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RESEARCH PAPER

Structural Dynamics of Indian Commodity Derivatives Market

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ABSTRACT

The inter temporal dimensions of an asset are examined through the price discovery function analysis of futures and spot price dynamics. The present study used Granger causality test and Chow test to analyze the price discovery function and the structural break of the agriculture, base metals, bullion, and energy commodities futures and spot prices during 2016-2022. The findings revealed the bidirectional causality between both the spot and future markets except gold exhibited unidirectional causality where the future market lead on the spot return is greater than contrary. Since the selected time period captures the crisis period, understanding the dynamic patterns is important for derivative valuation, hedging and asset allocation. The result of structural break revealed that among the selected commodities, only few commodities does not exhibit the structural break during the crisis period. This infer that the demand and supply for those commodities would exist in equilibrium condition and the shocks would not be transmitted to the price of commodities. The study makes recommendations for market participants to use arbitrage and hedging tactics. Additionally, it assists the regulators in assessing the steadiness of expanding commodity futures markets in India.

HIGHLIGHTS

- The paper analyzes the structural dynamics of commodities derivatives of spot and future market.
- The study used Granger causality test and Chow test to analyze the price discovery function and the structural break of the agriculture, base metals, bullion, and energy commodities futures and spot prices.
- Based on the results, only few commodities do not exhibit the structural break during the crisis period.

Keywords: Commodities Derivatives, Structural break, Crisis Period, Spot Price, Future Price

Agriculture, Metal and Energy are valuable commodities to the producers, lenders, processors, brokers and consumers. Such commodities trade both on spot and future across global commodity derivatives market (Priolon, J. 2019). Forwards and futures contracts are traded on commodity derivative markets, and these contracts obtain their values from the spot commodities on the market. An effective commodity futures market is crucial in managing the price risk uncertainty related to the major commodities as a strategy for enhancing wellbeing. Commodity futures markets play a substantial role in establishing a reference price for producers and trade functionaries in an open economy by lowering price volatility in commodity prices and hazy production decisions (Varghese, G. 2017).

In addition to price discovery, the futures market is an important tool for risk management because it offers financial benefits like information

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dissemination and effective resource allocation (Li, M. and Xiong, T. 2021). Fundamental variables such as demand and supply, market structure, and governmental policies eventually have an impact on the spot price. In contrast, the futures price is driven by hedgers, speculators, traders, and other market participants.

Over the time, there has been an increase in interest in the Indian commodity futures markets. A more appealing alternative to the security markets for investing is commodity futures, which are also becoming a more often used method of hedging assets (Sehgal, S., Rajput, N., and Deisting, F. 2013). An efficient operating commodity futures market is important economically, according to the literature that is currently available on price discovery and market efficiency in Indian commodity futures markets. Gupta, S., Choudhary, H., and Agarwal, D. R. (2018) studies focused on the economic significance and operation of the commodities futures markets in developed nations.

However, futures markets are more profoundly regulated by the government in developing nations, and reforms are still quite new. Government policies are gradually moving away from an interventionist approach to market-based framework. So, the discussion over the economic advantages of these markets, such as price discovery and hedging, was sparked by the role that commodity futures markets play in the economy.

Following the 2003 reform of the commodity derivative market in India, trading in agricultural, metal, and bullion commodities for the future is expanding significantly on the country's major commodity exchanges (Kumar, B. and Pandey, A. 2011). However, more research is required to determine how the growth of the commodity futures market has affected economic efficiency and the reduction of price risk. Investigating the problems that underlie the dynamics of pricing behavior on Indian commodity futures markets is crucial.

It is necessary to examine the dynamics of the futures market's price behavior since they are crucial for managing price risk and serving as the economy's price discovery mechanism for the spot market. For evaluating the success of the commodities futures market in India, these issues are more important. The present study attempts to determine the price discovery role of commodities traded in MCX and structural break in the market during country's socio-economic crisis.

