How macroeconomic indicators influence gold price management

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Abstract

Purpose – This study purposes to measure the influencing relations between macroeconomic indicators and the prices of gold. Further study measures several factors with the gold price in the context of the United States.

Design/methodology/approach – The secondary data are collected to measure relationship and fluctuation of gold prices the data collected from the website world development indicators (WDI) for the period of 31 years 1990–2019. This paper uses different econometric analysis such as analytical unit root test for stationary of data, descriptive statistical analysis for description of data, correlation coefficient test for measuring the inter correlation, and ordinary least square regression analysis for determine the impact of dependent and independents variables. In this research paper, gross domestic product (GDP), inflation rate (IR), unemployment rate (UR), real interest rate (RIR), gross national product (GNP), standard trade value (STV) are included in macroeconomic indicators and consider as independent. The gold prices are considered as dependent variable.

Findings – This study's overall results show an important and optimistic association between GDP, IR and STV with the gold price. Moreover, the RIR shows negative and does not show significant relation with the gold prices.

Originality/value – Since several economic crises were included during the data selection studied in this research paper, data error may be present, resulting in the instability of the overall data. However, the study still hopes to find the guiding role of these macro gold price factors in the price of gold from the limited data set. The basic scope of research is that research is limited in the United States.

Keywords Macroeconomic factors (MF), Gross domestic product (GDP), Real interest rate (RIR), Standard trade value (STV), Inflation rate (IR), Gold prices (GP)

Paper type Research paper

Introduction

The research focuses on gold prices and was carried out using the Bretton Woods framework, a post-war international accord that regulated exchange rates while keeping inflation low and maintaining employment and financial trading. The framework was an economic standard reliant on US dollar (USD) and gold (Kanjilal and Ghish, 2014; Zhu *et al.*, 2017) and was specifically created linking the USD and gold prices to the fixed financial standards set by the IMF (Baraviera *et al.*, 2019; Singhal *et al.*, 2019).

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In 1971, the US left the Bretton Woods monetary system, but the tradition of setting the official gold price in the US continued. Since then, the USD price of gold has skyrocketed and economists have observed that gold prices are correlated with inflation (Huang *et al.*, 2019; Lili and Chengmei, 2013; Bhunia, 2013; Alameer *et al.*, 2019; Bouoiyour *et al.*, 2018; Mohi-U-Din and Mubasher, 2013).

This research is founded on gold prices and macroeconomic issues, and its basic aim is to measure the results of macroeconomic indicators on the value of gold in the US.

Influences affecting the price of gold

Below, a list of the factors is provided which impact the gold price fluctuations. This research identifies the number of macro factors that are most closely related to gold prices, such as:

Gross domestic product (GDP)

Unemployment rate (UR)

Real interest rate (RIR)

Standard trade (ST)

Gross national product (GNP)

Inflation rate (IR)

The economic situation of the US

The Dollar Index (USDI) for the gold is the main indicator of the exchange rate of USD on the international exchange market, which is interlinked with the international gold price (Kalsum *et al.*, 2020; Hussin *et al.*, 2013).

A fall in the USDI implies a devaluation of the USD, and the expansion for gold demand which encourages financial investors to purchase gold which then decreases the demand for USD. This leads to increasing interest in gold and the global USD gold price increases and appreciates.

At the same time, the US can rely on the USD-dominated international economic system to obtain an imposing number of seigniorage on global resources and merchandise. The "no-profit" consequence of the USD world currency status is a significant factor in the US economy's continued strength (Beckmann *et al.*, 2019; Liu and Li, 2017).

Limitations and scope of the study

Based on previous research, this study lists the four most important aspects of analyzing gold prices and the macroscopic influencing factors. The data are taken from annual real gold prices from 1990 to 2019, seasonally adjusted GDP, RIR, IR and UR.

