

Impact of Macro-Economic Factors on Indian Commodity Futures

Susmita Patra^{1*} and Gouri Prava Samal²

¹ Research Scholar (Ph.D.), P.G. Department of Commerce, Rama Devi Women's University, Bhubaneswar, Odisha.

E-mail: papasusmita@gmail.com

² Assistant Professor, P.G. Department of Commerce, Rama Devi Women's University, Bhubaneswar, Odisha.

E-mail: pravafinance@gmail.com

*Corresponding Author

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Abstract: India being an emerging nation is one of the largest consumers of metal, energy and bullion which makes the commodity markets' role crucial. The study looks at the price trend of spot and futures of a few chosen commodities as well as the macroeconomic variables' effect on the Indian commodity futures market. The study considered eleven MCX iCOMDEX composite index commodities and the macroeconomic measures that were used are the WPI, CPI, IIP, M3, and ER (INR-USD). To analyse the study's objectives, line charts, ADF tests, PP tests, Granger causality tests and multiple regression statistics, were employed. As to the study's findings, only the log futures prices of aluminium, cotton, crude oil, and lead are significantly impacted by macroeconomic variables such as ER, Nifty 50, M3, and MIBOR. This study will give investors, portfolio managers, and market participants a guideline for estimating the volatility risk in commodities futures.

1. Introduction

In India, the gradual change of commodity markets has been critical for both the country's broad economic distribution and its ties with financial sector. With the advent of time and introduction of futures market, the prices have become more volatile and unstable which gives an opportunity to the investors for easy entry and exit. Imports and Exports are often considered to be the main determinants of the production of an economy (Nirmala and Vadivel, 2019). This shoots up the demand for goods and widens their price determinants i.e., macroeconomic variables. So, the supply and demand dynamics in the market drive these commodity futures pricing (Chowdri, 2020). Variables affecting the globally traded commodities increase its price volatility which may be controlled by the commodity futures market (Shao *et al.*, 2019). Better price discovery is possible when the commodities market transmits price information with sufficient efficiency (Gupta, 2018). However, the evaluation of the price volatility of the Indian commodities futures market is significantly influenced by both domestic and global

economic factors (Sreenu *et al.*, 2021). The exchange rate i.e., INR-USD has an immediate impact on 15 exporting industries and a longer-term impact on 9 industries (Iqbal *et al.*, 2023). Commodity prices are also indirectly impacted by other investment options like money market instruments and stock market investments. So, to safeguard the commodity price risk volatility, the commodity markets have to disseminate the macroeconomic information as well. This raises queries on commodity market's efficiency regarding its reactions towards macroeconomic factors. This research aims to analyse the effects of several macroeconomic factors on the commodity market in India.

2. Important Macro-Economic Factors Affecting the Indian Commodity Futures

There are several economic factors which affect the commodity futures in India. Following are the list of such factors:

2.1. Wholesale Price Index (WPI)

WPI records the average movement of wholesale prices of goods and in India, the changes in the WPI are used as a barometer of inflation for the agricultural commodities. For an instance, the long-term relationship between castor, cotton, and soyabean is illustrated by the cointegration between their monthly near-month futures prices and monthly wholesale prices. (Sehrawat and Kumar, 2022).

2.2. Consumer Price Index (CPI)

CPI calculates the changes in household spending over time for a variety of products and services. CPI is expressed for a population in three ways: CPI-Urban, CPI-Rural, and Consolidated CPI for Urban + Rural. Research demonstrates that aggregate supply shocks in energy commodities such as aluminium and copper can have a major impact on CPI (Wei, 2019).

2.3. Index of Industrial Production (IIP)

IIP is a combined indicator that represents the magnitude of production in India's industrial sector by measuring short-term variations in the volume of production of a group of industrial goods during a certain span. A rise in IIP can potentially alleviate financial market volatility, in turn minimising volatility in the commodities market by boosting public confidence (Joarder, 2018).

2.4. Broad Money (M3)

The total supply of money that is used by the general people, including households, enterprises, regional governments, and other entities, is known as the money supply. In India, long-term time deposits with banks except from interbank deposits are included in the M3, together with the M1 (currency components and demand deposits). The central bank shall exercise caution while adjusting the money supply in the market since an excessive rise could adversely affect investments (Khan and Khan, 2018)

2.5. Mumbai Inter-Bank Offer Rate (MIBOR)

MIBOR is the interest rate that banks in the Indian interbank market can borrow money at, in marketable size, from other banks. Most money market transactions in India also use it as a benchmark rate.

