The linkage of Oil prices, gold prices, Exchange rate, and the Indian stock market during the Russia- Ukraine war

A Dissertation for

FSC413 Project Work

Credits: 4

Submitted in partial fulfillment of Masters / Bachelor's Degree

MBA in Financial Services

by

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DATE: APRIL 2023

Examined by:

Seal of the School

INDEX

DECLARATION BY STUDENT

I hereby declare that the data presented in this Dissertation / Internship report entitled, "**The Linkage of Oil Prices, gold prices, Exchange Rate, and the Indian stock market during Russia-Ukraine War**" is based on the results of investigations carried out by me in the MBA (Financial Services) at the Goa Business School, Goa University under the Supervision/Mentorship of Dr. Prachi Kolamkar 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 its authorities will not be responsible for the correctness of observations / experimental or other findings given the dissertation.

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COMPLETION CERTIFICATE

This is to certify that the dissertation report "**The Linkage of Oil Prices, gold prices, Exchange Rate, and the Indian stock market during Russia- Ukraine War**" is a bonafide work carried out by Ms. Pooja Gupta under my supervision/mentorship in partial fulfillment of the requirements for the award of the degree of Master's degree in the Discipline MBA (Financial Services) at the Goa Business School, Goa University.

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Place: Goa Universite

School Stamp

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2	ARDL	Autoregressive Distributed Lag
3	USD-INR	US Dollar Indian Rupee
4	ADF	Augmented Dickey Fuller
5	KPSS	Kwiathowski-Phillips-Schmidt-Shin
6	FEVC	Forecast Error Variance Decomposition (FEVC)

CHAPTER I

1.1 Introduction:

The price of oil has long been seen as a reliable indicator of changes in exchange rates in the global economy. This is due to the fact that most oil transactions are conducted in US dollars, which causes initial currency devaluation as oil demand increases. Additionally, fluctuating international oil prices brought on by changes in its force and demand cause fluctuations in the exchange rate of an oil-importing economy. Fluctuations in global oil prices, particularly for oil-importing nations like India, result in rupee depreciation and an increase in the affectation rate.

The oil industry in 2020 has been turned on its head by two major forces: the price war between Russia and Saudi Arabia, and the sharp global economic downturn prodded by the global pandemic. This has led to a price collapse, until now, was unbelievable to utmost oil assiduity investors and economists. For the first time ever, the cost of oil drilling in the United States became negative. Dealers bothered about a glut of unsaleable oil industry transferred the price of standard West Texas Intermediate (WTI) crude oil industry sinking as they paid other parties to take the over-supplied commodity off their hands. While oil prices offered a modest answer following the collapse, it's unclear whether the earning are sustainable. The reason demand for oil is sinking faster than force in a shrinking global frugality. Crude oil price oscillations are a frequent market phenomenon that depends on several factors including demand and force, geo-political situation, and programs of crude oil-producing countries. An indicator of the cost of crude oil imports into India is the transnational crude oil price of the Indian Basket.

The coronavirus epidemic has shocked the oil assiduity, submerging companies with further force than the world can burn and busting small players. As the coronavirus epidemic has kept people at home and around manufactories to a halt, demand for oil painting dropped drastically. At the same time, Russia broke off accommodations to stem drilling with Saudi Arabia and OPEC mates. rather, the two countries, some of the world's biggest oil exporters, launched a price war by ramping up and cutting prices in expedients of grabbing further request share. Gold prices had a weak launch to the time as rate hike prospects increased, US real yields rose, and the US bone performed well. still, when the pressure between Russia and Ukraine come to the fore, these earlier-mentioned motorists sluggishly but surely lost their influence on gold prices. Gold prices started to bounce in advance. Prices of gold have increased by 10 percent since the end of January. When Russia raided Ukraine, advanced oil painting, gas, wheat, and other commodity prices touched off a considered rise in affectation prospects. These prospects have outplaced the rise in nominal yield performing in lower real yield in the major husbandry. This has supported gold prices. But there's further. Gold has started to bear like a safe haven asset again. It now has a positive relationship with US equity request volatility and the US bone. We've held the view that gold's safe haven appeal is erratic and not unstable and that there are ages when it behaves like a safe haven and other ages like a threat asset The war in Ukraine has improved the fortune of gold, as it has for a number of other commodities. An increase in gold price might beget investors to withdraw their plutocrats from the stock market, which leads to a decrease in the stock market.

1.2 Literature Review:

According to past studies from a different perspective the oil price and stock market studied for instance: A study conducted by (Kelesbayev et al. (2022) to find the linkage between oil price, Stock market, and exchange rate using the VAR Model and causality. The finding shows that oil prices positive Impact on the KASE index but, the exchange rate has a negative effect on the KASE index. Similarly, Sreenu (2022) examines the crude oil volatility effect on the Indian stock market in various sectors. They used a quantile regression model and the study reveals that the crude price oil volatility index's informational quality enhances the accuracy of the volatility predictions for stock market returns. Joo and Park (2021) investigate the effect of oil price volatility on stock markets and the sample taken from oil-importing countries. The period of this study was from 2001 to 2019 and the findings indicate that when both oil price volatility and stock returns are low, increasing oil price volatility has a negative impact on stock returns. A rise in oil price volatility, on the other hand, causes an increase in stock returns when stock returns are high and oil price volatility is low. In addition, Kumar et al. (2021) covered the relationship between the prices of natural gas, crude oil, gold, exchange rates, and the stock market index. In this study crude oil prices, gold prices, exchange rates, stock prices, and natural gas price variables were used and they run Autoregressive Distributed Lag (ARDL) model. The study's conclusions show that gold, natural gas, and the stock market all have different impacts on crude oil over the long term, while crude oil also has asymmetric effects on natural gas over the short term. Philips et al. (2022) investigated the inflation rate as a periodical on oil prices and stock prices in exporting and importing countries by using a panel nonlinear autoregressive distributed lag model. The study concludes that the inflation rate linked between oil prices and stock returns is insignificant while the exchange rate is significant.

