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Analysis of Macroeconomic Effects on Gold Price

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Abstract: *This study aims to analyze the effects of selected macroeconomic variables, which are the Fed Funds Rate, US Inflation Rate, DJIA Index Price and WTI Price – as independent variables on the gold price – as dependent variable. The research data consists of monthly-interval data, which observed through the period of 1971 to 2019, totaled 588 specimen for each variables. All data used are secondary in panel data formats hence sampling method is not required. The method of data analysis is Multiple Linear Regression (MLR) Analysis. The analysis results found that all independent variables simultaneously have a positive-significant effect on gold price and coefficient of determination (R-squared)of79.8%. Furthermore, it was founds that both the Fed Funds Rate and the US Inflation Rate had no effect on gold price. On the other hand, both the DJIA Index Price and the WTI Price havea positive-significant effect on gold price. The implication of this study is that gold stakeholders are recommended to paya closer attention on DJIA Index Price and WTI Price fluctuations when making decision to Buy or Sell gold.*

Keywords*: Gold Price, Fed Funds Rate, US Inflation, DJIA Index Price, WTI Price*

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I. Introduction

Gold price started to fluctuate significantly since the Bretton Woods system was unilaterally abandoned by the United States (US) on 15 August 1971. This means that all member country's currencies, which was previously pegged to USD – and USD then pegged to gold at fixed price of USD 35 per Troy Ounce, inevitably found themselves becoming fiat currencies without backup commodity whatsoever. Such event also recognized as the end of gold standard era, and immediately after, the gold price experiences market-driven price dynamics up until today.

Along with such transformation in the world's monetary system, gold became a liquid asset, which traded at high volume, high frequency and highly fluctuated prices all over the world. Diverse investment instruments for gold commodity were then introduced and enthusiastically welcomed by the market and related stakeholders, including derivatives such as options, forward and future contracts. Even though USD no longer pegged to gold, hence no rationale for other currencies to maintain it as a standard, however history tells that it continues its dominance as both reserve and trading currency globally. Therefore, to date USD also mainly used as gold trading price unit with the most prominent trading symbol is XAU/USD (one Troy ounce of gold / USD).

To deal with the ever-changing gold prices and its ever-increasing trading volume, stakeholders require a mechanism or formula to forecast the gold price. These stakeholders include gold miners, gold distributors, central banks, major investors such as hedge funds, technology companies who utilize gold in their high-tech products, or even individual investors and physical old consumers. Price forecast is essential for them to be thriving in their decision making process of when to Buy or Sell gold, hoping to gain profits or at least safeguarding their investment values. Nevertheless, several endeavors to formulate gold price forecast proven to be challenging, as there are too many variables involved.

The most conservative approach in forecasting gold price, and proven to be effective in medium and long terms, is through close monitoring of supply-demand data. It is based on a fact that gold demand may fluctuate, however the supply of physical gold – which includes additional gold mine production and gold recycling, is limited. Yet, for a short-term price forecasting, supply-demand approach is not effective, therefore not very useful, especially for those traders who intend to transact a gold contract on daily or weekly basis. To add up the challenge and puzzlement of gold price forecasting, there were varieties of events in the past where gold price may wildly fluctuate, mostly upward, when an economic recession was anticipated or when certain geopolitical turbulences were taking place at any major countries or regions in the world. Such upward price movement is recognized as demonstration of a gold-specific feature known as safe haven, where investors turn into whenever they perceive signs of market uncertainty, with the intention of protecting of their assets value.

Having considered the above-mentioned conditions and limitations in gold price forecasting, most stakeholders now turn to various macroeconomic indicators, specifically macro data from major countries in the

world. Some of the most widely used macroeconomic indicators include currencies, interest rate, inflation rate, money supply, gross domestic product growth, consumer price index, producer price index, stock index prices, commodity prices, etc. Major countries and region that mostly observed are the US, European Union, China, India and Japan. A particular attention is paid to India and China, which are the two biggest physical gold consumer in the world.