Stability in MIBOR will increase exports and reduce the import activities in India (Rajaswaminathan *et al.*, 2015).

2.6. Exchange Rate (INR-USD)

The foreign exchange rate (Forex Rate), which is set in the Forex market, is the rate at which one country's money is converted into another country's currency. INR-USD conversion rate is the amount needed to convert one Indian rupee to one USD. The exchange rate is a crucial macroeconomic indicator having a significant impact on how agricultural commodity prices are linked over time (Harri *et al.*, 2009).

2.7. Nifty 50 Index

The NSE's benchmark index, NIFTY 50 which consists of 50 stocks is owned and managed by NSE Indices, formerly known as Indian Index Services and Products Ltd. (IISL). Nifty 50 had negative relationship with Comdex Futures and Energy Futures during the controlled state, while a positive correlation during the crisis period. However, there is inverse relationship of gold with equity markets (Shalini and Prasanna, 2016). Thus, the main macroeconomic factors such as WPI, CPI and IIP serve as representative for inflation, Broad money (M3) and MIBOR are defined for money market. The exchange rate is depicted by INR-USD and NIFTY 50 as a substitute investment option. With these selected variables and understanding its importance, the study aims to look at how macroeconomic factors affect commodities futures prices.

3. Review of Literature

India being one of the fastest-growing emerging economies on the planet, depends on an efficient commodity market for higher economic growth which is very much impacted by commodity prices (Legomsky, 2008). By analysing quarterly data for Eastern Europe and the former Soviet Union from the first quarter of 1970 to the third quarter of 1992, it was identified the main economic factors influencing commodity prices are the global demand, commodity export countries and commodity supply (Borensztein and Reinhart, 1994). The significance of 187 macroeconomic and financial, real and notional indicators from industrialised and developing nations on the NYMEX West Texas Intermediate (WTI) oil futures returns were examined from November 1993 to March 2010. It was discovered that the inflation adjusted macroeconomic measures of developing countries have major influence on crude oil price, and the daily crude oil futures price volatility has an adversely significant impact on GDP (Yannick and Benoît, 2011). Using the Granger-Causality test and Johansen cointegration test, it was discovered that, between 1960 and 2005, there was a short- and long-term relationship among oil prices and four macroeconomic indicators i.e., GDP, CPI, unemployment rate, and equity prices (Lescaroux and Mignon, 2009; Mohanty *et al.*, 2023). Similarly, agricultural commodity prices in the USA like Corn, Soybeans, Soybean oil, Cotton found correlated with exchange rate, crude oil price, over a study on an eight-year period from January 2000 to September 2008, with an exception of Wheat and that the association of agricultural commodity prices over time is significantly influenced by the exchange rate (Harri *et al.*, 2009). Regression analysis on the USA Gold and Silver Futures from