The data have some limitations and one-sidedness. On one hand, the research compares all the variables on the same timeline, in this case, annual data from 1990 to 2019, and makes sure the dataset is broad enough. On the other hand, since several economic crises were included during the data selection time period, data errors may be present, resulting in the instability of the overall data. However, the study still hopes to find the guiding role of the macroeconomic indicators on gold.

Price factors on the cost of gold in the limited dataset. The basic scope of research is limited to the US.

The basic aim of the research

The basic objective of this research is as follows:

(1) Discuss the macroeconomic indicators that influence the price of gold as evidenced in the US.

(2) To investigate how gold prices were affected by fluctuations in the macroeconomic indicators.

Literature review

Long and Hanh (2019) researched the outcome of macroeconomic issues on gold prices by utilizing the dataset of global macroeconomic markers. In this research, data are used in financial markets, energy crises and gold prices and the results indicate two main contributions to research. First, all the factors influencing the gold prices have been classified and divided into three groups: the gold reserve, price of energy products and the financial markets. Results concluded that gold reserves and energy products show positive effects, while the financial market's impact indicates that macroeconomic indicators have a negative effect on gold prices. This research utilized the FAVAR model to measure all macroeconomic factors that influence gold prices and trends (Long and Hanh, 2019).

Bhunia and Ganguly (2015) examined the effects of IR, commodity prices and the conversation rate on stock market performance in Malaysia and showed the relationship among variables included exchange rates and bonds. The results concluded that the IR and exchange rate indicate positive and significant relationships between them. However, there is no relative importance between the price of gold and oil. In addition, macroeconomic factors implementing the relevant policies and results show there has been an adverse impact on the Malaysian Stock Exchange as well as in further research (Bhunia and Ganguly, 2015; Singh, 2014a).

Some studies investigate the research results of macroeconomic factors on gold prices. Data collected over eight years from daily-based prices of variables show that there is a moderate effect between macroeconomic variables and gold prices (Oluyemi and Isaac, 2017; Jain and Biswal, 2016).

Many studies deliberately focus on influential macroeconomic indicators on gold prices and measure the relationship of each variable related to gold prices in the Indian context. Data were secondary and collected from different websites. Data gathered from seven years show a positive and important relationship between the USD and gold price. However, the rates of inflation do not show a substantial relationship with the price of gold (Mukhuti, 2018; Shiva and Sethi, 2015; Beckmann *et al.*, 2019; Bhunia and Mukhuti, 2013; Hassani *et al.*, 2015).

Nurulhuda *et al.* (2018) and many others have studied the dynamic and relationship analysis of all macroeconomic variables affecting gold prices. The essential purpose of this research is to measure the gold price fluctuation as a result of macroeconomic indicators. Different test analysis results concluded that the gold price does not affect the exchange rate, NSE index rates and interest rates, but that the inflation rate independently impacted gold prices (Nurulhuda *et al.*, 2018; Akbar *et al.*, 2019; Beckmann and Czudaj, 2013; Singh, 2014b).

Methodology

Our model's primary purpose is to measure the effects of all macroeconomic indicators on the value of gold by creating a model that estimates each macroeconomic factor and consequence on gold prices in different forms. This research model explains through regression analysis, correlation analysis, an ANOVA and unit test analysis.

Descriptions of data

Data were collected from different sources, including web development indicators and world banks and observed annual figures from 1990 to 2019. The nature of the data is quantitative and is based on secondary form. For our purposes, we used different independent variables of

macroeconomic factors, including IR, GDP and GNP, and measured their impact on gold prices. The gold price is considered reliant on variables, and all the macroeconomic factors are independent variables. This study is based on a quantitative method.

Sampling techniques

This study collected information from global development indicators and used probability sampling techniques for data analysis. The data are based on secondary sources and collected from various internal and external sources as shown in Table 1. The secondary data give the latest information.

Theoretical model

As shown in Figure 1.

