FUTURES MARKET HEDGING IN INDIAN COMMODITIES MARKET- A COMPARATIVE STUDY ON SPOT AND FUTURES PRICE

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ABSTRACT

Over the years, the prices of commodities have been moving in an upward direction and hence Commodities Investment is considered an attractive portfolio diversification. Risk is a part of all investments and investors need to use a mechanism which can help them to minimize their risk in investment. One of the derivatives namely futures contracts are used as a tool to effectively manage the risks involved in investments. The present study evaluates the pricing behaviour of Indian Commodities Markets and assesses the hedging effectiveness of futures contract for selected sample commodities, traded at Multi Commodity Exchange India Limited. The major results of the study indicate that the future price of commodities determines the spot price for majority of sample commodities and natural gas future contracts provided a higher hedging effectiveness when compared to other sample commodities.

Keywords: Portfolio, Derivatives, Hedging Effectiveness, Future Contracts.

JEL Classification: G14

INTRODUCTION

Commodity prices are typically characterized by substantial volatility. In particular, producers need to manage their exposure to fluctuations in the prices for their commodities. They are primarily concerned about fixing prices on contracts to sell their produce and hence the existence of futures markets. In particular, the investors need to manage their exposure to fluctuations in the prices for their commodities as it can have direct effect on their returns.

Managing risk involves the process of identifying, quantifying and managing the risks that an investor faces. As the outcome of market uncertainty, they are said to have some element of risk. Almost all investments are exposed to it.

Investing community needs to be informed about strategies in minimizing the risk i.e. hedging strategies. Lack of awareness among investors in making proper use of hedging techniques, can result in heavy losses. An improper usage of hedging strategies will lead to losses for the investors. The hedging strategies can be effectively applied only with the proper prediction of the future spot prices. The objective of the present study focuses on the spot and future price movements. Therefore, the aim of the present study is to analyse the price behaviour

in the Indian commodities markets. An evaluation of price movements in commodities markets can help the investors to better understand the market and hedge futures contracts accordingly. The study will help the Investing Community to understand the pricing mechanism existing in the commodities markets and the ways to minimize the risk involved in commodity investments.

The present paper was designed with the following objectives

- To test the stationarity in the daily spot and futures price returns of sample commodities.
- To analyze the co-movement between spot and futures price returns of sample commodities.
- To assess the efficiency and hedging effectiveness of futures contracts of the sample commodities.

The current paper has been organized into five sections- Section-I provides the Introduction to the study which is already discussed in the above paragraph and the rest of the sections are arranged as follows- Section- II gives a brief overview of earlier studies related to the current area of study, Section – III brings out the design of the study which covers statement of the problem, significance of the study, Objectives and hypothesis of the study. Section- IV discusses the methodology of the study which includes sample selection, period of the study, Tools used for analysis and Limitations of the present study. Section- V concludes the paper by discussing the results of the study and its implications.

LITERATURE REVIEW

This section describes the work previously done by researchers in the area of present study. The review of the literature was carried out according to the systematic review process defined by Centobelli et al. (2021); Altarawneh et al. (2020) and Wadesango et al. (2020) that are well-known in the field of literature reviews concerning managerial topics.

Theory of Normal Backwardation (Keynes, 1923) stated that futures price is unreliable estimates of the future spot price. Telser (1958) and Cootner (1960) found conflicting results in testing this theory. Dusak (1973) applied the Capital Asset Pricing Model in future pricing with risk premium and a forecast for future spot price. Carter et al. (1983) found seasonality of non-market risk. Fama & French (2016) also followed testing time-varying risk premium.

A working paper titled, *"The Dynamic Hedging Effectiveness for soybean farmers of MATO GROSSO with futures contracts of BM&F"* examined the dynamic hedging effectiveness for soybean using the Ordinary Least Squares and Bi-Variate GARCH Models. The study found that the financial effectiveness of the dynamic hedge model is superior and can be used by farmers for several decision making purposes such as price discovery, cash flow projections, market timing etc. (da Rocha & Caldarelli, 2010).

An article entitled, *"Efficiency in Agricultural Commodity Futures Market in India: Evidence from Co-Integration and Causality Tests"* analyzed the efficiency of the futures market for agricultural commodities traded at National Commodities and Derivative Exchange India Ltd(NCDEX). The results of the study indicated that except for wheat and rice, co-integration was noticed in spot and futures prices for all other sample agricultural commodities (Ali & Gupta, 2011).