Similarly, Chkir et al. (2020) covered the relationship between oil prices, stock market, and exchange rates in exporting and importing countries by running a vine copulas approach. The results showed that oil and exchange rates are significantly negative during other periods except for the British Pound and Japanese Yen exchange rates. By using the DCC-GARCH model, Jain and Biswal (2016) investigate the relationship between the world prices of gold, crude oil, and the USD-INR exchange rate on the Indian stock market. The study's results also support the rise of gold as a kind of investment asset among investors. and the requirement for dynamic policymaking in India to use the price of gold and oil as tools to control stock market volatility and currency rate variations. Caporale et al. (2022) examine exchange rates, and oil prices that affected sectoral stock return in BRICS-T Countries by utilizing a time-varying approach. The analysis reveals that oil prices have a significant, positive impact on all BRICS-T countries except for India; a significant, negative impact on all countries except Turkey's industrial sectors; a negative impact on Brazil, Russia, India, and South Africa's financial sectors; a negative impact on India and Turkey's transportation sectors and a positive impact on Russia's; and finally, the most significant impact is on the chemicals sector, though it varies by country. Hashmi et al. (2022) Interlinkage between oil prices, exchange rate, and stock returns in Pakistan with an application of quantile ARDL model. The influence of stock and oil prices on exchange rates is consistent across all phases of the currency market and Xu et al. (2022) investigate the dynamic moderating effect of the exchange rate market on the oil-stock nexus, and the paper adopts VAR GARCH model. The finding indicates a rise in crude oil prices boosts stock market returns, and also the boost is lessened as the growth rate of exchange rate returns approaches zero.

Recently Kumeka et al. (2022) examine the performance of stock prices, oil prices, and exchange rates in twelve exporting countries during COVID-19 by using the panel vector autoregressive model and Granger causality model. It estimates that crude oil prices vary in the

exchange rate and the stock market at various periods, but is neither influenced by the stock market nor the exchange rate in the post-COVID-19 pandemic. In addition, Zeinedini et al. (2022) During the COVID-19 pandemic, the quantile regression approach was used to examine the relationship between world oil and gold prices on the Indian stock market. The results showed that there is no substantial correlation between the price of gold globally and the Tehran Stock Exchange index, but that there is a large and inverse correlation between the price of OPEC oil and the index. Alexandri et al. (2022) inspect oil prices and currency exchange rates on the Indonesian stock market during the COVID-19 pandemic using the VAR model. Closing costs are influenced favorably by oil prices, trade prices are impacted by closing post costs, and currency exchange rate prices around the time of the Covid-19 Pandemic.

1.3 Meaning, Scope, and Importance:

This research is based on the impact of oil prices, gold prices, and the Stock market in the Russia and Ukraine war. Through this study, the impact and causality of oil prices, and gold prices on the Indian stock market during the Russia and Ukraine war would be analyzed. The war is still going on and also, and we do not know what will happen in the future, as this research would be based on the available data. As a result of the impact and causality of oil prices, gold prices, and the Indian stock market would help to make a proper policy regarding the oil price and gold prices and how India depends on their own resources in the future. As India is having a very close relationship between Russia and other major economic power around the world and how to control the oil prices to have proper policies against anything happening around the world.

1.4 Research Gap

In the past, research has been conducted on the impact of oil prices, and gold prices on the stock market and real exchange rate. Similarly, the relationship among these variables has been covered during the long and short term. Recently with the effect of Covid 19, everything affects and also researchers covered enough studies regarding the impact of Covid 19 on the stock market, oil prices, and how everything has changed due to this pandemic. Currently, due to the ongoing war between Russia and Ukraine, the fuel supply and fuel prices impacted around the world including in India. As we know fuel is one of the main sources for companies, besides that everything has been affected due to this war. Regarding the studies, there are a limited number of research and no study was conducted to find how the stock market was affected due to oil price and gold price during the war. I want to fill this gap and support how this war affected the stock market of India.

1.5 Objective

1. To study the linkage of oil prices, gold prices, exchange rate, and the Indian Stock market during Russia Ukraine War.
2. To examine how much one market affects another market in the short term.
3. To evaluate the causality between oil price, gold price, and the stock market.

1.6 Methodology

This study which based on the impact of oil prices and gold prices on the Indian stock market during the Russia and Ukraine war which started on 24 Feb 2022 and is still ongoing. This

study used secondary data from Yahoo Finance and another reliable source. The study period is from 24th February 2022 to 8th April 2023. In this study, the daily prices of global gold, the OPEC crude oil based on the US dollar, and the total stock index of the Indian Stock Exchange have been considered. the oil, gold, and stock index data used in this research was collected from OPEC, World Bank, and Indian Stock Exchange respectively. The change in oil price, gold price, and the Indian stock Exchange within the war period has been demonstrated. Since the Indian Stock Exchange is closed during the official holidays, the observations of oil and gold were removed for these special days in order to synchronize the data.

I used the Vector Autoregression model to explore the link between oil price, gold price, exchange rate and Indian stock market during Russia- Ukraine war. Since it allows me to find the major interaction between these markets as well as the response to shocks in other markets. In time series research, vector autoregressive (VAR) models are commonly employed to investigate the dynamic interactions that exist among variables that interact with one another, which was the purpose of Sim (1980).

The conventional form of the VAR model used in this paper is as follows:

$$\mathrm{R(t)} = \mathrm{c} + \sum_{\mathrm{k-1}}^{\mathrm{p}} A(K)\,\mathrm{R(t-k)} + \mathrm{e(t)},$$

In this model, R (t) is a 6*1 column vector of daily returns on the market indices in time t. C is a 6*1 column vector of constant terms, and A(k) is a 6*6 coefficient matrix, with the i, jth component measuring the effect of a change in the jth market on the market after k periods. e(t) is a 6*1 column vector of innovations such that E (eit) equals 0, E (e2it) equals si2, E (eit, ejt) equals sij, and E (eit, ejtk) equals 0. The inventions, e (t), can be contemporaneously associated even though they are serially uncorrelated.

