

Influencing of Macro-Economic Determinants on Gold Prices Volatility in India

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Abstract: *The objective of the present study is how macro-economic variables influencing the gold price volatility between the years from 2000 to 2025. As a managing wealth a verge against inflation, and an investment in asset, gold is one of the significant to the Indian economy. The study examines how selected macroeconomic factors, like, GDP, exchange rates, real interest rates, inflation rates, and crude oil prices, relay to gold prices. The secondary data for this study collected from the world bank indices. To analyse the association between the macro-economic variables and gold prices, the study used research tools like, multiple regression, correlation analysis, and descriptive statistics. The outcomes from the analysis showed that whereas gross domestic product, real interest rate and crude oil prices are not significantly influence the gold prices in India throughout the study period. The exchange rates and inflation rate have significantly influenced the gold prices during the study pride. The result from regression analysis also revealed that a significant fluctuation in the gold prices, it means, the select macro-economic factors significantly influence the gold prices. The study concludes that the during the study period two macro-economic factors i.e, inflation and currency rate changes are predominantly influencing the volatility of gold prices*

Keywords: Gold Price Volatility, Macroeconomic Variables, Exchange Rate, Inflation Rate, GDP, Real Interest Rate, Crude Oil Prices, Multiple Regression Analysis.

I. INTRODUCTION

In Indian economy Gold is the important factor and is still the Indian, especially Indian women's holding nearly 11% of the world's total gold stock, it is showing gold is very popular asset to save and making investment in it. Gold is not only considered as a metal and also it represents the social standing and wealth. It is often used in religious rituals, marriages, and festivals and is regarded as a safe way to save for the future generations. According to the (World Gold Council, 2021) As India is one of the world's leading gold importers and consumers of the gold in both the domestic economic environment and global market. It makes the significant fluctuations and impact domestic gold prices (World Gold Council, 2021). Gold is considered a safe asset and an excellent investment hedge for times of urgent need. During periods of financial crisis or market volatility, investors typically shift their funds from high-risk assets into gold, which is viewed as having stable value. Gold prices frequently increase during periods of political and economic turmoil. Due to this characteristic, gold has become a key component of risk management and investment portfolio diversification strategies (Baur & Lucey, 2010). India's gold prices are very volatile, with regular and occasionally abrupt swings over time. Policymakers, jewellers, investors, and families are all impacted by this volatility. Changes in gold prices have an impact on consumers' saving and spending habits. Volatility offers investors both possibilities and hazards. Because India depends so heavily on imported gold, changes in gold prices have an influence on the country's import bill, current account deficit, and foreign exchange reserves from a macroeconomic standpoint (Reserve Bank of India, 2023). Gold price volatility is thought to be influenced by a number of macroeconomic factors. Given that gold is frequently employed as a hedge against price increases, inflation is one of the most significant factors. Investors frequently purchase gold to preserve their wealth's buying power as inflation rises (Ghosh et al., 2004). Because gold is traded worldwide in dollars, changes in exchange rates, especially the weakening of the Indian Rupee relative to the US



dollar, can have a significant impact on local gold prices. According to Singh and Kaur (2020), the local price of imported gold rises as the currency declines. Interest rates affect the opportunity cost of owning a non-yielding asset, which in turn affects gold prices. The gold is always top in the investors list than fixed income assets that gives low interest rates. Crude oil and stock markets are other options for investors and when stock market is fluctuates more the investors turn to investment in gold. When crude oil prices increase it can create the inflationary pressure and potentially increase the demand of gold. Furthermore, growth of gross domestic product (GDP) makes the impact of purchasing power and income levels of peoples; this may lead the investment and consumption of gold in India (Sailaija et., 2022). The current study titled "Influence of Macro-Economic Determinants on Gold Price Volatility in India," examines how Gross Domestic Product (GDP), inflation, currency exchange rates, interest rates, and crude oil prices affect the volatility in gold prices in India.