Econometric model

The determinants of macroeconomic and gold prices are analyses from overall panel data. These panel data frameworks defined with the multiple regression equations such as:

$$Y = \propto + \beta 1x + \varepsilon_1 \tag{1}$$

Regression model

Gold prices present as a dependent variable, while the independent variable macroeconomic indicators included GDP, IR, UR, GNP, STV and RIR.

So, regression models have been developed and are as follows:

$$\mathrm{GP} = \propto + \beta^1\mathrm{GDP} + \beta^2\mathrm{IR} + \beta^3\mathrm{UR} + \beta^4\mathrm{RIR} + \beta^5\mathrm{GNP} + \beta^5\mathrm{STDS} + \varepsilon_1 \tag{2}$$

Where:

GP = Gold price

GDP = Gross domestic product

IR = Inflation rate

UR = Unemployment rate

RIR = Real interest rate

GNP = Gross national product

STV = Standard trade value

Table 1.

Variables	Notation
Independent variable	
Gross domestic product	GDP
Inflation rate	IR
Unemployment rate	UR
Real interest rate	RIR
Gross national product	GNP
Standard trade value	STV
Dependent variable	
Gold price	GP

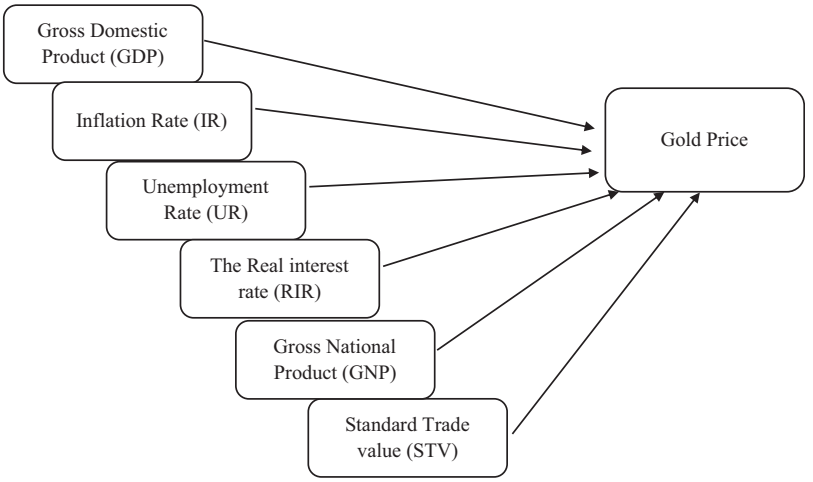

Figure 1.

Hypothesis

H0. There is no relationship between macroeconomic factors and value of gold.

H1. There is a relationship between gross domestic product and value of gold.

H2. There is an associated relationship between inflation rate and value of gold.

H3. There is a relationship between the unemployment rate and the value of gold.

H4. There is a relationship between monetary policy and value of gold.

H5. Gross national product is associated with the gold price.

H6. Standard value of trade shows significantly relationship to the price of gold.

Results and discussions

Descriptive statistic

Table 2 explains the descriptive statistical analysis while the research study describes macroeconomic indicators and gold prices, with the gold price as the dependent variable. Descriptive statistics depict the overall performance of variables. The mean value of the gold price is 408.30. Its maximum value is 871.96 with a probability value of 0.0002, which shows a 100% significant gold price level. The sum of the square deviation value is 430,675.5, and its overall observation is 19. The second is GDP as an independent variable; its mean value is 15.486, which shows that 15% average value as its standard deviation value is 0.9193 represent the 91% deviation from the mean. The skewness value of the GDP is −0.5853, and the overall probability is 0.5812, which shows a significant 58%. The third indicator is IR with the average value of inflation rate being 2.8249, while its highest value is 8.06, and lowest value is 1.182. The standard deviation value is 1.924, which shows a 10% deviation from the average value. The probability value is 0.0004, which shows a significant 100% level. The descriptive statistical analysis describes macroeconomic variables' overall performance relating to the gold price fluctuations in the markets. Similarly, the real IR is considered an independent variable; its mean value is 3.155. The highest value is 6.378, and the lowest value is −4.11 which shows negatively that the probability value is 0.017.

