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Identifying the relationship between the gold price, crude oil price and stock market index with reference to India

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Abstract:
Purpose
This study aims to investigate the trend of historical prices of Crude oil, gold and Nifty points. Further, this study aims to identify the relationship amongst the three variables and attempts to establish the estimating model using Nifty points and crude oil prices as independent variables creating significant impact on prices of Gold.
Design/methodology/approach
This research explores the relationship amongst gold prices and Nifty and crude oil prices in India, focusing on their dynamic interaction over time. Using historical data for the period of 11 years ranging from 2013 to 2023, and statistical methods such as correlation analysis, this study examines how the changes in gold prices correlate with the fluctuations in major stock indices like the NIFTY 50. The study uses the ADF test for the presence of unit root, Johansen cointegration test for estimating the cointegration among the variables. The study employed the correlation tests to identify pair wise relationship among the variables. The study also conducted tests for multiple regression and tried to predict the impact of Nifty index points and crude oil on the prices of gold.
Findings
The results revealed that the trend of the data collected for all the variables was stationary. There does not exist any co-integration in all the three variables in long run. While pair wise correlation coefficients indicate significant positive relationship between gold prices and Nifty and weak correlation among gold price and crude oil.
Research limitations/implications
The scope of this study is limited focusing on the two major macro-economic variables like Crude oil and capital market represented by Nifty. The researchers can explore the scope by covering other variables like GDP, exchange rates, etc.
Originality/value
This study is entirely original and provides a comprehensive analysis of the relationship between crude oil prices and the Indian stock market, with gold prices and a specific focus is done on examining the causal links between these variables.
Key Words: Crude oil prices, Gold prices, Nifty, relationship, trend analysis

1. INTRODUCTION:

The Indian stock market is significantly impacted by three key factors: international crude oil prices, gold prices, and exchange rates (Amalendu Bhunia, 2013). Gold is having a prominent place in India in terms of tradition as well as an investment option. Gold also supports national reserves, act as a hedge instrument and also builds up investor's confidence. India is also one of the potential markets for oil consumption(Kaur & Gupta, 2019) It plays a vital role in industry growth and revenue generation. Indian is one of the largest importer and consumer of crude oil in the world.

While the Indian stock market has always been amongst one of the primary choices of the Foreign Institutional Investors across globe. It is oldest in Asia and is projected around $3 trillion. Therefore, this study has been carried out to analyse all the above mentioned three major contributors to Indian economy.

Next section of the paper covers the detailed review of highly relevant literature which are primarily available in the context of gold price, crude oil prices and the stock exchange. Next section describes the objectives of the study which are achieved using an exploratory research design reflected in the next section and key findings of the research are described in the following section. The research is then concluded explaining the relationship amongst the variables as well throws light for the further scope of the study.

2. LITERATURE REVIEW:

(KP et al., 2021) The authors have studied the trend analysis of all three major contributors to Indian economy like Gold, Crude Oil and the stock market - Nifty. This paper also derived the relationship amongst these variables and found that there existed positive correlation between gold price and crude oil while there does not exist any significant relationship between Nifty and crude oil for the time frame between the years 2000 to 2019.

(Chew L M et al., 2023) here the authors created a model to forecast gold prices using bidirectional LSTM using gold prices, S&P 500 index, USD index crude oil and Consumer Price Index.

Daga, James (2020)Here the authors have studied the effect of foreign exchange rate, crude oil prices and rate of inflation on the prices of gold with reference to Indian economy. For this the authors have studied 10 years of data and have used statistical tools like correlation and regression. Here the results reflected low correlation between the Gold prices and Crude oil Prices while there existed negative correlation between Gold prices and Forex Rate.

(Gokmenoglu & Fazlollahi, 2015)Here the authors have done the analysis of Brent crude oil spot prices, S&P 500, Gold historical prices and volatility indices of gold and oil for the period starting from January 2013 to November 2014. The authors find that there existed a strong negative correlation between gold price and S&P 500 while moderate to weak correlation amongst other variables for the said period. The author also concluded that the data is stationary at order one.

