



## IMPACT OF PANDEMIC ON UNDERLYING COMMODITIES AND EXCHANGE RATE: AN INDIAN PERSPECTIVE

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**Abstract:** *The COVID 19 global pandemic has impacted all the economies in a disruptive manner resulting in precariousness and the financial market volatility. Exchange rate pressure in the pandemic situation signifies underlying stress to global policymakers. The present state witness no upsurge in the dollar as against other currencies, vulnerability in the exchange rate is dependent majorly on foreign exchange reserves, commodities and exports etc. The paper tries to investigate the macro economic consequences of corona virus pandemic on the variations in ‘price of Crude oil’, ‘price of Gold’ and on ‘rate of exchange of USD-INR’.*

*The literature on the subject mentioned in this paper is for more than a decade, right from 2004 until 2020 for different countries, thus the investigation in this paper is India focused study particularly relevant to COVID-19. Co-integration Test was undertaken to estimate long run relations in the variables. The results reflect co-integration between the three variables doesn't exist. Granger Causality Test concludes a unidirectional relation in price of crude oil with rate of exchange. Also, crude oil and Gold share a unidirectional relationship whereas the gold price and the currency exchange of USD-INR share a bidirectional relationship.*

**JEL Classification:** C58, E44, F31

**Keywords:** Macroeconomics, Gold Prices, Crude Oil, Commodities, Foreign Exchange, Exchange rate, Granger Causality.

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### 1. INTRODUCTION

The pandemic situation globally due to Corona virus has impacted the economy immensely in a disruptive manner bringing in uncertainty and instability in the financial market. Exchange rate pressure in the pandemic situation signifies underlying stress to global policymakers. Literature evidences dearth of studies on global pandemics and economic fallout. The present state witness no upsurge in the dollar as against other currencies, vulnerability in the exchange rate is dependent majorly on foreign exchange reserves, commodities and exports etc. The paper tries to investigate the macro economic consequences



of Corona virus (COVID-19) pandemic on the fluctuations in the Crude oil prices (CRUD), Gold prices (GOLD) and their bearing on the Exchange Rate (EXCH) USD-INR. There is well established relationship known to foreign exchange experts related to three the variables however there is a measurement of exception in this study, these variables under COVID-19. The progression of the disease and its economic aftermath is extremely uncertain, which makes it complex for policymakers to devise appropriate macroeconomic policy. Studies in this direction would have important implications on the policy formulation and decisions coordinated at global level for achieving macroeconomic outcomes. Thus, the lesson drawn from this study may be useful in times of future crisis either natural or man-made.

According to the Ministry of Statistics, India's economic growth in Q4 of the fiscal year 2019-20 dropped to 3.1%. The Indian economy has been highly impacted due to the coronavirus pandemic which largely disruptive. The World Bank has emphasized the fact that this epidemic of COVID-19 has overblown the already existing risks of India's economic position.

The pandemic has hit hard not only to the Indian economy but to the whole world economy. It has a negative impact on the global economic growth that has been experienced in nearly a century. A 3% reduction in the worldwide GDP owing to the COVID-19 pandemic is forecasted by the IMF. The coronavirus has spread at an alarming speed infecting millions of people, which has brought the economic activities close to a standstill position because of the restrictions that have been imposed by the administration of countries to halt the spread of the virus. But this has created an adverse effect on the economy which is evident and has had been the largest economic shock in decades.

It can be observed from the graph below that it depicts the downfall of global GDP over a period of time and how the COVID-19 pandemic has the steepest collapse as compared represented by the red line, as compared to the global recessions in the earlier years 2009 - orange line and 1991 - blue line. The X-axis represents the months in a year while as the Y-axis gives the Real GDP %.

In crisis year there is tendency of GDP growth rate to decline. In all these three crisis periods an economic slowdown can be observed. While in 1991 in the twelve months above there was a decline from September to following June, there was a much steeper drop in the growth rate in the year 2009 and a similar decline was observed in 2013. This graph describes the period between the 10 months of economic slowdown. The COVID -19 impact on the economic growth was prominent from March 2020 as described by the red line.

