

EXPLORING THE CORRELATION BETWEEN ECONOMIC INDICATORS: GOLD PRICES, OIL PRICES, AND THE INDIAN RUPEE, AND THE INDIAN COMMODITY MARKET

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Abstract: A commodity market deals in primary products, unlike markets trading in manufactured goods. Soft commodities include agricultural products like wheat, coffee, cocoa, and sugar, while hard commodities involve mined resources such as gold, rubber, and oil. These markets engage in both physical and derivatives trading, using spot prices, forwards, futures, and options on futures. While oil is often blamed for market volatility, other commodities like corn and gold also impact daily stock prices, though empirical evidence, particularly in non-Western markets, is limited. This paper examines the impact of changes in commodity prices—specifically gold, crude oil, and the Indian rupee—on the commodity index and analyzes their connection to the broader Indian economy. The study finds minimal impact of gold, crude oil, and the Indian rupee on the commodity market index, despite oil's reputation for volatility. The Johansen Co-Integration Rank Test supports these findings.

Keywords: ADF, ASM, Commodity, Probability, Eigenvalue.

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1. INTRODUCTION

A commodity market is a market that trades in primary rather than manufactured products. Soft commodities are agricultural products such as wheat, coffee, cocoa and sugar. Hard commodities are mined, such as gold, rubber and oil. Commodity markets can include physical trading and derivatives trading using spot prices, forwards, futures, and options on futures. Farmers have used a simple form of derivative trading in the commodity market for centuries for price risk management. The modern commodity derivatives exchanges offer state-of-the-art facilities like online trading, clearing and settlement of futures transactions and the existence of a settlement guarantee fund assures prudent risk management practices by the exchanges, thereby providing an investor a completely monitored trading platform. Commodity traders and investors are in the absence of counterparty risk. This thus makes the overall procedure of commodity futures trading simpler than expected.

The Economy of India is the seventh-largest in the world by nominal GDP and the third-largest by purchasing power parity (PPP). The country is one of the G-20 major economies, a member of BRICS and a developing economy among the top 20 global traders according to the WTO. India was the 19th-largest merchandise and the 6th largest services exporter in the world in 2013; it imported a total of \$616.7 billion worth of merchandise and services in 2013, as the 12th-largest merchandise and 7th largest services importer.

The world consumption of new gold produced is about 50% in jewellery, 40% in investments, and 10% in industry. It's easy to trade. We find gold bars to buy, but also to sell. Some special coins for example are not always easy to sell. The premiums we pay on gold bars are in general lower than on gold coins. So in general we are paying almost the same price for a gold bar as the spot price of gold increased with a low premium. Gold bars are a form of physical gold, meaning we don't carry any counterparty risk. Whatever happens with the economy, stock market, or debt crisis, our gold will not be affected; it will remain ours.

Heavy crude oils provide an interesting situation for the economics of petroleum development. The resources of heavy oil in the world are more than twice those of conventional light crude oil. High Energy Density, Easy Availability, Infrastructure for Transport and Use, Crucial for wide variety

of Industries, Easy to Produce and Refine, Constant Power Source and Reliability.

The Indian rupee is the official currency of the Republic of India. The issuance of the currency is controlled by the Reserve Bank of India. India imports key inputs like oil which is the fuel for its growth. Rising imports will increase the current account deficit. This paper is primary concerns with how the price movement in the gold price, curd oil price and Indian rupee will affect commodity market.

2. OBJECTIVES OF THE STUDY

- To study relationship between commodity market and Indian economy with reference to gold, crude oil, Indian rupee.
- To analyse the overall relationship between commodity market and the Indian economy.

3. REVIEW OF LITERATURE

Niels Fold *et al.* (2014) has investigated recent decades, artisanal and small-scale mining (ASM) in Africa has increased tremendously. An unknown but significant part is constituted by activities that are not based on legally registered mining licenses. The division of formal and informal ASM is, however, dissolved in the marketing chain where trading channels are intertwined: traders buy from miners with and without a license. So far state institutions and civil society organizations have endeavored to ‘formalize’ the informal sector by focusing on relatively isolated entry points in the ASM chain from production to consumption. This paper argues that future research and design of policy mechanisms needs to focus on the inter-linkages of actors and material flows within the complex intertwinement of the formal and informal ASM sectors. Our point of departure is the findings on interlocked markets within the literature on rural dependency relations, barriers for poverty eradication and agricultural development. The paper outlines the previous debate on formalization and maps out the territorial and organizational configuration of the present ASM gold chain in Tanzania and Ghana. On this basis we maintain that state action is inevitable and suggest possible institutional mechanisms to set up incentives for possible formalization pathways for African ASM gold chains.”