(Sood Vishal et al., 2019)The authors have investigated the relationship between gold price against crude oil, USD and Nifty with reference to India for the period April 2014 to March 2018. They find that there existed unidirectional relationship of gold with crude oil and Nifty. There exists very low positive correlation between Nifty and Gold while gold prices had moderate correlation with crude oil and negative correlation with the exchange rates.

(Dhanabhakyam, 2018)This study is carried out for the year 2014 to 2017 and it attempts to find out the relationship between changes in price of crude and changes in the price of gold. The results of regression analysis describes that the two variables are positively correlated.

(Shaikh & Sharma, 2021)This study mainly aims to study the anomaly caused in the year 2020. It identified that the gold prices are strongly positively correlated with the equity markets and currency movements. However, the gold prices had weak negative correlation with Bret Crude. The authors adopted regression modelling to derive the results.

(G et al., 2023)This study aims to study the impact of crude oil prices and gold on the Indian stock market with reference to Sensex - BSE. The research covers the data ranging from January 2012 to June 2023. It applies unit root test, co-integration tests as well as causality test to predict the relationship.

3. OBJECTIVES:

- To identify the trend of the historical prices of crude oil, gold and Nifty points
- To identify the relationship amongst gold price with crude oil and Nifty points.
- To predict the relationship between gold price with crude oil and Nifty points in the long run

4. RESEARCH METHODOLOGY:

This study is an exploratory study which aims to establish the trend as well as relationship between historical gold prices with crude oil and the stock market. Several studies have been carried out across various time frames and studying the relationship amongst different variables. (G et al., 2023; Kaur & Gupta, 2019; Sujit & Rajesh Kumar, 2011)

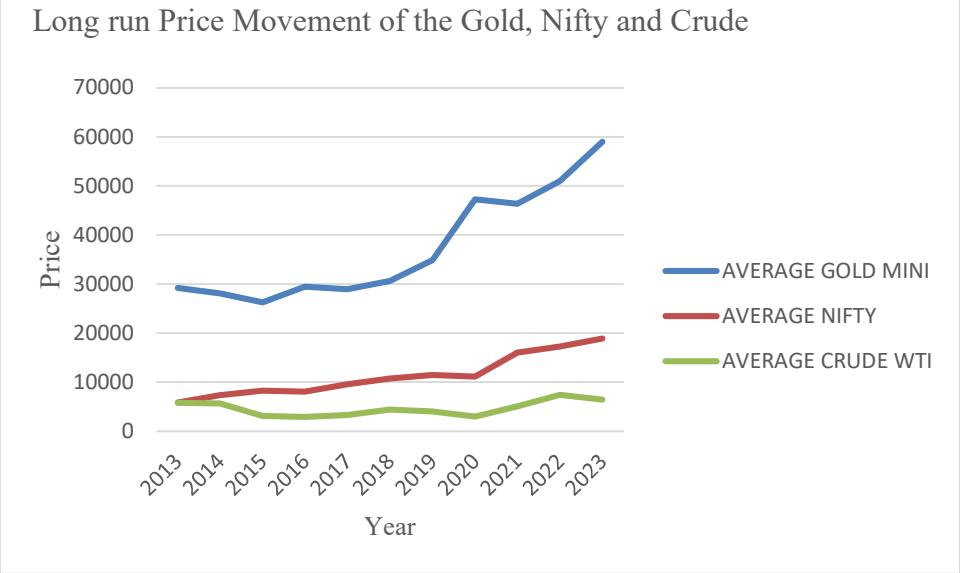
This research exclusively covers the historical data of gold prices, crude oil prices and Nifty points for the period starting from January 1, 2013 to December 31, 2023 – a decade witnessing the pre and post Covid 19 pandemic. The short run stationarity is checked in 2 parts being the first part identified as a Pre covid 19 phase for the period of 6 years starting from the year 2013 to 2018 while the second part identified as a witness and Post covid 19 phase for the period of 5 years starting from the year 2019 to 2023.