II. REVIEW OF LITERATURE

The several existing empirical studies has been conducted and analysed to check the association between macroeconomic factors and changes in gold prices. These research studies having the result that the complex relationship of geopolitical factors, financial factors, and economic factors affects gold prices. Few studies that are different from mentioned in the introduction and especially relevant to the current study on gold price volatility in India are highlighted in the following review of literatures. Robert Barsky and Lawrence H. Summers (1988) were in their study, the argued that the inflation is the only factor influencing gold prices and also showed that real interest rates and general macroeconomic prospects are important factors in determining the movement of gold prices. They opposed that the monetary policy, investors' expectations for future economic stability had a substantial impact on gold prices. According to Richard D. Jaffe's (1989) they studied when considering the role of gold and precious metals in investment portfolios, gold offers diversification benefits due to its relatively low correlation with conventional financial assets. The study concludes that financial instability and macroeconomic shocks make gold more attractive, while also increasing price volatility. In 2010, Dirk G. Baur and Thomas K. McDermott conducted a study on whether gold serves as a safe and important hedge in global markets. They concluded that gold acts as a reliable safeguard when stock markets decline, indicating that volatility in financial markets significantly impacts the price of gold. Richard Levin, Peter Wright, and Mahua Mahdavi (2006) examined the long-term relationship between gold prices, inflation, and currency exchange rates. Using cointegration approaches, they found that currency fluctuations and inflation expectations impact gold prices over time, highlighting the significance of these factors in understanding price trends. According to a study on emerging markets by Cevdet Aksoy and A. Topcu (2013), exchange rate fluctuations and global liquidity conditions significantly impact gold prices. Their findings are particularly relevant to India, as gold imports here expose local prices to changes in the rupee-dollar exchange rate and global monetary conditions. Cagatay Topcu and S. Sarigül (2015) investigated how interest rates and oil prices affected the markets for precious metals. The study came to the conclusion that rising crude oil prices cause inflationary pressures and economic instability, which in turn raise gold prices. This result implies that shocks to oil prices have a significant role in determining the volatility of gold prices. Cagatay Topcu and S. Sarigül (2015) examined how interest rates and crude oil prices impact the markets for precious metals. Their study concluded that rising crude oil prices generate inflationary pressures and economic instability, leading to an increase in gold prices. This finding indicates that sudden fluctuations in crude oil prices play a significant role in determining the volatility of gold prices. In 2014, Javier A et al. conducted a study and showed that valuable metals prices are significantly impacted by macro-economic volatility relatively than just the number of economic variables. Their findings suggest that volatility in interest rates, inflation, and currency rates can exacerbate changes in the price of gold. M. K. Suresh and R. V. Rajesh (2018) discovered that the most significant factors influencing domestic gold prices in India were inflation and depreciation of the currency rate. In a similar vein, R. K. Sharma and S. Mathur (2021) found statistically significant influences on gold returns in India from both stock market volatility and crude oil prices. M. K. Suresh and R. V. Rajesh (2018) found that inflation and the depreciation of the currency exchange rate are the most significant factors determining domestic gold prices in India. Similarly, R. K.



Sharma and S. Mathur (2021) found that both stock market volatility and crude oil prices have a statistically significant impact on gold investment returns in India. A review of the literature demonstrates that various macro-economic variables such as inflation, interest rates, foreign exchange rates, stock market fluctuations, and crude oil prices affect gold prices. Although previous studies have demonstrated these associations in other countries, data specific to India remains very limited. Moreover, they often focus on only a few factors rather than considering a wide range of variables. The present study aims to bridge this gap by examining the impact of key macroeconomic factors on gold price fluctuations in India within an integrated empirical framework.

