultural products of futures contract under MCX for the period from 01 Jan 2024 to 31 Dec 2024.

1.6 TOOLS USED IN THE STUDY

The following are the tools used in the study

Value at Risk (VaR)

- **Historical simulation method**
- Individual commodity derivative futures.
- Portfolio commodity derivative futures.
- **Variance and covariance (or) delta normal method**
- Individual commodity derivative futures.
- Portfolio commodity derivative futures.

2.0 REVIEW OF LITERATURE:

Hyun-Jung R, Graham S (2004) has analysed the impact on the spot market of trading in KOSPI 200 futures. Empirical results show that futures trading increases the speed at which information is impounded into spot market prices, reduces the persistence of information and increases spot market volatility. The spot and futures prices are cointegrated and there is bidirectional causality between the two markets. The lead-lag relation is asymmetric with weaker evidence that the spot index leads futures and stronger evidence that the stock index futures market leads the spot market.

Sehgal, S., Rajput, N., & Dua, R. K. (2012) analyse the effect of futures trading activity on spot price volatility for seven agricultural commodities (guar seeds, turmeric, soya bean, black pepper, barley, Maize and Castor Seed). The relationship of the unexpected liquidity of futures market is done with Unexpected volatility of spot market returns which is estimated by taking the residuals of the GARCH model. Using Granger Causality test, it was found that unexpected futures trading volume is Granger causing spot price volatility and are significant for five out of seven agricultural commodities (Guarseed, Turmeric, Soybean,

Maize and Castor Seed), and the reverse effect was found for one commodity i.e. Pepper the effect of spot volatility on futures trading and for Barley no causality is revealed either from future to spot or Vice-Versa.

Sumudu W. Watugala (2014) in the paper examined result from new information about the expected future interest rates, convenience yields, and risk premia. This motivates the empirical analysis of the volatility impact of economic and inaction regimes and commodity supply-demand shocks. Using data on major commodity futures markets and global bilateral commodity trade, the author analyse the extent to which commodity volatility is related to fundamental uncertainty from increased emerging market demand and macroeconomic forecast uncertainty, while controlling for the potential impact of financial frictions introduced by changing market structure and commodity index trading. Higher con- centration in emerging market importers of a commodity is associated with higher futures volatility. The author finds commodity futures volatility is significantly predictable using variables capturing macroeconomic uncertainty. The author examined the conditional variation in the asymmetric relationship between returns and volatility, and how this relates to the futures basis and sensitivity to consumer and producer shocks.

Bhat, A. P. (2015) examined the performance of alternative models for estimating Value at Risk (VaR) of four different currencies against the Indian rupee. The author examined whether incorporating a volatility estimate capturing the ARCH effects in the normal linear VaR model yielded a better estimate of market risk than the traditional models based on historical simulation and historical moving average volatility. The author tested the effectiveness of different VaR models during the volatile period of June-September 2013 and found that VaR models based on an estimate of time-varying volatility performed better than traditional models during turbulent times.

Wang &Liu, 2016) investigated volatility spillovers and dynamic correlations between crude oil and stock markets using GARCH-class models. They analysed the dynamic relationships of seven major oil-exporting countries and nine oil-importing countries. Their main findings based on in-sample and out-of-sample evidence suggest that the volatility spillovers and dynamic correlations between global crude oil market and a country's stock market depend on the net position of oil imports and exports of this country in the world market. In addition, crude oil risk can be better hedged by investing in stocks of oil-exporting countries than in those of oil-importing countries.

Raghavendra, R. H., Velmurugan, P. S., & Saravanan, A. (2016) in their study examines the relationship between spot and future prices of agricultural commodities such as Soya bean, Chana, Maize, Jeera and Turmeric for a period from January 2010 to March 2015 traded in NCDEX, Empirical results suggest the existence of long-run equilibrium relationships between futures and spot prices for all the 5 agricultural commodities that were taken for this study. Regression model pertaining to Lead-Lag relationship between Spot and Future markets suggests that for the commodities Maize, Jeera and Turmeric, both the spot and future markets price plays the leading role in the price discovery process and said to be informationally efficient and reacts more quickly to each other.

Radha, K., & Balakrishnan, Sujatha, (2017) in their paper investigate the efficiency of Indian futures market in discovering prices and mitigating risk for agricultural commodities consequential of significant price rise in recent times. Johansen's test of cointegration, Vector Error Correction Model (VECM) and Granger causality test are employed to understand the relationship between spot and futures prices. Optimal hedge ratio and hedging effectiveness are measured using VECM. The results indicate cointegration between spot and futures prices for all the four commodities studied in near month and next to near month contracts. For near month contracts, mostly, both the markets react simultaneously and

contribute to price discovery, but for next to near month contracts, futures market plays a dominant role. Hedgers benefit by participating in the futures market for all the commodities, although variance reduction is relatively higher for the near month contracts and hedging effectiveness varies across commodities.