Shobana et al. (2012) examined the Price Discovery Process of spot and future prices of twelve sample commodities from Multi Commodity Exchange of India Limited using GARCH model. The data consisted of daily closing prices from 2003-2011 and the study period results evidenced lead-lag relationship spot and future prices of commodities.

Vijayakumar et al. (2012), in their study analyzed the spot and future price relationship for five agricultural commodities traded at NCDEX from January 2008 to December 2010 using Johansen Co-Integration and Vector Error Correction model and the results indicated long run relationship in the spot and future prices of sample commodities and disequilibrium between markets was also noticed for the sample commodities.

Steen & Gjolberg (2013) examined the co-movements across commodities using monthly prices of twenty commodities for the period 1986-2010 and found that there existed a tendency towards increased co-movements across and between countries after the year 2004.

A study on, *"Market Behavior and Price Discovery in Indian Commodity Markets"* examined market behaviour and causality between spot and futures price in the Indian commodity market. The study concluded that price discovery mechanism was effective for majority of sample commodities (Dash & Andrews, 2010).

"Opposite Behaviour of food markets from that of other commodities: A cause of high Inflation", provided a conceptual comparison of Consumer Price Index and Wholesale Price Index of commodities in India and found that the prices of Food and Beverage contributed towards a higher volatility.

de Nicola et al. (2014) in the discussion paper on *"Co-movements of major Commodity Price Returns: A Time Series Assessment"*, tested the co-movements in the nominal price returns of eleven major commodities using monthly data from 1970 to 2013. The results of Conditional Correlation and Rolling Regression model indicated existence of co-movement in the sample commodities (de Nicola et al., 2014).

Aggarwal et al. (2014) examined the Price Discovery and Hedging Effectiveness of Commodity futures for six agricultural and two non-agricultural commodities over a period from 2003 to 2014 and the findings revealed lower hedging effectiveness for majority of sample commodities (Aggarwal et al., 2014).

METHODOLOGY

For the purpose of analysis, a sample of nine commodities from various categories traded in Multi Commodity Exchange, based on the nature of volatility and turnover of the commodities during the period of the study, was selected. Availability of data was also taken into consideration. In order to assess the price behaviour of Indian commodities markets, a period of five years from 01.04.2015 to 31.03.2018 was considered for the analysis. The study has certain limitations which are as follows: The study made use of only one Commodity Exchange in India- the Multi Commodity Exchange Ltd. Hence the results will not be applicable to other commodity exchanges; all the limitations of secondary data are applicable to this study also. Further, the results of the study may vary when different periods are taken into account and all the limitations of the tools apply to this study also.

Tools used for Analysis

Augmented Dickey Fuller Test
Johansen –Juselius (JJ) Co- integration Test
Vector Error Correction Model
Hedging Effectiveness

RESULTS AND DISCUSSION

The test for stationary of time series data of the sample commodities, using Augmented Dickey Fuller Test, is presented in Table 1. Ignoring the sign, it can be inferred that the ADF t-statistic for all the sample commodities were greater than the significance values at 1%, 5% and10% level. Hence the H01: *"There is no stationarity in the daily price returns of sample commodities' is rejected. Therefore it can be concluded that all the sample commodities"* spot and futures price returns attained stationarity at the level difference itself.

Table 1
Summary of Stationarity Test for Daily Returns of Spot and Future Prices of sample Commodities

S.No.	Name of the Commodities	ADF t-statistic Level Difference		Significance			Prob.
		Spot	Futures	1%	5%	10%	
1	Aluminium	-20.649	-29.355	-3.435	-2.863	-2.567	<0.001
2	Cardamom	-6.260	-9.158	-3.435	-2.863	-2.567	<0.001
3	Lead	-26.480	-31.974	-3.435	-2.863	-2.567	<0.001
4	Natural Gas	-28.895	-20.096	-3.435	-2.863	-2.567	<0.001
5	Copper	-22.331	-17.370	-3.435	-2.863	-2.567	<0.001
6	Silver	-18.795	-18.898	-3.435	-2.863	-2.567	<0.001
7	Zinc	-29.757	-19.041	-3.435	-2.863	-2.567	<0.001
8	Crude Oil	-25.212	-19.085	-3.435	-2.863	-2.567	<0.001
9	Nickel	-25.9157	-20.650	-3.435	-2.863	-2.567	<0.001

Source: Data collected from mcxindia.com and Computed using E-Views.