January 1992 to December 1995 showed that the unemployment rate and capacity utilisation affected the prices of both metals, but the CPI, GDP, and PPI solely affected the price of gold (David *et al.*, 2000). On investigating the impact of monetary policy, financial market data and economic conditions on the volatileness of Indian commodity futures market applying GARCH-MIDAS model, revealed that both national and global macroeconomic variables have less impact (Sreenu *et al.*, 2021). An analysis on the relationship among macroeconomic variables like interest rate, exchange rate, IPI and Crude Palm Oil Futures (FCPO) from January 1999 to December 2019 indicated that these variables had a major long-term impact on FCPO prices, with interest and exchange rate having a turn down impact and IPI showing a positive impact (Ahmed *et al.*, 2020). A study on the impact of business cycle, monetary environment, and financial market sensibility on the volatility of Gold, Silver, Platinum, and Palladium from January 1986 to May 2006 showed no impact, indicating that they act differently and cannot be regarded as a single asset class (Batten *et al.*, 2010). Granger Causality analysis of the volatility of crude oil futures prices on the NYMEX for macroeconomic information from 1984 to 2004 revealed that crude oil prices respond negatively to macroeconomic data and have an adverse effect on future GDP (Guo and Kliesen, 2005). A study between January 1997 and June 2009 in US, notes that commodity prices including those for energy, agricultural commodities, base metals, and precious metals are less responsive to macroeconomic news compared to financial assets, and that commodities behave asymmetrically to adverse economic news (Roache & Rossi, 2010). Another study by incorporating GARCH-MIDAS model to analyse the effect of the macroeconomic factors on the variance of futures' return volatility demonstrated that the level of macroeconomic measures significantly affects the volatility of Chinese futures' return (Liu *et al.*, 2019). The expansion of the commodity futures market has a notable impact on inflation, although this effect may diminish as the market matures (Sahi and Raizada, 2006). The aforementioned research emphasises the significance of macroeconomic variables effects on commodity futures prices, aiding the paper's goal. The majority of earlier research has been conducted in the global commodity market with an emphasis on analysing how various macroeconomic factors affect the prices of various commodities. While in India, studies tend to focus more on theoretical concepts such as development of commodity market or changes in policy or empirically on the link between the spot and futures markets. There are less Indian studies that examine how macroeconomic variables affect Indian commodities futures that too with one or few variables. To gain better knowledge of commodity trading and the impact of macroeconomic factors on commodity futures, the authors tried to examine the major constituent commodities over an extended period of time with daily trade from all angles.

4. Relevance of the Study

India being a resource rich country, have a large demand for consumption, production, and commerce. India is the world's greatest consumer of precious metals (bullion and silver), metals (copper, zinc, lead, etc), and agricultural items (cotton, maize, wheat, turmeric, dairy products, etc). The volume of trade in the Indian commodity market has increased and indicates a positive growth (Bansal *et al.*, 2014). The growth is influenced by various factors, including demand and supply changes, government policies, and RBI policies. For instance, the Indian imports and exports increased tremendously after

1991 reform and so importing of goods affects the exchange rate which in turn impact the commodity prices. Various other investment avenues also indirectly impact the commodity prices. Hence, studying about the impact of various macroeconomic variables on Indian commodity futures is important.

5. Objectives of the Study

Following objectives are aimed at:

- To understand the significance of macro-economic factors affecting the commodity futures.
- To examine the price trend pattern of commodities spot and futures prices in India.
- To analyse the impact of macroeconomic variables on the Indian commodity futures market.

6. Scope of the Study

The scope of the study is limited to iCOMDEX composite index of MCX which validate to the universal best standards set by the International Organisation of Securities Commissions (IOSCO). In India, there are 21 commodity exchanges, 16 of which are regional and 6 of which are national. As of June 2015, 99.84% of all commodities traded were on national commodity exchanges. MCX is the top commodity derivatives exchange in India among the six national exchanges, holding a 92.9% market share based on the value of commodity futures contracts traded in the FY 2021–22. Besides that, the study also confines to only seven macro-economic variables i.e., WPI, CPI, IIP, NIFTY 50, M3, ER (INR-USD), and MIBOR.

7. Hypothesis of the Study

H0: There is no significant impact of the macroeconomic variables on the commodity futures prices.

H1: There is significant impact of the macroeconomic variables on the commodity futures prices.

8. Limitations of the Study

- MCX traded commodities are selected as it holds the major share in commodity derivatives exchange traded platform
- The study is confined to the traded contracts of the MCX-iCOMDEX (Composite Index) commodities during the period of study.
- The period for the study is limited to 9 years (2012-13 to 2020-21).
- Also, only seven variables i.e., NIFTY 50, WPI, CPI, IIP, M3, ER and MIBOR are selected for the study.

9. Research Methodology

9.1. Research and Sample Design

The study is descriptive and analytical in nature It is analysed using secondary data collected from MCX's official website and other official sources. The study has considered MCX iCOMDEX Composite Index for the analysis. It constitutes of 11 commodities such as Aluminium, Copper, Cotton, Crude

Palm Oil (CPO), Crude Oil, Gold, Lead, Natural Gas, Nickel, Silver and Zinc. MCX iCOMDEX indices derive values from prices of futures contracts traded on MCX. The futures and spot prices of selected commodities are collected from official website of MCX (www.mcxindia.com).