To study the dynamics of the system, the VAR model in Equation (2) can be transformed into a moving average representation expressed as

$$\mathrm{R(t)} = \sum_{\mathrm{k=0}}^{\infty} C(k)\, \mathrm{e(t-k)},$$

In this equation, the transformed innovations, e (t), are now uncorrelated with one another at all delays and simultaneously.

The VAR model's moving-average representation also makes it easy to track the system's dynamic responses to shocks. The i, jth component of C(k) This depicts the ith market's impulse reaction over the course of k periods following a shock of one standard error in the jth market. In other words, the value of the ith market (Ri) changes by cij if there is a unit shock in the innovation of the jth market in period t (ujt) in the following period and by cij,2, cij,3, and so on in successive future periods.

The Granger Causality Test is a general approach used to test for causality between two (or more) variables. Its ease of use and wide adoption make it popular. Using Monte Carlo simulations, Guilkey-salemi (1982) showed that the Causality test is appropriate, especially in empirical studies using small samples. The standard Granger causality test for two variables is as follows:

$$X_t = \mu_1 + \sum_{i=1}^{p} \alpha_{1,i} Y_{t-i} + \sum_{i=1}^{p} \beta_{1,i} X_{t-i} + \varepsilon_{1,t}$$

$$H_o : \sum_{p} \alpha_{1,i} = 0$$

$i=1$

If the null hypothesis: is rejected Y is said to granger cause X

$$Y_t = \mu_2 + \sum_{i=1}^{p} \alpha_{2,i} X_{t-i} + \sum_{i=1}^{p} \beta_{2,i} X_{t-i} + \varepsilon_{2,t}$$

$$H_o : \sum_{i=1}^{p} \alpha_{2,i} = 0$$

If the null hypothesis: is rejected X is said to Granger caused Y

If the null hypothesis is rejected from both cases, it is said that there is a bi-directional causality between X and Y.

1.7 Limitation

As the Russia and Ukraine war started recently and also there are limited studies have been done due to this war the fuel price affected around the world. My study covers the period from the start till now, as the war still going on and the future is still not clear. My study's main limitation is the period and the study can be done when the war is over across different nations.

1.8 Chaptalization

Chapter I: In this chapter included Introduction, Meaning, Scope and Importance, Literature review, research gap, Objective, Methodology, and Limitation.

Chapter II: Represent the Empirical result of the quantile regression model and Granger causality.

Chapter III: In this chapter summarized the results of the models, and concludes with the main findings and suggestions.

CHAPTER II

2.1 Introduction

In this study, the chapter would address the empirical study and discussion of the major topic, which is the linkage of gold prices, oil prices, exchange rate and India stock market in short run. In order to run the preliminary VAR model, the model was verified for lag length criteria to establish sufficient lags for the model.

To run the VAR and granger causality test for this study run two tests and the data become stationary. After determining an adequate lag length, the model was altered accordingly; in the meantime, a diagnostics test was done based on the requirement of a suitable model to ensure the accuracy of the results. The model has been determined to be devoid of any statistical problems as a consequence of these diagnostic tests,

Hence, the ADF and KPSS for checking stationary and the Forecast Error Variance Decomposition (FEVD) and Impulse Response Function (IRF) have been interpreted:

Table 1: Augmented Dicky-Fuller Unit Root Test

Market	Augmented Dicky-Fuller test			
	Without Intercept	P-value	With Intercept	P-value
R NIFTY	-15.73384	0.0000	-15.70997	0.0000
R GOLD	-16.52102	0.0000	-16.49913	0.0000
R OIL	-15.35286	0.0000	-15.32699	0.0000
R INR/USD	-17.81111	0.0000	-17.93409	0.0000

Note: The critical value for 1%, 5%, and 10% without trend respectively are -3.432958, -2.862578, and -2.567368 similarly, with the trend the critical value for 1%, 5%, and 10% respectively are -3.961979, -3.411734 and -3.127749.

Table 2: Kwiatkowski-Phillips-Schmidt-Shin Unit Root Test

Market	KPSS test	
	Trend and Intercept (LM-Stat)	With Intercept (LM-Stat)
R NIFTY	0.055505	0.072812
R GOLD	0.047019	0.366146
R OIL	0.049489	0.054112
R INR/USD	0.023684	0.196787

Note: The critical value for 1%, 5% and 10% without trend respectively are 0.739000, 0.463000 and 0.347000 similarly, with the trend the critical value for 1%, 5%, and 10% respectively are 0.216000, 0.146000, and 0.119000.

There are various techniques for determining whether the data are steady because VAR models need this property. for examining the stationary, two popular tests Kwiatkowski-

Phillips-Schmidt-Shin (KPSS) and enhanced Dicky-Fuller (ADF) tests were employed in this study. Table 2 and Table 3 provide the results of the ADF and KPSS tests.

If the p-value is less than 1%, the null hypothesis of the unit root test is rejected according to the ADF test. If the LM stat is more than the critical value, the null hypothesis is rejected according to the KPSS test. All of the variables returned when running the VAR model are stationary because if they weren't, there would be a problem with misleading predictions. To get around this, I adjusted the variables to be stationary and used the E-views software to run the VAR model primarily.