Undeniably, the US is the biggest economy in the world since the end of nineteenth century, with current size of almost a quarter of global GDP. Hence, it is reasonable to state that whatever happens to US economy may have significant impact to the world economy. Therefore, US macroeconomics indicators are selected to be analyzed in this study, which comprised of the Fed Funds Rates (FFR), the US inflation rates and its main stock market index – the Dow Jones Industrial Average (DJIA). To obtain a broader portray, an equivalently and widely traded commodity also selected, which is crude oil benchmark price West Texas Intermediate (WTI). These four indicators are expected to provide an adequate representation of macroeconomic effects on gold price. Comparison between these indicators with gold price fluctuation presented in the following figure.

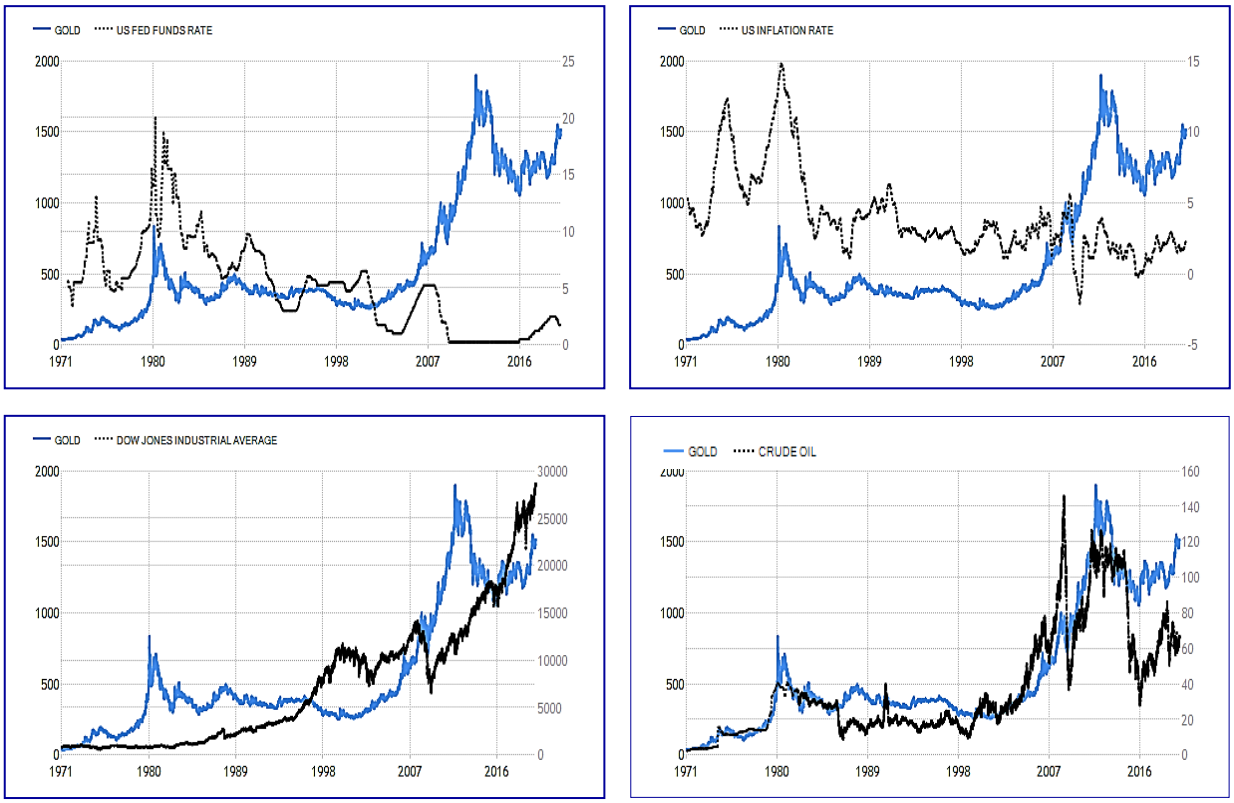


Figure 1: Historical Charts of Gold Price vs FFR, US inflation, DJIA & WTI in 1971 to 2019
Source: *TRADINGECONOMICS.COM*