Table 2.

	Gold price	Gross domestic product	Inflation rate	Unemployment rate	Gross national product	Real interest rate	Standard trade value
Mean	408.30	15.486	2.8249	6.6935	1.78	3.155	57.432
Median	363.38	15.731	2.2190	6.0429	1.68	3.193	48.185
Maximum	871.96	17.195	8.0634	10.348	3.16	6.378	146.43
Minimum	271.04	13.515	1.1829	4.5942	1.184	−4.111	33.716
Std. dev.	154.68	0.9193	1.9241	1.9288	7.64	2.436	28.940
Skewness	1.8565	−0.5853	1.8526	0.6168	−0.028	−1.1638	1.7798
Kurtosis	5.7063	2.9888	5.3467	1.9434	3.095	5.1991	5.8117
Jarque-Bera	16.712	1.0850	15.228	2.0887	0.0098	8.117	16.290
Probability	0.0002	0.5812	0.0004	0.3519	0.995	0.017	0.0002
Sum	7757.78	294.250	53.673	127.17	3.38	59.956	1091.2
Sum sq. dev.	430675.5	15.212	66.645	66.970	1.05	106.86	15075.7
Observations	19	19	19	19	19	19	19

Correlation analysis

Table 3 represents the correlation analysis among all indicators and that this test analysis illustrates the relationship among variables, including one that represents the 100% significance level. According to this test, analysis shows that all variables are interlinked. GNP is positively linked with gold prices and shows 0.655 probability, while the STV also shows a positive relationship with gold prices at 0.75711. The IR and gold price show 0.1032, which is 10% significant and a positive relationship. However, the IR shows a negative relationship with the GDP at −0.3401 and negatively links with the GDP at −0.5263; similarly, the IR shows a negative relationship with STV at −0.2289. The correlation analysis represents the intercorrelations linked between one variable to another variable related to the gold prices.

Regression analysis

Table 4 describes the regression analysis. In this study, the gold price is a dependent variable, and the macroeconomic indicators are considered independent variables. The research included the factors of macroeconomic variables, including GDP, GNP, IR, RIR and standard trade, all as independent variables. This linear regression analysis shows the hypothesis acceptance and the rejection of variables. Research study analysis and its results are founded on coefficient values, the value of standard error, the value of *t*-statistic value and probability. The overall performance of research is based on *R*-squared and its value is 0.8832, which shows that 88% model is fit for analysis. The adjusted *R*-square value is 0.82, which shows that 82% of the adjusted value of *R*-square; the standard error of regression value is 64.72, and the overall probability value is 0.000, which shows a 100% significant level. The total national output independent variable is *t*-measurement value of 0.1999, and probability value is 0.8448, which shows a positive but inconsequential relationship between the GDP and gold prices. So, the results reject the null hypothesis and accept H1.

Similarly, the IR considers macroeconomic indicators used in this research as the independent variable. Its *t*-statistic value is 3.5708. The probability value is 0.003, showing an optimistic and significant relationship between IR and gold prices, so linear regression analysis accepts H2. The unemployment rate is also included in independent indicators, its *t*-statistic value is 1.18, and its probability value of 0.09 shows a positive and significant relationship between the gold price and unemployment rate. Another is the GNP *t*-statistic value is 3.527, and its probability value is 0.0042, which shows a 100% significance level, so the results accept H4. Similarly, the standard trade value shows positive relationship with 3.23, and its probability value is 0.0071 shows 100% significance, and therefore the results accept H5.