Table 3: Descriptive Statistics

	R Nifty	*R Gold*	*R Oil*	*RINR/USD*
Mean	0.0299	0.0165	-0.0524	0.0350
Median	-0.0191	0.0363	0.2979	0.0054
Standard Deviation	0.9791	1.0093	3.2017	0.3526
Sample Variance	0.9586	1.0188	10.2507	0.1243
Kurtosis	0.2779	0.4758	2.0424	0.8556
Skewness	0.0291	0.0504	-0.1250	0.1415
Range	5.5373	5.9332	27.3760	2.3197
Minimum	-2.6891	-2.8262	-12.9267	-1.0640
Maximum	2.8482	3.1070	14.4493	1.2557
Sum	7.9884	4.4102	-13.9816	9.3526
Count	267.0000	267.0000	267.0000	267.0000

Table 3 represents the result of the descriptive statistics of the gold price and oil prices, Exchange rates, and stock market. The average daily return of Nifty, Gold, and Exchange rates are positive but for Oil it is negative. The highest return is coming from the Exchange rate followed by nifty and gold. For the same period, the gold market is having highest median which means it is going to the positive side of the mean. According to the standard division which shows the volatility in the market and the highest volatility is coming from oil prices followed by gold and nifty. The minimum return for the 4 variables is negative, highest for the oil prices followed by the gold. Nifty and exchange rate. The maximum return is for oil followed by gold, nifty, and exchange rates.

2.2 Forecast Error Variance Decomposition (FEVC):

Tables 4, and 5,6,7 below represent the result of FEVC based on VAR analysis of nifty, gold, oil, and exchange rate under study.

Table: 4

Variance Decomposition of R_NIFTY:					
Period	S.E.	R_NIFTY	R_GOLD	R_OIL	RINR_USD
1	0.978679	100.0000	0.000000	0.000000	0.000000
2	0.979848	99.93150	1.82E-06	0.015685	0.052813
3	0.984338	99.05409	0.004059	0.414430	0.527425
4	0.984621	99.00517	0.012769	0.444826	0.537237
5	0.984692	98.99125	0.020682	0.447376	0.540689
6	0.984696	98.99045	0.021226	0.447419	0.540900
7	0.984697	98.99027	0.021382	0.447421	0.540927
8	0.984697	98.99026	0.021386	0.447422	0.540927
9	0.984697	98.99026	0.021388	0.447422	0.540928
10	0.984697	98.99026	0.021388	0.447423	0.540928

Table 4 indicates the forecast error variance in nifty is not significantly explained by other variables. On day 1, 100% of the error variance in nifty explained by itself. On the other day also, the contribution of nifty is explaining forecast error variance in nifty remains significantly at 98.99% and the remaining around 2 % variance in nifty is explained by other three variables gold, oil, and exchange rate.

Table: 5

Variance Decomposition of R_GOLD:					
Period	S.E.	R_NIFTY	R_GOLD	R_OIL	RINR_USD
1	1.007004	0.007741	99.99226	0.000000	0.000000
2	1.014236	0.464627	98.57186	0.239959	0.723553
3	1.019869	0.775626	98.07437	0.254158	0.895845
4	1.020049	0.775802	98.03990	0.287335	0.896961
5	1.020104	0.778675	98.03188	0.287396	0.902050
6	1.020111	0.778783	98.03075	0.288135	0.902330
7	1.020111	0.778784	98.03071	0.288152	0.902351
8	1.020111	0.778784	98.03071	0.288156	0.902352
9	1.020111	0.778784	98.03071	0.288156	0.902352
10	1.020111	0.778784	98.03071	0.288156	0.902352

On the other hand, table 5 indicates the forecast error variance in gold is not significantly explained by other variables. On day 1, 99.99% of the error variance in gold was explained by itself. Considering the other days also the major variance in nifty explained by its own market and only 2% variance in this market explained by other these three variables. Table 3 represents the variance decomposition of oil returns.

Table: 6

Variance Decomposition of R_OIL:

Period	S.E.	R_NIFTY	R_GOLD	R_OIL	RINR_USD
1	3.180397	0.042861	8.812085	91.14505	0.000000
2	3.198734	0.087964	8.754841	90.58773	0.569463
3	3.246889	0.162493	10.80232	88.47206	0.563126
4	3.247794	0.163980	10.80002	88.45056	0.585442
5	3.248701	0.166739	10.84477	88.40136	0.587133
6	3.248730	0.166772	10.84495	88.40087	0.587414
7	3.248742	0.166902	10.84528	88.40018	0.587635
8	3.248743	0.166902	10.84529	88.40017	0.587639
9	3.248743	0.166903	10.84530	88.40016	0.587642
10	3.248743	0.166903	10.84530	88.40016	0.587642

The forecast error variance in oil is not significantly explained by other variables. On the first and second days, 91.14% and 90.58% respectively, the error variance in oil was explained by itself, and on the other day onwards only 88.47 variances of oil are explained by itself and the rest are explained by other variables. The majority of the variance has been explained by gold which is from 8 to 10% and the remaining has been explained by nifty and exchange rates.

In Table 7, the forecast error variance in the exchange rate is not significantly explained by other variables. On day 1, 93.06% of the error variance in the exchange rate was explained by itself. On other days, the 88.62% variance of the exchange rate is also explained by itself. The