The fluctuations in the commodity prices impact the import and export of a country, thus influencing the GDP of that country. As it is said a country's currency's worth rises when its GDP rises similarly a country's currency weakens if the GDP falls. Thus, it becomes necessary to design policies such that in a crisis situation there are no steep downfalls which impact the global economy.

The developing economies and markets are hit by the situation created due to the pandemic with destructed tourism and trade, restricted capital flows, unpredicted financial circumstances and increase in the debt.

Exporters of energy or industrial commodities are in particular hit hardly. It can be observed a significant drop in the oil demand and its prices caused due to the current crisis. This difficult and epidemic situation and the struggle to reduce it have prompted an exceptional downfall in oil imports and a reduction in oil prices. It had an adverse effect on the economy of the exporter and the positive influence on the exchange rate of an importer.

The below graph shows how the rate of exchange of USD-INR has weakened within a period of just 5 months where the X axis represents the day-wise period and Y axis represents the rate of exchange in terms of USD.

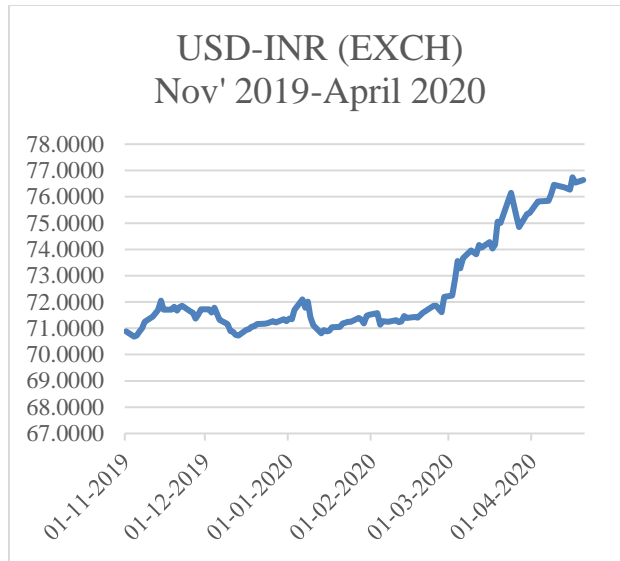


Figure 1: USD-INR Exchange Rate  
Data Source: RBI

Given the fact the India relies heavily on crude oil imports for energy needs, the direct impact would be on the USD-INR exchange rate. In the Financial Year 2019-20 the Indian Crude Oil basket started with \$71 per barrel in April but dropped down by almost 53% in the month of March 2020 to \$33.36. Following the global oil trajectory due to COVID-19, lesser the demand, the benchmark Indian Crude oil price dropped to a record low \$16.38 per barrel. India relies more than 80% on the imports to meet its oil needs. This has reducing the import bill and the INR gain due to reduce in outflow of dollars.

The macro-economy is highly influenced by the tremendous variabilities in the price of Crude oil. The study done by Yeu-Jun, Hsien-Tang, and Yi-Ming (2008), Krichene (2005), and Yousefi and Wirjanto (2004) emphasizes on the causal relation between EXCH and CRUD.

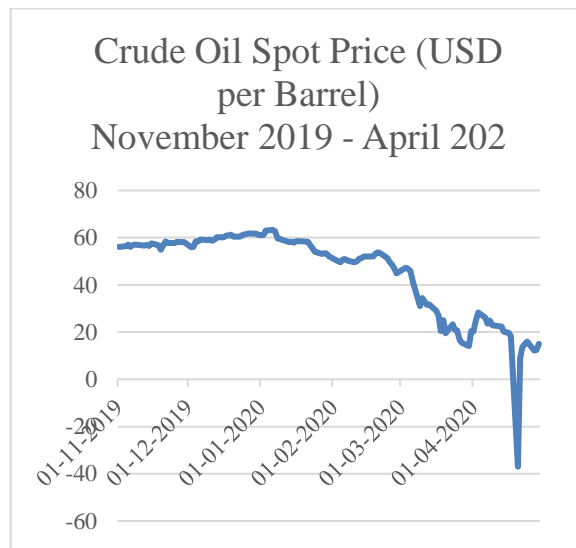


Figure 2: Source: Thomson Reuters: Compiled by authors from information - <https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=RWTC&f=D>



