# Analysis of the factors affecting the price of gold based on multiple linear regression

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Abstract. Gold has a variety of properties, in addition to the commodity properties, gold also has a monetary function. There are many investment values, so the price of gold is also much attention by investors. Many factors may affect the price of gold. In this paper, relevant data from December 2011 through December 2018 have been selected from a number of sources in order to provide as comprehensive a picture as possible of the various factors that may affect the price of gold. An Ordinary Least Squares regression model was used for the analysis. It was found that U.S. stock market conditions, gold mining conditions, U.S. dollar exchange rate, and crude oil-related indices have different correlation results from various perspectives of the index analysis. Besides, there is a significant positive relationship between the price of other precious metals and Gold Price. Meanwhile, The U.S. Economic Related Index has a significant negative impact relationship with Gold Price.

Keywords: OLS regression model, gold price, influencing factors.

## 1. Introduction

Gold has several properties, before it had the purchasing power, gold played the value of ordinary commodities, with commodity attributes. After gold is fixed to act as a general equivalent, it evolves into money. Gold naturally plays a monetary function in this situation [1]. In addition, gold also has other special investment values, like risk-avoiding, inflation-proof, and so on. Because of this, the price of gold also got more attention. However, the price of gold often fluctuates, leading to the impact of gold investment, and its characterization has also laid a theoretical analysis for the analysis of the gold reserve function [2]. Therefore, the study of the influence factors of gold price is significant.

There are many factors affecting the price of gold, such as the dollar index, inflation, and so on. Li used Vector Error Correction Model to study the inflation situation, the dollar index, and the dollar interest rate index on the impact of the international gold price. The research pointed out that inflation on the gold price has a significant negative correlation. In a certain period, the dollar interest rate index and the gold price have a negative correlation, but in the long term, there is a significant positive correlation [3]. Yan pointed out that the dollar value index has both a significant impact in the short term and the long term on the price of gold [4]. Zhang analyzed the mechanism of how factors affect China's spot gold price in the role of gold price. The study concluded that the RMB exchange rate has a positive correlation with the international gold price and the price of gold. The Chinese stock price index has a negative correlation with the U.S. Stock Price Index and China's spot gold price. After using the Vector Autoregression Model to analyze the Chinese stock price index, the U.S. Stock Price Index, and China's

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spot gold price, it concluded that the price of gold itself has the greatest impact, followed by interest rates [5]. Tu used the Generalized Method of Moments and Error Correction Model to analyze the data of gold price and money supply for a total of 117 months from 2002 to 2012 and found that money supply had a significant impact on gold price [6]. In addition to the economic factors mentioned above, many other factors affect the gold price.

Monetary policy and social conditions also have an impact on the gold price. Shang studied the role of the three influencing factors of the asset portfolio balance channel, signaling channel, and liquidity channel under different monetary policies. And found that the tight monetary policy will reduce the gold price; the steady monetary policy has less influence on the gold price; the loose monetary policy will increase the gold price, which shows that the monetary policy is also one of the influencing factors [7]. Lu studied the impact of the gold price on the GDP growth rate, unemployment rate, and other factors. The research found that its influence is not significant in general, but when the announced GDP growth rate, unemployment rate, and other data do not match the market expectations, the price of gold will change [8]. In the long term, the gold price is influenced by the following factors.

In addition, the gold price will be affected by some special events. Wu analyzed the change in the price of gold before and after four events in the trade friction between China and the United States. Only the event that the Chinese and U.S. governments both implement the measures to increase tariffs has a significant negative correlation with the gold price. Other three events that the G20 summit of the U.S. and China consultations, the Trump administration declared to raise tariffs on China, and China and the United States signed a trade agreement all have a positive correlation with gold prices [9]. Wu and Yang selected the data of 10 years before and after the financial crisis. Found that at the end stage of the financial crisis, there was a significant effect on the short-term changes in the price of gold, but the impact of shocks at the outbreak stage was not significant [10].

This paper will use the Ordinary Least Squares to analyze the gold price and other data that may be relevant to the price of gold in recent years. Examining the factors that influence the price of gold in the long run.