Table 2
SUMMARY OF JOHANSEN CO-INTEGRATION TEST FOR DAILY RETURNS OF SPOT AND FUTURE PRICES OF SAMPLE COMMODITIES

Commodity	Trace Statistic	Max-Eigen Statistic	0.05 Critical Value	Prob.
Aluminium	66.235	88.247	3.841	<0.001
Cardamom	58.706	74.706	3.841	<0.001
Lead	108.48	115.06	3.841	<0.001
Natural gas	117.77	124.22	3.841	<0.001
Copper	63.295	78.634	3.841	<0.001
Silver	50.236	88.648	3.841	<0.001
Zinc	113.375	135.638	3.841	<0.001
Crude Oil	78.971	100.083	3.841	<0.001
Nickel	117.778	68.063	3.841	<0.001

Source: Data collected from mcxindia.com and Computed using E-Views.

The results of Johansen co-integration test and Vector Error Correction Model to know the co movement in spot and futures price returns of sample commodities are presented in Table 2 and Table 3 respectively**.** It is to be noted that the Trace Statistic and Max-Eigen statistic for the spot and futures price returns of the sample commodities were greater than 0.05 critical values for all the sample commodities. Further, the probability values were statistically significant. Hence the H02: *"There is no co-integration in the spot and futures price returns of sample commodities"* is rejected. This indicates that the sample commodities were co-integrated in the long run.

The efficiency of futures contracts of sample commodities in reducing the risk of spot price during the study period was explored through Hedging Effectiveness which is explained in Table 4.

Table 3
RESULTS OF VECTOR ERROR CORRECTION MODEL FOR SPOT AND FUTURE PRICE RETURNS OF SAMPLE COMMODITIES

Commodities	Co-Efficient		Standard Error		t-statistic		Inference
	Spot	Future	Spot	Future	Spot	Future	
Aluminium	-0.6	0.075	0.14	0.043	-21.6	0.172	Futures price leads the spot price and corrects the disequilibrium if any.
Cardamom	-0.02	-0.811	0.03	0.037	-0.68	-21.663	Futures price determines the spot price
Lead	0.00	-0.757	0.04	0.035	0.03	-21.212	Spot Price leads the futures price.
Natural gas	0.00	-0.757	0.04	0.035	0.03	-21.212	Spot price corrects the disequilibrium in futures price.
Copper	-0.6	-0.053	0.05	0.049	-13.1	-1.085	Spot price leads the future price.
Silver	-0.00	-0.690	0.04	0.046	-0.22	-14.891	Futures price determines the spot price.
Zinc	0.12	-0.811	0.03	0.037	-0.68	21.663	Futures price determines the spot price.
Crude Oil	-0.67	0.117	0.04	0.048	-15.4	2.438	Futures price determines the spot price.
Nickel	-0.03	-0.730	0.03	0.038	-0.97	19.141	Futures price determines the spot price

Source: Data collected from mcxindia.com and Computed using E-Views.

Table 4
ESTIMATION OF HEDGING EFFECTIVENESS OF SAMPLE COMMODITIES DURING THE STUDY PERIOD

Commodity	Co-Variance (St, Ft)	Variance(Ft)	Hedging Effectiveness
Aluminium	0.0052	-0.00256	-2.029
Cardamom	0.000645	0.001559	0.4137
Lead	0.004725	0.005458	0.8659
Natural gas	0.001895	0.001897	0.9989
Copper	0.001506	0.001509	0.9980
Silver	0.000340	0.00114	0.2966
Zinc	0.001550	0.00114	1.350
Crude Oil	-0.001607	0.001906	-0.8431
Nickel	0.001512	0.00125	1.2096

` Source: Data collected from mcxindia.com and computed using E-Views.

It can be inferred from the table that Natural Gas future contract recorded a higher Hedging Effectiveness which reduced considerable risk of investment for the investors during the study period. Copper's future contract provided 99.80% risk reduction for the investors during the study period, followed by Lead (86.5%), Cardamom (41.3%) and Silver (29.6%). The futures contract hedging was not effective for Aluminium and Crude Oil as it recorded negative hedging effectiveness. Further, Zinc and Nickel future contract recorded the least hedging effectiveness. Hence it can be concluded that the null hypothesis, namely, *"There is no risk reduction in the daily returns of sample commodities"* is rejected for Lead, Natural Gas, Copper and Cardamom whereas for all other commodities, it is accepted.

