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Impact of macroeconomic factors on the price of gold

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Abstract
The research aims in determining the influence of various macroeconomic variables like stock market indices, exchange rate, interest rates and crude oil prices on the price of gold. This has been carried out by collecting daily prices of the above mentioned variables for a period of 8 years ranging from 1-4-2009 to 31-3-2017. Tools like regression and correlation have been used to evaluate the relationship between each independent variable with the dependent variable. It has been observed that gold has a significant relationship with SENSEX and interest rates, a moderate relationship with exchange rate and a low relationship with crude oil.

Keywords: gold prices, stock market index, exchange rate, crude oil prices, interest rates

Introduction
Gold is one of the most malleable, ductile, dense, conductive, non-destructive, brilliant and beautiful metals (Hauptfleish, Putnins, & Lucey 2015). The utility of gold in far-reaching. It has been claimed that there is no other mineral which is more useful than gold. And this has been justified by the special properties it possesses.

This metal can be long associated with the history of the world as it has been considered by almost every established cultures as a symbol of beauty, power, purity, accomplishment, heritage and pride. Today we continue to use gold to make the most significant things wedding rings, Olympic medals, Oscars, Grammys, crucifixes and ecclesiastical art. This makes it evident that no other metal holds a more visible value in the lives of human beings.

The primary use of gold in every man's life is undoubtedly for making jewellery. Owning gold jewellery is considered to be a symbol of pride in many cultures particularly in India. For a long time now, gold has been considered to be a good investment option because it acts as a hedge against inflation and because it has the least risk when compared to other investments. The gold is also used as a financial backing for currency in the form of gold bars known as gold bullion. Gold is also used in various other industries like electronics, computers, dentistry, medicine, aerospace, glass making and for awards.

The benefits and uses of gold thus extend to the Indian market. But the Indian gold market has always had a staggering growth rate due to low income growth in the country. However gold is intertwined in every Indian's life. Gold has become a part of every man's life whether they are urbane or sophisticated. The sentimental value attached to gold will guarantee the existence of demand for this commodity for the centuries to come in India.

The hardships caused due to increasing gold prices and the risk involved in investing in gold due to huge volatility in prices calls for a study in analyzing the factors which majorly determine the movement of gold prices in the Indian economy. Since, I have a background in this industry, I wanted to ponder upon the factors causing gold price fluctuations and how the estimation of future prices can be carried out in order to avoid risk and enhance returns both for common men and for those who operate businesses based on gold. The aim of the research is thus to investigate the impact of the macroeconomic factors like crude oil prices, US dollar rates, domestic interest rates and stock market index rates.

Review of Literature
Karunanithy (2014) [7], in his article, finds that there exists a causal relationship between stock prices and gold prices, however no relationship vice versa. The variables used by the author were causality, BSE SENSEX, co- integration and gold price. The methodology adopted by him is descriptive statistics, unit root test and test of co-integration. Finance Club (2013) [5], conducted a study determine the strategies used to invest in gold after taking into consideration the factors which affect its price. It was suggested in the article that investors should opt for investments in gold as it generates returns above the inflation rate. The significant variables used were oil prices, GDP and the study was categorized as an explorative study.

Sahida Laily (2017), constituted a stipulated relationship between all the macroeconomic factors and the price of gold. The tools used for research were SPSS, descriptive statistics, coefficient of correlation and multiple regression analysis. Banhi Guha (2016), used the ARIMA model to forecast the price of gold in the Indian market using the historical data in order to provide guidelines for an investor to buy gold. The key variables used in his research were gold price, ARIMA forecasting and the research tools adopted by him were auto-correlation and partial auto correlation.

Muhamad Khairul Amar Bin Sukri (2015) [1], studied the macroeconomic factors and their impact on gold prices in Malayisa. It was found that the relationship between real Malaysian GDP and gold prices were positive and the inflation rate was negative. The variables used by him were GDP, Inflation, crude oil prices and the research tool adopted by him was the multiple linear regressions.

Rahul Bishnoi (2014) [2], analyzed the critical factors affecting the price of gold using statistical techniques like ordinary least square, white-test, and weighted least square. The results proved that gold prices are positively inclined to US dollar, crude oil prices and is negatively related to rate of inflation and long run interest rates. The prime variables used in his study are GDP, Inflation and the tools adopted by him were multivariate regression model and statistical tests.

Guntur Archana Raju (2016), studied the impact of inflation on gold prices fluctuations in India, China and USA. It was found in the study that there is a co-integration between the inflation and gold prices; however, there is a short term relationship between inflation and gold prices. The variables used in the research were gold prices, co-integration. Granger causality, VECM and the tools used were unit root test, Vector auto regression, Granger causality test, Johansen co-integration test.

L.K Tripathi (2014) [11], examined the existence of causal relationship between gold prices in India and various other global factors like Foreign institutional investment, Forex reserves etc. The results suggested long run integration between the above mentioned variables. The variable used were crude oil, FII, FOREX and the research tools used were unit root test, Granger causality test using the software E-views.

Pratap Singh (2013) [10], aimed to explore the trends in gold prices and its demand, volatility in gold prices and causes of mounting prices of gold in the Indian economy. It analyses the comparative trend pattern in India and China. The variables used by him were ETF, production costs and GDP. Research methodology adopted by him was Descriptive. Bismal Jaiswal (2015) [6], dealt with various aspects attached to gold like its relevance, reasons for price fluctuation and impact on Indian economy in the times of gold crisis. The variables used by him were commodity market, inflation, global crisis and ETF. He used the findings, analysis and interpretation model.

Research design and methodology

Data for analysis has been collected for the last 8 years in order to study the trend. The longer the period, the higher the validity. We confine the sample to 8 years because MCX trading in India was commenced then. So crude oil prices in India will not be available for the period before that. However, other information can be obtained for a longer time frame. The scope is limited to India and the research results are only applicable to India. The type of research design will be co-relational. A co-relational study determines whether or not two variables are connected.