Michael Souček (2013) unique in its investigation of the co-movements between trading activity on the equity, crude oil, and gold futures market, proxies by open interest. It provides empirical evidence that stock and crude oil futures demand for hedging is positively related, but reacts negatively to sudden shocks in open interest on the other market. Furthermore, gold futures open interest reacts positively to shocks in the crude oil futures trading activity. The level of instantaneous linkage is related to external market conditions. During periods of unstable financial markets, the correlation between equity and energy futures open interest decreases, and the correlation of the open interest on the equity and gold futures market turns weak negative. This indicates hedging funds allocation toward gold market in periods of stock market uncertainty.

Juan C. Reboredo (2013) assesses the role of gold as a hedge or safe haven against oil price movements. We use an approach based on copulas to analyse the dependence structure between these two markets. Empirical evidence for weekly data from January 2000 to September 2011 revealed the following: (a) there is positive and significant average dependence between gold and oil, which would indicate that gold cannot hedge against oil price movements; and (b) there is tail independence between the two markets, indicating that gold can act as an effective safe haven against extreme oil price movements. These results are useful for both portfolio risk managers and designers of policies aimed at using gold to preserve or stabilise oil exporter purchasing power.

Bradley T. Ewinga & Farooq Malik (2013) employs univariate and bivariate GARCH models to examine the volatility of gold and oil futures incorporating structural breaks using daily returns from July 1, 1993 to June 30, 2010. We find strong evidence of significant transmission of volatility between gold and oil returns when structural breaks in variance are accounted for in the model. We compute optimal portfolio weights and dynamic risk minimizing hedge ratios to highlight the significance of our empirical results. Our findings support the idea of cross-market hedging and sharing of common information by financial market participants.

3. RESEARCH METHODOLOGY

This research is based on quantity method of data collection. Data were obtained from open source for the period between 2009–2014. In statistics

and econometrics, an augmented Dickey–Fuller test (ADF) is a test for a unit root in a time series sample. It is an augmented version of the Dickey–Fuller test for a larger and more complicated set of time series models. The Johansen test is a test for co-integration that allows for more than one co-integrating relationship, unlike the Engle–Granger method, but this test is subject to asymptotic properties, i.e. large samples.

4. STATEMENT OF THE PROBLEM

When it comes to commodities and the stock market, investors are quick to blame oil for causing market volatility. While this is the case more often than not, other commodities such as corn and gold have a tremendous impact on daily stock prices. Global commodities are typically broken down into a variety of basic headers; energy, metals, agriculture, meat & livestock, and softs. Energy, as we know, is the most heavily scrutinized assets and include oil and natural gas. Metals, on the other hand, track our most precious assets, gold and silver. Agriculture, meats, and softs observe corn, coffee and live cattle, just to name a few. Since commodities are key inputs in many goods, they have a profound impact on the earnings of public companies which produce them.

“As the price of oil has dropped, gold, on the other hand, has experienced its highest price level since August 2014 as many investors have sought to invest in the market to park their capital. With the Euro falling to an 11 year low as a result of a number of factors including the Swiss National Bank’s decision to decouple from the Euro and the European Central Bank’s quantitative easing measures, gold has risen very quickly.” There is various study landscape the rise and fall in price of Oil commodity and rupee price would affect the commodity quickly same reflects in the economy of any counties. Most of the western countries has done lot of research on that, whereas few study only taken place in non-western countries. Hence there is an attempt to made to study to measure how come the price volatility of selected economic indicators would affect the commodity market in India.

5. ANALYSIS AND DISCUSSION

The results of ADF Test with regard to the Indian rupees for the period of 2013 are presented in the Tables 1 and 2. According to above the statistical value

for the Augmented Dickey-Fuller (ADF) value was -1.234 and its probability was 0.609. The test critical values were -4.4206 at 1% level, -3.25981 at 5% level and -2.77113 at 10% level. It is to be noted that the calculated statistical value (-1.234) was higher than the critical value (-4.4206) at 1% level, (-3.25981) at 5% level and (-2.77113) at 10% level. It is clear that the ADF Test provided the evidence of stationary in respect of Indian rupee.