III. OBJECTIVE AND METHODOLOGY

The primary objective of this research study is to examine the impact of macro-economic variables on the fluctuations of gold prices in India. For this study, secondary data were collected from World Bank data indicators and other relevant published sources. The study covers a 25-year period, from 2000 to 2025. To fulfill the objective of the study, the following 'null hypothesis' was formulated: H01: There is no significant relationship between macroeconomic factors and gold prices in India. In this study, the price of gold is treated as the dependent variable, while macroeconomic factors are considered independent variables. The independent variables include Gross Domestic Product (GDP), foreign exchange rates, real interest rates, inflation rates, and crude oil prices. Various statistical tools including descriptive statistics, correlation analysis, and multiple regression analysis were employed to analyze the relationships between variables. These tools were used to examine the nature, strength, and significance of the relationship between macroeconomic factors and gold prices in India.

IV. ANALYSIS AND INTERPRETATION

Table 1: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness		Kurtosis	
Gold price	25	3.63	5.10	4.321	.41656	.174	-.256	.464	-.829	.902
GDP	25	-.83	.99	.7460	.35469	.126	-3.936	.464	17.510	.902
Exchange Rate	25	1.62	1.92	1.752	.10092	.010	.321	.464	-1.476	.902
Real Interest Rate	25	-.50	1.81	.6392	.44949	.202	-.650	.464	3.387	.902
Inflation Rate	25	.52	1.08	.7528	.16509	.027	.536	.464	-.867	.902
Crude Oil Prices	25	-.84	.20	-.1596	.29080	.085	-.800	.464	-.478	.902

The above table 1 depicts the descriptive statistics of the variables used in the study. The average gold price over the 25 observations is 4.3216, with values ranging from 3.63 to 5.10. The standard deviation of 0.41656 indicates moderate variability in gold prices during the study period. The skewness value (-0.256) shows that the distribution is slightly negatively skewed, while the kurtosis value (-0.829) suggests a flatter-than-normal distribution. GDP has a mean value of 0.7460, with a minimum of -0.83 and a maximum of 0.99. The relatively low standard deviation (0.35469) indicates limited variation in GDP values. The skewness value of -3.936 reveals a highly negatively skewed distribution, implying that most values are concentrated at the higher end with a few extremely low observations. The kurtosis value of 17.510 indicates a highly leptokurtic distribution, meaning the data contain extreme values or outliers. The exchange rate variable records a mean of 1.7524 and a standard deviation of 0.10092, showing relatively stable movement. Its skewness value (0.321) indicates slight positive skewness, whereas the kurtosis value (-1.476) suggests a platykurtic



distribution with fewer extreme observations. The real interest rate has an average value of 0.6392, ranging from -0.50 to 1.81. The standard deviation of 0.44949 indicates moderate dispersion. The skewness value (-0.650) shows moderate negative skewness, while the kurtosis value (3.387) indicates a leptokurtic distribution with relatively heavier tails than a normal distribution. Inflation rate shows a mean value of 0.7528 and a standard deviation of 0.16509, implying relatively low volatility. The distribution is slightly positively skewed, as indicated by the skewness value of 0.536. The kurtosis value (-0.867) suggests a flatter distribution compared to the normal distribution. Crude oil prices have a negative mean value of -0.1596, with values ranging from -0.84 to 0.20. The standard deviation of 0.29080 indicates moderate variability. The skewness value (-0.800) reveals moderate negative skewness, while the kurtosis value (-0.478) indicates a slightly platykurtic distribution. Overall, the descriptive statistics suggest that most variables exhibit moderate variability and non-normal distribution characteristics, particularly GDP and real interest rate, which show evidence of skewness and high kurtosis.

