A Study on Impact of Selected Macroeconomic Variables on Selected Commodities in India

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DECLARATION BY STUDENT

I hereby declare that the data presented in the Dissertation report entitled "**A Study on impact of Selected Macroeconomic variables on Selected Commodities In India**" is based on the results of investigations carried out by me in the (Commerce) at the Goa Business School Goa University under the Guidance of Assistance Professor Aakruthi Alarnkar and the same has not been submitted elsewhere for the award of a degree or diploma by me. Further, I understand that Goa University or it's authorities will be not be responsible for the correctness of observations experimental or other findings given the dissertation.

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Abbreviation

Entities	**Abbreviation Used**
Augmented Dickey Fuller	ADF
Business Confidence Index	BCI
Composite Leading Economic Indicator	CLI
Consumer Price Index	CPI
Dependent Variable	DV
Error Correction Term	ECT
Exchange Rates	X-RATES
Gross Domestic Product	GDP
Industrial Production Index	IPI
Long Term Interest Rates	LTIR
Multi Commodity Exchange	MCX
Organization For Economic Co-Operation And Development	OECD

Phillips-Perron	PP
Reserve Bank Of India	RBI
Securities Exchange Board Of India	SEBI
Short Term Interest Rates	STIR
Vector Autoregression	VAR
Vector Error Correction Model	VECM

Preface

In this research, an attempt has been made to check and understand the relationship among the selected MCX commodities and macroeconomic variables as well as impact of macroeconomic variables on commodities. The monthly returns of selected commodities, which are traded regularly and macroeconomic variables from January 2013 to February 2023 were taken for the study. The unit root test, cointegration test and VAR/ VECM were employed for finding relationship, followed by factors affecting the commodities were proved by Granger causality test. The finding of the study reported that, from selected commodities, the impact of macroeconomic variables were not seen on three commodities,that is zinc,aluminium and mentha oil .

Keywords-Commodity futures, Macroeconomic variables

CHAPTER 1

1.1 INTRODUCTION

The economy's market structure is primarily divided into three branches: debt, commodities, and equity. Investors are forced to move their investments due to the poor returns they obtain ,to commodities in order to earn higher returns and manage risk due to the uncertainty in the equities market and the rise in interest rates. India's three main economic sectors are the primary, secondary, and tertiary sectors. The primary sector includes commodities like metals, natural gas, crude oil, and agricultural goods, all of which are essential inputs for the secondary sector.

"Commodity" covers a wide range of things, such as agricultural products, metals, precious metals, and energy sources like crude oil and natural gas. Commodities are often produced in large numbers, are of a similar type, and are traded in their raw, unprocessed state without any additional value. They are traded in the market to meet the needs of producers and industrial buyers with the intention of delivery and trade. Commodities may be divided into two broad categories: soft commodities, which include agricultural items like wheat, livestock, sugar, corn, coffee, soybeans, maize, and others, and hard commodities, which are natural resources like gold, rubber, and oil that need to be extracted or mined.

The market for commodities is important for the growth of India's economy. Commodities are exchanged on commodity markets in order to make linkages between buyers and sellers in the market easier. In comparison to the stock market, however instead of buying and selling of equities, one purchases and sells commodities. To meet the demands of buyers and sellers, commodities exchanges like "National Commodity & Derivatives Exchange Limited -NCDEX, Indian Commodity Exchange -ICEX, Multi Commodity Exchange -MCX, National Multi Commodity Exchange -NMCE" operate in India. However, MCX and NCDEX are the most

widely used commodities exchanges because of the number of transactions and contractual execution in the market.

COMMODITY

A item, product, or substance that can be purchased and sold is referred to as a commodity. Even experienced retail investors may find it difficult to understand commodities. But commodities are easy to understand in terms of the basic concepts of supply and demand. Retail investors should understand the advantages and disadvantages of commodities future before making an investment.

Since the price of commodities has traditionally been less volatile than that of stocks and bonds, commodity future eare a good choice for a portfolio.

For a product or item to be considered a commodity, it must have some of the following basic characteristics:

- The final product need to be in its purest, unadulterated state.
- The product's shelf life must be lengthy enough to accommodate changes in future contract deliveries.
- In a market, there would be several rival product vendors.
- Product prices are influenced by supply, demand, and market dynamics; prices need to change sufficiently to create ambiguity, which shows potential gains or losses in terms of money for both sellers and purchasers.

COMMODITY MARKET

In the commodity market, rational factors are taken into account when purchasing or selling commodities and their derivatives. Commodities exchanges are companies or organizations that support commodity trade. Various commodities can be traded in a commodity market. Earlier ,

commodity markets used to resemble free markets where merchants would post bids and buy and sell commodities. Commodities can be bought or sold at a predetermined delivery price on a certain date on the commodity futures market. Purchasing and selling commodities necessitates using the services of a registered exchange broker, and transactions must follow the guidelines of a typical future contract. The markets for commodities are essential to the economic growth of a country.

DERIVATIVES MARKET

In the derivatives market, contracts are valued based on an underlying asset, index, or rate in the financial system. This market includes a wide range of financial products that are used for arbitrage, speculation, and risk reduction, including as futures, options, swaps, and forwards. A wide range of assets, such as commodities, stocks, fixed-income securities, currencies, and interest rates, constitute the basis for the structuring of derivatives. This market is essential to price setting, liquidity availability, and risk management. But because of its complexity and potential for danger, it is strictly regulated and observed.

The Chicago Mercantile Exchange (CME Group), Shanghai Future Exchange (SHFE), London Metal Exchange (LME), New York Mercantile Exchange (NYMEX), Multi commodities Exchange of India Ltd (MCX), and Intercontinental Exchange (ICE) are the leading commodities exchanges in the world. The trade of many commodities, including metals, energy products, and agricultural items, is made easier by these exchanges. In the international commodities market, they are vital for investment, risk management, and price discovery.

The Multi commodities Exchange of India Ltd (MCX) is the main commodities exchange in India. The largest commodity derivatives exchange in the nation, MCX provides future trading on a variety of commodities, including energy (natural gas, crude oil), agricultural goods (cotton,

palm oil, spices), and metals (gold, silver, copper). Because it offers market players across the country a venue for price discovery, risk management, and investment possibilities, MCX is an important player in the commodities market in India.

MULTI COMMODITY EXCHANGE OF INDIA LTD (MCX)

Founded in 2003, the Multi Commodity Exchange of India Ltd (MCX) is the biggest exchange for commodity derivatives in India. MCX provides future trading on a range of commodities, including energy resources like natural gas and crude oil, precious metals like gold, silver and copper, and agricultural goods like cotton, palm oil and spices. In India's commodities market, MCX is an essential player that helps with investment possibilities, risk management, and price discovery. The Securities and Exchange Board of India (SEBI) is in charge of overseeing MCX, which provides services to a wide spectrum of users, including investors, hedgers, and traders. In summary, MCX is a major participant in the Indian commodities market, promoting development and advancement with its open and effective trading platform for a variety of commodities.

MACROECONOMIC VARIABLES

The area of economics known as macroeconomics focuses on the overall state of the economy. As a result, macroeconomic variables show how the economy is doing overall. Macroeconomics is a branch of economics that examines an economy's overall functioning, organisation, conduct, and decision-making procedures as opposed to only certain markets.

Macroeconomic variables are important indicators for evaluating an economy's overall health. These include the unemployment rate, which represents the proportion of job seekers who are unable to find employment, the inflation rate, which indicates the pace at which prices grow, and the gross domestic product (GDP), which calculates the entire value of goods and services

produced. Interest rates, currency rates, government debt, consumer and corporate confidence, and others are important variables. These indicators are often monitored since they offer important information on a nation's stability and state of the economy.

It might be challenging to understand the economy before making investments by regularly studying all the macroeconomic elements. Consequently, identifying the variables influencing changes and expansion in the commodities market may be aided by carrying out empirical research. Macroeconomic factors have an impact on the economy's performance, which can therefore have an effect on investment decisions. This emphasizes how important it is to look at how macroeconomic factors impact commodities markets since doing so might help investors and politicians make better decisions. Macroeconomic factors divide into two primary categories: domestic and foreign variables. International macroeconomic indicators show a country's standing internationally, whereas domestic macroeconomic variables show a country's economic activity within its borders. Both kinds of factors have the potential to affect investment decisions and the commodities market.

This research considers few domestic macroeconomic variables as well as international macroeconomic variables. The domestic macroeconomic variables considered are inflation (CPI), composite leading economic indicatior (CLI), business confidence index (BCI), Industrial production index (IPI) ,Long term interest rates, and Short term interest rates. The international variables considered are Exchange rate. These variables have been selected on the basis of assessibility of data and theory.

Consumer price index (CPI)-The average change in prices that customers pay over time for a basket of products and services is examined by the Consumer Price Index (CPI). It is a crucial measure of inflation as it expresses a currency's buying power. The process of calculating the

CPI involves averaging the price changes for each item in the pre-established basket of products. Governments and central banks utilise it extensively to determine monetary policy, which includes interest rate setting. A lower CPI suggests that prices have fallen, perhaps indicating deflation, whereas a higher CPI shows that prices have grown on average, resulting in a decline in buying power.

Composite Leading economic Indicator (CLI)-Similar to early warning signs for the economy are Composite Leading Indicators (CLIs). They consist of a number of different variables, such as consumer confidence and stock prices, which often fluctuate before the economy. Economists can forecast whether the economy will expand or contract in the near future by examining these signs. This supports decision-making by policymakers over issues like interest rates and public spending.

Business Confidence Index-Businesses' perceptions of the present and future state of the economy are measured by the Business Confidence Index (BCI). It is predicated on surveys or statistics that document the opinions of corporate managers about things like sales, plans for employment, plans to make investments, and the state of the economy as a whole. A low BCI displays negativity and might indicate an approaching economic decline, whereas a high BCI suggests confidence among firms, indicating possible growth and expansion. The BCI is used by analysts and policymakers to measure business sentiment, which may have an impact on choices about investments and economic policies.

Industrial Production Index-A measure used to monitor the production of industrial sectors including mining, manufacturing, and utilities is known as the Industrial Production Index (IPI). It displays the amount of output generated by various sectors in relation to a base period. The

industrial sector, which is an essential part of the economy, is reflected in the IPI, which makes it significant. While a lower IPI can suggest a downturn, a higher IPI shows increasing industrial activity, which can be a sign of economic growth. The IPI is a tool used by economists and policymakers to assess industrial output patterns and determine appropriate economic measures.

Exchange rates-Exchange rates display the value of one currency in relation to another. A few examples of the variables that affect them are inflation, interest rates, and economic stability. Governments establish fixed rates, whereas the market determines floating rates. Exchange rate fluctuations may have an impact on global investment and commerce.

Long term interest rates-The yields on government bonds having maturities of ten years or more are known as long-term interest rates. They are affected by things like central bank policy, economic growth, and inflation. While high long-term rates might have the opposite impact, low rates can encourage borrowing and economic growth. Central banks use their monetary policy to monitor and perhaps impact long-term rates.

Short term interest rates-The yields on bonds with one-year or shorter maturities are known as short-term interest rates. Both the state of the economy and central bank policies have an impact on them. Variations in these rates influence the cost of borrowing for consumers, companies, and banks, which has an effect on decisions about investments and expenditures. Short-term rates are used by policymakers to control inflation and economic expansion.

By reducing price swings, improving market efficiency, and luring investments, a strong commodities futures market may significantly contribute to the development of the Indian economy. Growth in the Indian commodities futures market is dependent on a number of variables, including regulatory frameworks, government regulations, infrastructure

improvements, and market players' awareness and active participation. It's interesting to see how macroeconomic variables affect the commodities market's volatility (Baffes & Savescu, 2014). Commodity prices are very unpredictable due to a variety of factors, including exchange rates, GDP growth, inflation, interest rates, and regulatory regulations. However, fundamental changes in the economy, advancements in technology, and shifts in global demand and supply patterns can all have an impact on long-term volatility. Short-term fluctuations in the commodities future market can be influenced by factors like currency exchange rates and stock market performance. On the other hand, macroeconomic variables such as interest rates, inflation rates, and GDP growth are the main drivers of long-term instability.(Sreenu et al., 2021).Research on the commodities futures market has identified some problems such as , to look at the direct relationship between particular commodity futures in India. In addition, it also highlights how relationship between selected commodities and macroeconomic variables have changed over time and what has influenced their ongoing dynamics. The study also seeks to ascertain if variations in certain commodity future prices and shifts in macroeconomic factors in the Indian economy are causally related or not. It also looks into the problem on how important the macroeconomic variables affects the volatility of certain commodity future in India,. The broad-based, long-lasting spike in commodity prices that was witnessed between 2002 and mid-2008 is particularly notable. In daily life, commodities are used for a variety of reasons, and demand for them always exceeds supply. As a result, the recent spike in commodity prices has put developing and growing countries like India under significant strain and increased inflationary pressures domestically(Jena, 2009).. The aim of the research is to understand the correlation between macroeconomic factors and the volatility of commodities future. Additionally, the study will pinpoint particular macroeconomic variables that have a greater impact on the volatility of

commodities future returns in the Indian market. Instead of investing in individual commodities, the investors are more interested in commodities as a group, such as index investments(Jena, 2009)

1.2 BACKGROUND

The emerging market sector has started to play a significant role in influencing commodity prices and market volatility. The commodities future market has shown a consistent upward trend since 2003, reaching its peak in mid-2010. However, the global financial market crisis led to a significant and rapid decline in commodity prices between 2010 and 2011. (Arango et al., 2012).