The macroeconomic indicators i.e., WPI, CPI, IIP, M3, ER (INR-USD) data are collected from RBI website, Office of the Economic Adviser, Ministry of Commerce and Industry, GOI (<https://eaindstry.nic.in/>), National Statistical Office (NSO), Ministry of Statistics and Programme Implementation, Government of India (www.mospi.gov.in), MIBOR data is collected from Financial Benchmarks Pvt Ltd (www.fbil.org.in) and National Stock Exchange (NSE) and Nifty 50 spot prices from official website of NSE (www.nseindia.com).

9.2. Data Period

The study evaluated daily data for a few chosen commodities over a nine-year period, from April 1, 2012, to March 31, 2021. The annual macro-economic factors data are also gathered for 9 years from FY 2012-2013 to FY 2020-2021 so as to evaluate its impact on the commodities futures.

9.3. Tools for Analysis

For analysing the effect of macro-economic factors on Indian commodity futures, appropriate models are used to answer the study objectives. Line graph is used to study the commodities futures and spot prices pattern in India for the period taken. These commodity futures prices and macroeconomic variables are measured in different denominations. Reliability of the analysis is contingent upon all the variables being on the same base. So, all the variables are transformed to log values, except for MIBOR, which is expressed as a percentage.

The research data must be checked for unit root before moving on to the models as it is a time series data. In the random process of $X_t = \tilde{n}X_{t-1} + u_t$, the unit root test checks whether $\tilde{n} = 1$. If the estimated \tilde{n} is statistically equal to 1, then X_t is said to be non-stationary.

To check the stationarity of the futures prices of selected commodities, Augmented Dickey-Fuller (ADF) Test and Phillips Perron (PP) Test are used.

$$\text{ADF test regression: } \Delta X_t = \beta_1 D_t + \delta X_{t-1} + \sum_{i=1}^m a_i \Delta X_{t-i} + \varepsilon_t \quad (1)$$

Where X_{t-1} is the initial lagged value to X_t , ΔX_{t-1} is the shift in X_t 's lagged value, D_t - intercept ε_t is a pure white noise error term, and ΔX_t is the dependent variable. The time series is non-stationary, according to the null hypothesis, H_0 , which is $\delta = 0$.

$$\text{The PP test regression is: } \Delta X_t = \beta_1 D_t + \delta X_{t-1} + u_t \quad (2)$$

Where, ΔX_t - regressand factor, D_t - intercept, X_{t-1} is the initial lagged value to X_t and u_t is a pure white noise error term. If $\delta = 0$ for H_0 , then the time series is non-stationary.

Multiple regression is used to capture the impact of macroeconomic variables over commodities futures. Using the least-squares method, the sample regression coefficients ($a_0, a_1, a_2,$ and a_3) are computed as estimates of the population parameters ($\alpha_0, \alpha_1, \alpha_2,$ and α_3). Multiple regression's equation is as follows:

$$CFPt = a_0 + a_1WPI_t + a_2CPI_t + a_3IIP_t + a_4ER_t + a_5M3_t + a_6NIFTY50_t + a_7MIBOR_t + u_t \quad (3)$$

Where CFP- Commodity Futures Prices, WPI- Wholesale Price Index, CPI- Consumer Price Index, IIP- Index of Industrial Production, NIFTY 50- benchmark of Indian stock market index, M3- Broad Money, MIBOR- Mumbai Inter-Bank Offer Rate and ER is USD-INR; u is the error term and t represents time.

10. Price Trend Pattern of Commodities

One basic analysis tool that helps investors quickly understand the movements in commodity prices is the line graph. Additionally, it facilitates the tracking of changes across both short and long-time horizons.