II. Literature Review

Previous Research. Many scholars had researched various factors affecting gold price dynamics, most of whom also cluster their analysis on similar macroeconomic indicators examined in this study. The earlier research include *Toraman et al (2011)* who analyzed the effect of currency, oil price, interest rate, inflation rate and stock market index on gold price, using monthly data for the period of June 1992 to March 2010. Their research concluded that currency had a negative effect on gold price. On the other hand, oil price had a positive effect. Meanwhile, interest rate, inflation rate and stock market index had no effect.

*Choong et al (2012)*investigated the effect of currency, inflation rate, silver price and oil price on gold price, using quarterly data for the period of 1971 to 2011. They concluded that the inflation rate, silver price and oil price had a positive effect on gold price. On the contrary, currency had a negative effect.

Sindhu (2013) examined the effect of currency, oil price, interest rate and inflation rate on gold price, using daily data for the November 2006 to December 2011 period. He concluded that oil price and inflation rate had a positive-significant effect on gold price. Conversely, currency and interest rate had a negative-significant effect. *Seemuang & Romprsert (2013)* analyzed the effect of inflation rate, GDP, currency, money supply and

interest rate on gold price. Data population not specified. They concluded that inflation rate had a positive effect on gold price. On the other hand, GDP, currency, money supply and interest rate had a negative effect.

Later on *Kamran et al (2014)*studied the effect of currency, interest rate, inflation rate, stock market index, silver price, domestic (state) savings rate and per capita income on gold price, using average annual data for the 1980 to 2009 period. They concluded that silver price, per capita income and stock market index had a positive-significant effect on gold price. On the other hand, the level of domestic savings and currency had a negative-significant effect. Meanwhile, interest rate and inflation rate had no effect. *Sipkova & Sipko (2014)*investigated the effect of various types of commodities prices – including crude oil, inflation rate, money-supply expectations and stock market index on gold price, using monthly data for the 1971 to 2013 period. They concluded that the inflation rate and money supply expectation had a negative effect on the gold price. On the contrary, the stock market index and oil prices had a positive effect. Meanwhile, other factors had no effect.

*Bishnoi & Lan (2014)*examined the effect of inflation rate, interest rate, currency, real GDP growth and oil price on gold price, using annual data for the period of 1994 to 2013. They concluded that currency and oil price had a positive effect on gold price. On the other hand, inflation rate, interest rate and real GDP growth had a negative effect. *Tripathi et al (2014)*studied the effect of stock market index, currency and oil price on gold price, using monthly data for the period of April 2004 to March 2013. They concluded that the stock market index, currency and oil price had a negative effect on gold price. *Choueiri & Kawarani (2014)*analyzed the effect of stock market index, inflation rate, currency and interest rate on gold price, using annual data for the period of 1981 to 2013. They concluded that stock market index, currency and interest rate had a negative effect on gold price. On the other hand, inflation rate had a positive effect. *Nadeem et al (2014)*studied the effect of inflation rate, stock market index, currency and oil price on gold price, using monthly data for the 2002 to 2012 period. They concluded that inflation rate and oil price had a positive effect on gold prices. Conversely, stock market index and currency had a negative effect.

Anuar bin Sukri et al (2015) examined the effect of oil price, GDP, currency and inflation rate on gold price, using quarterly data for the period of 2005 to 2014. They concluded that oil price and GDP had a positive-significant effect on gold price. On the contrary, currency had a negative-significant effect. Meanwhile, the inflation rate had no effect. *Young and Malelak (2015)*analyzed the effect of inflation rate, interest rate, stock market index and oil price on gold price, using monthly data for the period of 1997 to 2013 from the US and UK. They concluded that partially, the interest rate had a negative-significant effect on gold price. On the contrary, stock market index and oil price had a positive-significant effect on gold price. Meanwhile, the inflation rate of the United States had no effect. It was further concluded that inflation and oil price of the UK, as well as interest rate and stock market index in the US simultaneously have a significant effect on gold price. *Akgül et al (2015)* examined the effect of stock market index and oil price on gold price, using monthly data for the period of April 1986 to November 2013. They concluded that stock market index and oil price had a positive effect on gold price.