LITERATURE REVIEW

Price discovery forecasts anticipated futures spot prices and uses those futures prices as a benchmark for spot market prices. Additionally, it aids in establishing a benchmark price for the spot market and identifies the information-feedback mechanism between futures and spot prices. The projected spot prices are shown in futures prices. The intertemporal link between spot and futures prices determines how the price is determined on the futures market.

If one market processes information more quickly than the other, there may be a lead-lag relationship between the spot and futures markets. The ease of short sales, decreased transaction costs, institutional arrangements, and the impact of market microstructure are some of the variables that affect the lead-lag relationship. The lead-lag characteristics of the spot and futures markets show how quickly one market absorbs information compared to another. The allocation of production and consumption across time is made easier by futures trading since it offers market direction for holding inventories. When the futures price for later delivery is higher than for immediate delivery, delaying consumption makes sense. Hence, when the price of futures changes, spot prices also fluctuate as a result. Due to their lack of interest in the physical commodity and the ease with which a futures position can be offset, speculators prefer to keep futures contracts. Additionally, hedgers who want the physical commodity but have limited storage space can protect themselves by purchasing a futures contract. In order to respond to information, both hedgers and speculators may trade in futures rather than the spot market. As a result, futures prices frequently precede spot prices. In light of the aforementioned, there is a very clear rationale for researching the connection between futures and spot prices and the issue of the causal link between two markets.

METHODOLOGY

The present study used daily spot and future

price data of 11 commodities collected from MCX database during the period of 2016 to 2022. The price data of Cotton, Mentha Oil, Aluminum, Copper, Lead, Nickel, Zinc, Gold, Silver, Crude oil, Natural gas commodities were employed which comprise of Agricultural, Base Metals, Bullion and Energy commodities. The timeframe selected purposively to examine the structural breaks during major socio – economic events in the country. As the time frame captures series of events like in 2016 Demonetization, 2017 Goods and Service Tax, 2020 Covid Pandemic and 2022 Russia Ukraine War. The price data is converted to return series which is defined as the difference between natural logarithmic spot prices ($S_t - S_{t-1}$) and future prices ($F_t - F_{t-1}$) mentioned (Sahabuddin, M *et al.* 2022) as follows:

$$\Delta S_t = R_{st} = \log\left(\frac{S_t}{S_{t-1}}\right) * 100$$

$$\Delta F_t = R_{ft} = \log\left(\frac{F_t}{F_{t-1}}\right) * 100$$

The flow of the methodology part follows with Stationarity test, Causality test and Chow test. The methods are briefed out below,

Initially, before performing any time series analysis, it is necessary to determine the whether the time series data is stationary or not. Only stationary data or no unit root allow for further data estimation. If it contains unit root, then have to make it stationary by differencing the data sets. In this paper, the test for stationary was performed for the both spot and future returns of 11 commodities using Augmented Dickey Fuller (ADF) test and Phillips Perron (PP) test.

Secondly, Granger causality test "to test the direction of causation, bidirectional or unidirectional between all the possible pairs by using bivariate regressions of the form:

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \ldots. + \alpha_p Y_{t-p} + \beta_1 X_{t-1} + \ldots. + \beta_p X_{t-p} + \varepsilon_t$$

$$X_t = \alpha_0 + \alpha_1 X_{t-1} + \ldots. + \alpha_p X_{t-p} + \beta_1 Y_{t-1} + \ldots. + \beta_p Y_{t-p} + u_t$$

$$H_0 = \beta_1 = \beta_2 = \ldots\ldots = \beta_P = 0$$

For each equation, the null hypothesis is that X does not Granger-cause Y in the first regression and that Y does not Granger-cause X in the second regression."

Thirdly, in order to study the structural breaks for socio economic events viz., Demonetization, Goods and Service Tax, Covid Pandemic and Russia Ukraine War Chow test was used in this study. "The chow test involves following steps, first to run the regression using all the data of selected variables without any breaks. Collect the residual of sum of squares (RSSp). Next run two separate regression before and after the structural breaks, collect the RSS in both the results, mentioning as RSS_1 and RSS_2. Calculate the test statistic (Chow F values) using these three values,

Identify the critical values from the F-table with k predictors and n-2k degrees of freedom. By comparing Chow F calculated values and critical F table values decide to accept or reject the null hypothesis. The alternative hypothesis means that there is a structural break, while the null hypothesis means that there is no structural break."