# 2. Methodology

## 2.1. Data source and description

There are many factors that may affect the price of gold, such as the U.S. stock index, the U.S. dollar index, the exchange rate between the U.S. dollar and other currencies, the price of precious metal futures, and the price of crude oil futures. Therefore, the data from December 2011 to December 2018 are selected for this paper in many aspects. There are sixteen data items in total. Includes Gold Price (GP), S&P 500 Index (SP), Dow Jones Index (DJ), Eldorado Gold Corporation (EG), EUR USD Exchange rate (EU), Brent Crude oil Futures (OF), Crude Oil WTI USD (OS), Silver Futures (SF), US Bond Rate (USB), Platinum Price (PLT), Palladium Price (PLD), Rhodium Prices (RHO), US dollar Index Price (USDI), Gold Miners ETF (GDX), Oil ETF USO (USO) and Cobalt Price (CO).

The research will use this data to describe as fully as possible the various factors that may affect the price of gold. The frequency of each data is the same, and they are all measured in days. The data are all from the Kaggle database.

## 2.2. Indicators selection

In this paper, SP and DJ are chosen to represent the situation of the U.S. stock market. EG and GDX represent the situation related to gold mining. EU represents the exchange rate between the U.S. dollar and other currencies. OF, OS, and USO represent the situation related to crude oil. SF, PLT, PLD, RHO, and CO represent the situation of precious metal futures. USB and USDI represent the situation related to the U.S. economy (Table 1).

The mean value of gold price in the sample is \$127.323, the minimum is \$100.92, and the maximum is \$173.2, while the standard deviation is 17.527, which indicates that the price of gold fluctuates a lot in the period selected in this paper. The standard deviation of the EUR USD Exchange rate is only 0.101,

the standard deviation of the US Bond Rate is only 0.433, and the standard deviation of the Cobalt Price is only 0.493, which indicates that its volatility is small, while all other variables are more volatile especially Dow Jones Index and Silver Futures.

Items	Min	Max	Mean	Std. Deviation
GP	100.920	173.200	127.323	17.527
SP	122.060	293.090	204.49	43.832
DJ	11769.210	26833.471	18161.094	3889.752
EG	2.770	80.200	28.277	20.326
EU	1.039	1.393	1.208	0.101
OF	27.880	126.220	77.505	27.401
OS	26.550	110.300	70.153	23.472
SF	33170.000	65292.000	43284.478	7530.704
USB	1.358	3.239	2.263	0.433
PLT	775.600	1737.600	1183.915	273.842
PLD	470.450	1197.500	766.805	148.307
RHO	0.000	2600.000	1130.442	570.013
USDI	78.300	103.288	89.809	7.516
GDX	12.700	57.520	26.747	10.621
USO	7.820	41.600	22.113	11.431
СО	1.936	3.954	2.938	0.493

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# 2.3. Research method

This paper aims to investigate the factors that affect the price of gold. Therefore, it will be analyzed using ordinary least squares regression (OLS) analysis, which can be used to study the effect of independent variables on dependent variables. The basic formula of ordinary least squares regression analysis is:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_P x_P + \varepsilon \tag{1}$$

Where y is the dependent variable,  $x_i$  is the independent variable,  $\beta_0$  is the regression constant,  $\beta_p$  represents the regression coefficient, and  $\varepsilon$  is the random error.

# 3. Results and discussion

# 3.1. Correlation analysis

According to the results of correlation analysis, all the data have a significant correlation with GP, so all of them are selected as indicators of this study. Based on the positive and negative correlation coefficients in the graph it can be concluded whether there is a positive or negative correlation between the variables. The results show that GP has a significant negative correlation with SP, DJ, USB, PLD, and USDI. Besides, GP has a significant positive correlation with EG, EU, OF, OS, SF, PLT, PLD, RHO, GDX, USO, and CO (Figure 1).

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Figure 1. Correlation results.

In this study, GP was used as the dependent variable, and SP, DJ, EG, EU, OF, OS, SF, USB, PLT, PLD, RHO, USDI, GDX, USO, and CO were the independent variables. Based on this, the formula of the OLS model built is:

GP = 201.209 - 0.216 \* SP + 0.002 \* DJ - 0.049 \* EG - 33.247 \* EU + 0.095 \* OF + 0.051 \* OS + 0.000 \* SF - 4.320 \* USB + 0.016 \* PLT + 0.003 \* PLD + 0.001 \* RHO - 0.903 \* USDI + 0.783 \* GDX - 0.843 \* USO + 4.068 \* CO(2)

## 3.2. OLS regression results

In this study, GP was used as the dependent variable, and SP, DJ, EG, EU, OF, OS, SF, USB, PLT, PLD, RHO, USDI, GDX, USO, and CO were the independent variables. By using OLS regression, it can be seen that the model R2=0.987, which indicates that each independent variable can explain the cause of 98.7% of the change in GP. The F-test of the model was conducted and it was found that the model passed the F-test (F=8446.244, p=0.000<0.05). It shows that at least one of SP, DJ, EG, EU, OF, OS, SF, USB, PLT, PLD, RHO, USDI, GDX, USO, and CO will have an impact relationship on GP.