Some highlighted events that hampered commodities market during last few decades that is,from 2001 till 2023, a number of important events had a substantial influence on the commodities markets. The terrorist attacks on September 11, 2001, caused market disruptions and increased uncertainty, which had an impact on the price of gold and oil.

A significant increase in commodity prices occurred in India before, in the middle of 2008. The price of energy increased by over 100% to $144 a barrel, the price of metals increased by 150%, and the price of agricultural products increased by at least 77%. But during the financial crisis, there was an apparent decline in the price of food, energy, and metals worldwide, which was linked to the decline in demand for commodities as a result of the recession. The Indian government responded to the crisis by introducing stimulus packages and changing policy in an effort to boost the country's economy. A worldwide economic recession brought about by the 2008 Financial Crisis resulted in a sharp decline in commodities prices. By early 2009, commodities prices had recovered to pre-crisis levels in large part to these initiatives. The volatility of commodity prices over this time frame demonstrates the influence of world

economic conditions on commodity markets and the efficacy of policy measures in mitigating the crisis.

When compared to other commodities, the real prices of agricultural and food commodities saw a huge decline of about 50% as a result of the financial crisis. The income and economic growth of emerging countries and agricultural producers were negatively impacted by this price fall. The Doha Round of the World Trade Organisation also reduced trade barriers and agricultural subsidies for developed countries, which raised commodity prices and improved the welfare and income of agricultural commodity exporting countries.(Hewitt, 2006) and(Swinnen, 2014)

The economic boom in China significantly raised demand for commodities, which had an effect on pricing in sectors including agriculture, metals, and energy. During 2010 and 2012, the Arab Spring hampered oil supply, which resulted in price increase and volatility. Between 2018 and 2020, the US-China trade war resulted in a decrease in worldwide trade, which had a significant impact on the commodities markets. The COVID-19 pandemic lockdown that lasted from 2020 to 2021 reduced demand, which sharply dropped commodity prices, particularly in the oil and gas industries. The demand for commodities used in renewable technologies was also impacted by shifts towards renewable energy sources, which changed market dynamics and affected prices.

Macroeconomic indicators typically manifest on a daily or monthly basis, whereas the pricing data in the commodity future market tends to exhibit a slightly higher frequency, such as daily or intra-daily intervals(Sreenu et al., 2021).One common indicator of economic performance is the Gross Domestic Product (GDP). During the 1930s, economist Simon Kuznets developed the GDP idea as a way to measure the US economy's productivity in the face of the Great

Depression. The 1929 stock market crash, overproduction, and high levels of consumer debt were some of the main causes of the Great Depression, a severe financial crisis that started in the United States and lasted until the 1930s. There was a great deal of unemployment, bank failures, and general poverty during this time. The goals of President Franklin D. Roosevelt's New Deal programmes were to provide aid and promote economic growth. The long-lasting effects of the Great Depression had a profound impact on the political climate, social structure, and economic environment of the United States for a considerable amount of time.

Inflation has historically been a common occurrence, resulting from a number of variables including depreciation of the currency, increased money circulation, and changes in the economy. The 19th century saw significant changes in inflation trends as a result of the Industrial Revolution and banking system developments. The 20th century witnessed a spike in inflation during times of war and the execution of inflation-targeting policies. Globalisation and technical progress have a major impact on inflation dynamics today, which helps explain why inflation rates are quite low in many developed countries.

The inflation of food prices lead to instability within food markets and also begin to diminish the actual income of the people , as significant portion of household expenditures were allocated to food in less developed countries (LDCs). Since supply and demand dynamics primarily affect food commodity prices.(Ozdemir et al., 2003).In order to provide support for the adaptation requirements of the least developed countries (LDCs), the establishment of the Least Developed Countries Fund (LDCF) was approved during the 7th Conference of the Parties (COP7) in 2001. Commodities has a positive link with inflation since commodities are used as a hedge against inflation. On the other hand, high levels of inflation might lead to a rise in interest rates, which

would then result in a drop in commodity prices. Since volatility measures variations in prices, macroeconomic shocks are anticipated to affect both the returns on commodities and their volatility.

Another effective macroeconomic variable is exchange rates, that plays an essential role in promoting international trade throughout history. A system where currencies were based on the value of gold was created in the 19th century with the establishment of the gold standard. The Bretton Woods Agreement, which fixed a number of currencies to the US dollar, was put into effect after World War II. But in the 1970s, this system fell apart, and the period of fluctuating exchange rates began.

1.3 AIMS AND OBJECTIVES

1. To study the relationship between selected macroeconomic variables and selected commodities future returns in India.
2. To study the impact of macroeconomic variables on the volatility of the selected commodities future returns in India.

1.4 RESEARCH QUESTIONS

1. Is there any relationship between selected commodities future returns and macroeconomic variables in India?
2. Is there any impact of macroeconomic variables on the volatility of the selectedcommodities future returns in India?

1.5 HYPOTHESIS (NULL)

H_0:There is no relationship between the macroeconomic variables and selected commodities future return in India.

H_0:There is no impact of macroeconomic variables on the volatility of the selected commodities future returns in India

1.6 RESEARCH GAP

The period of study and some additional impact of macroeconomic variables on commodity market is a major research gap in this study. The study uses 9 commodities from different sectors and 7 macroeconomic variables to check impact of macroeconomic variables on commodity market.

1.7 SCOPE OF THE STUDY

The scope of the study is to examine the relationship between specific macroeconomic variables and the future returns of chosen commodities in India. It will analyze how changes in macroeconomic factors affect the returns of selected commodities in the futures market. Additionally, the study aims to investigate the impact of the macroeconomic variables on the volatility of commodity futures returns. By focusing on India's commodities market, the study intends to provide insights into how macroeconomic factors influence the returns, aiding investors, policymakers, and market participants in making informed decisions.

CHAPTER 2

2.1 LITERATURE REVIEW

(Kalyan, 2023) the study examines the characteristics of volatility on the Chittagong Stock Exchange (CSE) and evaluates the impact of several macroeconomic variables on the volatility. For the study, information from the World Bank and CSE websites for the years 2009 to 2018 was collected. The approaches of Vector Autoregression (VAR) and Generally Autoregressive Conditional Heteroscedasticity (GARCH) were used to analyse the volatility and influence of macroeconomic factors. The stationarity of the data was verified using the Phillips-Perron (PP) and Augmented Dickey Fuller (ADF) unit root tests. The study found that the CSE's volatility patterns could be accurately anticipated by both the VAR and GARCH (1,1) models. Notably, it was discovered that interest rates had a major negative influence on CSE volatility whereas inflation, the money supply, and remittance inflow all significantly positively impacted volatility. Furthermore, conditional heteroskedasticity was seen in the residuals, and volatility was directly impacted by shocks to the macroeconomic variables. (**Sreenu et al.**, **2021**)The study examines that metal, oil, and agricultural commodity future as well as the effect of macroeconomic variables on the volatility of the commodity future market in India. These macroeconomic indicators includes the state of the economy, financial market data, and monetary policy impacts. The study looks at the connection between daily price volatility and low-frequency macroeconomic indicators using the GARCH-MIDAS model. The model separates the volatility series into short- and long-run components in order to evaluate the possible impact of macroeconomic factors on long-term variation. The study examines that both domestic and international economic variables account for a sizable amount of the price volatility in the Indian commodities futures market.**(Ahmed et al., 2021)**This study examines how several

macroeconomic variables affected commodity future prices for crude palm oil future between January 1999 and December 2019. The writer considers a few key elements, including Interest rate, exchange rate, and IIP. Cointegration, VECM, and the Granger causality test were used in the study's analysis. The results demonstrates that, over time, IR, EX, and IIP has a major influence on FCPO. And concludes that there is no discernible short run causation between FCPO prices and the VECM findings. This research recommends the policymakers to carefully draft their policies, in order to safeguard investors and hedgers from future price fluctuations in commodities. **(Hu et al., 2020)**The author finds that different commodities react differently to shocks of the macroeconomy. The study also examines, the influence of geopolitical concerns and macroeconomic factors on crude oil volatility. The analysis also shows that the macroeconomic influence on realised commodity volatility varies over time. **(Zhang et al., 2020)**the study explains the association between China's macroeconomic variables and domestic commodity prices. China's commodities prices were shown to have a similar trend using a dynamic factor model. The structural relationships between the common trend in commodity prices and several real economic, financial, and fiscal variables were investigated using the structural Vector Auto-regression model. The Empirical investigation reveals that the macroeconomic factors pertaining to China have a notable and quantifiable impact on commodities pricing. **(Economics, 2020)**The study looks into the various macroeconomic variables that affects the stock market. October 2014 to September 2019 was the 60-month period covered by the analysis. The investigator utilizes techniques including multiple regression analysis, correlation matrix analysis, and descriptive statistics. The results showed that all independent variables and stock value had a positive connection, but interest rates had a negative correlation with these variables. The study contends that a number of macroeconomic factors

influence the value of the stock market. **(Su et al., 2020)**This study investigates the existence of numerous price bubbles for copper. It also provides that the frequent formation and breakdown of those price bubbles to different factors, including financial crises, supply and demand mismatches, speculation, and variations in the value of the US dollar.**(Keswani & Wadhwa, 2019)** the study examines that there was stationarity in the variables at the first difference. And significant correlations between share prices, currency rates, government policies, and disposable income were found using correlation analysis. On the other hand, no meaningful correlations between share values, inflation rates, and interest rates were found. In the NSE and BSE markets, the Granger Causality test revealed causal links between certain macroeconomic parameters and the returns on security exchanges. The impact of these variables on the share values of the NSE and BSE was further examined by multiple regression analysis.**(Kumar & Kumar Jena Assistant Professor, 2017)** examines the relationship between commodities index prices and macroeconomic variables in India. It states that both the price of the energy index and the price of the agricultural index appear to be positively correlated with macroeconomic factors over the long term. It concludes that IIP and exchange rates had positive and significant effect on agricultural index price. It also indicated that while IIP is a key macro variable influencing factor on the price of the energy index, and no other macro variable had a discernible impact on the price of the metal index.**(Shang et al., 2016)and(*W4119.Pdf*, n.d.) e**xamines that a commodity considered to produce poorer returns during economic downturns if its returns show a strong negative connection with positive shocks to the real exchange rate. It also adds to the empirical research on the compensation of risks to their investors holding long-only commodities future. It also examines insight into the current debate regarding if it is profitable to invest in portfolios made up entirely of commodities future. **(Shang et al., 2016) and (Y.-C. Chen et al.,**

