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Predicting Gold prices: Using Crude Oil, Currency movement & Stock Market

(Impact of anomalies in the relationship witnessed in 2020)

Sana Shaikh
Shivani Sharma
Students, Masters in Finance, NMIMS University,Mumbai, India

Abstract:
Gold is a favoured investment class especially for Indians and has been the same for generations. Gold is also a preferred asset class during economic and financial crisis for safe guarding their wealth. This paper is basically focused on the factors affecting Gold prices like Stock market, exchange rate of US dollar with INR, Crude oil prices. Each of the factors relationship is studied with the gold prices individually and collectively. This paper also focused the impact caused due to anomalies witness in 2020.
We conclude that, each factor studied have significant impact on Gold price. The Gold price has a negative relationship with Oil price movements and a positive relationship with the Stock market which an anomaly witness in 2020.
Keywords – *Gold prices, exchange rate, NSE Nifty, crude oil prices, Regression, multicollinearity*

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I. Introduction:

Gold has been a treasured asset in India since ancient times. Even today the yellow metal is a sign of prosperity and Indian families strive to purchase gold. Investing in gold has been considered a reliable and safe investment as compared to investments in the stock market or any other financial instruments. It is also added to the portfolio in order to reduce volatility as during the time of crisis it is considered to be a safe haven. Even when inflation rises, purchasing power of currency goes down which intensifies the demand for gold that leads to people holding money in the form of gold. In case of physical gold one can receive immediate cash by selling it so gold is highly liquid as compared to other assets. One can even pledge gold and take a loan from financial institutions. So investing in gold has a lot of advantages and is in demand most of the time. Gold prices usually soar whenever there is an economic or social crisis, while equity markets usually show a negative turn, as Gold regarded as a safe haven for investors. However, in Covid crisis of 2020, there was an anomaly witnessed in this relationship and few other factor which effect Gold prices. Through this model, we will study and understand the impact of crude oil, exchange rate and the stock market on Gold prices and create a model factoring this anomaly.

II. Objectives of the Study:

i. To study the impact of NIFTY, oil prices and currency movement on gold prices and determine the direction of the relationship between them, taking into consideration the anomalies reported in 2020
ii. To create a model with these factors to predict Gold prices.

III. Literature Review:

Based on review of Literature for factors affecting gold prices, 3 major factors namely, Stock price movement through Nifty, Exchange rate through USD INR rates, Crude Oil through brent crude oil have been selected details of same as below

1. **Stock Exchange (Nifty):** The gold relationship with the stock market is studied through NIFTY index. Nifty is composed of a weighted average of 50 most actively traded shares on the NSE, acting as an indicator for the growth and development of the industries in the Indian economy. Saravanan et al (2020) [(1)] in their paper suggested that when the market is bullish investors tend to invest more in the stock market and there is a fall in demand for gold due to which gold prices decrease. Dr Naliniprava Tripathy et al. (2016) [(2)] stated that if the market is in a bearish trend then investors withdraw money from the market and start investing more in gold

increasing gold prices. Therefore, there exists an inverse relationship between the stock market (Nifty) and gold prices.

2. **Exchange rate:** Mongi Arfaoui et al (2017) [3] discuss the relationship of Gold prices and USD rate and have established a positive relationship between USD rates and Gold prices Soumya Sharma (2018)[4] in per discussed that rupee and Gold have a negative relation ie depreciation of rupee against USD results in an increase of Gold price

3. **Crude Oil:** Crude oil is one of the factors for inflation. To hedge against inflation people invest in gold. As per Dr Sindhu et al (2013) [5] “Gold prices and Crude oil price share a positive correlation”

4. While the relationship has been between Gold prices and the factors Stock market, Exchange rate and Crude oil has been established and discussed in these papers, However during Covid lockdown, there were certain anomalies between these factors and gold prices were reviewed, As discussed by Kay Ng (2020) [6] there has been a disconnect between Oil prices and Gold prices. Also, Ashutosh R Shyam (2020) [7] discuss why Dollar, Equities and Gold rallied in 2020. **Hence this paper tries to review the relationship between the variables and see any impact caused to Covid**.

IV. Data and Sources of Data:

The study was conducted by using secondary data for a period of five years from 1st January 2015 to 31st December 2020. The data used is daily gold price in Rupee value unit per troy ounce has been collected from the websites of the World Gold Council, Nifty 50 daily closing and has been collected from NSE website, Exchange rate impact is studied through daily closing of USD/INR and has been taken from investing.com and crude oil prices ie Brent crude in USD per barrel from Nasdaq historical data and accordingly adjusted in rupees.

LN of each data value is computed as it's a convenient means of transforming a highly skewed variable into a more normalized dataset. The sample size of the data is 1474 observations.

V. Research Methodology:

The data values have been analysed in two stages:

i. One by using a simple linear regression model to look at the impact of each of the independent variables on the dependent variable individually, and establish if a relationship exists with a Gold price to aid further research

ii. Second by using the multiple linear regression model to study the impact of a selected set of independent variables on the dependent variable to understand the overall influence.