CONCLUSION

The study made use of daily closing prices of commodities at Multi Commodity Exchange Limited and evaluated the Price Discovery and Hedging Effectiveness of future contracts of sample commodities. However the study used only Multi Commodity Exchange Ltd and used only secondary data for analysis. The results of the study have practical implications for commodity market investors in formulating their investment strategies and timing. The results of

the study reveal that spot and future price were associated in the long run and futures prices of commodities helped in determining the spot price. The results of hedging evidenced Natural gas, Copper and Lead futures recorded a higher hedging effectiveness which reduced considerable risk of loss for investors. As there was a positive relationship between spot and futures prices of commodities, a careful observation of spot prices is required for effectively utilizing hedging strategies for minimizing the risks of future contracts. Further, unlike stocks, where the flow of market information acts as a factor in determining the price, commodities are widely influenced by demand, supply and natural factors. Therefore, in the case of commodities investment the investors are advised to make hedging decisions based on future prices displayed on the exchange website which can serve as a better risk management tool. The current area of research is associated with real time and can be studied in view of changing political, economic, market and other factors. Further, the number of commodities can be extended covering a large number of periods and a comparative study could also be made.

REFERENCES

Aggarwal, N., Dutta, S., & Sharma, A. (2014). *The exchange rate exposure of Indian firms*. Working Paper of Indira Gandhi Institute of Development Research 2014-3-28.

Ali, J., & Gupta, K.B. (2011). Efficiency in agricultural commodity futures markets in India. *Agricultural Finance Review*.

Altarawneh, M., Shafie, R., & Ishak, R. (2020). CEO characteristics: A literature review and future directions. *Academy of Strategic Management Journal*, *19*(1), 1-10.

Carter, C.A., Rausser, G.C., & Schmitz, A. (1983). Efficient asset portfolios and the theory of normal backwardation. *Journal of Political Economy*, *91*(2), 319-331.

Centobelli, P., Cerchione, R., Esposito, E., & Oropallo, E. (2021). Surfing blockchain wave, or drowning? Shaping the future of distributed ledgers and decentralized technologies. *Technological Forecasting and Social Change*, *165*, 120463.

Cootner, P.H. (1960). Returns to speculators: Telser versus Keynes. *Journal of political Economy*, *68*(4), 396-404.

da Rocha, W.A., & Caldarelli, C.E. (2010). The dynamic hedging effectiveness for soybean farmers of mato grosso with futures contracts of BM&F. *Rural & Agroindustrial Organizations*, *12*(1), 34-45.

Dash, M., & Andrews, S.B. (2010). *A study on market behaviour and price discovery in Indian commodity markets.*

de Nicola, F., De Pace, P., & Hernandez, M.A. (2016). Co-movement of major energy, agricultural, and food commodity price returns: A time-series assessment. *Energy Economics*, *57*, 28-41.

Dusak, K. (1973). Futures trading and investor returns: An investigation of commodity market risk premiums. *Journal of Political Economy*, *81*(6), 1387-1406.

Fama, E.F., & French, K.R. (2016). Commodity futures prices: Some evidence on forecast power, premiums, and the theory of storage. In *The World Scientific Handbook of Futures Markets* (pp. 79-102).

Keynes, J.M. (1923). Some aspects of commodity markets. *Manchester Guardian Commercial: European Reconstruction Series*, *13*, 784-786.

Steen, M., & Gjolberg, O. (2013). Are commodity markets characterized by herd behaviour?. *Applied Financial Economics*, *23*(1), 79-90.

Telser, L.G. (1958). Futures trading and the storage of cotton and wheat. *Journal of Political Economy*, *66*(3), 233-255.

Vijayakumar, N., Parvadavardini, S., & Dharani, M. (2012). Relationship between futures and spot market for selected spices in India. *Prajnan*, *41*(3).

Wadesango, N., Charity, M., Blessing, M., & Haufiku, H. (2020). The effects of corporate governance on financial performance of commercial banks in a turbulent economic environment. *University of Pecs*, *16*(4).