The data has been collected from verified secondary sources for a period of 8 years. Daily prices of gold has been collected from the online terminal of RSBL ltd. Daily prices of crude oil has been collected from www.macrotrends.net. Daily prices of interest rate has been obtained from www.allbankingso lutions.com. The daily prices of exchange rates have been collected from the RBI website and the daily rates of SENSEX has been collected from www.moneycontrol.com.

Data analysis has been carried out using two major tools:

Regression tool

In statistical modelling, regression analysis is a statistical process for determining the relationships between variables. It includes many techniques for analyzing several variables, where the focus is on the relationship between a dependent variable and one or more independent variables. Multivariate regression can be used as there is more than one independent variable.

Correlation

Correlation is a statistical technique that can show whether and how strongly pairs of variables are related.

Though adequate care is given in ensuring accurate results, the research will suffer many limitations:

1. The tool might suffer limitations which will be reflected on the research results.
2. The scope of the research is only the Indian subcontinent
3. Uncertainty is something which cannot be predicted, the results might not work in such cases
4. There are many other factors affecting gold prices like interest rates, repo rates, crude oil reserve etc. But the study just deals with the two major aspects of stock prices and US dollar.

Despite the limitations discussed above, the research conducted will bring about clarity in determining gold prices based on the other macroeconomic factors. The trends in movement of gold prices can be understood in a better manner. The research would also lead to new theories in the field of price determination of gold. Understanding the magnitude of influence of each variable on the price of gold will lead to accurate price determination enabling better strategies for investment in gold.

Data Analysis

Hypotheses:

H0- Macroeconomic factors do not impact gold price

H1- Macroeconomic factors impact gold price

Regression
Dependent Variable: GOLD_PRICE Method: Least Squares
Date: 11/23/17 Time: 17:25
Sample: 1 1035
Included observations: 1035

Table 1

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	17131.19	12343.85	1.387832	0.1655
Crude_oil	-34.11573	38.06984	-0.896135	0.3704
Interest_rates	3233.948	658.0460	4.914472	0.0000
Sensex	0.382938	0.188342	2.033204	0.0423
USD	-525.6761	274.7349	-1.913394	0.0460
R-squared	0.073350	Mean dependent var		24865.28
Adjusted R-squared	0.069751	S.D. dependent var		19216.73
S.E. of regression	18534.42	Akaike info criterion		22.49747
Sum squared resid	3.54E+11	Schwarz criterion		22.52134
Log likelihood	-11637.44	Hannan-Quinn criter		22.50653
F-statistic	20.38262	Durbin-Watson stat		1.996040
Prob (F-statistic)	0.000000			

Results and Discussion

The p value for each term tests the null hypotheses that the coefficient is equal to zero. A low p value (<0.05) indicates that null hypotheses can be rejected and alternate hypotheses is accepted which means that the change in the independent variable are related to the change in the dependent variable. The p value for the regression analysis between gold prices and crude oil is 0.3704 which indicated that there is no significant relationship between gold prices and crude oil. The p value for regression between gold price and interest rate is 0.00 which indicates that there is a very significant relationship between gold prices and interest rates. The p value for the regression analysis between gold prices and SENSEX is 0.043 which indicates a significant relationship between the two. The p value between gold prices and USD is 0.0460 which indicates a significant relationship between gold prices and Exchange rates.

Correlation

The results of correlation indicate that gold and crude oil prices have a very low negative correlation indicating that changes in crude oil price has a very low effect on the change in price of gold. Gold and Exchange rates are also negatively related and have a low level of correlation but better than that of gold and crude oil. Gold and interest rates have a low positive relationship. Gold and SENSEX also have a low positive relationship.

Table 2

Correlations		Goldprice	crudeoil	USD	interestrates	SENSEX
	Pearson Correlation	1	-.024	-.136**	.238**	.190**
goldprice	Sig. (2-tailed)		.439	.000	.000	.000
	N	1035	1035	1035	1035	1035
	Pearson Correlation	-.024	1	.001	.294**	.294**
crudeoil	Sig. (2-tailed)	.439		.980	.000	.000
	N	1035	1035	1035	1035	1035
	Pearson Correlation	-.136**	.001	1	-.296**	-.183**
USD	Sig. (2-tailed)	000	.980		000	000
	N	1035	1035	1035	1035	1035
	Pearson Correlation	.238**	.294**	-.296**	1	.355**
interestrates	Sig. (2-tailed)	.000	.000	.000		.000
	N	1035	1035	1035	1035	1035
	Pearson Correlation	.190*	-.500**	-.183**	.355**	1
SENSEX	Sig. (2-tailed)	.000	.000	.000	.000	
	N	1035	1035	1035	1035	1035

Conclusion

Based on the analysis on the impact of macroeconomic factors on the price of gold, the following results can be obtained. The results have been obtained by taking into consideration both, the regression and correlation analysis.

The relationship between gold and crude oil prices: Though the correlation analysis has indicated a very low negative relationship, regression analysis confirms that there is no significant relationship between the two.

The relationship between gold and interest rates: Though the correlation analysis has indicated a very low positive relationship, regression analysis confirms that there is a very significant relationship between the two.

The relationship between gold and exchange rates: Though the correlation analysis has indicated a very low negative relationship, regression analysis confirms that there is a moderate relationship between the two.

The relationship between gold and SENSEX: Though the correlation analysis has indicated a low positive relationship, regression analysis confirms that there is a significant relationship between the two.

Since most of the variables show significant relationship with the price of gold, the alternate hypothesis i.e. macroeconomic factors affect gold price is accepted.

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