2010) the study examines that taking on real exchange rate risk usually pays off for investors. Investors in commodities future contracts expect to get excess returns in an equilibrium situation when the contract delivers lesser rewards in the event that the US dollar appreciates or other currencies depreciates. And at same time it supports the hypothesis that exchange rates are anticipatory, taking into account information about potential future changes in commodity markets. **(M.-H. Chen, 2010; Sánchez Lasheras et al., 2015)** This study examines that global copper prices fluctuates significantly in recent years, showing both notable gains and reductions. A popular metal commodity, copper is traded on a number of physical future platforms, including the Shanghai Future Exchange (SHFE), the New York Commodity Exchange (COMEX), and the London Metal Exchange (LME). **(Lescaroux, 2009),(Author & John, 2008) and (Erb & Harvey, 2006)**the study investigates the excessiveness co-movement of commodity prices, with a particular focus on the significant influence of fundamental factors on short-term market dynamics. It also examines that there has been a rise in commodity future trading globally. An intriguing observation was made in which they stated that the correlation between various commodity future is significantly lower as compared to the different stock sectors. After the dotcom crisis in 2000 it increased the value of the height of significance of alternative asset investment, with commodity future being considered a secure, safe and optimal alternative asset. And also examines that commodity rates are greatly influenced by the effect of monetary and real interest rates . **(Jegadeesh & Titman, 1993)(Christie–David et al., 2000) and (Kim et al., 2011)**The study examines that the prices of silver and gold exhibites significant fluctuations in response to the disclosure of capacity utilization. Gold demonstrates a pronounced reaction to the Consumer Price Index (CPI), while silver's response is comparatively less pronounced. It shows that news about US monetary policy has a moderating influence on commodity volatility. The

study looks at the linkages between the price changes of gold and silver. The research examines the future trading spread between the prices of gold and silver. Notably, this research shows that these approaches outperform simple buy-and-hold and moving-average methods across a variety of investment horizons.**(Batten et al., 2010; Smales, 2017)(Elder et al., 2012; Hayo et al., 2012; Shang et al., 2016)(Karali & Ramirez, 2014)(Ye et al., 2021) and(Hayo et al., 2012)**the study examines that there are ample numbers of factors that can influence the volatility of Commodity Future ,and part of the research focused on assessing the impact of the macroeconomic environment, it also demonstrates number of factors such as inflation, economic growth, money supply and exchange rate influence on the volatility of commodities. It also examines the performance and volatility of commodity prices, including both spot and future markets, is influenced by macroeconomic factors such as money supply, interest rates, inflation, and economic activity. **(Chávez & Rodríguez-Puello, 2022),(Atienza & Modrego, 2019), (WU & HU, 2016) and(Buncic & Moretto, 2015)** this study analyses the beginning and end of speculative bubbles and also looks at the phenomena of moderate price volatility in copper markets. Copper is an important metal that is used extensively in many different industries, including the building, manufacturing, and electrical industries. The study also examines the poor price elasticity of supply and demand for copper, and concludes that minor disruptions can result in large price rises and swings.**(Boschi & Pieroni, 2009)t**he study examines that by calculating cross-correlations and depicting relevant time series data, one may gain a preliminary understanding of the empirical relationship between the macroeconomic factors and the aluminium market. **(Kaufmann et al., 2008), (Dutta, 2018)** this study assesses, rising non-OPEC production as a result of rising Chinese oil consumption causes a spike in demand, which in turn led to increase in OPEC spare capacity in year 2008. Later the study examines that there

was a drop in oil prices that had significant impact on metal price changes, and market returns exhibites a leap dynamic pattern that may be a sign of future market collapses. **(Boschi & Pieroni, 2009)(Econometrics, 2009)(Frankel, 2006)** The study examines the dynamics of the global aluminium market price and stockholding activities with the effects of monetary policy and other macroeconomic shocks. The reasons were identified in this research are, the historical data for the aluminium market were similar to that of many other industrial commodities, which showed no indication of stockouts and no empirical support for nonlinear price dynamics. **(Lokare, 2007; Naik & Jain, 2002)**the study examines that there is a speculative activity seen in agricultural commodities together with a progressive increase in the efficiency of metals commodity markets and also concluded, that the three- and fifteen-month future prices do not provide fair projections of future spot prices over the long run.**(Ozdemir et al., 2003)**The study examines ,the inflation of food prices that lead to instability within food markets that begin to diminish the actual income of the people , Since supply and demand dynamics primarily affects the food commodity prices. As per the study, the growth rates of the GDP and the Index of Industrial Production (IIP) have a big influence on the volatility of future prices. It also discovers a strong correlation between inflation and future price volatility by considering the nearest three months contract from national commodity and derivative exchange. The results later led in forecasting the price of the commodity and production decision making along with hedging effectiveness of it.**(Rasmussen & Roitman, n.d.)** These research paper conveys that decrease in the buying power of consumers in countries, that import the goods might result from an increase in the pricing of commodities causes by variations in storage demand. At the same time they observed that exporting nations saw an increase in consumer income, which might offset any overall effects on global GDP through aggregate demand. According to studies, for instance,

even large shocks to the price of oil usually had limited and temporary negative effects for the vast majority of countries globally.

CHAPTER 3

This chapter mainly tells about the research methods used to carry out the study. The study has been done to analyze the relationship between the commodity future market (FUTCOM) and macroeconomic variables. At the same time, the impact of selected macroeconomic variables on volatility of the commodity future market has also been assessed.

3.1 SOURCES OF DATA

The monthly data of the commodities has been extracted from the Multi Commodity Exchange (MCX) websites and the monthly data of the macroeconomic variables have been extracted from the website of the Organisation for Economic Co-operation and Development (OECD), X-Rates and RBI.

3.2 POPULATION OF THE STUDY

The study concentrates on the relationship between commodity markets and macroeconomic variables as well as the impact of selected macroeconomic variables are analysed on the commodity future returns.

3.3 SAMPLING METHOD

The study used Purposive sampling as the sample technique for investigating the correlation between macroeconomic variables and the commodity market, and the influence of certain macroeconomic variables on the volatility of the commodity future market. Multi commodities Exchange has been selected to represent the Indian commodities market in the research since it holds market share of greater than 80%. The study has focused on the actively traded

commodities from the commodities segment of bullion , base metals, energy and agriculture that are traded on the Multi Commodity Exchange (MCX) every day and macroeconomic variable as the consumer price index (CPI),composite leading indicator (CLI),business confidence index(BCI),Exchange rates ,Industrial production index(IPI), Long term interest rate, Short term interest rate are taken into consideration in this study based on past literature.

3.4 SAMPLE SIZE

Commodities- In the study nine actively traded commodities are considered which are traded on daily basis. Some commodities have started trading recently and some commodity has stopped trading on Multi commodity exchange (MCX) has been excluded.

Out of the nine commodities, two are from Bullion (gold, silver), and four are from Base metals (aluminium, copper,nickel, zinc),and two from Energy (natural gas and crude oil) and one from Agricultural commodities (mentha Oil).

Macroeconomic variables- In the study , Consumer Price Index (CPI) ,Composite Leading Economic Indicator (CLI) , Business Confidence Index (BCI), Exchange Rates, Industrial production Index (IPI), Long term interest rates, Short term Interest rates has been considered in this study.

3.5 STATISTICAL TOOLS

All the future closing prices for the sample commodities and macroeconomic variables were collected in Excel Spreadsheet format. All the analysis is carried out with the help of Microsoft Excel, Eviews12.

3.6 PERIOD OF THE STUDY

The period of study is from January 2013 to February 2023 (monthly). The list of sample variables and the respected data periods have been presented in the table 3.1.

3.7 DATA DESCRIPTION

The study uses secondary data for the research. The selected commodities daily future data are collected from websites of MCX and the macroeconomic variables data are collected from the website of OECD , X-Rates and RBI .The purpose of the study is to analyze the impact of macroeconomic variables on the commodities and also to study the relationship between the commodities and macro economic variables.

3.8 RESEARCH DATA

To identify nature of selected commodities and macroeconomic variables by using Descriptive statistics, After that the unit root test ,to check the stationarity using ADF test. Later, results of Johansen's co-integration test, VECM/VAR is discussed, to know the long and short run relationships between the variables. Granger causality test is discussed to know the causality among the variables. Multiple correlation and regression analysis to find out the impact of macroeconomic variables on commodity future returns. This is accomplished through the EVIEWS12 Software.

Table 3.1- List of selected variables and respected data period

Commodities		
Sr.No	Commodity	Data period
Bullion		
1	Gold	01/01/2013 – 02/02/2023
2	Silver	01/01/2013 – 02/02/2023
Base metal		
3	Aluminium	01/01/2013 – 02/02/2023
4	Copper	01/01/2013 – 02/02/2023
5	Nickel	01/01/2013 – 02/02/2023
6	Zinc	01/01/2013 – 02/02/2023
Energy		
7	Crude oil	01/01/2013 – 02/02/2023
8	Natural Gas	01/01/2013 – 02/02/2023
Agricultural		
9	Mentha oil	01/01/2013 – 02/02/2023
Macroeconomic variable		
1	Consumer Price Index(CPI)	01/01/2013 – 02/02/2023
2	Composite Economic leading Indicator(CLI)	01/01/2013 – 02/02/2023
3	Business Confidence Index(BCI)	01/01/2013 – 02/02/2023
4	Exchange rate	01/01/2013 – 02/02/2023
5	Industrial production Index (IPI)	01/01/2013 – 02/02/2023
6	Long term interest rate	01/01/2013 – 02/02/2023
7	Short term interest rate	01/01/2013 – 02/02/2023

Source: Authors compilation using E-views12.

CHAPTER 4

4.1 Descriptive statistics

Descriptive statistics are used to summarise a given data set that shows a set of descriptive coefficients in a way that facilitates interpretation .It shows a dataset's key features and also the measures such as measures of central tendency (mean, median, and mode), measures of dispersion (range, variance, and standard deviation) as well as distribution / measures of normality with the help of skewness ,kurtosis and with the help of Jarque- bera statistics.

Table 4.1 Descriptive statistics of commodities (January 2012-February 2023)

Variables	Mean	Median	Standard deviation	Skewness	Kurtosis	Jarque-Bera	Probability
Commodities							
Bullion							
1)Gold	0.501568	0.305869	3.186745	0.431332	4.176822	10.822930	0.004465
2)Silver	0.099394	0.190809	5.392574	0.743696	4.760393	26.99921	0.000001
BASE METALS							
1)Aluminium	0.537928	0.079384	5.922394	0.399071	16.10052	875.6578	0.000000
2)Copper	0.455332	0.412375	4.617000	-0.128013	4.182449	7.440649	0.024226
3)Nickel	0.734087	0.460149	6.849037	1.055628	7.326301	117.8026	0.000000
4)Zinc	0.748251	0.788168	5.544140	-0.188099	3.271266	1.093481	0.578833
Energy							
1)Crude oil	0.175054	0.979777	10.80679	-0.838299	7.097557	99.63821	0.000000
2)Natural Gas	-2.323837	0.129338	29.50081	-8.154195	81.57498	32736.62	0.000000
Agriculture							
1)Mentha oil	-0.237298	-0.610851	6.692571	0.866528	6.147638	65.63145	0.000000

Source: Authors compilation based on data collected from MCX official website using E-views12.

Table 4.1, explains the MCX monthly series data for commodities. Results exhibit that the mean values of all sample commodities are positive except the Natural gas (-2.323837) and Mentha oil (-

0.237298). The highest mean return value as per the above information is seen in Zinc (0.7482510,Nickel (0.734087) followed by Aluminium(0. 537928), Gold (0.501568) , copper (0.455332) respectively. Among all the sample commodities which earned lowest mean returns reported are Crude oil (0.175054) and Silver(0.099394).

To determine the highest volatility, it is observed through standard deviation, the highest value is of Natural gas (29.50081) followed by crude oil (10.80679) ,nickel (6.8490370) and Mentha oil (6.692571) which suggests that the volatility of these commodities are higher.

The lowest volatility exhibits future price of aluminium (5.922394), Zinc (5.544140), Silver (5.392574), and Gold (3.186745) which shows that these commodities are less volatile because it deviates less from the standard values.

Although, skewness of zero (0) and kurtosis of three (3) shows normal distribution . Out of Nine, four commodities are negatively skewed namely, Natural Gas (-8.154195), Crude oil(-0.838299), Zinc(-0.188099), copper (-0.128013) and rest of the commodities that is gold ,silver , aluminium , nickel and Mentha oil are positively skewed .With respect to kurtosis value, all 9 commodities are leptokurtic distribution (peaked curve)because their values are above/ more than three (>3).both the tests ,that is skewness and kurtosis violates the normality assumptions.

The jarque Bera statistics of sample commodities series p-value are less than 0.05 ($p < 0.05$) at significant at 5% level ,except Zinc (0.578833) is above 0.05.

Table 4.2 Descriptive statistics of Macroeconomic Variables (January 2012-February 2023)

Variables	Mean	Median	Standard deviation	Skewness	Kurtosis	Jarque-Bera	Probability
Macro economic variable							
1)Consumer Price Index(CPI)	5.986087	5.800000	2.304720	0.614610	3.581038	8.857811	0.011928
2)Composite Economic leading Indicator(CLI)	99.41478	100.0000	2.205863	-4.469325	27.48748	3256.111	0.000000
3)Business Confidence Index(BCI)	98.74522	98.30000	2.589223	0.060251	4.444786	10.07174	0.006501
4)Exchange rate	67.97417	67.19900	6.333897	0.133592	2.735576	0.677094	0.712805
5)Industrial production Index (IPI)	105.9009	106.9000	10.06996	-1.650821	9.893940	279.9639	0.000000
6)Long term interest rate	7.333923	7.390000	0.787687	0.037974	2.408084	1.706469	0.426035
7)Short term interest rate	6.341991	6.400000	1.795884	-0.115039	2.686784	0.723732	0.696376

Source:Authors compilation based on data collected from OECD ,X-Rates and RBI official website using E-views12.

The descriptive statistics value for the selected macroeconomic variables as shown in table 4.2, the mean value of every macroeconomic variable has shown positive values. The highest average showing macroeconomic variables are IPI (105.9009) followed by CLI (99.41478) and BCI (98.74522) respectively.