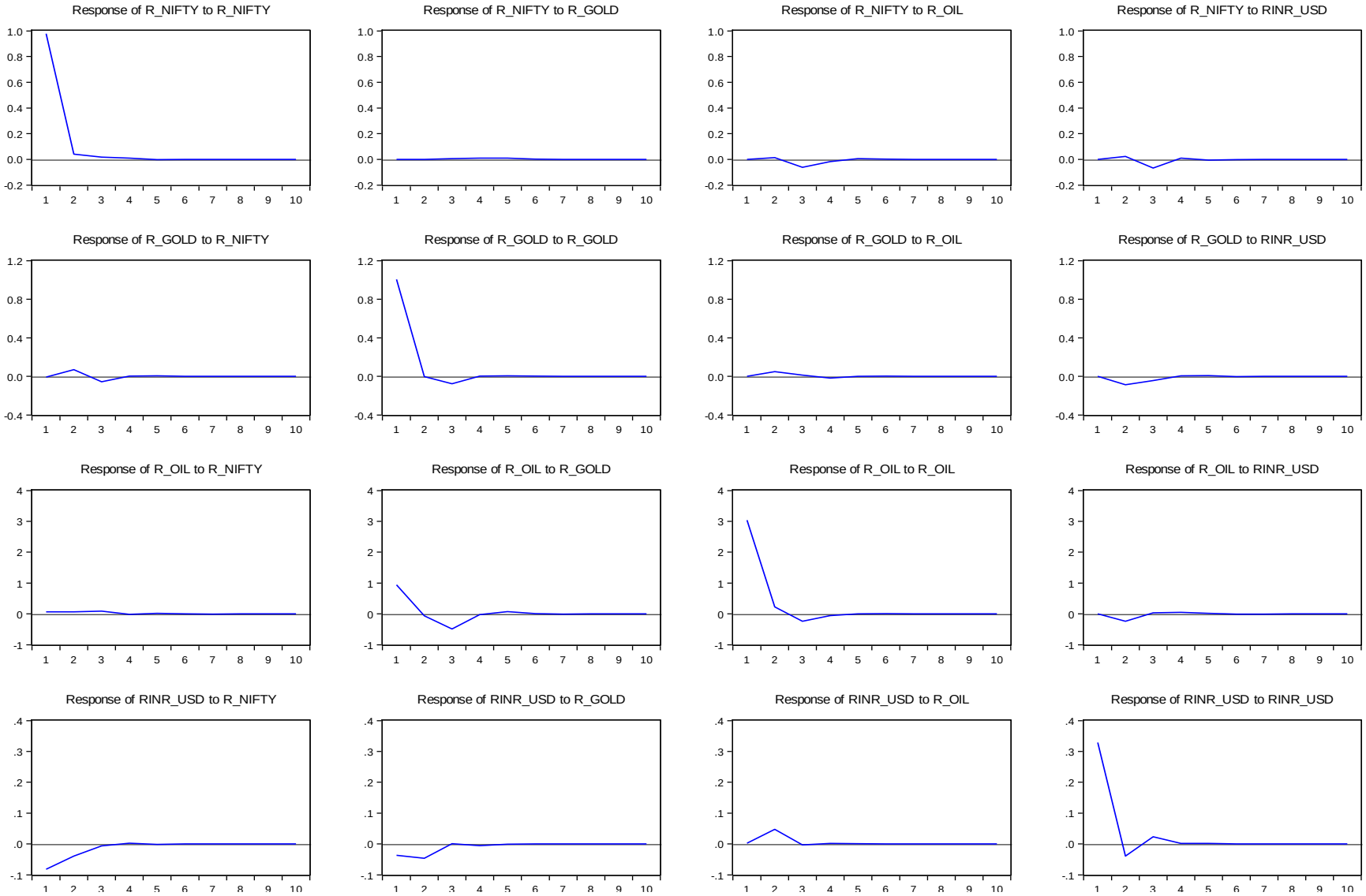
remaining variance which is left out was explained by nifty, 5 to 7%, followed by gold and oil which is 2 to 3% and 1% respectively.

Table: 7

Variance Decomposition of RINR_USD:

Period	S.E.	R_NIFTY	R_GOLD	R_OIL	RINR_USD
1	0.340657	5.728584	1.197984	0.005838	93.06759
2	0.351621	6.646071	2.888849	1.838512	88.62657
3	0.352479	6.650104	2.875639	1.836644	88.63761
4	0.352545	6.653653	2.900811	1.838033	88.60750
5	0.352551	6.654786	2.900863	1.838410	88.60594
6	0.352551	6.654830	2.900864	1.838453	88.60585
7	0.352551	6.654828	2.900871	1.838452	88.60585
8	0.352551	6.654829	2.900871	1.838452	88.60585
9	0.352551	6.654829	2.900871	1.838453	88.60585
10	0.352551	6.654829	2.900872	1.838453	88.60585

Figure 1: Impulse response from gold market, oil market, exchange rate, and the Indian stock market