Table 2: Correlation Analysis of Gold Price and Macro Economic Variables

		Gold Price	GDP	Exchange Rate	Real Interest Rate	Inflation Rate	Crude Oil Prices
Gold Price	Pearson Correlation	1	-.062	.840**	-.069	.284	-.477*
	Sig. (2-tailed)		.768	.000	.744	.169	.016
	N	25	25	25	25	25	25
GDP	Pearson Correlation	-.062	1	-.127	-.092	-.043	.353
	Sig. (2-tailed)	.768		.546	.662	.839	.084
	N	25	25	25	25	25	25
Exchange Rate	Pearson Correlation	.840**	-.127	1	.166	-.145	-.680**
	Sig. (2-tailed)	.000	.546		.428	.489	.000
	N	25	25	25	25	25	25
Real Interest Rate	Pearson Correlation	-.069	-.092	.166	1	-.469*	.082
	Sig. (2-tailed)	.744	.662	.428		.018	.697
	N	25	25	25	25	25	25
Inflation Rate	Pearson Correlation	.284	-.043	-.145	-.469*	1	.244
	Sig. (2-tailed)	.169	.839	.489	.018		.240
	N	25	25	25	25	25	25
Crude Oil Prices	Pearson Correlation	-.477*	.353	-.680**	.082	.244	1
	Sig. (2-tailed)	.016	.084	.000	.697	.240	
	N	25	25	25	25	25	25

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

The above table 2 explains the relationship between gold prices and the selected macroeconomic variables. The results show that gold price has a strong positive and statistically significant relationship with the exchange rate ($r = 0.840$, $p < 0.01$). This means that when the exchange rate increases, gold prices also tend to increase. Gold price also has a moderate negative and significant relationship with crude oil prices ($r = -0.477$, $p < 0.05$), indicating that rising crude oil prices are associated with a decrease in gold prices. On the other hand, gold price has weak and statistically insignificant relationships with GDP ($r = -0.062$), real interest rate ($r = -0.069$), and inflation rate ($r = 0.284$), suggesting that these variables do not have a strong influence on gold prices during the study period.



The analysis further shows that exchange rate and crude oil prices are strongly and negatively related to each other ($r = -0.680$, $p < 0.01$), meaning that an increase in exchange rate is generally associated with a decrease in crude oil prices. Similarly, real interest rate and inflation rate have a moderate negative and significant relationship ($r = -0.469$, $p < 0.05$). Overall, the findings suggest that among all the variables, exchange rate has the strongest association with gold prices, followed by crude oil prices, while GDP, inflation, and real interest rate show only weak relationships.

Multiple Regression Analysis of Gold Prices and Macro-Economic Variables

H_{01} = The null hypothesis is there is no significant relationship between macro-economic variables and gold prices in India.

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. Change
1	.938 ^a	.880	.849	.16203	.880	27.925	5	19	.000

a. Predictors: (Constant), GDP, Exchange Rate, Real Interest Rate, Inflation Rate, Crude Oil Prices

The table 3 shows model summary results of the overall impact of macroeconomic variables on gold prices in India. The correlation coefficient ($R = 0.938$) indicates a very strong relationship between gold prices and the independent variables, namely GDP, exchange rate, real interest rate, inflation rate, and crude oil prices. The R Square value of 0.880 means that 88% of the variation in gold prices can be explained by these macroeconomic variables, while the remaining 12% is influenced by other factors not included in the model. The adjusted R Square value of 0.849 also confirms that the model has a strong explanatory power even after adjusting for the number of variables used. The F-statistic value of 27.925 with a significance value of 0.000 indicates that the overall regression model is statistically significant. Since the p-value is less than 0.05, the null hypothesis (H_{01}), which states that there is no significant relationship between macroeconomic variables and gold prices in India, is rejected. Therefore, it can be concluded that macroeconomic variables have a significant relationship with gold prices in India during the study period.

Table 4: ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.666	5	.733	27.925	.000 ^b
	Residual	.499	19	.026		
	Total	4.165	24			

a. Dependent Variable: Gold Price

b. Predictors: (Constant), GDP, Exchange Rate, Real Interest Rate, Inflation Rate, Crude Oil Prices

The ANOVA table 4 shows whether the overall regression model is statistically significant in explaining changes in gold prices. The regression sum of squares value (3.666) is much higher than the residual sum of squares value (0.499), which indicates that the independent variables explain a large portion of the variation in gold prices. The F-value of 27.925 is high, and the significance value ($p = 0.000$) is less than 0.05, showing that the model is statistically significant. This means that GDP, exchange rate, real interest rate, inflation rate, and crude oil prices together have a significant effect on gold prices. Therefore, the regression model is reliable and suitable for analyzing the relationship between gold prices and the selected macroeconomic variables.