Figure 1: Aluminium



Figure 2: Copper

Sources: www.mcxindia.com



Figure 3: Cotton



Figure 4: CPO

Sources: www.mcxindia.com



Figure 5: Crude Oil



Figure 6: Gold

Sources: www.mcxindia.com



Figure 7: Lead



Figure 8: Natural Gas

Sources: www.mcxindia.com

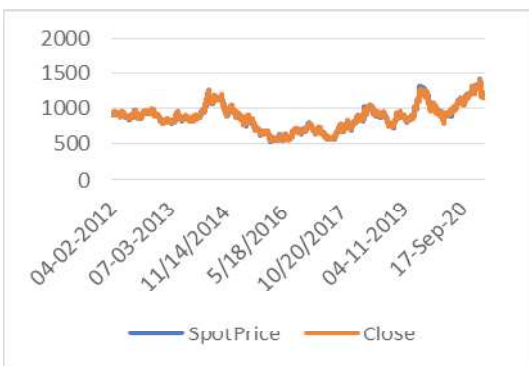


Figure 9: Nickel



Figure 10: Silver

Sources: www.mcxindia.com



Figure 11: ZINC

Sources: www.mcxindia.com

11. Analysis of Trending Pattern of Commodity Futures in India

The figures 1-11 indicates the trend line of spot and futures prices of all the selected commodities from MCX iCOMDEX Composite index. From these, figures, it can be seen that almost in all commodities, future prices move along with its spot prices. This provides a broad overview of commodity spot and futures price trends over the past decade for these commodities that were chosen and traded. Reason for the increase in prices for both the metals i.e., gold and silver during the mid-year of 2020 is the coronavirus pandemic. COVID-19 induced uncertainty on the global economy, attracting investors betting on these safe heaven assets. In 2020, the COVID-19 pandemic caused governments to suspend businesses and restrict travel, which sharply decreased the demand for oil globally. The pandemic caused an unparalleled demand shock in the oil sector, which caused oil prices to plummet. Aluminium prices are also on the rise because it is one of the most in-demand commodities worldwide, including

Table 1: Correlation Matrix of Seven Macroeconomic Variables

	WPI	IIP	CPI	ER	M3	NIFTY 50	MIBOR
WPI	1.000						
IIP	0.697*	1.000					
CPI	0.897**	0.809**	1.000				
ER	0.854**	0.774*	0.968**	1.000			
M3	0.822*	0.996**	0.987**	0.914**	1.000		
NIFTY50	0.911**	0.856**	0.979**	0.920**	-0.981**	1.000	
MIBOR	-0.795*	-0.679*	-0.946**	-0.886**	-0.883**	-0.908**	1.000

Source: NSE, RBI, FBIL, NSO, Office of Economic Adviser

Note: * 5% significance, ** 1% level of significance

in a developing nation like India. In addition to global causes, the expansion of the industrial sector in India drives up the demand for zinc, which keeps prices on an upward trajectory. Similarly, Copper and CPO show a constant trend in their prices till mid of 2020 and then starts increasing in an increasing order because of positive news on vaccine development during that period or the world shifting towards cleaner energy sources enabling more than double the use of copper in manufacturing Electrical vehicles. Cotton price is moving within a range of Rs. 15,000 to Rs. 25,000 since 2012 till date. A decrease in the prices of nickel can be observed during 2015-17 because of easing supply disruption concerns and rising stockpiles and weak Chinese demand. The end of 2018 saw a jump in natural gas prices due to low U.S. gas stocks, higher-than-normal electricity usage during a mild autumn, and nuclear power plant outages.

It is evident from table 1 that there is a correlation between the seven macroeconomic indicators, with the exception of CPI, IIP, and WPI, which have strong correlations. The government considered the IIP to be ineffective in measuring industrial growth, whereas the CPI primarily serves as a gauge of consumer spending. WPI was therefore deemed to be the most pertinent variable for the study, and the number of selected macroeconomic factors was decreased from seven to five.

Table 2: Correlation Matrix of Remaining Five Macroeconomic Variables

	WPI	ER	M3	NIFTY 50	MIBOR
WPI	1.000				
ER	0.854**	1.000			
M3	0.822*	0.914**	1.000		
NIFTY50	0.911**	0.920**	-0.981**	1.000	
MIBOR	-0.795*	-0.886**	-0.883**	-0.908**	1.000

Source: NSE, RBI, FBIL, NSO, Office of Economic Adviser

Note: * 5% significance, ** 1% level of significance

The table 2 shows the association among the five macroeconomic variables- WPI, NIFTY 50 spot price, INR-USD, M3 and MIBOR. All the variables are highly correlated. (Garg *et al.*, 2023) also revealed that exchange rate negatively impacts the nifty financial services sector. However, the exchange rate plays a significant role in country's trade performance, thereby regarded as one of the vital macroeconomic indicators. Also, most of the metal and energy related commodities are imported by India which influences the exchange rate. Economists use M3 to quantify the total amount of money in an economy, and central banks use it to formulate monetary policy that controls growth, inflation, consumption, and liquidity across medium- and long-term timeframes. Interest rates are significant because they draw investors into the commodity market due to the better return on commodity trading than MIBOR. NIFTY 50 is an important alternative for investment. In order to examine their influence on commodity futures, WPI, INR-USD, M3, NIFTY 50, and MIBOR are taken into account.

