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Impact of exchange rate and foreign exchange gold reserve on prices of gold

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ABSTRACT- Gold has maintained its existence in Indian economy since centuries and there is no need for explaining the importance of this yellow metal in Indian culture as this valuable commodity always has a significant economic effect worldwide. This precious metal has marked a land mark upward trend in terms of prices after phase of recession in 2008 and early 2009 in global economy. Gold has emerged as safe haven for investment due to downfall of equity markets in recent years. Beginning of new millennium has witnessed a period where prices of this yellow metal started to climb robustly on a continue basis. Gold has been treated as hedge against inflation and exchange rate fluctuations. In the light of above scenario, this paper has analyzed the impact of exchange rate and foreign exchange reserve on gold prices.

KEYWORDS- Exchange Rate, Foreign Exchange Reserve, Recession, Inflation.

I. INTRODUCTION

Indian culture has witnessed the dominant presence of gold and carries a status of valuable commodity throughout the history of humanity. The importance of this precious metal since ancient time and the evidence of the existence of this precious metal can be found in various spiritual books like Vedas, Puranas, and Upnishads etc. Being a monetary standard, it has a significant impact on the economy worldwide and irrespective of its abolishment as gold standard. Investment in gold predominately acts as cushion against inflation in terms of hedging and also participates actively in creating diversified portfolio. This is a practice of central bank of a country to retain gold reserve in terms of security for crisis in economy. These gold reserves in central bank are major source of world gold supply (Shahriar Shafiee & Erkan Topal, 2010)

Gold was prevalent as an exchange system across the world when there was no exchange of paper currency but with the abolishment of Bretton Woods system, this method replaced with fiat money policies to maintain equality. However, yellow metal had not lost its significance and still maintain its dominance worldwide. Gold has always been treated as safe mode of investment in India but changing global economic scenarios have transformed its role and now it is being traded and predicted as a commodity. Dollar is treated as strong currency amongst all currencies and investors prefer to purchase dollar denominated assets in case of rising dollar price but whenever there is downfall in dollar, they start moving towards buying gold for maintaining and increasing profit (S.Venkata Seshaiah & Aviral kumar Tiwari, 2017).

Gold is the most precious and liquid asset, which keeps on mesmerizing mankind since its inception. It is treated as backbone of all economies and one of the best investment options for common people. But the new millennium has witnessed a drastic change in the prices of gold in upward direction on a strong and continuous basis. The financial crisis of 2007-2009 had played a significant role in changing the prices of gold and by 2013 there is a decrease in gold prices but the yellow metal has maintained relative stability (Zaeem-Al Ehsan, n.d). However, during this financial crisis, the prices of other key minerals fell and there was a downfall in other equities also, but gold had emerged as rising star and maintained its supremacy in terms of increasing prices (Shahriar Shafiee & Erkan Topal, 2010).

This study tries to determine the causal relationship between exchange rate & foreign gold reserve and gold prices. The present work offers a value addition to the existing literature. The remaining of this paper is structured as follows: Section two describes literature review, Section three demonstrates the methodology and data used in the study. Section four through light on the empirical results of study. Final section presents the concluding observation of study.

II. OBJECTIVES

The study is based on the following objectives:

- To understand the significance of gold in an economy.
- To discuss the impact of exchange rate and foreign exchange gold reserve on price of gold.

III. RESEARCH METHODS

It is being hypothesized that the prices of gold are dependent on the exchange rate and foreign exchange gold reserve. The linear model of regression has been used for analyzing this causal relationship. The study has considered two predictors and one dependent variable so this will be an application of multiple regression model. The predictors are exchange rate and foreign exchange gold reserve and dependent variable is

gold price. The study has considered data for a period of fifteen years from 2006-07 to 2020-21.

The regression model will be:

$Y_i = (b_0 + b_1X_{1i} + b_2X_{2i}) + E_i$

Gold $Price_i = b_0 + b_1$ exchange $rate_i + b_2$ foreign exchange gold $reserve_i + E_i$

IV. HYPOTHESES OF THE STUDY

This paper has aspires to study the impact of exchange rate and foreign exchange gold reserve on gold prices based on the following hypotheses:

H0: There is no causal relationship between the selected variables;

$b_1 = 0; b_2 = 0$

H1: There is a significant causal relationship between the selected variables.