Table 1: Descriptive Statistics on Indian Rupees for the Period of 2014

S. No.	Statistics	Value
1	Mean	0.001756
2	Median	0.00687
3	Maximum	0.023463
4	Minimum	-0.028805
5	Std. Dev.	0.016076
6	Skewness	-0.575486
7	Kurtosis	2.146431
8	Jarque-Bera	1.026659
9	Probability	0.5985
10	Sum	0.021069
11	Sum Sq. Dev.	0.002843
12	Observations	12

Table 2: Augmented Dickey-Fuller Test Statistic

	<i>t-Statistic</i>	<i>Prob.*</i>
Augmented Dickey-Fuller test statistic	-1.234	0.609
Test critical values		
1% level	-4.4206	
5% level	-3.25981	
10% level	-2.77113	

*MacKinnon (1996) one-sided p-values

Table 3: Augmented Dickey-Fuller Test Statistic

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-6.85174	0.0005
Test critical values		
1% level	-4.4206	
5% level	-3.25981	
10% level	-2.77113	

*MacKinnon (1996) one-sided p-values

Table 4: Descriptive Statistics on Gold Price for the Period of 2014

S. No.	Statistics	Value
1	Mean	-0.00459
2	Median	0.003955
3	Maximum	0.036591
4	Minimum	-0.07007
5	Std. Dev.	0.035905
6	Skewness	-0.457
7	Kurtosis	1.968394
8	Jarque-Bera	0.94981
9	Probability	0.621944
10	Sum	-0.05502
11	Sum Sq. Dev.	0.014181
12	Observations	12

Table 5: Augmented Dickey-Fuller Test Statistic

	<i>t</i> -Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.18387	0.0102
Test critical values		
1% level	-4.20006	
5% level	-3.17535	
10% level	-2.72899	

*MacKinnon (1996) one-sided p-values

Table 6: Descriptive Statistics on Crude Oil Price for the Period of 2014

S. No.	Statistics	Value
1	Mean	-0.0457
2	Median	-0.02812
3	Maximum	0.037832
4	Minimum	-0.19976
5	Std. Dev.	0.075248
6	Skewness	-0.84929
7	Kurtosis	2.55842
8	Jarque-Bera	1.54009
9	Probability	0.462992
10	Sum	-0.54841
11	Sum Sq. Dev.	0.062285
12	Observations	12

The results of ADF Test with regard to the Indian rupees for the period of 2013 are presented in the Table 3. According to above the statistical value for the Augmented Dickey-Fuller (ADF) value was -6.85174 and its probability was 0.0005. The test critical values were -4.4206 at 1% level, -3.25981 at 5% level and -2.77113 at 10% level. It is to be noted that the calculated statistical value (-6.85174) was lesser than the critical value (-4.4206) at 1% level, (-3.25981) at 5% level and (-2.77113) at 10% level. It is clear that the ADF Test provided the evidence of stationary in respect of Indian rupee.

The results of ADF Test with regard to the Gold price for the period of 2014 are presented in the Tables 4 and 5. According to above the statistical value for the Augmented Dickey-Fuller (ADF) value was -4.18387 and its probability was 0.0102. The test critical values were -4.20006 at 1% level, -3.17535 at 5% level and -2.72899 at 10% level. It is to be noted that the calculated statistical value (-4.18387) was higher than the critical value (-4.20006) at 1% level, lesser than the (-4.18387) at 5% level and (-2.72899) at 10% level. It is clear that the ADF Test provided the evidence of stationary in respect of Gold price.