It can be seen from the graphical representation above, the X-axis representing the day-wise period for 5 months and the crude oil prices in USD (per barrel) on Y-axis. The decrease and a steep fall of crude oil price after mid-April 2020 is ascertained from the graph, thus making it more imperative to study the impression by crude oil price on rate of exchange.

Based on RBI's Monetary Policy report, the rupee came under strong and unremitting burden of depreciation from mid-January which reflected the emerging markets to weaken. For centuries together, Gold has been the foundation of the monetary system globally. Prior to 1973, countries settled their balance of payments by means of transferring Gold under the Gold Standard, where a country's currency was backed by Gold reserves. After the equity markets, Gold is considered to be an important alternative asset with minor risk. When the value of US dollar goes down in the international market, the investors, bankers, and traders hedge their risk by investing in Gold as an asset. This arrangement helps them protect the value of their other investments. Thus, the increasing demand in investing in Gold has increased its value in the global market. Gold is considered to be the safe-haven trade as it typically correlates to the stock market. As the market dropped violently during March and April, Gold soared as the investors fled the equity market to the safety of Gold. The below figure shows the rise in the Gold prices since November 2019 till April 2020, where day wise (X-axis), Gold price (USD per troy ounce - Y-axis) is considered.

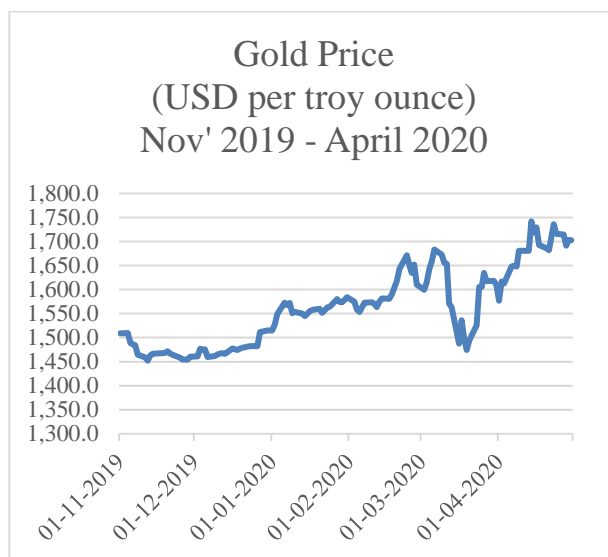


Figure 3: Source: Authors compiled information from: <https://www.gold.org/goldhub/data/gold-prices>

The objective of this paper is to highlight interdependent relationships of the commodities with the exchange rate in Indian context during the pandemic situation. The study provides a global analytical insight which points out the direct and indirect interactions between the commodities and the exchange rate of India and USA for the period starting from November 2019 - April 2020. The paper tries to observe the association amongst two commodity prices - oil and gold with that of the rate of exchange (USD-INR) fluctuations during this pandemic situation of COVID-19.

In lieu of the foregoing the focus of this research is to understand the bearing of the commodity prices on the rate of exchange in Indian perspective. The paper comprises of the following sections:



## Organization of Content:

The paper is divided into various sections as follows:

1. Overview
2. Review of Literature
3. Methodology
4. Analysis and Findings
5. Concluding Remarks

## 2. LITERATURE REVIEW

It is important to stabilize the currency in a pandemic situation through policy decisions considering the factors that influence the fluctuations. A considerable amount of literature is available which talks about the connection between price of oil and price of Gold with exchange rate.