RESULTS AND DISCUSSION

Descriptive Statistics

The descriptive statistics of spot and future return for selected 11 commodities from MCX are illustrated in Table 1 and 2. The average return in the spot market is higher than the future market except Mentha Oil, Lead, Gold and Silver future return is higher than the spot return. The standard deviation explains about the volatility, thus among 11 commodities six commodities standard deviation is higher in the future market than the spot market whereas Aluminum, Lead, Nickel, Crude oil and Natural gas have higher volatility in the spot market than the future market. The spot return's distribution is negatively skewed for Cotton, Mentha Oil and Crude Oil whereas the future return's distribution is negatively skewed for Cotton, Mentha Oil, Gold, Silver and Natural Gas.

Stationarity test

The unit root test Augmented Dickey Fuller (ADF) and Phillips Perron (PP) test results are presented in Table 3 and 4. The tests reveal that log of both spot and future return at level is stationary for all the selected commodities at 1% level of significance. As the time series is stationary at the level, thus it's

Table 1: Descriptive Statistics for Spot return of Selected Commodities in MCX

Group	Commodity	Mean	Std Deviation	Skewness	Min	Max
Agriculture	Cotton	0.0329	0.8135	-1.3139	-8.7867	5.4144
	Mentha oil	0.0060	1.5907	-0.3141	-14.5438	9.4613
Base Metals	Aluminum	0.0444	1.4845	0.2774	-9.6605	12.2431
	Copper	0.0475	1.3424	0.6114	-10.4103	12.2721
	Lead	0.0259	1.4003	1.4096	-5.6856	18.9131
	Nickel	0.0841	2.4929	4.8448	-33.4104	53.4331
	Zinc	0.0526	1.4595	0.4221	-6.2379	11.3544
Bullion	Gold	0.0442	0.7606	2.8814	-4.8758	12.8490
	Silver	0.0409	1.5168	2.3567	-18.4949	27.0296
Energy	Crude oil	0.0571	3.3701	-2.5945	-56.8435	34.7046
	Natural Gas	0.0587	10.9499	0.0732	-303.2217	303.7192

Source: Author's Calculation.

Table 2: Descriptive Statistics for Future return of Selected Commodities in MCX

Group	Commodity	Mean	Std Deviation	Skewness	Min	Max
Agriculture	Cotton	0.0296	1.5232	-6.0261	-33.0539	13.8244
	Mentha oil	0.0116	2.3661	-0.7078	-27.5070	17.8472
Base Metals	Aluminum	0.0421	1.3930	0.8164	-8.7939	13.5820
	Copper	0.0456	1.3836	1.1135	-18.0329	21.9834
	Lead	0.0271	1.3544	0.6630	-7.6726	13.9281
	Nickel	0.0818	2.1512	2.9886	-15.8992	39.3467
	Zinc	0.0510	1.6646	0.7750	-11.3531	20.4859
Bullion	Gold	0.0447	0.8408	-0.0347	-5.0048	5.1704
	Silver	0.0425	3.0466	-0.0223	-21.8871	21.4025
Energy	Crude oil	0.0514	3.0114	4.5401	-24.1077	62.3209
	Natural Gas	0.0567	7.1820	-0.0556	-49.1442	49.7336