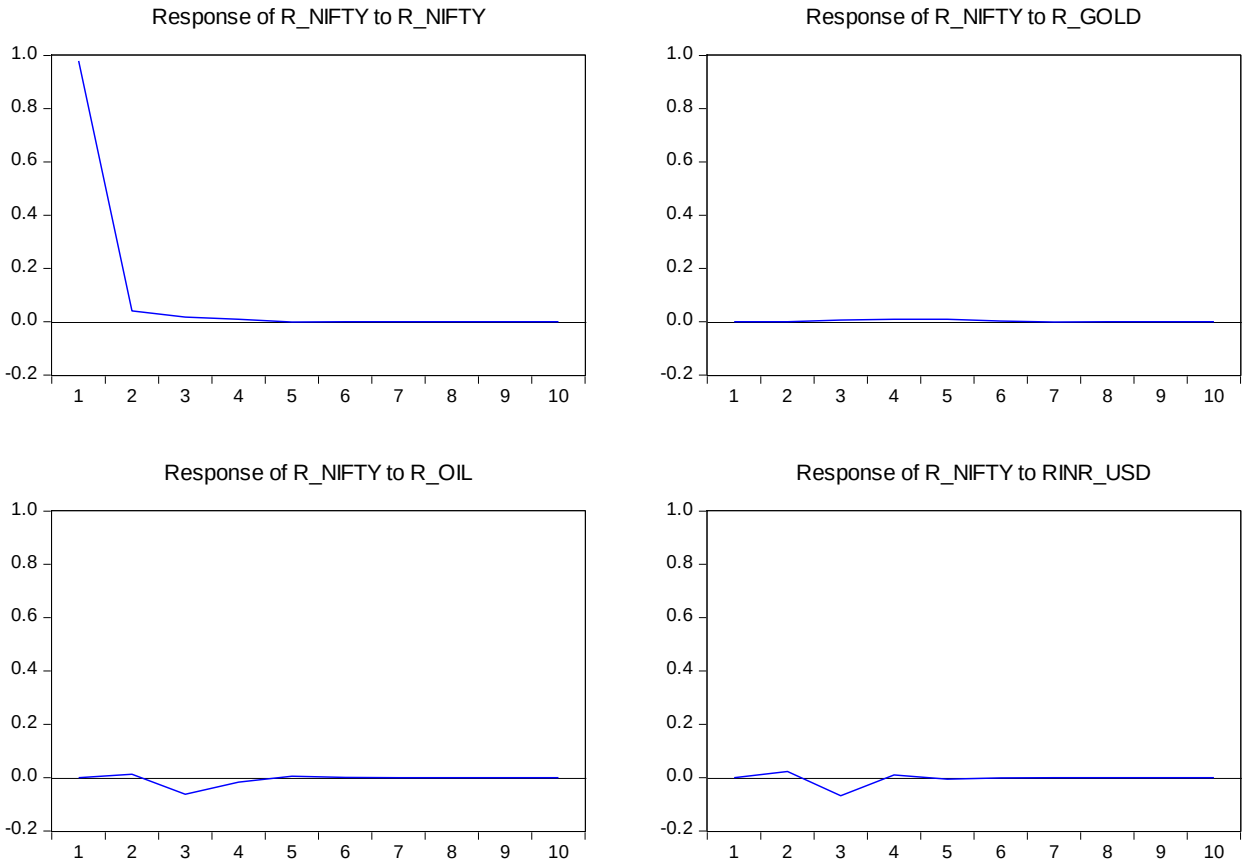


Figure 2: Impulse responses on nifty from other three market

The result of the impulse response for Nifty is presented graphically in Figure 1. As the impulse response represents that with innovation in one market what will the reaction of other markets and for how long these effects continue? Figure 2 represents the response of the Nifty market to the other three markets. The result shows that the Nifty market does not react significantly to any other Gold, Oil, and Exchange rate and it shows on the first day of any innovation happening in any other three markets the Nifty will impact by zero, while on the second day, this impact continues. Any innovations happening in Nifty on day 1 impacted almost 1, while on the day it decreases to zero, and from day 2 onward it does not show any responses to its own market.

Figure 3 shows the result of the impulse response analysis of the gold market responses to innovation in the other three markets.

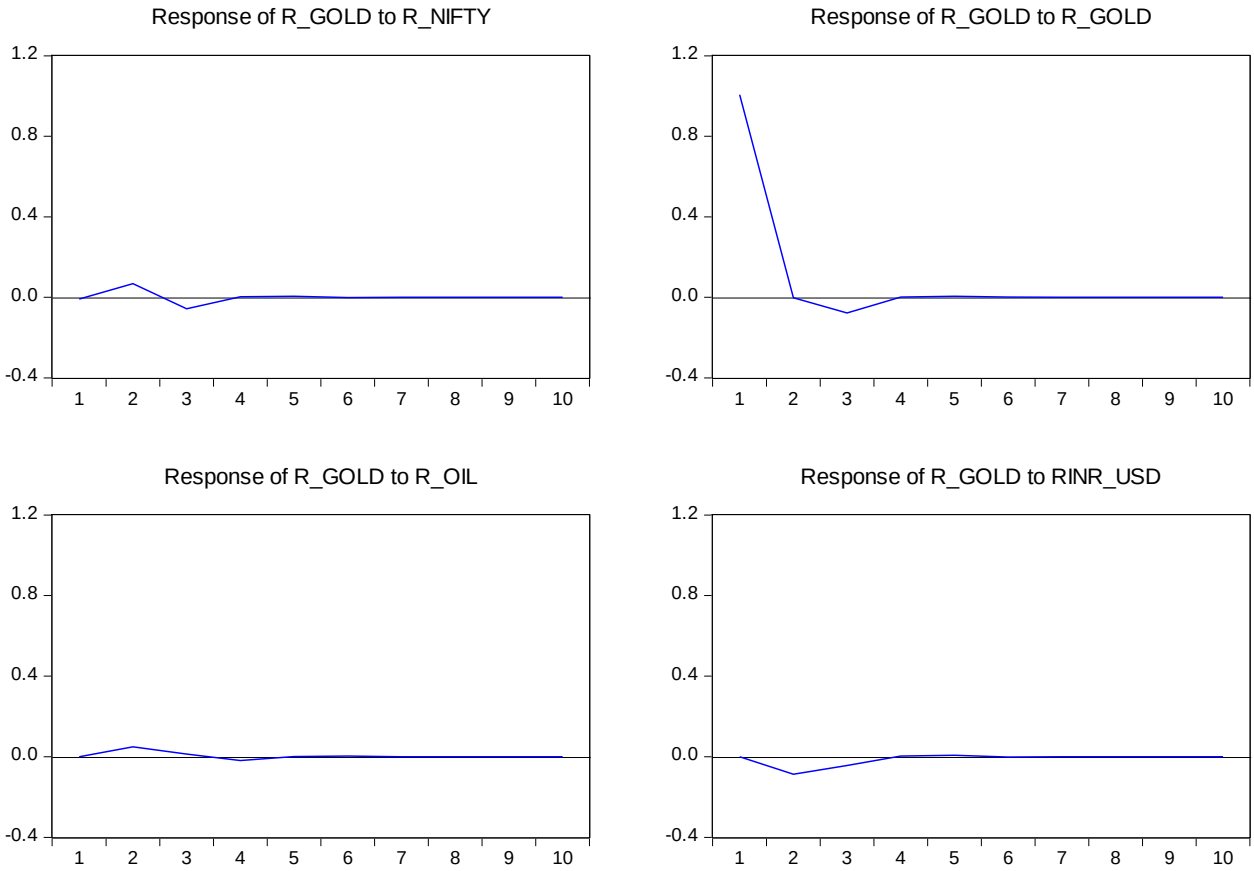


Figure 3: Impulse response on gold market from other three market

The outcome of the gold market impulse response to the other three markets. As in Figure 3, the impact of nifty on gold is not significant, on day 1 nifty was impacted by 0 on the gold market but on day 2 it bounced to more than zero, and on other days it negatively impacted the gold market. Then from the next day to the 10th day, the impact was zero. The impulse response from the gold market to its own market is significant, on the first day its impact is close to 1.2, and on 3rd day it is negative and zero from the next day. The gold market impacted very little on the oil and exchange rate market.