The literature review is topical and is organized as follows:

- The association of Oil-Prices and Exchange-Rate
- The association of Gold-Prices and Exchange-Rate
- The commodity prices and FOREX Market

### 2.1 The association of Crude-oil price and rate of Exchange:

The paper by Kumar (2019), studies the cause and effect connection between price of oil, currency and price of stock in reference to India. He has used the Hiemstra and Jones (1994), tests such as causality and the ARDL tests. The results indicate a bi-directional non-linear association between rate of exchange and oil, and between stock price and oil. The results of the NARDL test suggest a substantial effect on exchange rate due to the shocks occurring in the oil prices (positive as well as negative). The consistently robust findings suggest that there is an uneven influence of oil prices on price of stock and rate of exchange. A similar study by Bal & Rath (2015), suggests that amongst the variables under study in India and China there is an important bi-directional Granger causality and oil price impacts foreign currency.

Also, study by Huang & Sissoko (2014), determines the bond of crude oil prices with exchange rates of five nations. A univariate Granger causality exists in short run between variables from EXCH to CRUD and vice-versa in long run.

Yousefi & Wirjanto (2004) have implemented an innovative and realistic approach to study the formation of price of crude oil and thus, to understand price reactions due to the variations in the rate of exchange. It is observed that in the international oil market a single determined price does not exist.

This article (Beckmann, Czudaj, & Arora, 2020) provides an academic and experimental review in research where there exists association between price of oil and currency. The empirical analysis confirms that there is a strong association among the two variables and these two variables can be good predictors in the short run of the other variable.

The study establishes a bidirectional relation among oil and FX markets in Nigeria. It also reveals the fact that if the oil is included in the varied portfolio of FX it will develop the risk-adjusted return performance in this research (Salisu & Mobolaji, 2013).

This academic study (Alam, Uddin & Jamil, 2020), aims to document the influence of oil prices on the actual dollar-to-rupee exchange rate. Since India is one of the top five oil importers and oil prices are listed in USD (U.S. Dollar) on the global market, this is done in relation to the USD. The exchange rate is found to have a long-term negative relationship with oil prices, but a short-term positive relationship. The Wald test's findings also show that the short-term causation between the exchange rate and the short-term interest rate and crude oil prices exists. The study's findings demonstrate that short-



and long-term driving relationships between short-term interest rates and exchange rates and oil prices exist.

## **2.2 The association of Gold Prices and exchange rate:**

While the research (Seyyedi, 2017; Singh et al., 2022; Sharma et al., 2022; Rastogi et al., 2022; Jadwani et al., 2022; Parkhi et al., 2022), suggests that the variables under study, the prices of Gold and Crude and the EXCH do not depend on each other which indicates that policies of energy and financial policies must be separated.

The research (Seshaiah, Sarma & Tiwari, 2017) determines the influence of several economic variables such as trade deficit, oil prices, fiscal deficit and exchange rate on the Gold prices. The study suggests a long term association between the variables and that the Gold prices is explained by Gold itself by 93% where as there is negligible influence of other variables on the Gold prices.

Another paper by Nair, Choudhary & Purohit (2015), examines the impact of recession of 2008 on the association between the currency rates USD - INR with the Gold prices. The analysis is done in three phases separately, pre, during and post-recession of these variables to understand the changes or variations on the relationship.

The analysis done in the research (Sinton, 2014) states existence of relation of stock price indices, exchange rate and Gold prices of Jakarta. It discloses a causal linkage in price indices and exchange rate on commodity price while no causal relation among the price of stock, 'gold and currency rate.

The ability of precious metals to hedge against risks associated with unfavorable economic and financial conditions for Pakistan, the USA, China, and India over the long term is examined in this article (Yaqoob & Iqbal, 2021). Much more convincing proof of the long-term correlation between precious metals and consumer prices, the currency rate, and stock prices is provided by the cointegration test results after the structural breaks have been taken into account.

## **2.3 The Relationship between commodity prices and the foreign exchange market:**

The paper by Lodha (2017) attempts to study the linkage among price of Gold, exchange rate and oil prices by Johansen's co-integration, Granger causality test which concludes a bi-directional causal bond in crude oil and USD-INR currency. Though the price of oil causes the Gold price and no interdependence between the variables.