Table 3: Unit Root Test

	<i>Augmented Dickey Fuller</i>				<i>Philips Perron</i>			
	<i>At Level</i>		<i>At 1st Difference</i>		<i>At Level</i>		<i>At 1st Difference</i>	
	<i>t-stat</i>	<i>p value</i>	<i>t-stat</i>	<i>p value</i>	<i>Adj t-stat</i>	<i>p value</i>	<i>Adj t-stat</i>	<i>p value</i>
LNWPI	-2.7466	0.2614	-3.3350	0.1674	-1.6853	0.6653	-3.5530	0.1198
LNER	-3.9420	0.0694	-4.0725	0.0716	-8.3138	0.0013	-7.6571	0.0041
LNNIFTY50	-4.7074	0.0400	-5.8042	0.0241	-2.4569	0.3335	-6.7279	0.0072
LN M3	-3.4741	0.1889	N/A*	N/A*	-6.3603	0.0157	-1.4151	0.7477
MIBOR	-4.3766	0.0549	-2.9140	0.2427	-1.3997	0.7763	-1.3277	0.7897
LNALUMINIUM	-2.9296	0.1532	-52.1792	0.0000	-3.0165	0.1278	-52.3279	0.0000
LNCOPPER	-1.2082	0.9078	-55.2615	0.0000	-1.3682	0.8700	-55.0881	0.0000
LNCOTTON	-2.3489	0.4066	-52.5045	0.0000	-2.4041	0.3772	-52.5088	0.0000
LNCPO	-1.0852	0.9299	-45.7170	0.0000	-1.5281	0.8200	-46.6073	0.0000
LNCRUDEOIL	-2.3195	0.4226	-24.7235	0.0000	-2.5083	0.3240	-47.7643	0.0000
LNGOLD	-1.6605	0.7684	-51.5068	0.0000	-1.7302	0.7377	-51.4072	0.0000
LNLEAD	-3.8124	0.0159	-50.1544	0.0000	-3.6726	0.0243	-50.2142	0.0000
LNNATURAL GAS	-3.9445	0.0106	-45.8697	0.0000	-3.9394	0.0108	-45.9021	0.0000
LNNICKEL	-1.8401	0.6849	-50.4775	0.0000	-1.7302	0.7377	-50.5148	0.0000
LNSILVER	-1.7735	0.7175	-48.5725	0.0000	-1.7994	0.7050	-48.5707	0.0000
LNZINC	-2.4230	0.3673	-52.2520	0.0000	-2.6176	0.2724	-52.1026	0.0000

Source: NSE, RBI, FBIL, NSO, Office of Economic Adviser, MCX

In Table 3, the Log of WPI, Log of INR-USD, Log of M3, Log of NIFTY 50 and MIBOR and Log value of commodities i.e., Aluminium, Copper, Cotton, Crude Palm Oil (CPO), Crude Oil, Gold, Lead, Natural Gas, Nickel, Silver and Zinc futures prices are tested for unit root with ADF and PP tests.

The results indicate that the macroeconomic indicators, LNWPI is non-stationary at level as well as at 1st difference under both the methods. Whereas, LNER is found to be stationary at 10% level of significance under ADF method and at 1% level of significance under PP test respectively as per level and 1st difference both. LNNIFTY 50 can be seen stationary at 5% level of significance under ADF method at both level and 1st difference, whereas, under PP test it is stationary at 1st difference only with p value of 0.0072. The significance of the ADF t-statistics at the 10% level of significance, with a p-value of 0.0549 (at level), clearly shows MIBOR. Lastly, it is observed that at level, LNM3 is non-stationary in ADF test and stationary at 5% level of significance under PP test with p value of 0.0157. Thus, from the results of unit root test of macroeconomic variables it is concluded that the variables, all the variables except WPI is not considered for the study as it is not stationary.