The standard deviation mainly determines the deviation from the mean value. Long term interest rates (0.787687) showed lower deviation followed by short term interest rates (1.7958840), IPI(10.069960 and exchange rates (6.333897)have more deviation from the standard values.

BCI (2.589223) followed by CPI (2.304720)and CLI(2.205863)also showed a deviation from mean value, showing that they are volatile as well.

The skewness values can be divided into positive and negative skewed categories. The negative skewed are namely CLI (-4.469325),IPI (-1.650821) and short term interest rate (-0.115039) and remaining macroeconomic variables are positively skewed namely ,CPI(0.614610), BCI(0.060251),Exchange rates (0.133592) and Long term interest rate (0.037974) respectively . with referernce to kurtosis , all macroeconomic variables are above 3 (>3) that is leptokurtic, except exchange rates (2,735576), Long term interest rate (2.408084), Short term interest rate (2.686784) respectively are Platykurtic (<3).

As per Jarque –Bera test statistics the probability of all the macroeconomic variable are less than 0.05 are statistically significant except exchange rates (0.712805), long term interest rate (0.426035) and Short term interest rate (0.696376) respectively are above 0.05, that is above significance.

4.2 UNIT ROOT TEST OF THE SELECTED COMMODITIES AND MACROECONOMIC VARIABLES.

Table 4.3 and 4.4 exhibits the Unit root Test Statistics of the time series used. To apply econometric models in the study,ADF test is carried out to check the stationarity in all the sample commodity, and also it is necessary to check the unit root , to know the order of integration in all samples.

Table 4.3 Unit root test results for Commodity Future Returns

Variables	**At level**		**At First difference**	
Commodities	**t-statistics**	**p-value**	**t-statistics**	**p-value**
Bullion				
1)Gold	-9.032142	0.0000	-10.63274	0.0000
2)Silver	-8.370957	0.0000	-7.186770	0.0000
BASE METALS				
1)Aluminium	-12.04150	0.0000	-8.972148	0.0000
2)Copper	-8.770066	0.0000	-10.57213	0.0000
3)Nickel	-8.043849	0.0000	-11.79279	0.0000
4)Zinc	-9.423774	0.0000	-10.98555	0.0000
Energy				
1)Crude oil	-8.229332	0.0000	-8.776601	0.0000
2)Natural Gas	-10.96744	0.0000	-12.04173	0.0000
Agriculture				
1)Mentha oil	-8.888516	0.0000	-13.94834	0.0000

Source: Authors compilation using E-views12.

In the given above table 4.3, the ADF values for all the commodities mentioned ,that is gold, silver, aluminium ,copper ,nickel ,zinc, natural gas, crude oil and mentha oil are found to be stationary at level.

Table 4.4 Unit root test results for Macroeconomic variables

Variables	**At level**		**At first difference**	
Macro economic Variables	**t-statistics**	p-value	**t-statistics**	p-value
1)Consumer Price Index(CPI)	-3.442327	0.0113	-8.539303	0.0000

2)Composite Economic leading Indicator(CLI)	-5.202611	0.0000	-9.819038	0.0000
3)Business Confidence Index(BCI)	-1.774483	0.3915	-5.262312	0.0000
4)Exchange rate	-1.255769	0.6479	-9.545019	0.0000
5)Industrial production Index (IPI)	-3.625623	0.0066	-9.960410	0.0000
6)Long term interest rate	-1.407805	0.5764	-8.955310	0.0000
7)Short term interest rate	-1.292200	0.6316	-6.617939	0.0000

Source:Authors compilation using E-views12.

In the given above table 4.4,it represents the ADF results for seven macroeconomic variables,Consumer Price Index (CPI), Composite Economic Leading Indicator(CLI), Business confidence Index (BCI), Exchange rates, Industrial production index, long term interest rates and short term interest rate as independent variables of the study. The outcomes presents that only 3 macroeconomic variable are stationary namely, Consumer price index (CPI), Composite leading economic indicator (CLI) and Industrial production Index (IPI) are at level and so we check all macroeconomic variables at first difference I(1). As per ADF test results at 1^{st} difference, the p-value is < 0.05 .therefore ,we reject the null hypothesis that the selected variables have presence of unit root.

4.3 JOHANSEN'S CO-INTEGRATION

RELATIONSHIP BETWEEN SELECTED MACROECONOMIC VARIABLE AND COMMODITY MARKET

Johansen's Co-integration is generally used to find out the long –run equilibrium relationship among the variables used in the study. If the variables are not co-integrated, the results derived from regression tends to be not real. And so, regressing non stationary time series data may show significant relationship when actually they are not and mostly time series data have naturally long run relationships.

Table 4.5 Results Of Johansen's Co-integration Test Of Gold And Macroeconomic Variables

Unrestricted Co-integration Rank Test (Trace) for Gold					
Hypothesized No. of CE(s)	Eigen value	Trace statistics	Critical Value 0.05	prob. **	Remark
None*	0.60555	239.256	159.53	0.0000	Cointegrated
At most 1 *	0.35475	145.3	125.615	0.0018	Cointegrated
At most 2 *	0.31001	101.05	95.7537	0.0205	Cointegrated
At most 3	0.24307	63.5721	69.8189	0.1423	No Cointegrated
At m ost 4	0.14431	35.4455	47.8561	0.4247	No Cointegrated
At most 5	0.11195	19.7045	29.7971	0.4431	No Cointegrated
At m ost 6	0.05061	7.71341	15.4947	0.4965	No Cointegrated
At most 7	0.02414	2.46824	3.84147	0.1162	No Cointegrated
Unrestricted Co-integration Rank Test (Maximum Eigen value) for Gold					
Hypothesized No. of CE(s)	Eigen value	Max-Eigen Statistic	0.05 Critical Value	prob.**	
None *	0.60555	93.9564	52.3626	0.0000	Cointegrated
At most 1	0.35475	44.2496	46.2314	0.0804	No Cointegrated
At most 2	0.31001	37.4783	40.0776	0.0954	No Cointegrated
At most 3	0.24307	28.1266	33.8769	0.2077	No Cointegrated
At most 4	0.14431	15.741	27.5843	0.6876	No Cointegrated
At most 5	0.11195	11. 99109	21.1316	0.5485	No Cointegrated
At most 6	0.05061	5.24517	14.2646	0.7106	No Cointegrated
At most 7	0.02414	2.46824	3.84147	0.1162	No Cointegrated

Source: Authors compilation using E-views12.

H_0: "There is no long run equilibrium relationship between Gold and the selected macroeconomic variables".

The result of Johansen's cointegration test has been reported in table 4.5, both trace and max statistics are used for the analysis. The results of no cointegration are rejected as the trace statistics is greater than the critical values in case of : None, Atmost 1and Atmost 2 cointegrating equations.With consideration of Max Eigen Value statistics, the results of no cointegration are rejected as the maximum eigen statistic is greater than the critical values in case of: None cointegrating equations. The H_0 is rejected and the presence of Atmost 1and Atmost 2 cointegrating vector confirms that , the gold futures market and macroeconomic variables tend to move together in long run and any shocks which affects the equilibrium get corrected over time.

Table 4.6 Results Of Johansen's Co-integration Test Of Silver And Macroeconomic Variables

Unrestricted Co-integration Rank Test (Trace) For Silver					
Hypothesized No. of CE(s)	Eigen value	**Trace Statistic**	**0.05 Critical Value**	**prob.****	**Remarks**
None*	0.5468	227.485	159.53	0.0000	Cointegrated
At most 1 *	0.37233	147.552	125.615	0.0012	Cointegrated
At most 2 *	0.32271	100.512	95.7537	0.0226	Cointegrated
At most 3	0.2351	61.1571	69.8189	0.2015	No Cointegrated
At most 4	0.14966	34.0878	47.8561	0.497	No Cointegrated
At most 5	0.10498	17.7134	29.7971	0.5873	No Cointegrated
At most 6	0.0416	6.51 1223	15.4947	0.6351	No Cointegrated
At most 7	0.02173	2.21927	3.84147	0.1363	No Cointegrated
Unrestricted Co integration Rank Test (Maxim um Eigen value) for Silver					
Hypothesized No. of CE(s)	Eigen value	Max-Eigen Statistic	0.05 Critical Value	prob.**	
None *	0.5468	79.9329	52.3626	0.0000	Cointegrated
At most 1 *	0.37233	47.0398	46.2314	0.0409	Cointegrated
At most2	0.32271	39.3551	40.0776	0.0601	No Cointegrated
At most3	0.2351 02	27.0693	33.8769	0.2597	No Cointegrated
At most4	0.14966	16.3744	27.5843	0.6338	No Cointegrated
At most5	0.10498	11.2022	21.1316	0.6271	No Cointegrated
At most6	0.0416	4.29195	14.2646	0.8273	No Cointegrated

At most 7	0.02173	2.21927	3.84147	0.1363	No Cointegrated

Source: Authors compilation using E-views12.

H_0: "There is no long run equilibrium relationship between Silver and the selected macroeconomic variables".

The result of Johansen's cointegration test has been reported in table 4.6, both trace and max statistics are used for the analysis. The results of no cointegration are rejected as the trace statistics is greater than the critical values in case of : None, Atmost 1and Atmost 2 cointegrating equations.With consideration of Max Eigen Value statistics, the results of no cointegration are rejected as the maximum eigen statistic is greater than the critical values in case of: None and Atmost 1 cointegrating equations. The H_0 is rejected and the presence of Atmost 1and Atmost 2 cointegrating vector confirms that, the silver futures market and macroeconomic variables tend to move together in long run and any shocks which affects the equilibrium get corrected over time.

Table 4.7 Results Of Johansen's Co-integration Test Of Aluminium And Macroeconomic Variables

Unrestricted Co-integration Rank Test (Trace) For Aluminium					
Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	prob. **	Remarks
None*	0.44325	214.429	159.5297	0.0000	Cointegrated
At most 1 *	0.36875	155.279	125.6154	0.0002	Cointegrated
At most 2 *	0.30414	108.814	95.75366	0.0047	Cointegrated
At most 3 *	0.25088	72.1915	69.81889	0.0319	Cointegrated
At most 4	0.20502	43.0172	47.85613	0.1322	No Cointegrated
At most 5	0.11593	19.8446	29.79707	0.4334	No Cointegrated
At most 6	0.05038	7.39902	15.49471	0.5317	No Cointegrated
At most 7	0.02134	2.17824	3.841465	0.14	No Cointegrated
Unrestricted Co-integration Rank Test (Maximum Eigen value) For Aluminium					
Hypothesized No. of CE(s)	Eigen value	Max-Eigen Statistic	0.05 Critical Value	prob. **	
None *	0.44325	59.1503	52.36261	0.0088	Cointegrated

At most l *	0.36875	46.4649	46.23142	0.0472	Cointegrated
At most 2	0.30414	36.6227	40.07757	0.1165	No Cointegrated
At most 3	0.25088	29.1743	33.87687	0.1644	No Cointegrated
At most 4	0.20502	23.1726	27.58434	0.1662	No Cointegrated
At most 5	0.11593	12.4456	21.13162	0.5043	No Cointegrated
At most 6	0.05038	5.22078	14.2646	0.7138	No Cointegrated
At most 7	0.02134	2.17824	3.841465	0.14	No Cointegrated

Source: Authors compilation using E-views12.

H_0: "There is no long run equilibrium relationship between Aluminium and the selected macroeconomic variables".

The result of Johansen's cointegration test has been reported in table 4.7, both trace and max statistics are used for the analysis. The results of no cointegration are rejected as the trace statistics is greater than the critical values in case of : None, Atmost 1, Atmost 2and Atmost 3 cointegrating equations.With consideration of Max Eigen Value statistics, the results of no cointegration are rejected as the maximum eigen statistic is greater than the critical values in case of: None and Atmost 1 cointegrating equations. The H_0 is rejected and the presence of Atmost 1, Atmost 2 and Atmost 3 cointegrating vector confirms that , the aluminium futures market and macroeconomic variables tend to move together in long run and any shocks which affects the equilibrium get corrected over time.

Table 4.8 Results Of Johansen's Cointegration Test Of Copper And Macroeconomic Variables

Unrestricted Co-integration Rank Test (Trace)for Copper					
Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	prob.**	Remarks
None *	0.49655	224.873	159.53	0.0000	Cointegrated
At most 1 *	0.38022	155.56	125.615	0.0002	Cointegrated
At most 2 *	0.3098	107.243	95.7537	0.0064	Cointegrated
At most 3	0.2376	69.7947	69.8189	0.0502	No Cointegrated
Atmost4	0.19587	42.3949	47.8561	0.148	No Cointegrated
At most 5	0.1 15396	20.3774	29.7971	0.3976	No Cointegrated

Atmost6	0.055	7.99331	15.4947	0.4661	No Cointegrated
At most 7	0.02232	2.2801 14	3.84147	0.131	No Cointegrated
Unrestricted Co integration Rank Test (Maximum Eigen value) for Copper					
Hypothesized No. of CE(s)	Eigen value	Max-Eigen Statistic	0.05 Critical Value	prob.**	
None*	0.49655	69.313	52.3626	0.0004	Cointegrated
At most 1 *	0.38022	48.3176	46.2314	0.0295	Cointegrated
At most 2	0.3098	37.448	40.0776	0.0961	No Cointegrated
At most 3	0.2376	27.3998	33.8769	0.2426	No Cointegrated
At most 4	0.19587	22.0175	27.5843	0.2195	No Cointegrated
At most 5	0.1154	12.3841	21.1316	0.5102	No Cointegrated
At most 6	0.055	5.71319	14.2646	0.6503	No Cointegrated
At most 7	0.02232	2.28011	3.84147	0.131	No Cointegrated

Source: Authors compilation using E-views12.