The regression coefficient is a parameter that indicates the magnitude of the effect of the independent variable on the dependent variable. The larger the value of the regression coefficient, the greater the influence of the independent variable on the dependent variable. A positive regression coefficient indicates that the dependent variable increases as the independent variable increases, which means that there is a positive influence relationship. A negative regression coefficient indicates means that there is a negative influence relationship.

The variable presents significance when P<0.01, which means that there is a significant influence relationship between the variable on the dependent variable. Conversely, it means that the variable does not have a critically effect relationship with the dependent variable. Among the indicators, all of them showed significance with p<0.01 except for OS with p=0.056>0.01.

From the analysis, it can be seen that DJ, OF, SF, PLT, PLD, RHO, GDX, CO will have a significant positive influence relationship on GP. and SP, EG, EU, USB, USDI, USO will have a significant negative effect on GP. However, OS does not have an impact on GP.

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	Coefficient	Standard Error	t	р	95% CI	
Constant	201.209	14.474	13.902	0.000**	172.841 ~ 229.577	
SP	-0.216	0.015	-13.964	0.000**	-0.246 ~ -0.185	
DJ	0.002	0.000	9.030	0.000**	$0.002\sim 0.002$	
EG	-0.049	0.018	-2.762	0.006**	-0.083 ~ -0.014	
EU	-33.247	5.635	-5.900	0.000**	-44.291 ~ -22.202	
OF	0.095	0.020	4.814	0.000**	$0.056 \sim 0.134$	
OS	0.051	0.027	1.916	0.056	$-0.001 \sim 0.103$	
SF	0.000	0.000	14.533	0.000**	$0.000 \sim 0.000$	
USB	-4.320	0.340	-12.712	0.000**	-4.987 ~ -3.654	
PLT	0.016	0.001	14.955	0.000**	$0.014\sim 0.018$	
PLD	0.003	0.001	3.080	0.002**	$0.001 \sim 0.006$	
RHO	0.001	0.000	8.148	0.000**	$0.001 \sim 0.001$	
USDI	-0.903	0.089	-10.176	0.000**	-1.076 ~ -0.729	
GDX	0.783	0.026	30.073	0.000**	$0.732 \sim 0.834$	
USO	-0.843	0.067	-12.526	0.000**	-0.975 ~ -0.711	
CO	4.068	0.291	13.994	0.000**	$3.498 \sim 4.637$	
R2	0.987					
Adj R2	0.987					
F	F (15,1702)=8446.244,p=0.000					
D-W	0.274					
Dependent Variable: GP						
* p<0.05 ** p<0.01						

Table 2. OLS model results.

#### 4. Conclusion

This paper finds that in the long run Dow Jones Index, Brent Crude oil Futures, Silver Futures, Platinum Prices, Palladium Prices, Rhodium Prices, Gold Miners ETF, and Cobalt Prices have a significant positive impact on GP. S&P 500 Index, Eldorado Gold Corporation, EUR USD Exchange rate, US Bond Rate, US Dollar Index Price, Oil ETF USO significantly negatively impact gold price.

From the results, it can be seen the overall situation of the U.S. stock market, the situation related to gold mining, and the exchange rate between the U.S. dollar and other currencies. the situation related to crude oil, the situation of precious metal futures, and the situation related to the U.S. economy all have an impact on the price of gold. However, only the situation of precious metal futures has a positive relationship with the Gold Price. Only the situation related to the U.S. economy has a negative relationship with Gold Prices. Other aspects of the data from different perspectives have different results, still need to follow up on this aspect of a more in-depth and comprehensive study.

This paper explores the impact of various factors on the price of gold, and the results of this paper can help the research on gold price prediction. Some factors that can be based on the data selected in this paper can be certain conclusions, but there is a need to carry out more in-depth research to confirm. Some factors need to be analyzed by selecting a wider range of data to obtain more certain conclusions.

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