5. RESULTS:

Table 1: Average Data of 11 years for Gold, Nifty and Crude

Year	Average Gold Mini	Average Nifty	Average Crude Wti
2013	29216	5915.9052	5,776
2014	28101	7360.303074	5,684
2015	26305	8285.916935	3,139
2016	29428	8092.193927	2,931
2017	28949	9590.717944	3,320
2018	30635	10749.39228	4,445
2019	34888	11432.63224	4,018
2020	47268	11161.4748	2,960
2021	46330	16026.76069	5,046
2022	50995	17245.43044	7,421
2023	59019	18903.13171	6,416

Source: Raw Data extracted from Investing.com, averaged by author



Source: Raw Data extracted from Investing.com, averaged by author

Table 2: Descriptive Statistics of 11 years for Gold, Nifty and Crude

Descriptive Statistics											
	N	Range	Min	Max	Mean	Std. Deviation	Variance	Skewness		Kurtosis	
Average Gold	11	32714	26305	59019	37375.82	11370.650	129291691.364	.851	.661	-.791	1.279
Average Nifty	11	12987	5916	18903	11342.17	4273.458	18262446.081	.704	.661	-.709	1.279

Average Crude	11	4490	2931	7421	4650.55	1536.085	2359557.273	.451	.661	-.978	1.279

Source: SPSS output

Ho: The time series of Crude oil, Gold prices and Nifty has unit root – They are non stationary

H1: The time series of Crude oil, Gold prices and Nifty has no unit root – They are stationary

Table3: Unit Root tests:

	Level		1st Difference	
Parameters	T statistics	Probability values	T statistics	Probability values
Crude	-2.0254	0.2758	-8.3919	0.0000
Gold	0.7765	0.9933	-8.5277	0.0000
Nifty	0.5241	0.9870	-8.6313	0.0000

Source: Data extracted from E views output

From the above table we can infer that the time series of all the three parameters has unit root at level, means they are non-stationary. In order to derive the stationarity, the 1st difference ($y_t - y_{t-1}$) is checked for the stationarity and from the above table it can be inferred that at lag 1, all the above parameters are stationary and does not have any root. This indicates that the data at first difference is eligible for further analysis and regression.

Cointegration test:

In order to find out the long run relationship among the variable, Johansen Cointegration test is adopted.

H0: There exists no cointegration – long run relationship amongst the variable – Gold, Crude oil and Nifty

H1: There exists cointegration – long run relationship amongst the variable – Gold, Crude oil and Nifty

Following table summaries the values and hypothesis:

Table 4: Cointegration test:

Lag	Trace statistics	0.05 Critical value	Probability	Remarks
None	34.28396	35.19275	0.0624	Trace statistics suggests no cointegration exists at 0.05 level
At most 1	14.13250	20.26184	0.2804	
At most 2	0.047428	6.316690	0.1676	
Lag	Max-Eigen statistics	0.05 Critical value	Probability	Remarks
None	20.15146	22.29962	0.0970	Max Eigen statistics suggests no cointegration exists at 0.05 level
At most 1	7.815810	15.89210	0.5698	
At most 2	6.316690	9.164546	0.1676	

Source: Output compiled from EViews

From the above output we can interpret that the probability values at both levels – Trace Statistics and Max-Eigen Statistics are > than 0.05, which states that the null hypothesis is accepted and alternate hypothesis is rejected stating that

in the long run there does not exist any cointegration or in the long run there does not exist any relationship among the variables.