H_0: "There is no long run equilibrium relationship between copper and the selected macroeconomic variables".

The result of Johansen's cointegration test has been reported in table 4.8, both trace and max statistics are used for the analysis. The results of no cointegration are rejected as the trace statistics is greater than the critical values in case of: None, Atmost 1, and Atmost 2 cointegrating equations. With consideration of Max Eigen Value statistics, the results of no cointegration are rejected as the maximum eigen statistic is greater than the critical values in case of: None and Atmost 1 cointegrating equations. The H_0 is rejected and the presence of Atmost 1, Atmost 2 cointegrating vector confirms that,the copper futures market and macroeconomic variables tend to move together in long run and any shocks which affects the equilibrium get corrected over time.

Table 4.9 Results Of Johansen's Co-integration Test Of Nickel And Macroeconomic Variables

Unrestricted Co-integration Rank Test (Trace) for Nickel					
Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	prob. **	Remark
None *	0.46031	199.318	159.53	0.0001	Cointegrated
Atmost 1 *	0.30741	137.025	125.615	0.0083	Cointegrated

At most 2 *	0.29407	99.9269	95.7537	0.025	Cointegrated
At most 3	0.22451	64.7547	69.8189	0.1186	No Cointegrated
At most 4	0.16932	39.0746	47.8561	0.2573	No Cointegrated
At most 5	0.11402	20.3376	29.7971	0.4002	No Cointegrated
At most 6	0.05628	8.1104	15.4947	0.4537	No Cointegrated
At most 7	0.02213	2.26005	3.84147	0.1327	No Cointegrated
Unrestricted Co integration Rank Test (Maximum Eigen value) for Nickel					
Hypothesized No. o fCE(s)	Eigen value	Max-Eigen Statistic	0.05 Critical Value	prob. **	
None*	0.46031	62.2923	52.3626	0.0036	Cointegrated
At most l	0.30741	37.0985	46.2314	0.335	No Cointegrated
At most 2	0.29407	35.1722	40.0776	0.1611	No Cointegrated
At most 3	0.22451	25.6801	33.8769	0.3406	No Cointegrated
At most 4	0.16932	18.737	27.5843	0.4351	No Cointegrated
At most 5	0.1 14021	12.2272	21.1316	0.5254	No Cointegrated
At most 6	0.05628	5.85035	14.2646	0.6325	No Cointegrated
At most 7	0.02213	2.26005	3.84147	0.1327	No Cointegrated

Source: Authors compilation using E-views12.

H_0: "There is no long run equilibrium relationship between nickel and the selected macroeconomic variables".

The result of Johansen's cointegration test has been reported in table 4.9, both trace and max statistics are used for the analysis. The results of no cointegration are rejected as the trace statistics is greater than the critical values in case of : None, Atmost 1 and Atmost 2 cointegrating equations. With consideration of Max Eigen Value statistics, the results of no cointegration are rejected as the maximum eigen statistic is greater than the critical values in case of None cointegrating equations. The H_0 is rejected and the presence of Atmost 1, Atmost 2 cointegrating vector confirms that, the nickel futures market and macroeconomic variables tend to move together in long run and any shocks which affects the equilibrium get corrected over time.

Table 4.10 Results Of Johansen's Co-integration Test Of Zinc And Macroeconomic Variables

Unrestricted Co-integration Rank Test (Trace) for Zinc					
Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	prob.**	Remark
None *	0.40211	200.029	159.53	0.0000	Cointegrated
Atmost 1 *	0.34585	148.08	125.615	0.001	Cointegrated
Atmost2 *	0.28653	105.214	95.7537	0.0095	Cointegrated
At most 3 *	0.23265	71 .11426	69.8189	0.0393	Cointegrated
At most4	0.20689	44.368	47.8561	0.1025	No Cointegrated
Atmost5	0.11965	20.9566	29.7971	0.3603	No Cointegrated
At most 6	0.05467	8.08619	15.4947	0.4562	No Cointegrated
At most 7	0.02356	2.40816	3.84147	0.1207	No Cointegrated
Unrestricted Co-integration Rank Test (Maximum Eigen value) for zinc					
Hypothesized No. of CE(s)	Eigen value	Max-Eigen Statistic	0.05 Critical Value	prob.**	
None	0.40211	51 .94954	52.3626	0.0551	No Cointegrated
At most1	0.34585	42.8663	46.2314	0.11	No Cointegrated
At most 2	0.28653	34.0993	40.0776	0.2019	No Cointegrated
At most 3	0.23265	26.7462	33.8769	0.2772	No Cointegrated
At most4	0.20689	23.4114	27.5843	0.1566	No Cointegrated
At most 5	0.11965	12.8704	21 .13162	0.4642	No Cointegrated
At most 6	0.05467	5.67803	14.2646	0.6548	No Cointegrated
At most 7	0.02356	2.40816	3.84147	0.1207	No Cointegrated

Source: Authors compilation using E-views12.

H_0: "There is no long run equilibrium relationship between Zinc and the selected macroeconomic variables".

The result of Johansen's cointegration test has been reported in table 4.10, both trace and max statistics are used for the analysis. The results of no cointegration are rejected as the trace statistics is greater than the critical values in case of : None, Atmost 1, Atmost 2 and Atmost 3 cointegrating equations. With consideration of Max Eigen Value statistics, the results shows that there are no cointegrating equations. The H_0 is rejected and the presence of Atmost 1, Atmost 2 and Atmost 3 cointegrating vector confirms that ,the Zinc futures market and macroeconomic

variables tend to move together in long run and any shocks which affects the equilibrium gets corrected over time.

Table 4.11 Results Of Johansen's Cointegration Test Of Crude Oil And Macroeconomic Variables

Unrestricted Co-integration Rank Test (Trace) for Crude Oil					
Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	prob.**	Remark
None*	0.3905	200.155	159.53	0.0000	Cointegrated
Atmost 1 *	0.36978	150.148	125.615	0.0007	Cointegrated
At most 2 *	0.30021	103.518	95.7537	0.0131	Cointegrated
At most 3	0.23464	67.4645	69.8189	0.0759	No Cointegrated
At most 4	0.18597	40.4562	47.8561	0.2066	No Cointegrated
At most 5	0.11493	19.6753	29.7971	0.4451	No Cointegrated
Atmost6	0.04996	7.34426	15.4947	0.5379	No Cointegrated
At most 7	0.02124	2.16779	3.84147	0.1409	No Cointegrated
Unrestricted Co integration Rank Test (Maximum Eigen value) for Crude Oil					
Hypothesized No. of CE(s)	Eigen value	Max-Eigen Statistic	0.05 Critical Value	prob.**	
None	0.3905	50.0069	52.3626	0.0855	No Cointegrated
At most 1*	0.36978	46.63	46.2314	0.0453	Cointegrated
Atmost2	0.30021	36.0538	40.0776	0.1326	No Cointegrated
Atmost3	0.23464	27.0083	33.8769	0.2629	No Cointegrated
Atmost4	0.18597	20.781	27.5843	0.2897	No Cointegrated
Atmost5	0.1 14931	12.331	21.1316	0.5153	No Cointegrated
Atmost6	0.04996	5.17647	14.2646	0.7194	No Cointegrated
Atmost7	0.02124	2.16779	3.84147	0.1409	No Cointegrated

Source: Authors compilation using E-views12.

H_0: "There is no long run equilibrium relationship between crude oil and the selected macroeconomic variables".

The result of Johansen's cointegration test has been reported in table 4.11, both trace and max statistics are used for the analysis. The results of no cointegration are rejected as the trace statistics is greater than the critical values in case of : None, Atmost 1, Atmost 2 cointegrating

equations.With consideration of Max Eigen Value statistics, the results of no cointegration are rejected as the maximum eigen statistic is greater than the critical values in case of: Atmost 1 cointegrating equation. The H_0 is rejected and the presence of Atmost 1, Atmost 2 cointegrating vector confirms that ,the crude oil futures market and macroeconomic variables tend to move together in long run and any shocks which affects the equilibrium get corrected over time.

Table 4.12 Results Of Johansen's Co-integration Test Of Natural Gas And Macroeconomic Variables

Unrestricted Co-integration Rank Test (Trace) for Natural Gas					
Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	prob.**	Remark
None *	0.85852	358.016	159.53	0.0000	Cointegrated
At most 1 *	0.40052	160.501	125.615	0.0001	Cointegrated
At most 2 *	0.30424	108.819	95.7537	0.0047	Cointegrated
At most 3 *	0.27677	72.1813	69.8189	0.032	Cointegrated
At most4	0.19428	39.4543	47.8561	0.2426	No Cointegrated
At most 5	0.1035	17.636	29.7971	0.593	No Cointegrated
At most6	0.03971	6.60101	15.4947	0.6244	No Cointegrated
At most 7	0.02453	2.5084	3.84147	0.1132	No Cointegrated
Unrestricted Co integration Rank Test (Maximum Eigen value) for Natural Gas					
Hypothesized No. of CE(s)	Eigen value	Max-Eigen Statistic	0.05 Critical Value	prob.**	
None *	0.85852	197.516	52.3626	0.0000	Cointegrated
At most 1 *	0.40052	51 .68145	46.2314	0.0119	Cointegrated
At most 2	0.30424	36.6379	40.0776	0.1161	No Cointegrated
At most 3	0.27677	32.727	33.8769	0.0681	No Cointegrated
At most 4	0.19428	21 .81826	27.5843	0.2299	No Cointegrated
At most 5	0.1035	11 .03501	21.1316	0.6439	No Cointegrated
At most 6	0.03971	4.0926	14.2646	0.8494	No Cointegrated
At most 7	0.02453	2.5084	3.84147	0.1132	No Cointegrated

Source: Authors compilation using E-views12.

H_0: "There is no long run equilibrium relationship between Natural Gas and the selected macroeconomic variables".

The result of Johansen's cointegration test has been reported in table 4.12, both trace and max statistics are used for the analysis. The results of no cointegration are rejected as the trace statistics is greater than the critical values in case of : None, Atmost 1, Atmost 2 and Atmost 3 cointegrating equations.With consideration of Max Eigen Value statistics, the results of no cointegration are rejected as the maximum eigen statistic is greater than the critical values in case of: none and Atmost 1 cointegrating equations. The H_0 is rejected and the presence of Atmost 1, Atmost 2 and Atmost 3 cointegrating vector confirms that ,the natural gas futures market and macroeconomic variables tend to move together in long run and any shocks which affects the equilibrium get corrected over time.

Table 4.13 Results Of Johansen's Co-integration Test Of Mentha Oil And Macroeconomic Variables

Unrestricted Co-integration Rank Test (Trace)for Mentha Oil					
Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	prob.**	Remarks
None *	0.5093	223.22	159.53	0.0000	Cointegrated
Atmost 1 *	0.39189	151.317	125.615	0.0005	Cointegrated
At most 2 *	0.29443	101.079	95.7537	0.0204	Cointegrated
Atmost3	0.21722	65.8555	69.8189	0.0994	No Cointegrated
Atmost4	0.18988	41 .12019	47.8561	0.1849	No Cointegrated
Atmost5	0.11261	19.8525	29.7971	0.4329	No Cointegrated
Atmost6	0.0536	7.78629	15.4947	0.4885	No Cointegrated
Atmost7	0.02176	2.22195	3.84147	0.1361	No Cointegrated
Unrestricted Co-integration Rank Test (Maximum Eigen value) for Mentha Oil					
Hypothesized No. of CE(s)	Eigen value	Max-Eigen Statistic	0.05 Critical Value	prob.**	
None *	0.5093	71.9032	52.3626	0.0002	Cointegrated
Atmost 1*	0.39189	50.2379	46.2314	0.0177	Cointegrated
Atmost 2	0.29443	35.2235	40.0776	0.1593	No Cointegrated
Atmost 3	0.21722	24.7353	33.8769	0.4031	No Cointegrated

Atmost 4	0.18988	21 .26769	27.5843	0.2604	No Cointegrated
Atmost 5	0.11261	12.0662	21.1316	0.5411	No Cointegrated
Atmost 6	0.0536	5.56434	14.2646	0.6695	No Cointegrated
Atmost 7	0.02176	2.22195	3.84147	0.1361	No Cointegrated

Source: Authors compilation using E-views12.