Source: *Author's Calculation.*

Table 3: Unit Root test for Spot return for selected commodities

Variables	ADF Test		PP Test	
	Level		Level	
	Without Trend	With Trend	Without Trend	With Trend
Cotton	-13.08***	-13.11***	-33.18***	-33.20***
Mentha oil	-17.33***	-17.34***	-47.84***	-47.83***
Aluminum	-25.07***	-25.12***	-48.90***	-48.93***
Copper	-30.88***	-30.93***	-45.81***	-45.86***
Lead	-23.15***	-23.19***	-47.79***	-47.78***
Nickel	-23.08***	-23.15***	-39.38***	-39.41***
Zinc	-41.35***	-41.41***	-41.35***	-41.41***
Gold	-28.41***	-28.52***	-39.60***	-39.70***
Silver	-29.07***	-29.08***	-39.11***	-39.11***
Crude oil	-17.94***	-17.95***	-47.55***	-47.55***
Natural Gas	-26.02***	-26.01***	-82.15***	-82.12***

Source: *Author's Calculation (*** indicates 1% level of significance).*

Table 4: Unit Root test for Future return for selected commodities

Variables	ADF Test		PP Test	
	Level		Level	
	Without Trend	With Trend	Without Trend	With Trend
Cotton	-22.39***	-22.40***	-35.88***	-35.87***
Mentha oil	-32.97***	-32.95***	-50.71***	-50.69***
Aluminum	-25.59***	-25.63***	-43.01***	-43.02***
Copper	-31.60***	-31.65***	-45.78***	-45.81***
Lead	-25.18***	-25.20***	-45.58***	-45.58***
Nickel	-21.83***	-21.91***	-37.61***	-37.65***
Zinc	-25.22***	-25.29***	-44.87***	-44.91***
Gold	-40.99***	-41.07***	-40.99***	-41.07***
Silver	-20.91***	-20.94***	-89.82***	-89.87***
Crude oil	-21.57***	-21.58***	-44.20***	-44.19***
Natural Gas	-21.19***	-21.20***	-102.84***	-102.87***

Source: *Author's Calculation (*** indicates 1% level of significance).*

not necessary to check the stationary at differential level (Pani, U *et al* 2022). Once stationary test is checked and confirmed, can further proceed to time series analysis.

Granger Causality test

The results from Granger causality test are presented in Table 5 revealed that all selected commodities are bidirectional causality whereas only gold possess unidirectional causality. The unidirectional causality imply that null hypothesis of Gold Spot Price does not Granger cause Gold Future Price can be rejected but not vice versa. Thus, information on the spot price of gold market improves the prediction of its futures price. Likewise, the bidirectional causality in case all 10 commodities imply that both the null hypothesis of the spot price does not granger cause the future price and the null hypothesis of the future price does not granger cause the spot price (Pani, U *et al* 2022). Similarly, the information on spot prices of all 10 commodities improves the prediction of future price and vice versa.

Table 5: Granger causality test for Spot and Future return for selected commodities