$b_1 \neq 0; b_2 \neq 0$

V. LITERATURE REVIEW

The numerous studies and empirical researches are available for throwing light on gold. A few studies discussing the impact of various determinants on gold prices are discussed here:

Shafiee & Topal (2010) studied the gold market and gold prices with the help of trend analysis over a period of 40 years. The variables which are responsible for variation in gold prices are also discussed. The researcher has used the jump diffusion model and finally predicted the gold prices for next ten years.

Baber et.al (2013) focused on the rising gold prices in India during a period between 2022 to 2012. The factors like international business environment, political environment, market conditions, its induction in commodity market, buying behavior of consumers, and inflation are selected for analyzing their impact on the gold prices.

Lili & Chengmei (2013) presented the dynamics of gold prices in the gold exchange in New York and a dataset have been used which includes global macroeconomic indicators, financial market indices, quantities and prices of energy products. The study has utilized panel data series and estimated a Factor-Augmented Vector Auto-regression for gold prices. It is concluded that a factor correlated to purely financial developments contributes to the model performance, in addition to factors related to gold reserves and energy prices.

Dr. Sindhu (2013) emphasized on the relationship between the factors like exchange rate of US dollar with INR, Crude oil prices, repo rate and inflation rate with gold prices. The results shown that there exist an inverse relation between the US$ and gold prices. Further, gold prices are also affected by the crude oil prices. There is an element of interdependence between gold prices and repo rate. However, gold prices and inflation rate are also positively correlated and dependent on each other.

Seshaiah & Tiwari (2017) empirically analyzed the impact of Oil prices, Exchange rate, trade deficit, and fiscal deficit on the prices of gold in India. The study included a time frame of 1994 - 1995 to 2014 -2015 and utilized the Johansen's cointegraion, variance Decomposition and Granger causality test for this analysis. The results shown that all variables are stationary at first difference and that there are two cointegration relationships between Gold prices, crude oil prices, exchange rate, Trade Deficit and Fiscal deficit.

Soumya Sharma (2018) used the econometric technique and indicated the individual impact of exchange rates, BSE Sensex, personal disposable income and crude oil prices on gold prices. This impact is positive and significant. On the other hand, the individual impact of inflation and interest rates on gold prices is negative and insignificant. The combined impact of exchange rate, inflation, interest rate and crude oil prices are also tested and found to be statistically significant.

G. Rejikumar, et.al. (2021) offered policy directions for India's economic development by limiting imports of gold. The study utilized historical trade data and adopted descriptives, revealed comparative advantage, future predictions using Markov chain analysis, etc. The results demonstrated the various trends in India's gold trade. It is also shown that India's export of gold jewelry is highly dependent on the United Arab Emirates, however, other markets in the Middle East are under-explored.

VI. RESULTS AND DISCUSSION

After the application of linear regression model on selected data, the following results have been derived and discussed as under:

Table 1: Descriptive Statistics

	Mean	Std. Deviation	N
Average Price of Gold (Rupees per 10 gm)	25468.9533	10604.58684	15
Exchange Rate for Rupee Vis_a_Vis US Dollar	57.368533	11.2238048	15
Foreign Exchange Reserves in Gold (Rupees in Crore)	124590.33	61343.314	15

Table 1 tells us the mean and standard deviation of each variable in our model. This table is useful summary of the variables.