H_{01} = The null hypothesis is there is no significant relationship between macro-economic variables and gold prices in India.



Table 5: Coefficients^a

H_{01} = The null hypothesis is there is no significant relationship between macro-economic variables and gold prices in India.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
1 (Constant)	-3.300	.796		-4.149	.001	-4.965	-1.635
GDP	.058	.108	.049	.537	.598	-.168	.284
Exchange Rate	3.927	.502	.951	7.827	.000	2.877	4.977
Real Interest rate	-.042	.097	-.045	-.427	.674	-.246	.162
Inflation Rate	.980	.258	.388	3.797	.001	.440	1.519
Crude Oil Prices	.088	.198	.061	.442	.663	-.327	.503

Dependent Variable: gold price

Predictors: (Constant), GDP, Exchange Rate, Real Interest Rate, Inflation Rate, Crude Oil Prices

The table 5 coefficient results show the individual impact of each macroeconomic variable on gold prices in India. The exchange rate has a positive and highly significant effect on gold prices ($B = 3.927$, $p = 0.000$). This means that an increase in the exchange rate leads to an increase in gold prices. Since the significance value is less than 0.05, the null hypothesis for exchange rate is rejected, indicating a significant relationship with gold prices. Inflation rate also has a positive and significant effect on gold prices ($B = 0.980$, $p = 0.001$). This suggests that higher inflation increases gold prices. Therefore, the null hypothesis for inflation rate is rejected because it has a significant relationship with gold prices. GDP has a positive but insignificant effect on gold prices ($B = 0.058$, $p = 0.598$). Similarly, real interest rate has a negative and insignificant effect ($B = -0.042$, $p = 0.674$), while crude oil prices have a positive but insignificant effect ($B = 0.088$, $p = 0.663$). Since the significance values of GDP, real interest rate, and crude oil prices are greater than 0.05, the null hypothesis for these variables is accepted, meaning they do not have a significant relationship with gold prices in this study. Overall, the regression results indicate that among all the macroeconomic variables, exchange rate and inflation rate are the only variables that significantly influence gold prices in India.

V. CONCLUSION

The present study examined the impact of selected macroeconomic variables on gold price volatility in India during the period 2000 to 2025. Gold is considered an important investment and safe-haven asset in India, and its prices are influenced by various economic factors. The study used GDP, exchange rate, real interest rate, inflation rate, and crude oil prices as independent variables, while gold price was treated as the dependent variable. Secondary data collected from World Bank data indices and other published sources were analysed using descriptive statistics, correlation analysis, and multiple regression analysis. The findings revealed that macroeconomic variables have a significant influence on gold prices in India. The regression model showed strong explanatory power, indicating that the selected variables explained a major portion of the variation in gold prices. Among all the variables, exchange rate and inflation rate were found to have a positive and statistically significant impact on gold prices. This suggests that depreciation in the exchange rate and rising inflation contribute to higher gold prices in India. The correlation analysis also confirmed that exchange rate had the strongest relationship with gold prices. However, GDP, real interest rate, and crude oil prices did not show a statistically significant impact on gold prices during the study period. Based on the regression results, the null hypothesis stating that there is no significant relationship between macroeconomic variables and gold prices in



India was partially rejected, as exchange rate and inflation rate showed significant relationships with gold prices. Overall, the study concludes that macroeconomic conditions, particularly exchange rate fluctuations and inflation, play an important role in determining gold price volatility in India. The findings of the study may help investors, policymakers, and researchers to better understand gold price behaviour and make informed financial and economic decisions.

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