The results in the study undertaken (Ingalhalli, Poornima & Reddy, 2016) reveal that there is only unidirectional relations between the variables. The authors have applied causality test using Granger test which tells that the exchange rate, gold prices could be predicted by oil prices while Sensex granger causes the variation in oil prices. A study undertaken for Mexico shows that Gold prices impact the stock prices positively however oil prices affect them negatively, (Singhal, Choudhary & Biswal, 2019). Gold prices doesn't show a high impact on currency rate while oil prices alter the exchange rate negatively. The study's findings have major suggestions for monetary and fiscal policies. A similar study for Malaysia, (Ibrahim, Kamaruddin, & Hasan, 2014), observed a negative but significant association among rate of inflation and rate of exchange on price of Gold, while positive with crude oil price.

Sujit & Kumar, 2011, studied the relationship among various economic variables such as Gold price, oil price, stock market returns and exchange rate. It reflects that these variables are greatly influenced by the variation in other variables. However, the stock market doesn't influence the exchange rate significantly. The two models are tested in the paper suggest a weak long term association among variables.



Thus, the literature shows the bond amongst the Gold and oil with exchange rate at different time periods.

A recent study on how the COVID-19 pandemic has impacted the Indian economy reveals that the policy choices in economics have an important control on mitigating the effects of measures and the pace at which the economy can alter towards usual conditions after the outbreak. Also, on the conditional variability of the variables, it may be claimed that the conclusions obtained have statistically significant effects based on the authors' research (Ozturk & Cavdar, 2021). As a result, it has been discovered that market shocks are polluted with one another.

India is highly dependent on Crude oil imports and "GOLD" is utilized as an investment option to the adverse exchange value of dollar. The literature review suggests an interrelationship amongst crude oil price, Gold price and exchange rate during normal conditions. While it is essential to understand the relation between the commodities prices and the rate of exchange that leads back to the question of how the price of oil and Gold are correlated to the currency fluctuations during adverse situation of COVID-19 pandemic which has resulted in the economy distress.

The above literature focuses on various aspects such as inflation, GDP, commodity markets, exchange rate, etc., for various countries at different time ages. However, this does not cover the oil price and Gold price, exchange rate, their relationship during the period November 2019 - April 2020. Thus, this paper tries to study the pattern of prices of commodities and the rate of exchange, the interdependency, the cause-effect relationship of the variables under study in an unfortunate and unpleasant pandemic situation of COVID-19.

### 3. METHODOLOGY

#### 3.0 RESEARCH DESIGN

This research is undertaken to understand the relation in crude oil prices, Gold prices and exchange rate of Indian Rupee with US Dollar (in market known as the (USD-INR)) in the adverse circumstances of COVID-19. The research is based on empirical evidences available for the variables under study for a period of six months.

First, the variables under study in this study are identified through the literature review. Then, an analysis to study the relationship between the variables will be developed which will be followed by causality and direction. Then we will develop the hypothesis and test it with the data and examine the hypothesized relationship empirically.

In order to look at the stationarity of the time series for the period November 2019 - April 2020 a unit root test is applied. The Johansen Co-integration test is done to verify if interdependence exists in the variables under study. The test that is conducted is Granger-causality to understand the causal linkage in two or more variables. The appropriateness of these empirical tests is discussed in the paragraph below.

The study uses various statistical and econometric tools like descriptive statistics, Augmented Dickey Fuller Test, Johansen Co-integration Test, test of Granger Causality to determine the correlation and interdependency. Also a Granger Causality Test is done on the data to identify the cause-effect relationship between the variables.

#### 3.1 RESEARCH QUESTION

The price of Gold is touching historic heights and on the other hand oil prices are falling down. Thus, the question arises, does there exists a close relationship between the foreign currency and oil prices, Gold prices during the phase of corona virus pandemic? COVID-19 is creating a havoc in the global markets and its repercussions is influencing the Indian markets does this hold true still remains unanswered.