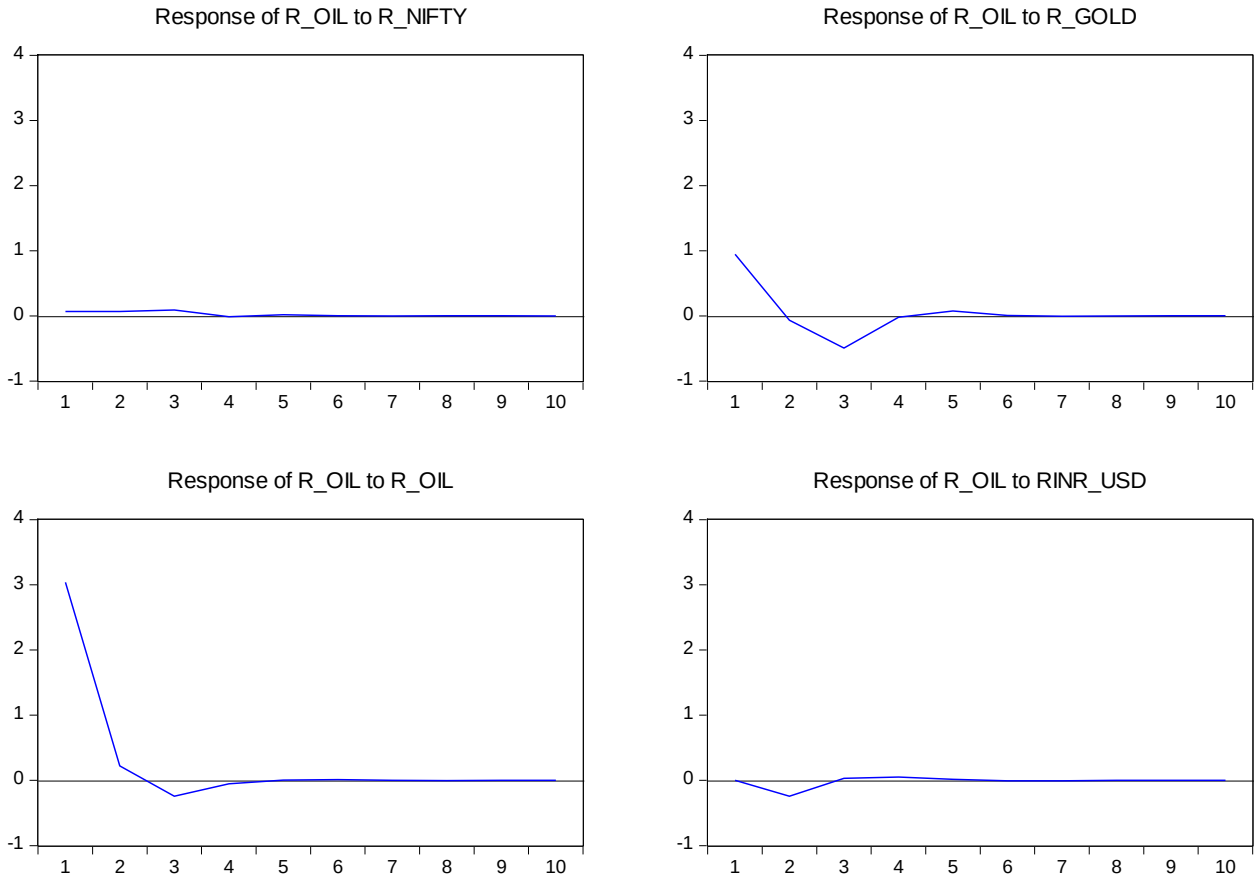


Figure 4: Impulse responses on oil market from other three market

Any innovation is happening in nifty and the exchange rate impacts very little on the oil market. If any invention occurs in the gold market it impacted positively on day 1, on the second day it became 0, on the 3rd day it impacted negatively and from the next day onward it is zero till the 10th day. The oil market was significantly impacted on its own market on day 1, on the second day it was close to zero but 3rd day negatively impacted the same market.

Figure 5 represents the response of the exchange rate on the other three markets and its own market. Any innovation happening in the nifty on day 1, the exchange rate impacted negatively, and this impact decreased till day 3. From day 3 onward the impact becomes zero till day 10. The gold market was impacted negatively on day 1 and day 2 but it was impacted positively by the oil market. The response from the exchange market to its own market is significant and on day 1 it impacted around 3 but on the second day, it was negative and inversely happened on other days. From that day onwards it impacted zero till the last day.