H_0: "There is no long run equilibrium relationship between Mentha Oil and the selected macroeconomic variables".

The result of Johansen's cointegration test has been reported in table 4.13, both trace and max statistics are used for the analysis. The results of no cointegration are rejected as the trace statistics is greater than the critical values in case of : None, Atmost 1and Atmost 2 cointegrating equations.With consideration of Max Eigen Value statistics, the results of no cointegration are rejected as the maximum eigen statistic is greater than the critical values in case of: none and Atmost 1 cointegrating equations. The H_0 is rejected and the presence of Atmost 1and Atmost 2 cointegrating vector confirms that the mentha oil futures market and macroeconomic variables tend to move together in long run and any shocks which affects the equilibrium get corrected over time.

4.4 VECTOR ERROR CORRECTION MODEL (VECM)

For variable series with first-order integration, the VEC model is utilised, and for price series with level stationarity, the VAR model. The VEC model is used to determine short-run dynamics once Johansen's cointegration test study is complete as well as long-term price changes in every sample price series. The VEC model need not be used if there is no cointegration between the variables in a price series. VECM model is used on future returns of commodity. Results represent long run error correction coefficient of future returns of commodities. In VECM, null hypothesis is that there is no long run causality on dependent variables.

Table 4.14 Results Of VECM for Bullion Commodity

	BULLION	
D.V	**GOLD**	**SILVER**
ECT(1)	-0.880537 (0.0000)	-0.834356 (0.0000)
ECT (2)	0.315118 (0.0011)	0.530178 (0.0022)
ECT (3)	0.753162 (0.0000)	1.063167 (0.0006)
C(4)	0.030508 (0.8035)	0.095195 (0.4440)
C(5)	-0.626331 (0.1549)	-1.463632 (0.0444)
C(6)	-0.227602 (0.3965)	0.209881 (0.6399)
C(7)	0.240252 (0.4818)	0.192648 (0.7234)
C(8)	-0.003611 (0.9510)	-0.046585 (0.6210)
C(9)	-0.056719 (0.9781)	-0.285901 (0.9345)
C(10)	0.130916 (0.8776)	1.224744 (0.3750)
C(11)	1.888943 (0.0549)	4.423550 (0.0112)
C(12)	0.139680 (0.6745)	-0.040958 (0.9401)

Source: Authors compilation using E-views12.
( ) p-values

As per the above table 4.14, significant error correction terms in all equation with Gold future returns as dependent variables are (-0.880537),(0.315118) and (0.753162). And error correction terms in all equation with Silver future returns as dependent variables are (-0.834356),(0.530178) and (1.063167) implies that whenever there is disequilibrium, future returns of commodity (Gold and Silver) try to adjust to maintain long term relationship. Here H_0 is rejected and table 4.14, reveals that there is long run causality.

Table 4.15 Results of VECM for Base Metals (ALUMINIUM AND ZINC)

	BASE METALS	
DV	**ALUMINIUM**	**ZINC**
ECT (1)	-1.229796 (0.0000)	-0.768714 (0.0000)
ECT (2)	0.199067 (0.0418)	0.303227 (0.0181)
ECT (3)	0.634494 (0.0339)	-0.051371 (0.040)
ECT (4)	-0.300896 (0.0412)	-0.273363 (0.0440)
C(5)	0.058888 (0.5804)	-0.150620 (0.1500)
C(6)	-0.512785 (0.5180)	-0.030536 (0.9666)
C(7)	-0.080466 (0.8678)	0.129732 (0.7747)
C(8)	-0.461955 (0.3915)	0.802847 (0.1147)
C(9)	-0.126572 (0.2159)	-0.058587 (0.5321)
C(10)	1.382991 (0.7229)	-3.372283 (0.3253)
C(11)	2.039587 (0.2191)	-1.460063 (0.3065)
C(12)	4.179100 (0.0182)	3.105849 (0.0518)
C(13)	-0.015434 (0.9792)	-0.379124 (0.4880)

Source: Authors compilation using E-views12.
( ) p-values

As per the above table 4.15, significant error correction terms in all equation with Aluminium future returns as dependent variables are (-1.229796),(0.199067), (0.634494) and (-0.300896). And error correction terms in all equation with Zinc future returns as dependent variables are (-0.768714),(0.303227) ,(-0.051371) and (-0.273363) implies that whenever there is disequilibrium, future returns of commodity (Aluminium and Zinc) try to adjust to maintain long term relationship. Here H_0 is rejected and table 4.15, reveals that there is long run causality.

Table 4.16 Results of VECM for Base Metals (COPPER AND NICKEL)

	BASE METALS	
D.V	**COPPER**	**NICKEL**
ECT (1)	-1.125798 (0.0000)	-0.647275 (0.0000)
ECT (2)	0.228067 (0.0178)	1.043713 (0.0000)
ECT (3)	0.317211 (0.0127)	0.966105 (0.0007)
C(4)	0.120916 (0.2269)	0.068765 (0.5386)
C(5)	-1.149973 (0.0372)	-2.138563 (0.0101)
C(6)	0.516225 (0.1265)	-0.821128 (0.0956)
C(7)	1.028662 (0.0068)	-0.355302 (0.5271)
C(8)	-0.173017 (0.0165)	-0.241684 (0.0238)
C(9)	2.246514 (0.3939)	-1.419515 (0.7164)
C(10)	-1.944027 (0.0700)	1.500624 (0.3411)
C(11)	3.527863 (0.0029)	6.830257 (0.0004)
C(12)	-0.413183 (0.3198)	0.647341 (0.2986)

Source: Authors compilation using E-views12.
( ) p-values

As per the above table 4.16, significant error correction terms in all equation with Copper future returns as dependent variables are (-1.125798),(0.228067)and (0.317211). And error correction terms in all equation with Nickel future returns as dependent variables are (-0.647275),(1.043713) and (0.966105) implies that whenever there is disequilibrium, future returns of commodity (Copper and Nickel) try to adjust to maintain long term relationship. Here H_0 is rejected and table 4.16, reveals that there is long run causality.

Table 4.17 Results of VECM for Energy

ENERGY COMMODITIES			
DV	**CRUDE OIL**	**DV**	**NATURAL GAS**
ECT (1)	-0.713338 (0.0000)	ECT (1)	-1.068036 (0.0000)
ECT (2)	0.792916 (0.0045)	ECT (2)	0.526052 (0.0290)
ECT (3)	1.021746 (0.0083)	ECT (3)	0.442579 (0.0035)
C(4)	0.120052 (0.2403)	ECT(4)	-0.853741 (0.0057)
C(5)	-0.224242 (0.8406)	C(5)	0.025941 (0.4734)
C(6)	0.746813 (0.3248)	C(6)	-3.847990 (0.0120)
C(7)	0.383626 (0.6063)	C(7)	0.270023 (0.7654)
C(8)	-0.131867 (0.3657)	C(8)	1.556411 (0.1175)
C(9)	-1.982409 (0.7134)	C(9)	0.055154 (0.7749)
C(10)	-0.800124 (0.7152)	C(10)	0.415359 (0.9524)
C(11)	2.845101 (0.2495)	C(11)	3.639167 (0.2089)
C(12)	-1.007764 (0.2327)	C(12)	10.15178 (0.0022)
-	-	C(13)	0.826883 (0.4584)

Source: Authors compilation using E-views12.
( ) p-values

As per the above table 4.17, significant error correction terms in all equation with Crude oil future returns as dependent variables (-0.713338),(0.792916) and(1.021746) and error correction terms in all equation with Natural gas future returns as dependent variables (-1.068036), (0.526052),(0.442579) and (-0.853741) implies that whenever there is disequilibrium, future returns of commodity (Crude oil and Natural gas) try to adjust to maintain long term relationship. Here H_0 is rejected and table 4.17, reveals that there is long run causality.

Table 4.18 Results OF VECM for Agricultural

	AGRICULTURAL
D.V	**MENTHA OIL**
ECT(1)	-0.986069 (0.0000)
ECT(2)	-1.200674 (0.0000)
ECT(3)	1.250027 (0.0001)
C(4)	0.124637 (0.2050)
C(5)	0.257091 (0.7781)
C(6)	-0.360574 (0.4954)
C(7)	0.449945 (0.4453)
C(8)	0.064457 (0.5743)
C(9)	2.448655 (0.5723)
C(10)	-2.127568 (0.2156)
C(11)	3.875934 (0.0423)
C(12)	0.260551 (0.6945)

Source: Authors compilation using E-views12.
( ) p-values

As per the above table 4.18 , significant error correction terms in all equation with Mentha oil future returns as dependent variables (-0.986069),(-1.200674)and (1.250027) implies that whenever there is disequilibrium, future returns of commodity (Mentha oil) try to adjust to maintain long term relationship. Here H_0 is rejected and table 4.18, reveals that there is long run causality.

4.5 GRANGER CAUSALITY TEST

Table 4.19 Result Of Granger Causality Test For Selected Commodities And Macro Economic Variables

Null Hypothesis	No. of obs	F-statistics	Probability
CPI does not Granger cause gold returns	121	0.00697	0.9336
Gold return does not Granger cause CPI		0.07971	0.7782
CLI does not Granger cause gold returns	121	0.79255	0.3751
Gold returns does not Granger cause CLI		0.01663	0.8976
Exchange rate does not Granger cause Gold return	108	4.60672	0.0341 *
Gold return does not Granger cause Exchange Return		15.8418	0.0001 *
Industrial production Index does not Granger cause Gold return	121	1.31613	0.2536
Gold return does not Granger cause Industrial production index		9.07440	0.0032 *
Long term interest rates does not Granger cause Gold return	121	1.70713	0.1939
Gold return does not granger cause long term interest rate		0.01936	0.8896
Short term interest rates does not Granger cause Gold return	121	1.28656	0.2590
Gold return does not Granger cause short term interest rates		0.17808	0.6738
BCI does not Granger cause Gold return	121	1.35387	0.2470
Gold return does not Granger cause BCI		0.75747	0.3859
CPI does not Granger cause Silver returns	121	1.52310	0.2196
Silver return does not Granger cause CPI		2.00115	0.1598
CLI does not Granger cause Silver returns	121	5.12963	0.0253 *
Silver returns does not Granger cause CLI		6.36161	0.0130*
Exchange rate does not Granger cause Silver return	108	4.99020	0.0276*
Silver return does not Granger cause Exchange Return		17.4415	6.E-05
Industrial production Index does not Granger cause Silver return	121	1.92810	0.1676
Silver return does not Granger cause Industrial production index		0.70223	0.4037
Long term interest rates does not Granger cause Silver return	121	3.51700	0.0632
Silver return does not granger cause long term interest rate		1.01777	0.3151
Short term interest rates does not Granger cause Silver return	121	1.84590	0.1769
Silver return does not Granger cause short term interest rates		0.39475	0.5310
BCI does not Granger cause Silver return	121	0.66331	0.4170
Silver return does not Granger cause BCI		1.40213	0.2387
CPI does not Granger cause Aluminium returns	121	0.69488	0.4062
Aluminium return does not Granger cause CPI		0.00055	0.9813
CLI does not Granger cause Aluminium returns	121	0.03528	0.8513
Aluminium returns does not Granger cause CLI		0.16081	0.6891

Exchange rate does not Granger cause Aluminium return	108	0.00538	0.9417
Aluminium return does not Granger cause Exchange Return		0.01709	0.8962
Industrial production Index does not Granger cause Aluminium return	121	0.01424	0.9052
Aluminium return does not Granger cause Industrial production index		0.09317	0.7607
Long term interest rates does not Granger cause Aluminium return	121	3.68056	0.0575
Aluminium return does not granger cause long term interest rate		2.75518	0.0996
Short term interest rates does not Granger cause Aluminium return	121	1.28503	0.2593
Aluminium return does not Granger cause short term interest rates		5.71349	0.0184*
BCI does not Granger cause Aluminium return	121	0.42345	0.5165
Aluminium return does not Granger cause BCI		0.21874	0.6409
CPI does not Granger cause Copper returns	121	1.86346	0.1748
Copper return does not Granger cause CPI		1.95579	0.1646
CLI does not Granger cause Copper returns	121	3.35401	0.0696
Copper returns does not Granger cause CLI		4.36325	0.0389*
Exchange rate does not Granger cause Copper return	108	1.76228	0.1872
Copper return does not Granger cause Exchange Return		2.81542	0.0963
Industrial production Index does not Granger cause Copper return	121	1.66185	0.1999
Copper return does not Granger cause Industrial production index		0.64064	0.4251
Long term interest rates does not Granger cause Copper return	121	9.62285	0.0024*
Copper return does not granger cause long term interest rate		1.06504	0.3042
Short term interest rates does not Granger cause Copper return	121	4.60194	0.0340*
Copper return does not Granger cause short term interest rates		0.00092	0.9758
BCI does not Granger cause Copper return	121	0.00745	0.9314
Copper return does not Granger cause BCI		2.74122	0.1004
CPI does not Granger cause Nickel returns	121	1.10429	0.2955
Nickel return does not Granger cause CPI		2.91836	0.0902
CLI does not Granger cause Nickel returns	121	0.25584	0.6139
Nickel returns does not Granger cause CLI		2.08284	0.1516
Exchange rate does not Granger cause Nickel return	108	0.41701	0.5198
Nickel return does not Granger cause Exchange Return		3.29614	0.0723
Industrial production Index does not Granger cause Nickel return	121	0.34502	0.5581
Nickel return does not Granger cause Industrial production index		3.21313	0.0756
Long term interest rates does not Granger cause Nickel return	121	2.74940	0.0999
Nickel return does not granger cause long term interest rate		3.83101	0.0527
Short term interest rates does not Granger cause Nickel return	121	2.14280	0.1459
Nickel return does not Granger cause short term interest rates		0.19766	0.6574