Table 2: Correlations

		Average Price of Gold (Rupees per 10 gm)	Exchange Rate for Rupee Vis_a_Vis US Dollar	Foreign Exchange Reserves in Gold (Rupees in Crore)
Pearson Correlation	Average Price of Gold (Rupees per 10 gm)	1.000	.885	.968
	Exchange Rate for Rupee Vis_a_Vis US Dollar	.885	1.000	.844
	Foreign Exchange Reserves in Gold (Rupees in Crore)	.968	.844	1.000
Sig. (1-tailed)	Average Price of Gold (Rupees per 10 gm)	.	.000	.000
	Exchange Rate for Rupee Vis_a_Vis US Dollar	.000	.	.000
	Foreign Exchange Reserves in Gold (Rupees in Crore)	.000	.000	.
N	Average Price of Gold (Rupees per 10 gm)	15	15	15
	Exchange Rate for Rupee Vis_a_Vis US Dollar	15	15	15
	Foreign Exchange Reserves in Gold (Rupees in Crore)	15	15	15

This table contains a Pearson correlation coefficient between every pair of variables, the one-tailed significance of each correlation and the number of cases contributing to each correlation. It can be observed in the table that along the diagonal of the matrix the values for the correlation coefficients are all 1.00 i.e. a perfect positive correlation because they are the correlation of each variable with itself. This correlation matrix also gives a sense of the relationship between predictors and the outcome and further gives a preliminary indication of multicollinearity.

This can be concluded from the above table that multicollinearity does not exist as there is no substantial correlation (r>0.9) between predictors. After looking at the outcome variable, it is apparent that of the predictors exchange rate and foreign exchange reserve of gold correlates best with the outcome (r = .885, p=.000, p<.001) and (r= .968, p= .000, p < .001).

Table 3: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.885[a]	.782	.766	5134.07445	.782	46.730	1	13	.000
2	.976[b]	.953	.945	2487.07855	.171	43.397	1	12	.000
a. Predictors: (Constant), Exchange Rate for Rupee Vis_a_Vis US Dollar									
b. Predictors: (Constant), Exchange Rate for Rupee Vis_a_Vis US Dollar, Foreign Exchange Reserves in Gold (Rupees in Crore)									
c. Dependent Variable: Average Price of Gold (Rupees per 10 gm)									

Table 3 describes the overall fit of the model. This is cleared from the above results that there are two models in the table because the study has used the hierarchical method with two blocks and the summary statistics are repeated for each block/model. Model 1 discusses the first stage in the hierarchy when only one predictor i.e. exchange rate has been used. On the other hand, Model 2 has considered all two selected predictors i.e. exchange rate and foreign exchange reserves in gold. The column labelled R shows the multiple correlation coefficient between the predictors and the outcome. However in Model 1, this is the simple correlation with one predictor.

The column R Square is a measure of how much variation in prices of gold is accounted for by the predictors. In the first model, its value is .782, which means that exchange rate accounts for 78.2% of the variation in prices of gold. However, when the foreign exchange reserve in gold prices is included as well in Model 2, then this value is .953 or 95.3% of the variance in prices of gold. Now, if exchange rate accounts for 78.2 %, then foreign exchange reserves in gold accounts for an additional 17.1%

The adjusted R^2 gives an indication about the generalization of this model, and on an ideal basis we'd like its value to be the same as or very close to, the value of R^2. In this case, the difference for the final model is small i.e. .953 - .945 = .008 or about 0.8%. This means that if the model is derived from the population rather than the sample it would account for approximately 0.8% less variance in outcome.

The section of change statistics gives information about the level of improvement in model fit after the addition of

predictor. It will tell that whether the change in R^2 is significant or not. In model 1, R^2 changes to .782 and gives rise to F- statistic of 46.730, which is significant with a probability less than .001. In model 2, after the addition of one more predictor i.e. foreign exchange reserves in gold, R^2 increase by .171 which makes the R^2 of this model .953. This is also significant as $p < .001$ with F-statistic of 43.397.

Table 4: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1231738301.111	1	1231738301.111	46.730	.000[b]
	Residual	342663366.378	13	26358720.491		
	Total	1574401667.489	14			
2	Regression	1500174950.738	2	750087475.369	121.264	.000[c]
	Residual	74226716.751	12	6185559.729		
	Total	1574401667.489	14			
a. Dependent Variable: Average Price of Gold (Rupees per 10 gm)						
b. Predictors: (Constant), Exchange Rate for Rupee Vis_a_Vis US Dollar						
c. Predictors: (Constant), Exchange Rate for Rupee Vis_a_Vis US Dollar, Foreign Exchange Reserves in Gold (Rupees in Crore)						

The table 4 tells us that whether the model is significantly better at predicting the prices of gold than using the mean outcome i.e. no predictors. F-test has been used for this purpose and it represents the ratio of the improvement in prediction that result from fitting the model, relative to the inaccuracy that still exist in the model. Here, F-statistic is 46.730, p<.001 in model 1 and 121.264, p<.001 for model 2. This can be interpreted that both models have significantly improved the ability to predict the outcome variable i.e. price of gold compared to not fitting the model.