In this context the research question will focus on:

To discover interdependence and impact of crude oil prices, Gold prices on USD-INR exchange rate for six months.

### 3.2 RESEARCH HYPOTHESIS

This study is designed to assess the hypothesis that if an association between the variables CRUD, GOLD, and EXCH exists. Also, to assess the cause-effect association between these variables. The hypothesis is tested utilizing the Johansen Co-integration Test and the Granger Causality Test.

*H<sub>01</sub>: There is no co-integration in EXCH and CRUD and GOLD*

*H<sub>a1</sub>: There is co-integration in EXCH and CRUD and GOLD*

and

*H<sub>02</sub>: There is no cause-effect relationship between EXCH, CRUD, and GOLD*

*H<sub>a2</sub>: There is cause-effect relationship between EXCH, CRUD, and GOLD*

### 3.3 DATA

This research is based on secondary data available in the public domain such as Reserve Bank of India (RBI) website, West Texas Intermediate (WTI), etc. The data is collected for a period of almost six months starting from 1<sup>st</sup> November 2019 to 21<sup>st</sup> April 2020, when the Corona virus took the charge of the world.

Also the daily data is collected for the Indian Rupee and US dollar exchange rate for the same time period, in all with 117 observations (eliminating non-trading days) after adjusting the missing values in the data set.

The daily exchange rate data are extracted from RBI website while the crude oil price is based on the West Texas Intermediate (WTI) spot price in dollars per barrel. The daily Gold price data is collected in terms of dollars per troy ounce.

The daily data is collected for Crude oil prices, USD-INR exchange rate and Gold prices to see interdependence of the variables on each other using correlation and regression analysis.

### 3.4 METHODOLOGY

This study pertains in examining relation between commodity prices and exchange rate of USD-INR various tools and techniques are used. Since the data involves time series analysis econometric techniques are applied on the data set using EViews 11. Thus, the study uses Johansen Cointegration Test to determine about the variables under study are co-integrated and Granger Causality Test to test the cause-effect association among the variables.

The present study applies various econometric tests, many of which are prevalent in the literature review as tabulated above.

Various methodologies such as Multiple regression analysis, Multivariate GARCH (MGARCH), Multivariate Stochastic Volatility (MSV) analysis, ARDL Bound co-integration testing, Unit Root Tests, Granger Causality Test, Cointegration Test, Vector Autoregression (VAR) model are used by researchers to explore relation within macroeconomic variables. The literature review provides enough evidence to narrow down the methodology used in this paper which is Johansen co-integration test and Granger Causality Test to analyze the time series data during COVID 19.





EViews 11 software is used to analyze the time series data collected for this study due to its quick and efficient analysis and also which allows the researcher to perform various statistical and economic analysis, generate forecasts and simulation models.

The analysis performed on the data set is classified into two baskets:

1. The Johansen's Cointegration Test
2. Granger Causality Test

#### THE JOHANSEN COINTEGRATION TEST:

Johansen Cointegration Test (Johansen, 1988; and Johansen and Juselius, 1990) to test cointegration between variables under study. Before applying the cointegration test, unit root test is used to make the series stationary.

#### Unit Root Test - Augmented Dickey Fuller (ADF) Test

For two or more time-series data its necessary to run a cointegration test where the data could be non-stationary at level form (raw data) but stationary at first differences, which means the series has to be integrated of order 1 (I1). Therefore, the Augmented Dickey Fuller (ADF) Test is done to examine occurrence of unit root in panel data taken under consideration. This test is considered as the basis for examining  $H_{01}$

#### GRANGER CAUSALITY TEST:

This test is performed for comprehending the cause-effect relations within variables under study. The Granger causality test in this study is the basis for examining  $H_{02}$

If the variables are cointegrated it indicates a long-run relation in stochastic variables, it might happen that two variables are not cointegrated in the long-run but there might be a possibility of short-run causal relation within two variables. Granger causality test is performed to determine short-run interrelationship for pairwise analysis.