Null Hypothesis	Equation	Excluded	chi^2	df	Prob > chi^2	Results
Agriculture Commodities Spot and Future Return Pairs						
Cotton Spot Price does not Granger cause Future Price	Spot Price	Future Price	102.19**	2	0.000	Bidirectional
Cotton Future Price does not Granger cause Spot Price	Future Price	Spot Price	5.8622*	2	0.053	
Mentha Oil Spot Price does not Granger cause Future Price	Spot Price	Future Price	19.557**	2	0.000	Bidirectional
Mentha Oil Future Price does not Granger cause Spot Price	Future Price	Spot Price	49.865**	2	0.000	
Base Metals Commodities Spot and Future Return Pairs						
Aluminum Spot Price does not Granger cause Future Price	Spot Price	Future Price	315.85**	2	0.000	Bidirectional
Aluminum Future Price does not Granger cause Spot Price	Future Price	Spot Price	13.739**	2	0.001	
Copper Spot Price does not Granger cause Future Price	Spot Price	Future Price	116.34**	2	0.000	Bidirectional
Copper Future Price does not Granger cause Spot Price	Future Price	Spot Price	24.759**	2	0.000	
Lead Spot Price does not Granger cause Future Price	Spot Price	Future Price	265.91**	2	0.000	Bidirectional
Lead Future Price does not Granger cause Spot Price	Future Price	Spot Price	5.8865*	2	0.053	
Nickel Spot Price does not Granger cause Future Price	Spot Price	Future Price	635.57**	2	0.000	Bidirectional
Nickel Future Price does not Granger cause Spot Price	Future Price	Spot Price	27.76**	2	0.000	
Zinc Spot Price does not Granger cause Future Price	Spot Price	Future Price	425.92**	2	0.000	Bidirectional
Zinc Future Price does not Granger cause Spot Price	Future Price	Spot Price	15.546**	2	0.000	
Bullion Commodities Spot and Future Return Pairs						
Gold Spot Price does not Granger cause Future Price	Spot Price	Future Price	384.61**	2	0.000	Unidirectional
Gold Future Price does not Granger cause Spot Price	Future Price	Spot Price	3.4573	2	0.178	
Silver Spot Price does not Granger cause Future Price	Spot Price	Future Price	325.99**	2	0.000	Bidirectional
Silver Future Price does not Granger cause Spot Price	Future Price	Spot Price	29.087**	2	0.000	
Energy Commodities Spot and Future Return Pairs						
Crude Oil Spot Price does not Granger cause Future Price	Spot Price	Future Price	183.36**	2	0.000	Bidirectional
Crude Oil Future Price does not Granger cause Spot Price	Future Price	Spot Price	23.488**	2	0.000	
Natural Gas Spot Price does not Granger cause Future Price	Spot Price	Future Price	84.538**	2	0.000	Bidirectional
Natural Gas Future Price does not Granger cause Spot Price	Future Price	Spot Price	34.378**	2	0.000	

Source: *Author's Calculation (** & * indicates 5% and 10% level of significance).*

Chow test Results

Following granger causality results, the chow test was estimated as the time period selected for the study includes the booms and bust cycles in country's economy. In order to examine the structural break or dynamics in spot and future markets for 11 selected commodities from MCX. In case of chow test, the null hypothesis means there is no structural break in the series (or exists structural stability in the series) and the alternate hypothesis means there is a structural break in the series (or exists structural instability in the series). The condition to accept the null hypothesis is when Chow F value is less than Critical F value and reject the null hypothesis is when Chow F value is greater than Critical F value (Biu, O. E. and Nwakuya, T. M. 2022). The results of chow test are presented in Table 6, 7, 8 and 9.

Table 6: Chow Test – A Structural Break during Demonetization

Commodity	Spot Market			Future Market		
	Chow F values	Critical F values	Decision	Chow F values	Critical F values	Decision
Cotton	0.27	3.00	Not Sig. Accept H_0	2.87	3.00	**Not Sig. Accept H_0**
Mentha oil	0.90	3.00	Not Sig. Accept H_0	5.51	3.00	Sig. Reject H_0
Aluminum	4.98	3.00	Sig. Reject H_0	5.15	3.00	Sig. Reject H_0
Copper	25.16	3.00	Sig. Reject H_0	10.83	3.00	Sig. Reject H_0
Lead	8.84	3.00	Sig. Reject H_0	8.68	3.00	Sig. Reject H_0
Nickel	2.77	3.00	Not Sig. Accept H_0	0.46	3.00	**Not Sig. Accept H_0**
Zinc	14.00	3.00	Sig. Reject H_0	4.14	3.00	Sig. Reject H_0
Gold	3.62	3.00	Sig. Reject H_0	11.96	3.00	Sig. Reject H_0
Silver	10.10	3.00	Sig. Reject H_0	0.52	3.00	**Not Sig. Accept H_0**
Crude oil	13.89	3.00	Sig. Reject H_0	5.67	3.00	Sig. Reject H_0
Natural Gas	6.87	3.00	Sig. Reject H_0	111.75	3.00	Sig. Reject H_0