Pair-wise Correlation Analysis:

In order to find out the relationship between the pairs, correlation coefficients are determined as follows:

Pair 1: Gold-Nifty

Pair 2: Gold-Crude

Pair 3: Nifty-Crude

Table 5: Correlations of 11 years for Gold, Nifty and Crude

		Average Gold Mini	Average Nifty	Average Crude Wti
Average Gold Mini	Pearson Correlation	1	.913**	.507
	Sig. (2-tailed)		.000	.111
	N	11	11	11
Average Nifty	Pearson Correlation	.913**	1	.522
	Sig. (2-tailed)	.000		.100
	N	11	11	11
Average Crude Wti	Pearson Correlation	.507	.522	1
	Sig. (2-tailed)	.111	.100	
	N	11	11	11
**. Correlation is significant at the 0.01 level (2-tailed).				

Source: SPSS output

From the above output, it can be interpreted that there existed significant positive relationship between Pair 1: Gold prices and Nifty (r=0.913, p=0.000) while there existed no significant relation ship between Pair 2: Gold prices and Crude (r=0.507, p=0.111) and Pair 3: Nifty and Crude (r = 0.522, p=0.100)

Identification of relationship between Gold price with Nifty and Crude oil with Regression modelling:

Dependent variable: Prices of Gold, Gold

Independent Variables: Nifty and Crude oil

Table 6: Model Summary of Multiple Regression for 11 years for Gold, Nifty and Crude

R	R Square	Adjusted R Square	Sig. F Change
.914[a]	.835	.793	.001

Source: SPSS output

Above table shows the model summary of the multiple regression run by the author for Gold being dependent variable while, crude and Nifty being independent variables. Above table indicates that the independent variables crude oil and Nifty are able to create 83.5% (R-square) variance in the dependent variable average gold prices. Significant value 0.001<0.05, which shows that the model is significant. The Durbin – Watson statistic has the value 2.068 suggests no autocorrelation exists in the above model.

Table 7: Model significance and fit of Multiple Regression for 11 years for Gold, Nifty and Crude

Fitting of model summary using ANOVA

	Sum of Squares	df	F	Sig.
Regression	1079224922.740	2	20.202	.001[b]
Residual	213691990.896	8		
Total	1292916913.636	10		

Source: SPSS output

Table 8: Coefficients of Multiple Regression for 11 years for Gold, Nifty and Crude

Parameters	Unstandardized Coefficients		t	Sig.
	B	Std. Error		
Intercept	9033.599	5581.337	1.619	.144
Average Nifty	2.370	.448	5.288	.001
Average Crude Wti	.314	1.247	.251	.808

Source: SPSS output

Above table summarizes the coefficients which are responsible for contributing to the change in the average prices of Gold. The beta coefficients are positive and hence can be derived that the Nifty and crude oil prices create the positive impact in the average prices of gold. The significant value for Nifty is 0.001<0.05 shows that the major contributor to the change in average price of Gold is Nifty and crude creates negligible impact.

6. DISCUSSION:

From the data collected by the author summarizing the trend of the prices of Gold, Crude and Nifty index points, it suggests that over the period of time all the three variables have shown an upward trend from the year 2013 to 2023. The trend of the prices for the above variables in stationary at lag 1. Furthermore, the cointegration test was conducted to check the long run relationship among all the 3 variables in common. The results showed that all the variables do not hold long term relationship when put all together. In order to track the impact of independent variables like crude and Nifty index points on the change in the average prices of gold, multiple regression analysis was done which showed the significant impact on the dependent variables.

8. CONCLUSION:

In this study the major variables like Gold prices, crude oil prices and Nifty points are analysed to identify the trend and relationship among them over a period of 11 years starting from 2013 to 2023. The study concludes that the gold prices and Nifty have significant and positive relationship over the period of time. Also using the historical prices of these variables, an attempt is made to regress these variables to track the impact of changes in crude oil and Nifty Index points on the changes in the prices of gold where we can notice that Nifty index points play a significant positive effect on the changes in the prices of gold. This hereby indicates that gold prices are bound to move into the direction of Nifty in the long run.

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