Table 5: Coefficientsa

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-22474.449	7137.629		-3.149	.008
	Exchange Rate for Rupee Vis_a_Vis US Dollar	835.709	122.253	.885	6.836	.000
2	(Constant)	-3799.090	4471.243		-.850	.412
	Exchange Rate for Rupee Vis_a_Vis US Dollar	220.810	110.543	.234	1.997	.069
	Foreign Exchange Reserves in Gold (Rupees in Crore)	.133	.020	.771	6.588	.000

Table 5 gives the estimates of the model parameters i.e. the beta values and the significance of these values. In model 1, the constant i.e. b_0 intercept and this value is -22474.449, which is indicating that in the absence of a predictor, the price of gold will have a negative value. Here value of b_1 is 835.709 and this is the slope of the line for the model and this represents the change in the outcome i.e. price of gold associated with a unit change in the predictor i.e. exchange rate for rupee. Further, the p< .001 and it concludes that exchange rate is a significant predictor for prices of gold.
In model 2, the value of constant i.e. b_0 intercept is -3799.090 and again describing that in the absence of predictor, the price of gold will have a negative value. In this case both the predictors have positive b-values and it shows that there is a positive relationship. Therefore, average prices of gold will increase, when there is an increase in exchange rate and foreign exchange reserves in gold. In this model, value of b indicates the degree to which each predictor affects the outcome if the effects of all other predictors held constant.

- Exchange Rate for Rupee Vis_a_Vis US Dollar: In this case b=220.810, which states that if exchange rate will increase by Rupee 1 then there will be in increase in average price of gold by Rs. 220.810. But it has p >.001and concluding that this predictor is not significant.
- Foreign Exchange Reserves in Gold (Rupees in Crore): Here, b=.133 indicates that increase of Rupee 1 in foreign exchange reserve in gold will lead to Rs. .133 in prices of gold. It has p<.001 and it can be concluded that this is a significant predictor.

The standardized beta values specifies that as predictor value will increase by one standard deviation, then value of outcome variable will increase by respective beta value in terms of standard deviation.

Table 6: Collinearity Diagnosticsa

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions		
				(Constant)	Exchange Rate for Rupee Vis_a_Vis US Dollar	Foreign Exchange Reserves in Gold (Rupees in Crore)
1	1	1.983	1.000	.01	.01	
	2	.017	10.675	.99	.99	
2	1	2.894	1.000	.00	.00	.01
	2	.100	5.387	.08	.00	.32
	3	.006	21.383	.92	1.00	.68
a. Dependent Variable: Average Price of Gold (Rupees per 10 gm)						

The table 6 gives information about the collinearity based on the eigenvalues and variance proportion. For checking this issue, the distribution of large variance proportion on different eigenvalues is checked as each predictor has its variance loading onto a different dimension than other predictors.

VII. CONCLUSION

Gold has derived its importance since ancient times across the globe and still treated as symbol of status and provide a safety cushion to the investors at the time of crisis. The researchers have analyzed various drivers which may affect the prices of gold and formulated different models. However, there is a state of contradiction among these studies, but every study has recognized the significance of this precious metal. This study also concluded that gold is a precious commodity and there are different factors which may have impact on prices of gold. But this study has studied the impact of exchange rate for Rupee against US Dollar and foreign exchange reserves of gold on the prices of gold. The results of the analysis has shown that both the predictors have significant relationship with the outcome i.e. price of gold and further the model establishes a causal relationship between the selected variables. However further studies may be conducted by incorporating more predictors and an improved version of model may be developed. The time frame of study may also be increased for assessing the better results.

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