Source: *Author's Calculation.*

Table 7: Chow Test – A Structural Break during Goods and Service Tax

Commodity	Spot Market			Future Market		
	Chow F values	Critical F values	Decision	Chow F values	Critical F values	Decision
Cotton	0.72	3.00	Not Sig. Accept H_0	3.19	3.00	Sig. Reject H_0
Mentha oil	3.99	3.00	Sig. Reject H_0	5.28	3.00	Sig. Reject H_0
Aluminum	8.56	3.00	Sig. Reject H_0	8.30	3.00	Sig. Reject H_0
Copper	63.89	3.00	Sig. Reject H_0	2.70	3.00	**Not Sig. Accept H_0**
Lead	19.33	3.00	Sig. Reject H_0	24.00	3.00	Sig. Reject H_0
Nickel	5.48	3.00	Sig. Reject H_0	0.14	3.00	**Not Sig. Accept H_0**
Zinc	13.25	3.00	Sig. Reject H_0	3.32	3.00	Sig. Reject H_0
Gold	5.13	3.00	Sig. Reject H_0	13.86	3.00	Sig. Reject H_0
Silver	11.44	3.00	Sig. Reject H_0	0.16	3.00	**Not Sig. Accept H_0**
Crude oil	14.30	3.00	Sig. Reject H_0	9.68	3.00	Sig. Reject H_0
Natural Gas	10.07	3.00	Sig. Reject H_0	101.45	3.00	Sig. Reject H_0

Source: *Author's Calculation.*

Table 8: Chow Test – A Structural Break during Covid Pandemic

Commodity	Spot Market			Future Market		
	Chow F values	Critical F values	Decision	Chow F values	Critical F values	Decision
Cotton	0.88	3.00	Not Sig. Accept H_0	6.63	3.00	Sig. Reject H_0
Mentha oil	23.44	3.00	Sig. Reject H_0	48.94	3.00	Sig. Reject H_0
Aluminum	6.25	3.00	Sig. Reject H_0	8.65	3.00	Sig. Reject H_0
Copper	155.84	3.00	Sig. Reject H_0	23.51	3.00	Sig. Reject H_0
Lead	13.23	3.00	Sig. Reject H_0	12.77	3.00	Sig. Reject H_0
Nickel	12.48	3.00	Sig. Reject H_0	0.40	3.00	**Not Sig. Accept H_0**
Zinc	8.11	3.00	Sig. Reject H_0	1.19	3.00	**Not Sig. Accept H_0**
Gold	8.20	3.00	Sig. Reject H_0	22.94	3.00	Sig. Reject H_0
Silver	64.31	3.00	Sig. Reject H_0	1.97	3.00	**Not Sig. Accept H_0**
Crude oil	79.48	3.00	Sig. Reject H_0	61.11	3.00	Sig. Reject H_0
Natural Gas	32.93	3.00	Sig. Reject H_0	66.88	3.00	Sig. Reject H_0

Source: *Author's Calculation.*

Table 9: Chow Test – A Structural Break during Russia Ukraine War

Commodity	Spot Market			Future Market		
	Chow F values	Critical F values	Decision	Chow F values	Critical F values	Decision
Cotton	3.89	3.00	Sig. Reject H_0	2.66	3.00	**Not Sig. Accept H_0**
Mentha oil	10.76	3.00	Sig. Reject H_0	5.89	3.00	Sig. Reject H_0
Aluminum	1.07	3.00	Not Sig. Accept H_0	1.93	3.00	**Not Sig. Accept H_0**
Copper	1.50	3.00	Not Sig. Accept H_0	1.36	3.00	**Not Sig. Accept H_0**
Lead	0.05	3.00	Not Sig. Accept H_0	1.71	3.00	**Not Sig. Accept H_0**
Nickel	32.10	3.00	Sig. Reject H_0	0.25	3.00	**Not Sig. Accept H_0**
Zinc	1.11	3.00	Not Sig. Accept H_0	0.72	3.00	**Not Sig. Accept H_0**
Gold	1.45	3.00	Not Sig. Accept H_0	0.47	3.00	**Not Sig. Accept H_0**
Silver	92.01	3.00	Sig. Reject H_0	0.22	3.00	**Not Sig. Accept H_0**
Crude oil	7.34	3.00	Sig. Reject H_0	21.24	3.00	Sig. Reject H_0
Natural Gas	14.57	3.00	Sig. Reject H_0	33.04	3.00	Sig. Reject H_0