Unit root test

Table 5 illustrates the unit root test analysis represented by the augmented Dickey Fuller test, which shows significant levels. There are three critical values, 1%, 5% and 10% that explain the significance. Another is representing the Dickey Fuller test equations. Results represent the probability value, and this unit test analysis also explains the *R*-square value. According to this analysis, the *R*-square value is 0.312 or 31%. So, this model is fit for analysis and accepted all hypotheses, excluding the null hypothesis. Its adjusted *R*-square is 0.2569, its SE of regression value is 100.4701 and its probability value is 0.0093, which shows a significant 100% level. *F*-statistics explain the impact of macroeconomic indicators on gold prices in the UK, and a unit root test is run through the e-views software. Its dependent variance value is 116.5551, and its mean dependent variance is 36.80321, showing that 30% value depends on mean. The gold price coefficient value is −0.035, and its probability is 0.407; its *t*-statistic value is −0.842 (see Figure 2).

This chart represents the trend cycle of gold prices and shows the macroeconomic effects on gold prices and their fluctuations. The blue line shows that the gold price rates red line

Table 3.

	Gold price	Gross domestic product	Inflation rate	Unemployment rate	Gross national product	Real interest rate	Standard trade value
Gold price	1.000000	−0.540530	0.103240	−0.202509	0.655546	−0.284429	0.757112
Gross domestic product	−0.540530	1.000000	−0.340185	−0.450558	−0.103685	0.222264	−0.234663
Inflation rate	0.103240	−0.340185	1.000000	0.413961	−0.526380	0.342030	−0.228966
Unemployment rate	−0.202509	−0.450558	0.413961	1.000000	−0.624888	0.107311	−0.555545
Gross national product	0.655546	−0.103685	−0.526380	−0.624888	1.000000	−0.360161	0.722684
Real interest rate	−0.284429	0.222264	0.342030	0.107311	−0.360161	1.000000	−0.166968
Standard trade value	0.757112	−0.234663	−0.228966	−0.555545	0.722684	−0.166968	1.000000

Dependent variable: Price of ovld

Method: Ordinary least squares (OLD)

Included observations: 19 after adjustments

Name of variable	Value of coefficient	The value of Std. error	*t*-statistic value	Probability value
C	−385.0975	623.0066	−0.618127	0.5480
GDP	6.079450	30.39983	0.199983	0.8448
IR	41.50912	11.62456	3.570813	0.0038
UR	28.93440	15.96346	1.812540	0.0950
GNP	1.41E-10	4.011	3.527800	0.0042
RIR	−10.41359	7.416657	−1.404081	0.1856
STDS	2.950805	0.911901	3.235883	0.0071

R-squared	0.883255	Mean dependent variance	408.3042
Adjusted *R*-squared	0.824883	SD dependent variance	154.6817
SE of regression	64.72959	Akaike info criterion value	11.45562
Sum squared resid	50279.03	Schwarz criterion	11.80357
Log-likelihood	−101.8284	Hannan-Quinn criteria	11.51451
F-statistic	15.13142	Durbin-Watson stat	1.714900
Probability (*F*-statistic)	0.000057		

Table 4.

shows the trend cycle. The Hodrick-Prescott filter test demonstrates that the gold prices fluctuate daily.

Conclusion

Different tests included regressions analysis conducted for this research paper, both based on the first difference. The research was concerned with five variables for our final gold model. These factors represent the real gross global product (GGP), the real RIR and the actual USDI and every variable was converted to first order.

The research financial model was estimated using the ordinary least squares (OLS) approach. The model demonstrates a statistically reinforced linkage between the real price of gold and the macro factors. The theory proposes a further tie among the actual price of gold and real GGP, RIR and real USDI. As expected, if we do not consider the statistic significant, the research found a positive relationship in the first difference of real GGP per quarter, and the primary difference of actual gold price was statistically significant. The research found a negative association in a RIR, and the first difference in the gold price was not statistically significant. The research study found an undesirable association in the primary difference of RIR, and the primary difference of actual gold price was statistically significant. Therefore, research can reject the null hypothesis in this case.