With the exception of LnLead and LnNatural Gas, which were stationary at a level in both the tests at 5% level of significance, similar results were obtained for the log of other commodity futures prices. Nonetheless, at a 1% level of significance, the reliability of t statistics and adjusted t-statistics

demonstrated that the log of each chosen commodities futures price series is stationary at first difference. As a result, the first difference series of all commodities is used for analysis in commodity futures prices.

Thus, the impact of MIBOR and Log of INR-USD, NIFTY50, M3 on Log value of iCOMDEX commodities Aluminium, Copper, Cotton, Crude Palm Oil (CPO), Crude Oil, Gold, Lead, Natural Gas, Nickel, Silver and Zinc futures prices are examined using their daily trading data through the multiple regression. The equation is:

$$\text{LNCFP}_t = \alpha_0 + a_1 \text{MIBOR}_t + a_2 \text{LNER}_t + a_3 + a_4 \text{LNNIFTY50R}_t + u_t \quad (4)$$

Where α_0 is the constant, a_1, a_2, a_3 is the coefficient, u is the error term, and t is the time. The log of commodity futures prices is represented by LNCFP, the log of NIFTY 50 by LNNIFTY50, the log of broad money supply by LNM3, the Mumbai Inter-Bank Offer Rate (a proxy for interest rate) and LNER is the log of exchange rate.

Table 4: Regression of Macroeconomic Variables on Commodities Futures

	CONSTANT	LNER	LNNIFTY50	LNM3	MIBOR	R ²	Adj R ²	p value
LNALUMINIUM	-10.416 (-3.383)	-1.829 (-4.286)	-1.310 (-1.688)	4.380 (3.768)	0.681 (2.323)	0.967	0.902	0.064
LNCOPPER	-13.862 (-3.860)	-3.036 (-5.517)	-3.122 (-3.120)	7.068 (4.716)	1.466 (3.883)	0.946	0.837	0.106
LNCOTTON	-14.811 (-5.745)	-1.758 (-4.602)	-4.531 (-6.523)	7.463 (7.714)	0.882 (3.366)	0.974	0.921	0.052
LNCPO	-14.148 (-2.356)	-1.700 (-1.868)	-3.642 (-2.201)	6.605 (2.666)	0.929 (1.488)	0.851	0.554	0.275
LNCRUDEOIL	-30.388 (-5.815)	-1.914 (-5.876)	-2.970 (-5.014)	5.671 (6.393)	1.733 (7.754)	0.981	0.943	0.038
LNGOLD	-3.383 (0.867)	-2.331 (-2.101)	-4.398 (-2.180)	6.828 (2.260)	-0.135 (-0.177)	0.779	0.337	0.393
LNLEAD	-10.806 (-3.187)	-1.693 (-3.449)	-2.237 (-2.505)	4.943 (3.697)	0.400 (1.186)	0.957	0.870	0.085
LNNATURAL GAS	-20.072 (-2.232)	-1.146 (-1.224)	-2.290 (-1.345)	5.252 (2.060)	2.063 (3.211)	0.842	0.527	0.290
LNNICKEL	-51.157 (-0.894)	-0.683 (-0.572)	-4.002 (-1.844)	3.975 (1.223)	-0.732 (-0.894)	0.744	0.232	0.446
LNSILVER	-1.746 (-0.258)	-1.563 (-2.145)	-2.615 (-1.973)	3.138 (1.581)	-0.138 (-0.276)	0.905	0.714	0.182
LNZINC	-21.586 (-0.430)	-1.515 (-1.296)	-0.217 (-0.102)	1.907 (0.599)	-0.367 (-0.457)	0.755	0.264	0.431

Source: NSE, RBI, FBIL, NSO, Office of Economic Adviser, MCX

Note: () denotes 't' statistics.

The impact of the macroeconomic variables LNER, LNNIFTY50, and MIBOR on the log futures prices of 11 commodities (Aluminium, Copper, Cotton, Crude Palm Oil (CPO), Crude Oil, Gold,

Lead, Natural Gas, Nickel, Silver, and Zinc) is displayed in Table 5. The aluminium futures price log value exhibits a strong influence, with a maximum of 4.380 units of positive changes in M3 at 5% level. The macro-economic variables i.e., LNER, LNNIFTY50, LNM3 and MIBOR explains 90.2% of impact on the aluminium futures prices. Aluminium is an important and valuable commodity as it is widely used for industrial manufacturing.