Source: *Author's Calculation.*

The Table 6 explains about the structural break due to Demonetization in the spot and future market. In case of spot market, Cotton, Mentha Oil and Nickel had structural stability accepted the null hypothesis whereas Aluminum, Copper, Lead, Zinc, Gold, Silver, Crude Oil and Natural Gas had structural instability rejected the null hypothesis. In case of future market, Cotton, Nickel and Silver had structural stability accepted the null hypothesis whereas Mentha Oil, Aluminum, Copper, Lead, Zinc, Gold, Crude Oil and Natural Gas had structural instability rejected the null hypothesis.

The Table 7 explains about the structural break due to implementation of Goods and Service Tax in the spot and future market. In case of spot market, Cotton had structural stability accepted the null hypothesis whereas Mentha Oil, Aluminum, Copper, Lead, Nickel, Zinc, Gold, Silver, Crude Oil and Natural Gas had structural instability rejected the null hypothesis. In case of future market, Copper, Nickel and Silver had structural stability accepted the null hypothesis whereas Cotton, Mentha Oil, Aluminum, Lead, Zinc, Gold, Crude Oil and Natural Gas had structural instability rejected the null hypothesis.

The Table 8 explains about the structural break due to Covid Pandemic in the spot and future market. In case of spot market, Cotton had structural stability accepted the null hypothesis whereas Mentha Oil, Aluminum, Copper, Lead, Nickel, Zinc, Gold, Silver, Crude Oil and Natural Gas had structural instability rejected the null hypothesis. In case of future market, Nickel, Zinc and Silver had structural stability accepted the null hypothesis whereas

Cotton, Mentha Oil, Aluminum, Copper, Lead, Gold, Crude Oil and Natural Gas had structural instability rejected the null hypothesis.

The Table 9 explains about the structural break due to Russia Ukraine War in the spot and future market. In case of spot market, Aluminum, Copper, Lead, Zinc and Gold had structural stability accepted the null hypothesis whereas Cotton, Mentha Oil, Nickel, Silver, Crude Oil and Natural Gas had structural instability rejected the null hypothesis. In case of future market, Cotton, Aluminum, Copper, Lead, Nickel, Zinc, Gold and Silver had structural stability accepted the null hypothesis whereas Mentha Oil, Crude Oil and Natural Gas had structural instability rejected the null hypothesis.

CONCLUSION

The study on the price discovery function and the structural break of the Agriculture (Cotton, Mentha oil), Base metals (Aluminum, Copper, Lead, Nickel, Zinc), Bullion (Gold, Silver), and Energy (Natural Gas, Crude Oil) commodities spot and future prices during 2016-2022 was attempted. The result highlighted the bidirectional causality between both the spot and future markets except gold which exhibited unidirectional causality where the future market lead on the spot return is greater than contrary. Both the spot and futures markets' prices can be used as a source of information by market participants. As the selected time period captures the crisis period, understanding the dynamic patterns is important for derivative valuation, hedging and asset allocation. The structural break of commodities affects the producers and consumers. The result of structural break revealed that among the selected commodities, most of the commodities exhibited the structural instability and few commodities had the structural stability during the crisis period. The structural stability infers that the demand and supply for those commodities would exist in equilibrium condition and the shocks would not be transmitted to the price of commodities and in case of structural instability, the condition is reverse.

Indian Commodity Derivatives market is expanding rapidly, the findings have implications for the various market participants to implement trading and arbitrage strategy. It will enable policymakers to monitor the market stability. In order to increase market participation and emphasize the effectiveness of futures markets, policymakers and regulators should successfully implement trading techniques that let market participants benefit from data accessibility. In this sense, the results can help traders and investors to estimate price movements more precisely, enabling them to determine when investment and arbitrage opportunities arise and how long they will last in the market. Additionally, the SEBI might work to increase public awareness of the newest financial instruments through investor awareness initiatives.

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