If a researcher wants to run a macro model that includes GGP, owing to gold prices being so volatile over the year, we were more willing to pick up the relationship. They do not move in the long term, and gold prices move randomly over a short period, so they are not following this long-term GGP trend, which was the same finding as in other studies (Zhao *et al.*, 2015; Patel, 2013; Mombeini and Yazdani-Chamzini, 2015).

This research model focuses on real data, and researchers chose the first difference with our gold model. First, all the signs agreed with the alternative hypothesis. Second, all the

Null hypothesis: GP has a unit root

Exogenous: Constant
Lag length: 1 (Automatic – based on SIC, max lag = 7)

		t-statistic	Probability*
Augmented Dickey-Fuller test statistic		−0.842575	0.7911
Test critical values:	1% level	−3.689194	
	5% level	−2.971853	
	10% level	−2.625121	

*MacKinnon (1996) one-sided *p*-values

Augmented Dickey-Fuller test equation
Dependent variable: D (GP)
Method: Least squares

Variable	Coefficient	Std. error	*t*-statistic	Probability
GP (−1)	−0.035369	0.041977	−0.842575	0.4075
D (GP(−1))	0.571918	0.170168	3.360902	0.0025
C	44.52811	35.55532	1.252361	0.2220

R-squared	0.312002	Mean dependent variance	36.80321
Adjusted *R*-squared	0.256962	SD dependent variance	116.5551
SE of regression	100.4701	Akaike info criterion	12.15855
Sum squared resid	252356.0	Schwarz criterion	12.30129
Log-likelihood	−167.2198	Hannan-Quinn criteria	12.20219
F-statistic	5.668646	Durbin-Watson stat	1.673642
Prob (*F*-statistic)	0.009329		

Table 5.

variables were motionless on the first alteration form. Third, the model says the only things that they were related to each year were the real USD and real price of gold. And research focusing on the annual model. Lastly, this research has quantified one implication of how the real macroeconomic factors affect the real price of gold. The researcher thinks that regression equations can help in evaluating the macro-influence factors of gold prices.

The research model provides a quantified linkage between the real gold price and real-world GDP, RIR and real USDI. Nevertheless, it is interesting to note that the result of the predicted rate of interest has the contrasting sign compared to the RIR in 2018. There is a phenomenon that shows when the rate of interest rises and the actual price of gold will not fall indefinitely. However, when the rate of interest falls, it is more likely to lead to a rebound in real gold prices.

The researcher believes those investors who hold long positions in commodities now have expectations for inflation and economic improvement. They think that, as the economy improves, the use of the metal industry will increase. For long positions in commodities, the strong USD trend will lead to a drop in commodity prices.

It is the continuous changes in market sentiment that have an impact on the trend of gold prices, which has caused some commodity markets to fall in the current volatile areas. Investors are looking for signs of economic recovery, but at the same time, they are also influenced by other factors that can make them hesitant.

This research study was successful in testing a specification of this model, but further research might enhance the model because the gold price is highly volatile. In the next section, there are suggested research paths that might be taken that could improve the model.

Source(s): Gold Price from Fred Website (February 8, 2018) < https://fred.stlouisfed.org
FRED Graph Observations from Federal Reserve Economic Data Website, (2018)< https://fred.stlouisfed.org/series/GOLDPMGBD28NLBM/> [Downloaded Feb 8, 2018]

Figure 2.

Recommendations

Even though this research used multiple methods to analyze the relationship between real gold prices, real GGP, real IR and STV, the model may still have some small problems.

In estimating my model of gold with different approaches to real data, the research found that several econometric problems need to be addressed in future studies. Some of these problems were corrected.

However, future research should conduct the error correction model (ECM) for omitted variables. The GGP should be substituted by the top gold producing countries' total GDP. The other option is that it might be useful to use a dynamic specification with the lag structure. Furthermore, a future study might select another dataset or a more significant dataset to avoid outliers.

Research needs to endure to study this subject in this zone. Gold prices are an exciting and complex subject, and there are many different study methods suitable to conduct further research and analysis in this area.

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