3.0 Analysis and Interpretation:

1. Analysis of the agricultural products using historical simulation method.

Table – 3.1

Statement showing the Weights of the agricultural products

PRODUCTS	VALUE (IN RUPEES)	WEIGHTS
Cardamom	200000	0.2
Cotton	200000	0.2
Crude palm oil	200000	0.2
Mentha oil	200000	0.2
Kapas	200000	0.2
TOTAL	**1000000**	**1.0**

Source: Authors Compilation

Table – 3.2

Statement showing the Portfolio Value at Risk of the agricultural products using Historical Simulation method

Probability of VaR calculations	0.05
Level of Certainty	0.95
No. of. Observation	523
Historic VaR at position	26
Normal Distribution value	1.644853627
VaR using Historical Simulation	**-13.699.78467**

Source: Authors Compilation

Analysis of the agricultural products using variance and covariance method.

Table – 3.3

Statement showing the Standard Deviation and Individual VaR of the agricultural products

S.No	Products	Standard deviation	VaR	Absolute VaR
1	Cardamom	1.80%	5910.38	5910.386
2	Cotton	0.90%	2945.86	2945.868
3	Crude palm oil	1.07%	3529.58	3529.582
4	Mentha oil	3.57%	11752.69	11752.693
5	Kapas	1.77%	5819.10	5819.104

Source : Authors Compilation

Table – 3.4
Statement showing the Diversified Portfolio VaR of the agricultural products

Level of Certainty	0.95
Normal Distribution Value	1.644853627
Worse case VaR	29957.63478
Diversified VaR	**6336.79711**

Source: Authors Compilation

Table - 3.5
Correlation Matrix and the Portfolio Value at Risk of the agricultural products using Variance and Covariance method

1	0.080339655	0.101274952	0.027217809	0.01308591
0.080339655	1	0.184655856	0.025237712	0.124325246
0.101274952	0.184655856	1	0.04528369	0.005992696
0.027217809	0.025237712	0.04528369	1	-0.069062134
0.01308591	0.124325246	0.005992696	-0.069062134	1
5910.386576	**2945.868911**	**3529.582372**	**11752.69232**	**5819.104605**

Source: Authors Compilation.

VaR using Variance and Covariance method	**15625.86668**

When the Value at risk (VaR) estimated based on Historical Simulation Method(-13.699.78467) is compared with the Value at risk (VaR) estimated based on Variance and Covariance method(15625.86668), and it is found the result is refined in the Variance and Covariance method.

4.0 FINDINGS OF THE STUDY

The chapter deals with findings that have been made on basis of analysis and interpretation. Based on the Value at Risk (VaR) models in commodity derivatives futures market of Cardamom, Cotton, Crude palm oil, Mentha oil and Kapas, the findings and suggestions were framed from 1st January 2024 to 31st December 2024**.**

1. From the analysis the study finds that the VaR is estimated for this portfolio at the 95% confidence levels. Therefore the probability for calculating VaR in both historical simulation method and variance and covariance method will be 0.05 (100% - 95% = 5%).
2. The study finds that the observation taken for this calculation for both methods are 523 (daily prices of the above said five agricultural products from 01.01.2020 to 31.12.2021)
3. The study finds that the normal distribution value for both the method is 1.644853627.
4. From the analysis the study finds that the portfolio changes are estimated based on the first difference between the price of two days and the weight of the portfolio.
5. The study finds that the position of value at risk (26th position) is estimated based on the probability and the observations involved.
6. The study finds that the value at risk (-13.699.78467**)** using historical simulation method is estimated based on the portfolio changes and the total weight of the portfolio.

7. From the analysis the study finds that the standard deviation estimated in the variance and covariance method is based on the first difference of the price movements of each five agricultural products.
8. From the analysis the study finds that the value at risk using variance and covariance method is estimated based on the Weight of each product, normal distribution value and the standard deviation of each product.
9. The study finds that the worse case VaR of the portfolio (29957.63478) is estimated based on the VaR of individual asset.
10. From the analysis the study finds that the correlation matrix of portfolio VaR is estimated based on the first difference of price movement of each individual asset.
11. The study finds that the value at risk (15625.86668) using variance and covariance method is estimated based on the correlation of each five agricultural products.
12. From the analysis and interpretation shows that the VaR based on variance and covariance method is refined as compared with historical simulation method.

4.1 SUGGESTIONS OF THE STUDY

The following are the suggestions of the study

1. The study suggests that the commodity derivatives have certain risk so the investors should not take immediate investment decision and instead they should wait and watch the market movement.
2. The risk and return analysis helps the investors to take proper investment decision at the time of investment.
3. Investors should have adequate knowledge about Value at Risk before they invest in commodity derivatives.
4. Updating of market information helps the investors to get maximum return even when the market is volatile.

4.2 CONCLUSION

The study deals with the historical simulation method and variance and covariance method of Value at Risk of agricultural products (Cardamom, Cotton, Crude palm oil, Mentha oil and Kapas) in commodity derivative future market. The study concluded that the commodity market is volatile and therefore it is mandatory to estimate the value at risk for better investment decision

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