### 4. ANALYSIS

#### 4.1 ANALYSIS AND FINDINGS

The time series data collected for six months has three variables under study viz. USD\_INR exchange rate (EXCH), Crude oil price (CRUD) and the Gold price (GOLD). The data for the exchange rate is in terms of value of USD per 1 INR. The descriptive statistics run on the data gives the following output as mentioned in Table No. 1 below:

Table No. 1 - Descriptive Statistics

	CRUD	GOLD	EXCH
Mean	46.70197	1552.254	0.013789
Median	53.36000	1556.900	0.013960
Maximum	63.27000	1741.900	0.014171
Minimum	-36.98000	1452.050	0.012992
Std. Dev.	16.90520	74.01522	0.000357
Skewness	-1.663267	0.415090	-1.019816
Kurtosis	6.680862	2.228483	2.466809
CV	36.198	4.768	2.589
Jarque-Bera	119.9961	6.261630	21.66641
Probability	0.000000	0.043682	0.000020



Sum	5464.130	181613.7	1.613365
Sum Sq. Dev.	33151.15	635477.3	1.48E-05
Observations	117	117	117

The descriptive statistics shows that the mean the median in each time series is almost similar. The data for crude oil prices is highly skewed while as for gold price and exchange rate it is quite normally distributed. The kurtosis values indicate that gold price and exchange rate have a flatter curve whereas oil price have a peaked curve than normal. Based on the standard deviation it can interpreted that the exchange rate is more stable during the period and the gold prices have seen the highest fluctuation in the pandemic.

The coefficient of variation for Crude oil (36.198%) being the highest suggests the highest fluctuation and/or variations in the Crude oil prices than the Gold prices (4.768%) and USD\_INR Exchange rate (2.598 %) during the COVID-19.

The further analysis being a time series data starts with the Unit Root Test. It can be observed that most of the times the time series data is non-stationary and need to be converted into stationary series. The Table No. 2 gives the ADF Unit root test results which was conducted on the time series data to discover if series are stationary or not.

**Table No. 2: ADF test for stationarity**

	t-statistic		Probability		Result @ first derivative
	@ Level	@ First derivative	@ Level	@ First derivative	
CRUD	-0.296996	-17.76706	0.9898	0.0000	The series is stationary
GOLD	-3.689896	-5.891530	0.0269	0.0000	The series is stationary
EXCH	-0.873853	-7.363076	0.9546	0.0000	The series is stationary

Thus, the null hypothesis that the series is not stationary is rejected at first difference series as the t-statistic is less than the critical value of ADF calculated at 1%, 5% and 10% significance level. Thus, it is proved that the series is non-stationary at their level form but stationary in first difference form i.e. I(1).

Subsequently, the Johansen Co-integration test is used to assess if co-integration exists in the series. In other words, the test is performed to study if there is long-term co-integration relationships between EXCH, GOLD and CRUD. To know the con-integrating vectors a trace test along with the maximum eigenvalue test is performed.



**Table No. 3: Johansen Cointegration Test Result**

Series: CRUDE GOLD EXCH				
No. of CE(s)	E V	Statistic	C V	Probability. **
None.	0.151451	26.93267	29.79707	0.1033
Atmost1	0.080848	11.00260	15.49471	0.2113
Atmost2	0.028705	2.825147	3.841465	0.0928
At 0.05 level the Trace test reflects that there is no cointegration				
The Unrestricted Cointegration Rank Test (Max. Eigenvalue)				
No. of CE(s)	E V	Statistic	C V	Probability. **
None.	0.151451	15.93008	21.13162	0.2290
Atmost1	0.080848	8.177448	14.26460	0.3609
Atmost2	0.028705	2.825147	3.841465	0.0928
E V - (Eigen Value), C V - (Critical Value)				

From table 5 above it can be observed that at five% l.o.s. neither the trace statistics nor the max. EV are higher than their critical values. It signifies there is no cointegration (long-run) in EXCH, GOLD and CRUD. Therefore, study establishes no long-run interdependence in these variables. Hence the first hypothesis of the study is accepted that there is no cointegration between the variables under study during the six months' period of the COVID pandemic starting from 1<sup>st</sup> November 2019.