To ensure the effectiveness of the model, the assumptions for Multiple Regression have been verified including No Multicollinearity (Checked through Correlation matrix and Variance Inflation Factor)

VI. Results & Interpretation of Output:

❖ **Results of simple Linear Regression of Gold prices with each independent variable in tabulated below:**

Results of Simple Linear Regression					
Independent Variables	Intercept	CoefficMultiple R	R2	Significance F	Result
LN Nifty	4.45	0.61	0.37	0.00%	Significant
LN Currency Movement	-0.97	0.84	0.71	0.00%	Significant
LN Brent Crude	11.97	-0.08	0.01	0.18%	Significant

❖ **Interpretation of results of Simple regression:**

The effect of each independent variable individually has been studied through Simple Linear Regression. Gold prices are strongly positively correlated with Equity Markets detonated through Nifty and Currency movements, however, with Brent Crude rates there is a weak negative correlation. All three simple regression models are statistically significant which means individually NIFTY, Currency movements and Brent crude can be used to predict gold.

❖ **Results of Multiple Linear Regression of Gold prices with an independent variable is tabulated below:**

Results of Multiple Linear Regression (5 years)				
Multiple R	R2	Adjusted R Square	Significance F	Result
0.92	0.85	0.85	0.00%	Significant

Independent Variables	Coefficients	Standard Error	t Stat	P-value
Intercept	-0.399	0.161	-2.47	1.40E-02
LN Nifty	0.734	0.020	37.4	1.10E-215
LN Currency Movement	1.895	0.045	42.46	9.40E-258
LN Brent Crude	-0.357	0.011	-31.81	2.10E-169

❖ **Interpretation of results of Multiple Regression:**

Significance F is less than 5% which clearly states that the model is significant. It means that the model can predict gold prices using NIFTY, Currency movement and Brent crude. Even the P values of all the independent variables are significant which again consolidates the fact that these independent variables can predict gold prices.

Also, to ensure the relevance of the selected variables in the equation, the assumption of no multicollinearity among independent variables was verified.

The results are illustrated below :

		Correlation matrix	Variance Inflation Factor
Nifty 50	Currency Movement	0.51	1.35
Nifty 50	Brent Crude	0.01	1
Currency Movement	Brent Crude	0.01	1

As per assumptions, the magnitude of the correlation coefficients should be less than .80 and VIF values higher than 5 indicate that multicollinearity is a problem.

As illustrated above the Correlation coefficients and VIF are well within the required limits thus there is no multicollinearity between the independent variables and they each are used for prediction in the model.

The regression equation can be denoted as below:

LN(Gold) = -0.39892 + 0.73426*(LN NIFTY)+ 1.89495*(LN Currency Movement) -0.35656*(LN Brent Crude)

The output obtained after performing Multiple Regression clearly shows that the gold prices are positively correlated with NIFTY which is the reverse of what was illustrated by Dr Naliniprava Tripathy et al. (2016) [(2)]. Gold prices are positively correlated with Currency movements which effectively means Gold prices increases when the rupee depreciates as illustrated by Soumya Sharma (2018)[(4)]. Gold prices and Brent Crude are negatively correlated, which is the reverse of what Dr Sindhu et al (2013) [(5)] illustrated.

R squared that is the coefficient of determination reveals about the 'goodness of fit' of the regression The value of R squared closer to 1 indicates that the regression line fits the data well, In this case, R squared is 0.85 which shows that 85% of the variation in the dependent variable that is gold prices is explained by Independent variables NIFTY, Currency movement and Brent crude.

In Multiple regression, the higher t statistic value of the Independent variable indicates which Independent variable has the highest impact on the dependent variable. So along with a lower P-value that is after checking if the P-value is less than 5 percent, t statistic can be observed. From our results, we see that Currency movement has the highest t statistic value that is 42.46 as compared with NIFTY and Brent Crude.

Interpretation of this is that the Currency movement has the highest impact on gold prices and Currency movement has maximum discriminating power as compared to other independent variables. Hence higher is the t statistic (lower is p-value), greater is the impact of independent variables.

VII. Conclusion:

Gold is a favoured investment class especially for Indians and has been the same for generations. It is used as a hedge against currency and oil prices movements. It is the choice of investors, especially during economic and financial crises.

The purpose of this paper was to analyse the impact of Gold prices in a period of over 5 years with the change in the stock market, exchange rate and oil price and build a model to predict the Gold price. Also, see the impact caused due to anomalies witness in 2020.

The dependent variables have a significant relationship with gold prices, as can be illustrated with the Correlation Coefficient (R) value and individually through P-value.

In our analysis, we have concluded that Currency movements have a significant impact on Gold prices, the Gold price has a negative relationship with Oil price movements and a positive relationship with the Stock market which an anomaly witness in 2020.

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