BCI does not Granger cause Nickel return	121	1.33928	0.2495
Nickel return does not Granger cause BCI		0.48211	0.4888
CPI does not Granger cause Zinc returns	121	0.49356	0.4837
Zinc return does not Granger cause CPI		2.53874	0.1138
CLI does not Granger cause Zinc returns	121	1.75523	0.1878
Zinc returns does not Granger cause CLI		7.59115	0.0068*
Exchange rate does not Granger cause Zinc return	108	0.02389	0.8775
Zinc return does not Granger cause Exchange Return		8.30719	0.0048*
Industrial production Index does not Granger cause Zinc return	121	0.00024	0.9876
Zinc return does not Granger cause Industrial production index		0.19526	0.6594
Long term interest rates does not Granger cause Zinc return	121	3.00896	0.0854
Zinc return does not granger cause long term interest rate		1.42146	0.2356
Short term interest rates does not Granger cause Zinc return	121	1.52995	0.2186
Zinc return does not Granger cause short term interest rates		3.67286	0.0577
BCI does not Granger cause Zinc return	121	0.90165	0.3443
Zinc return does not Granger cause BCI		0.01653	0.8979
CPI does not Granger cause Crude oil returns	121	0.24159	0.6240
Crude oil return does not Granger cause CPI		0.32496	0.5697
CLI does not Granger cause Crude oil returns	121	14.6353	0.0002*
Crude oil returns does not Granger cause CLI		14.2801	0.0002*
Exchange rate does not Granger cause Crude oil return	108	0.02088	0.8854
Crude oil return does not Granger cause Exchange Return		0.04724	0.8284
Industrial production Index does not Granger cause Crude oil return	121	0.00407	0.9493
Crude oil return does not Granger cause Industrial production index		0.04346	0.8352
Long term interest rates does not Granger cause Crude oil return	121	3.08121	0.0818
Crude oil return does not granger cause long term interest rate		11.8569	0.0008*
Short term interest rates does not Granger cause Crude oil return	121	3.91714	0.0501
Crude oil return does not Granger cause short term interest rates		5.34657	0.0225*
BCI does not Granger cause Crude oil return	121	1.50360	0.2226
Crude oil return does not Granger cause BCI		0.16963	0.6812
CPI does not Granger cause Natural Gas returns	121	5.34592	0.0225*
Natural Gas return does not Granger cause CPI		0.14266	0.7063
CLI does not Granger cause Natural Gas returns	121	0.00205	0.9640
Natural Gas returns does not Granger cause CLI		0.18005	0.6721
Exchange rate does not Granger cause Natural Gas return	108	4.23467	0.0421*
Natural Gas return does not Granger cause Exchange Return		0.30514	0.5819
Industrial production Index does not Granger cause Natural Gas return	121	0.56220	0.4549
Natural Gas return does not Granger cause Industrial production index		0.18819	0.6652

Long term interest rates does not Granger cause Natural Gas return	121	1.21178	0.2732
Natural Gas return does not granger cause long term interest rate		0.11558	0.7345
Short term interest rates does not Granger cause Natural Gas return	121	2.33601	0.1291
Natural Gas return does not Granger cause short term interest rates		0.30786	0.5800
BCI does not Granger cause Natural Gas return	121	0.32569	0.5693
Natural Gas return does not Granger cause BCI		0.52571	0.4699
CPI does not Granger cause Mentha Oil returns	121	8.96734	0.0033*
Mentha Oil return does not Granger cause CPI		0.59492	0.4421
CLI does not Granger cause Mentha Oil returns	121	2.35650	0.1274
Mentha Oil returns does not Granger cause CLI		0.37212	0.5430
Exchange rate does not Granger cause Mentha Oil return	108	0.22874	0.6335
Mentha Oil return does not Granger cause Exchange Return		0.45187	0.5029
Industrial production Index does not Granger cause Mentha Oil return	121	0.20935	0.6481
Mentha Oil return does not Granger cause Industrial production index		0.13906	0.7099
Long term interest rates does not Granger cause Mentha Oil return	121	0.67555	0.4128
Mentha Oil return does not granger cause long term interest rate		5.90673	0.0166*
Short term interest rates does not Granger cause Mentha Oil return	121	0.01782	0.8940
Mentha Oil return does not Granger cause short term interest rates		1.14490	0.2868
BCI does not Granger cause Mentha Oil return	121	1.44482	0.2318
Mentha Oil return does not Granger cause BCI		0.11837	0.7314

Source: Authors compilation using E-views12.
(*)p-values

The table 4.19, shows the results of causal relationship for selected commodities and macroeconomic variables. As per the results of null hypothesis, Exchange rates does not Granger cause gold returns and gold returns does not granger cause exchange rates, it rejects the null hypothesis by showing bi-directional causality between the variables. Gold return does not Granger cause IPI, has been rejected showing uni-directional causality between the variables.

CLI does not Granger cause Silver returns and Silver returns does not granger cause CLI, it rejects the null hypothesis by showing bi-directional causality between the variables .Exchange

rate does not Granger cause Silver return , has been rejected by showing uni-directional causality between the variables. Thus, from above results, since exchange rate does granger cause silver returns , it means that exchange rate can predict the impact on the silver returns .

Aluminium return does not Granger cause Short term interest rates, has been rejected showing uni-directional causality between the variables.

Copper return does not Granger cause CLI, has been rejected,showinguni-directional causality between the variables. Long term interest rates and short term interest rates does not Granger cause copper return,resulting unidirectional causality.Thus, from above results, since long term interest rates and short term interest rates does granger cause silver returns , it means that Long term interest rates and short term interest rates can predict the impact on the copper returns

Zinc return does not Granger cause CLI and exchange rates, has been rejected showing uni-directional causality between the variables.

CLI does not Granger cause crude oil returns and crude oil returns does not granger cause CLI, it rejects the null hypothesis by showing bi-directional causality between the variables. Crude oil does not Granger cause Long term interest rates and short term interest rates, has been rejected,showing uni-directional causality between the variables.

CPI and exchange rates does not Granger cause Natural gas return, has been rejected,showing uni-directional causality between the variables.Thus, from above results, since CPI and exchange rates does granger cause natural gas returns, it means that CPI and exchange rates can predict the impact on the Natural Gas returns.

CPI does not Granger cause Mentha oil returns, has been rejected showing uni-directional causality between the variables . Thus, from above results, since CPI does granger cause Mentha oil returns , it means that CPI can predict the impact on the Mentha oil returns. Also mentha oil does not granger cause long term interest rates has been rejected showing uni-directional causality between the variables.

4.6 CORRELATION MATRIX

Table 4.20 Correlation Matrix Of Macro Economic Variables And Selected Commodities

	Gold	Silver	Aluminium	Copper	Nickel	Zinc	Crude oil	Natural Gas	Mentha Oil
CPI	0.006	-0.078	-0.090	-0.170	-0.100	-0.065	-0.019	-0.242	-0.200
CLI	-0.086	-0.107	0.006	-0.099	-0.033	-0.041	-0136	0.033	0.161
BCI	-0.092	-0.038	0.028	0.017	0.139	0.118	0.096	0.107	0.134
Exchange rate	0.246	0.256	0.032	0.162	0.099	0.034	0.063	0.179	0.044
IPI	0.105	0.166	-0.019	0.055	0.113	-0.006	0.036	0.095	0.047
LTIR	-0.110	-0.187	-0.137	-0.290	-0.150	-0.142	-0.214	-0.084	-0.039
STIR	-0.059	-0.119	-0.097	-0.183	-0.097	-0.107	-0.206	-0.136	-0.011

Source: Authors compilation using E-views12.

As per the above table 4.20,CPI, exchange rates and IPI have a positive correlation with Gold returns. Since its close to positive one, means if CPI, exchange rates and IPI increases, Gold return will also increase and vice versa.CLI ,BCI LTIR and STIR have negative correlation with Gold returns , means if gold returns increases, CLI ,BCI, LTIR and STIR will decreases and vice versa. Exchange rates and IPI have a positive correlation with Silver returns . Since its close to positive one, means if Exchange rates and IPI increases , Silver returns will also increase and vice versa. CPI, CLI, BCI, LTIR AND STIR have negative correlation with Silver returns, means if silver returns increases, CLI, BCI, LTIR AND STIR will decrease and vice versa.

CLI, BCI and exchange rates have a positive correlation with aluminium returns since its close to positive one, means if CLI, BCI and exchange rates increases ,aluminium returns will also increase and vice versa. CPI, IPI, LTIR and STIR have a negative correlation with aluminium returns , means if aluminium returns increases, CPI, IPI, LTIR and STIR will decrease and vice versa.

BCI , IPI and exchange rates have a positive correlation with copper, nickel and crude oil returns since its close to positive one, means if BCI , IPI and exchange rates increases, copper, nickel and crude oil returns will also increase and vice versa. CPI ,CLI ,LTIR and STIR have a negative correlation with copper, nickel and crude oil returns, means if copper ,nickel and crude oil returns increases, CPI ,CLI ,LTIR and STIR will decrease and vice versa.

BCI and exchange rates have a positive correlation with zinc returns since its close to positive one, means if BCI and exchange rates increases , zinc returns will also increase and vice versa. CPI, CLI, IPI ,LTIR and STIR have a negative correlation with zinc returns, means if zinc returns increases, CPI ,CLI, IPI, LTIR and STIR will decrease and vice versa.

CLI ,BCI, exchange rates and IPI have a positive correlation with natural gas and Mentha oil returns since its close to positive one, means if CLI ,BCI, exchange rates and IPI increases , natural gas and mentha oil returns will also increase and vice versa. CPI ,LTIR and STIR have a negative correlation with natural gas and mentha oil returns, means if natural gas and Mentha oil returns increases, CPI ,LTIR and STIR will decrease and vice versa.