Table 7: Augmented Dickey-Fuller Test Statistic

	<i>t-Statistic</i>	<i>Prob.*</i>
Augmented Dickey-Fuller test statistic	1.735152	0.9981
Test critical values		
1% level	-4.4206	
5% level	-3.25981	
10% level	-2.77113	

*MacKinnon (1996) one-sided p-values

Table 8: Augmented Dickey-Fuller Test Statistic

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.9022	0.0179
Test critical values		
1% level	-4.29707	
5% level	-3.2127	
10% level	-2.74768	

*MacKinnon (1996) one-sided p-values

The results of ADF Test with regard to the Crude oil price for the period of 2014 are presented in the Tables 6 and 7. According to above the statistical value for the Augmented Dickey-Fuller (ADF) value was -1.735152 and its

probability was 0.9981. The test critical values were -4.4206 at 1% level, -3.25981 at 5% level and -2.77113 at 10% level. It is to be noted that the calculated statistical value (-1.735152) was higher than the critical value (-4.4206) at 1% level, lesser than the (-3.25981) at 5% level and (-2.77113) at 10% level. It is clear that the ADF Test provided the evidence of stationary in respect of Crude oil price.

The results of ADF Test with regard to the Crude oil price for the period of 2014 are presented in the Table 8. According to above the statistical value for the Augmented Dickey-Fuller (ADF) value was -3.9022 and its probability was 0.179. The test critical values were -4.29707 at 1% level, -3.2127 at 5% level and -2.74768 at 10% level. It is to be noted that the calculated statistical value (-3.9022) was higher than the critical value (-4.29707) at 1% level, lesser than the (-3.2127) at 5% level and (-2.74768) at 10% level. It is clear that the ADF Test provided the evidence of stationary in respect of Crude oil price.

The both test results shows that Trace value is 0.55, Eigen value is 0.55 and Critical value for the both cases are 3.84. P value is more than 0.05 ($P > 0.05$) which indicates that there is no significant relationship between stationary and non-stationary variables. Hence co integration exists between tested variable. Therefore, research hypothesis rejected and null hypothesis is accepted (Table 9).

Table 9: Johansen Co-Integration Rank Test for Indian Rupee

Unrestricted Co-integration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None*	0.246191	2.826168	3.841466	0.0927
Unrestricted Co-integration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None*	0.246191	2.826168	3.841466	0.0927

Trace test indicates no co-integration at the 0.05 level

Max-Eigenvalue test indicates no co-integration at the 0.05 level

*denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

The both test results shows that Trace value is 0.55, Eigen value is 0.55 and Critical value for the both cases are 3.84. P value is less than 0.05 ($P < 0.05$)

which indicates that there is significant relationship between stationary and non-stationary variables. Hence co integration exists between tested variable. Therefore, research hypothesis accepted and null hypothesis is rejected (Table 10).

Table 10: Johansen Co-Integration Rank Test for Gold Price

Unrestricted Co-integration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None*	0.569318	8.423864	3.841466	0.0037
Unrestricted Co-integration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None*	0.569318	8.423864	3.841466	0.0037

Trace test indicates 1 co-integration(s) at the 0.05 level
Max-Eigenvalue test indicates 1 co-integration(s) at the 0.05 level
*denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

The both test results shows that Trace value is 0.55, Eigen value is 0.55 and Critical value for the both cases are 3.84. P value is more than 0.05 ($P>0.05$) which indicates that there is no significant relationship between stationary and non-stationary variables. Hence co-integration exists between tested variable. Therefore, research hypothesis rejected and null hypothesis is accepted (Table 11).

Table 11: Johansen Co-Integration Rank Test for Crude Oil Price

Unrestricted Co-integration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None*	0.007381	0.074082	3.841466	0.7855
Unrestricted Co-integration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None*	0.007381	0.074082	3.841466	0.7855

Trace test indicates no co integration at the 0.05 level
Max-eigenvalue test indicates no co-integration at the 0.05 level
*denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

6. CONCLUSIONS

The results show that in the year 2012 there is a minor level of increases and decreases in Indian rupee value however in the month of July the highest Indian rupee value 125.7. The lowest value 88.6 in the month March 2010 were affected the market. With regards to Gold price value however in the month of August the highest Gold price value 145.1. The lowest value 84.9 in the month August 2014 which case the commodity volatility in the same period. In Crude oil price value however in the month of January the highest Crude oil price value 164.1. The lowest value 55.0 in the month December 2014 has closely shacked the commodity market. The results indicate that there should be a close relationship among the studied economic indicate with commodity market. The increases and decrease of one indicator will effects the increase and decrease in the commodity market, this is evident form the Johansen Co-Integration Rank Test for Gold, Curd oil and Indian rupee with Commodity index.

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