Since there is no interdependency in the long-run amongst variables further analysis is done to verify short-run interdependency for three variables. For this, pairwise Granger Causality Test was performed on the data set with return series of crude oil price, Gold price and the USD-INR exchange rate. Table no. 4 displays the output of Granger Causality Test and it shows test statistics along with their p-values for three pairs crude oil with Gold, Gold with exchange rate and crude oil with exchange rate.

From the table no. 4 results below, it can be observed that there occurs a unidirectional causality from GOLD to CRUD. However, there is a bidirectional causality within CRUD and EXCH and also between GOLD and EXCH. In other words, it can be stated that Gold Granger causes CRUD but CRUD does not Granger cause GOLD. And in bidirectional causality it can be stated that EXCH Granger causes CRUD as well as crude oil Granger causes EXCH. Similarly exchange rate Granger causes Gold as well as Gold Granger causes exchange rate.

Thus, the second hypothesis of the research is rejected, in other words, a cause-effect relation exists in USD-INR exchange rate, Gold and crude oil price in the short run.



Table No. 4: Pairwise Granger Causality Test Results

Null hypothesis Lag 2	Observations	F-Statisticvalue	Probability
GOLD - no Granger causality towards CRUD	109	6.95393	0.0015
CRUD - no Granger causality towards GOLD		1.07519	0.3450
EXCH - no Granger causality towards CRUD	109	3.60540	0.0306
CRUD - no Granger causality towards EXCH		9.06299	0.0002
EXCH - no Granger causality towards GOLD	118	3.35653	0.0384
GOLD - no Granger causality towards EXCH		3.62102	0.0299

## 5. CONCLUSION

The present study emphasizes short run relationship or interdependency between USD-INR exchange rate, crude oil prices and Gold prices. The analysis reveals that two variables - EXCH and CRUD are non-stationary at level form and stationary at first difference form, while as the Gold price is stationary at level form itself. However, the Johansen Co-integration Test reveals no co-integration in variables. Further the Granger Causality Test suggests a unidirectional causality from Gold to crude oil. In other words, it can be said that GOLD Granger causes CRUD but CRUD does not Granger cause GOLD. However, a bidirectional causality between Crude oil price and the rate of exchange and also among Gold price and exchange rate can be observed. Thus, in bidirectional causality it can be stated that exchange rate of USD-INR Granger causes crude oil price as well as crude oil price Granger causes exchange rate. Similarly exchange rate Granger causes Gold price as well as Gold price Granger causes exchange rate of Indian rupee with USD.

This study confirms the positive and direct relation in Crude oil price and exchange rate USD-INR, Gold price and exchange rate USD-INR, even in an adverse situation like this.

A complex situation has been developed for policy makers to plan and execute the appropriate fiscal and monetary policies due to the uncertainty of the progression of the illness and its commercial aftermath. Studies in this direction would have important implications on the policy formulation and decisions coordinated at global level for achieving macroeconomic outcomes. Thus, the lesson drawn from this study may be useful in times of future crisis either natural or man-made. The paper addresses the gap with the most recent data and in an unlikely and unfortunate situation of COVID-19.

Thus, the Government need to frame a policy to curb the fluctuations in the exchange rate influenced by commodity prices along with other economic factors. The reforms and actions to keep the economy stable are of utmost importance and imperative in such unpredictable situations.

## LIMITATIONS AND FUTURE SCOPE

The findings of this study are limited to the statistical and econometric tools and techniques mentioned in the methodology. This research is studied for the pandemic period from November 2019 - April 2020.



The present study is limited to gauge interdependency of only three variables under study. Future research can be taken up by considering the other methodologies and time period. Also, further research can be done using other macroeconomic variables and for other countries.

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