4.7 MULTIPLE REGRESSION

Table 4.21 Results Of Multiple Regression On Commodities Future Returns

Dependent variables	Independent Variables	Coefficients	Prob*	R-squared	Adj R2	Durbin Watson Statistics
Gold	C	10.6162	0.4962	0.1543	0.0990	1.7353
	CPI	0.0163	0.9093			
	CLI	0.0387	0.7953			
	BCI	-0.2735	0.0674			
	Exchange rate	0.3034	0.0002*			
	IIP	-0.0446	0.2303			
	LTIR	-1.1863	0.1941			
	STIR	0.8921	0.0402 *			
Silver	C	12.7627	0.6358	0.1306	0.0737	1.5484
	CPI	-0.0539	0.8273			
	CLI	-0.0506	0.8444			
	BCI	-0.2050	0.4247			
	Exchange rate	0.3881	0.0044*			
	IIP	-0.0251	0.6946			
	LTIR	-2.8948	0.0678			
	STIR	1.6355	0.0298*			
Aluminium	C	4.6333	0.8833	0.0333	-0.0298	2.2926
	CPI	-0.1212	0.6758			
	CLI	0.1001	0.7475			
	BCI	0.0643	0.8358			
	Exchange rate	-0.0087	0.9553			

	IIP	-0.0526	0.4832			
	LTIR	-2.2736	0.2188			
	STIR	0.4906	0.5739			
Copper	C	18.3349	0.4330	0.1391	0.0828	1.7436
	CPI	-0.1644	0.4439			
	CLI	-0.0616	0.7829			
	BCI	0.0705	0.7511			
	Exchange rate	0.1451	0.2129			
	IIP	-0.0633	0.2554			
	LTIR	-4.1137	0.0031*			
	STIR	1.4524	0.0261*			
Nickel	C	-27.6872	0.3763	0.0771	0.0168	1.4384
	CPI	0.0417	0.8844			
	CLI	-0.2097	0.4839			
	BCI	0.6381	0.0338*			
	Exchange rate	-0.0630	0.6849			
	IIP	0.0719	0.3340			
	LTIR	-3.5612	0.0530			
	STIR	1.3149	0.1298			
Zinc	C	-5.3486	0.8546	0.0566	-0.0050	1.8971
	CPI	0.0594	0.8245			
	CLI	-0.2104	0.4522			
	BCI	0.5058	0.0708			
	Exchange rate	-0.1141	0.4318			
	IIP	-0.0059	0.9315			

	LTIR	-2.4799	0.1474			
	STIR	0.5143	0.5239			
Crude oil	C	29.2485	0.5674	0.1066	0.0481	1.2271
	CPI	0.5074	0.2811			
	CLI	-0.8365	0.0898			
	BCI	0.9892	0.0441*			
	Exchange rate	-0.4117	0.1072			
	IIP	0.0532	0.6615			
	LTIR	-2.5325	0.3969			
	STIR	-0.8735	0.5366			
Natural Gas	C	-15.1889	0.9217	0.0857	0.0259	2.3294
	CPI	-3.3392	0.0187*			
	CLI	0.0182	0.9900			
	BCI	-0.6337	0.6628			
	Exchange rate	0.0837	0.2454			
	IIP	-0.1744	0.6309			
	LTIR	9.4624	0.2894			
	STIR	-2.7373	0.5166			
Mentha Oil	C	-58.4274	0.0970	0.0798	0.0196	1.8683
	CPI	-0.5339	0.0987			
	CLI	0.4460	0.1850			
	BCI	0.2255	0.4988			
	Exchange rate	0.0376	0.8285			
	IIP	0.0098	0.9055			
	LTIR	-2.3397	0.2533			

	STIR	1.2964	0.1816			

Source :Authors compilation using E-views12

H_{0-} There is no impact of macroeconomic variables on selected commodities.

From the above table 4.21, of analysis , multiple regression has been used .

Gold returns- In consideration of probability value we can interpret that exchange rates (0.0002) and short term interest rates(0.0402) rejects the null hypothesis since it is less than 0.05. Thus, it shows that exchange rates and short term interest rates have an impact on gold returns.

Silver return -In consideration of probability value we can interpret that exchange rates (0.0044) and short term interest rates (0.0298) rejects the null hypothesis since it is less than 0.05. Thus, it shows that exchange rates and short term interest rates have an impact on Silver returns.

Copper returns -In consideration of probability value we can interpret that long term interest rates (0.0031) and short term interest rates (0.0261) rejects the null hypothesis since it is less than 0.05 . Thus, it shows that long term interest rates and short term interest rates have an impact on copper returns.

Nickel returns- In consideration of probability value we can interpret that BCI (0.0338) rejects the null hypothesis ,since the value is less than 0.05. Thus, it shows that BCI have an impact on Nickel returns.

Crude oil returns- In consideration of probability value we can interpret that BCI (0.0441) rejects the null hypothesis ,since the value is less than 0.05. Thus, it shows that BCI have an impact on Crude oil returns.

Natural Gas returns- In consideration of probability value we can interpret that CPI rejects the null hypothesis ,since the value is less than 0.05. Thus, it shows that CPI have an impact on Natural gas returns.

In consideration of probability value we can interpret that , there is no impact of macroeconomic variables on zinc, aluminium and mentha oil return .Thus, it concludes that it accepts the null hypothesis.

4.8 SUMMARY

The selected commodities—copper, nickel, zinc, aluminium ,mentha oil, crude oil, natural gas, gold, silver have a major impact on the development and prosperity of the Indian economy in a number of different areas. The commodities market is volatile due to a number of variables that affect the economy and its growth. Thus, studying how macroeconomic factors affect commodity market prices is necessary for understanding the uneven impacts of price fluctuations.

To determine and provide statistical proof for whether or not certain macroeconomic conditions have an influence on the future returns of particular commodities. The MCX official website was used to gather daily closing price data for a sample of nine commodities from January 2013 to February 2023. The data was converted into monthly data for sample of seven macroeconomic indicators that were collected from the RBI, OECD, and X-RATES.

For research purpose the impact of macroeconomic variables, earlier stock markets was the only areas for research. Later on it shifted to commodity market. Several research were mainly focusing individually on crude oil, gold, agricultural commodities, metal, energy for analysis. The period of study and some additional impact of macroeconomic variables on commodity market is a major research gap for recent study. Literature review on impact of macroeconomic variables documented in chapter 2. To fill the research gap, the study uses 9 commodities from different sectors and 7 macroeconomic variables to check impact of macroeconomic variables on commodity market, to statistically test the relationship between the commodity market and macroeconomic variable, the following econometric tools were used, they are as follows: descriptive statistics, unit root (ADF) tests, Johansen's co-integration test, VECM, multiple correlation and regression model is used. The results of this methodology are interpreted in Chapter 4.

4.9 FINDINGS

DESCRIPTIVE STATISTICS OF SELECTED COMMODITIES

- Among the commodities examined, zinc and nickel have the highest mean returns, while silver and crude oil have the lowest mean returns. Gold, Silver, Zinc, Aluminium, and Natural Gas all have lower volatility levels than Natural Gas, which has the highest volatility. According to skewness study, gold, silver, aluminium, nickel, and mentha oil show positive skewness, whereas natural gas, crude oil, zinc, and copper show negative skewness. Every commodity included in the analysis exhibits a leptokurtic distribution. The majority of commodities, with the exception of zinc, have distributions that differ from normal, according to normality testing. Moreover, all commodities have distributions that are statistically different from normal at a 5% significance level, according to Jarque Bera Statistics, with the exception of zinc.

DESCRIPTIVE STATISTICS OF SELECTED MACROECONOMIC VARIABLES

- All macroeconomic indicators have positive mean values; the IPI, CLI, and BCI have the highest averages. Long-term interest rates have the lowest standard deviation from the mean, but exchange rates, IPI, BCI, CPI, and CLI all have bigger variances, which suggests increased volatility. According to skewness study, long-term interest rates, exchange rates, BCI, CPI, and short-term interest rates are favourably skewed, whereas CLI, IPI, and short-term interest rates are negatively skewed. Additionally, the kurtosis values show that every variable aside from exchange rates, long-term interest rates, and short-term interest rates is platykurtic (below 3) and leptokurtic (above 3). Most variables appear to have p-values below 0.05, indicating statistical significance, according to the Jarque-Bera statistics. Exchange rates, long-term

interest rates, and short-term interest rates, on the other hand, have p-values higher than 0.05, which suggests that they are not statistically significant.

STATIONARITY

- Gold, silver, aluminium, copper, nickel, zinc, natural gas, crude oil, and mentha oil are among the commodities whose ADF values are found to be at level and steady.
- The Consumer Price Index (CPI), Composite Economic Leading Indicator (CLI), Business Confidence Index (BCI), Exchange rates, Industrial Production Index, Long-Term Interest Rates, and Short-Term Interest Rates are the seven macroeconomic variables that the ADF results for as independent variables of the study, we check all macroeconomic variables at first difference I(1) because the results show that only three macroeconomic variables the consumer price index (CPI), the composite leading economic indicator (CLI), and the industrial production index (IPI) are stationary at the level. The p-value is less than 0.05 based on the first difference's ADF test findings .As a result, the null hypothesis that the chosen variables have a unit root is rejected.

COINTERGRATION

- **Gold**- The cointegration test reveals that there is Atmost 2 cointegrating long run equilibrium relationship between future returns of commodity and macroeconomic variables. The presence of Atmost 1and Atmost 2 cointegrating vector confirms that both the gold future market and macroeconomic variables tend to move together in long run and any shocks which affects the equilibrium gets corrected over time.
- **Silver**- The cointegration test reveals that there is Atmost 2 cointegrating long run equilibrium relationship between future returns of commodity and macroeconomic variables. The presence of Atmost 1and Atmost 2 cointegrating vector confirms that both the silver future market and

macroeconomic variables tend to move together in long run and any shocks which affects the equilibrium gets corrected over time.

- **Aluminium**- The cointegration test reveals that there is Atmost 3 cointegrating long run equilibrium relationship between future returns of commodity and macroeconomic variables. The presence of Atmost 1, Atmost 2 and Atmost 3 cointegrating vector confirms that both the aluminium future market and macroeconomic variables tend to move together in long run and any shocks which affects the equilibrium gets corrected over time.
- **Copper**- The cointegration test reveals that there is Atmost 2 cointegrating long run equilibrium relationship between future returns of commodity and macroeconomic variables.The presence of Atmost 1, Atmost 2 cointegrating vector confirms that both the copper future market and macroeconomic variables tend to move together in long run and any shocks which affects the equilibrium gets corrected over time.
- **Nickel**- The cointegration test reveals that there is Atmost 2 cointegrating long run equilibrium relationship between future returns of commodity and macroeconomic variables. The presence of Atmost 1, Atmost 2 cointegrating vector confirms that both the nickel future market and macroeconomic variables tend to move together in long run and any shocks which affects the equilibrium gets corrected over time.
- **Zinc**- The cointegration test reveals that there is Atmost 3 cointegrating long run equilibrium relationship between future returns of commodity and macroeconomic variables. The presence of Atmost 1, Atmost 2 and Atmost 3 cointegrating vector confirms that both the Zinc future market and macroeconomic variables tend to move together in long run and any shocks which affects the equilibrium gets corrected over time.

- **Crude Oil**- The cointegration test reveals that there is Atmost 2 cointegrating long run equilibrium relationship between future returns of commodity and macroeconomic variables. The presence of Atmost1 and Atmost 2 cointegrating vector confirms that both the crude oil future market and macroeconomic variables tend to move together in long run and any shocks which affects the equilibrium gets corrected over time.
- **Natural Gas**- The cointegration test reveals that there is Atmost 2 cointegrating long run equilibrium relationship between future returns of commodity and macroeconomic variables. The presence of Atmost 1, Atmost 2 and Atmost 3 cointegrating vector confirms that both the natural gas future market and macroeconomic variables tend to move together in long run and any shocks which affects the equilibrium gets corrected over time.
- **Mentha Oil**- The cointegration test reveals that there is Atmost 2 cointegrating long run equilibrium relationship between future returns of commodity and macroeconomic variables. The presence of Atmost 1and Atmost 2 cointegrating vector confirms that both the menthe oil future market and macroeconomic variables tend to move together in long run and any shocks which affects the equilibrium gets corrected over time.

VECTOR ERROR CORRECTION MODEL

- The significant error correction terms with respect to all selected commodities as dependent variables, implies that there is disequilibrium and future returns of selected commodities try to adjust to maintain long run relationship. This reveals that there is long run causality between the selected commodities and macro-economic variables.

GRANGER CAUSALITY TEST

- Exchange rates does not granger cause gold and gold does not granger cause Exchange rates,it shows bi-directional causality among the variables.
- CLI does not granger cause silver and silver does not granger cause CLI , it shows bi-directional causality among the variables.
- CLI does not granger cause crude oil and crude oil does not granger cause CLI, it shows bi-directional causality among the variables.

IMPACT OF MACROECONOMIC VARIABLES ON SELECTED COMMODITIES

- On Gold returns, it shows that exchange rates and short-term interest rates have an impact.
- On Silver returns, it shows that exchange rates and short-term interest rates have an impact.
- On Copper returns, it shows that short term interest rates and long-term interest rates have an impact.
- On Nickel and crude oil returns, it shows that BCI have an impact.
- On Natural Gas returns, it shows that CPI have an impact.
- There is no impact of macroeconomic variables on Zinc, Aluminium and Mentha oil returns.

4.10 LIMITATIONS

- High frequency data may be used that provides useful results to check the impact of macroeconomic variables on commodities.
- A study can be done for other macroeconomic variables which are not considered in this study.
- Commodity trading research can be done by taking country-wise .

- A Comparative study on impact of macroeconomic and microeconomic variables on commodities and by choosing best model according to AIC and SIC values that is not considered in this research.

4.11 CONCLUSION

In this study an attempt has been made to investigate how selected commodities of MCX and selected macroeconomic variables interact as well as how macroeconomic variables affects the commodity future returns. The monthly data of selected commodities, which are traded regularly and macroeconomic variables from January 2013 to February 2023 were taken for the study. In this research , an attempt has made to check and understand the relationship among the selected MCX commodities and macroeconomic variables as well as impact of macroeconomic variables on commodities..The unit root test, cointegration test and VAR/ VECM were employed for finding relationship,followed by factors affecting the commodities were proved by Granger causality test .The findings of the study reported that except three commodities that is Zinc,Aluminium and Mentha oil does not show any impact of macroeconomic variables on them . This information will help the investors to take performed decision before investing in particular commodities, also notify them about the indication of various macroeconomic variables on the commodities.

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