Crude Oil futures prices also show significant influence at 5% level of significance. M3 and MIBOR are positively influencing the crude oil futures prices with 5.671 and 1.733 units of change respectively. Whereas ER and NIFTY 50 both are negatively influencing the futures prices of copper with -1.914 and -2,970 units respectively. Crude oil is one of major resources of energy. It is a vital commodity for the country whose output is used for household as well as industrial purposes. India is the world's largest importer of edible oils and is probably going to stay that way in the future, thus the exchange rate will continue to have an adverse effect on the pricing. So combinedly all the macro-economic variables explain 94.3% of impact on the crude oil futures prices.

The 10% significance criterion for the log of Cotton and Lead futures prices also reveals a noteworthy influence of macroeconomic factors. The t-statistics are used to determine which macroeconomic variable has been impacted most. Thus, among the Exchange rate, Nifty 50, M3 and MIBOR, the influence of M3 is significantly more on both Cotton and Lead futures prices with 7.463 and 4.943 t-statistics respectively, followed by MIBOR with 0.882 and 0.400 t-statistics respectively. Comparably, log of Lead futures prices has significant positive influence of 4.943 units from M3 and 0.400 units from MIBOR, while -1.693 and -2.237 units of negative changes from Exchange rate and NIFTY50 respectively.

The log futures prices of Copper, CPO, Gold, Natural Gas, Nickel, Silver and Zinc has no significant impact of selected macroeconomic variables. Thus, the null hypothesis is accepted for these futures prices where as it is rejected for Aluminium, Cotton, Crude oil and Lead log futures prices showing significant impact of macroeconomic variables such as Exchange Rate, Nifty 50, M3 and MIBOR. It is also analysed from the table that M3 has positive impact on all the commodities futures prices.

12. Conclusion

The Liberalization policy 1991, encouraged imports and exports, which in turn helped the manufacturing sector grow. As a result, assessing the impact of macroeconomic indicators on commodity prices is critical. Over nine years of study period, from April 1, 2012, to March 31, 2021, the effects of the most important macroeconomic variables Exchange Rate (INRUSD) as an illustrative of exchange rate, NIFTY 50 as a different investment avenue, and MIBOR indicated as interest rate on commodity prices were analysed through multiple regression. Aluminium is influenced by Nifty 50 because of its wide trading in NIFTY METAL. Similarly, Crude oil is negatively influenced by Exchange Rate as India is the world's leading importer of edible oils. Lead is mostly influenced by Nifty 50 because Nifty Metal index has delivered over 250% gains since pandemic. These three macroeconomic variables do not influence the commodities i.e., Copper, CPO, Gold, Natural Gas, Nickel, Silver and Zinc. The results are similar with that of (Batten *et al.*, 2010) in case of Gold and Silver, whereas, contradict to

the results of (Ahmed *et al.*, 2020) in case of CPO. Therefore, based on the results, commodities like copper and CPO are unaffected by macroeconomic factors, which are primarily influenced by climate and agricultural output conditions. M3 is more influential when looking at a list of metal commodities that are more commonly utilised in industry, such lead and aluminium. Thus, from the analysis it is concluded that the null hypothesis i.e., the macroeconomic indicators significantly impact the commodity futures market gets rejected for Aluminium, Cotton, Crude oil and Lead and accepted for Copper, CPO, Gold, Natural Gas, Nickel, Silver and Zinc.

Therefore, examining the macroeconomic variables effect on Indian commodity futures prices gives a perception towards how external macro variables affect commodity pricing. Macroeconomic factors impact economic development, which must be integrated with the external market to function well. However, in emerging nations like India besides these selected variables, additional economic factors like GDP growth rate, international commodity prices, international stock indices, etc may also have its impact on the commodity futures prices. This study will provide a guideline to all stakeholders, portfolio managers, and market participants to gauge the risk of volatility in commodity futures. The study paves way to further research taking other index constituent commodities of MCX and NCDEX into consideration with other influencing macro-economic factors as well.

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