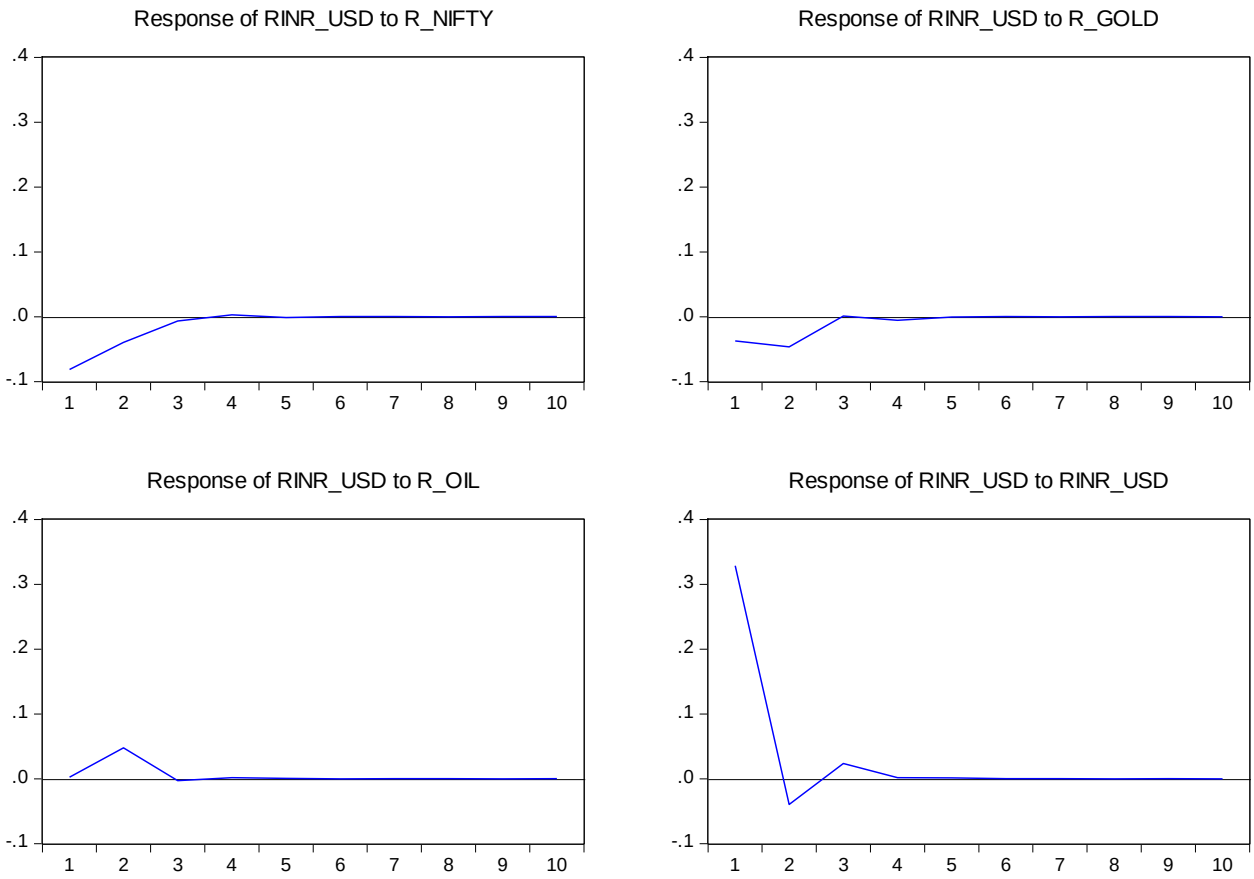


Figure 5: Impulse response on exchange rate from other three market

Table 8: Result of Pairwise Granger Causality Tests

Pairwise Granger Causality Tests
Date: 04/17/23 Time: 13:12
Sample: 2/25/2022 4/06/2023
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
R_NIFTY does not Granger Cause R_GOLD	265	1.02469	0.3604
R_GOLD does not Granger Cause R_NIFTY		0.00560	0.9944
R_OIL does not Granger Cause R_GOLD	265	0.37864	0.6852
R_GOLD does not Granger Cause R _OIL		2.25606	0.1068
RINR_USD does not Granger Cause R_GOLD	265	1.07232	0.3437
R_GOLD does not Granger Cause RINR_USD		2.59449	0.0766
R_OIL does not Granger Cause R_NIFTY	265	0.51255	0.5996
R_NIFTY does not Granger Cause R_OIL		0.20532	0.8145

RINR_USD does not Granger Cause R_NIFTY	265	0.77714	0.4608
R_NIFTY does not Granger Cause RINR_USD		2.33619	0.0987
RINR_USD does not Granger Cause R_OIL	265	0.47330	0.6235
R_OIL does not Granger Cause RINR_USD		0.96619	0.3819

The study investigates the causality from nifty to gold prices, gold prices to nifty, oil prices to gold prices to oil prices, the exchange rate to gold, gold to the exchange rate, oil to nifty, nifty to oil, exchange rate to nifty, nifty to exchange rate, the exchange rate to oil and oil to exchange rate. The Granger causality test result shows that when one variable is causing the other. From Table 8 the result shows a 5% level of significance between gold prices, oil prices, exchange rate, and the Indian stock market none of these variables cause each other, since the p-value is more than 0.05 we should accept null hypnosis which indicates there is no cause between these variables. If the study considers a 10% level of significance it indicates that only gold price causes the exchange rate and also the nifty cause the exchange rate.

CHAPTER III

3.1 Findings:

Based on the objective a vector Autoregression test was conducted in Chapter 2, and the most important findings are as follows:

Based on objective A:

- ✓ It has been found, there is significant interaction between oil prices, gold prices, exchange rate, and the stock market.

Based on the objective B:

- ✓ The result shows gold on nifty and nifty on oil doesn't impact on each other.
- ✓ It is found that the oil market is very volatile than the other three market.
- ✓ The significant variance in nifty and gold prices is contributing by its own market.
- ✓ An oil market the major variance is coming from gold market and the major variance an exchange rate is contributing by nifty.

Based On the objective of C:

- ✓ At 5% level of significance none of the variable cause each other.
- ✓ But at 10% level of significance only the gold prices and nifty cause the exchange rate.

3.2 Conclusion:

This study uses notable oil prices, gold prices, and exchange rate from 24th February 2022, to 06th April 2023, to evaluate the link between the variables. The data was sourced from a reputable website yahoo finance and investo.com. The vector Autoregression model and

Granger Causality model was used to detect the linkages, but two key tests were performed before running the VAR model and granger causality model: one for autocorrelation and the other for stationary.

Except fore nifty and gold market the result of forecast variance decomposition shows the majority of innovation in oil and exchange rate contributing by these two other markets and from 98 to 100% variance in nifty and gold is coming from their domestic market. Impulse response significant variance in nifty and gold prices is contributing by its own market. The majority variance for gold market and nifty is contributing by oil market and exchange rate respectively. At level of 5% none of the variable cause each other but at 10% only the gold prices and nifty cause an exchange rate.

3.3 Recommendations:

This study covered the linkage between oil prices, gold prices, and the exchange rate the on Indian stock market, which is one of the important aspects for the investor who invests in foreign currency, gold ETF and all the oil importing countries. The study is also helping investor to diversify their portfolio and invest across different market.

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