Furthermore, *Srithar et al (2016)*studied the effect of currency, inflation rate, GDP, stock market index and oil price on gold price, using monthly data for the period of January 1996 to December 2015. They concluded that currency, inflation rate and stock market index had a negative effect on gold price. On the other hand, GDP and oil prices had a positive effect. *Mohith et al (2016)* investigated the effect of oil price, currency and stock market index on gold price, using annual data for the 2005 to 2015 period. They concluded that oil price and stock market index had a positive effect on gold price. Conversely, currency had a negative effect.

*Erdogdu (2017)*analyzed the effect of oil price, silver price, currency, stock market index, interest rate and inflation rate on gold price, using monthly data for the period of January 2003 to June 2016. She concluded that currency had a negative-significant effect on gold price. On the other hand, oil price and silver price had a positive-significant effect. Meanwhile, stock market index, interest rate and inflation rate had no effect. *Hashim et al (2017)* examined the effect of oil price, inflation rate, GDP, interest rate and currency on gold price, using annual data for the period of 1996 to 2015. They concluded that oil price had a positive-significant effect on gold. On the other hand, inflation rate, GDP and interest rate had a negative-significant effect. Meanwhile, currency had no effect. *Liberda (2017)* examined the effect of various macroeconomic factors including interest rate, inflation rate, stock market index and oil price on the prices of several types of precious metals – including gold, using mixed daily & monthly data for the period of January 1997 to December 2016. He concluded that the stock market index and oil price had a negative effect on gold price. Meanwhile, interest rate and inflation rate had no effect. *Nylund (2017)*analyzed the effect of inflation rate, interest rate, currency, stock market index, industrial production index, seasonality and money supply on gold price, using monthly data for the period of 1975 to 2016. He concluded that currency and interest rate had a negative effect on gold price. On the other hand, inflation rate and seasonality had a positive effect. Meanwhile, other factors had no effect. Likewise, *Zizun (2017)* examined the effect of inflation rate, currency, interest rates and oil prices on gold price, using monthly data for the period of January 2007 to December 2016. He concluded that the inflation rate had a

positive effect on gold price. On the contrary, currency and the interest rate had a negative effect. Meanwhile, oil price had no effect.

Latest scholars include *Gnanendra & Nishta (2018)* who examined the effect of stock market index, currency, interest rate and crude oil price on gold price, using daily data for the period 1 April 2009 to 31 March 2017. They concluded that stock market index and interest rate had a positive-significant effect on gold price. On the other hand, currency had a negative-significant effect. Meanwhile, crude oil price had no effect. Lastly, *Zulaikha et al (2018)* examined the effect of interest rate, currency, inflation rate and oil price on gold price, using monthly data for the period of 2004 to 2012. They concluded that currency and oil price had a negative effect on gold price. On the contrary, inflation rate had a positive effect. Meanwhile, interest rate had no effect.

From the above-mentioned research, scholars concluded various effects of interest rate, inflation rate, stock market index and oil price on gold price, which can be sorted into three main conclusions: positive-effect, negative-effect and no-effect. The data time span also widely vary, ranging from five to forty years period. Meanwhile the data measurement vary from daily, weekly, monthly, quarterly and even annual intervals.

Although most of those scholars include currency as one macroeconomic indicators however, considering that more than 80% of the above research found that currencies had a negative correlation with gold price. This is easy to comprehend considering that gold commodity traded in certain currency – mostly USD, hence their relationship tends to be opposites. Therefore, currency is not included in this research.

Interest Rate. The interest rate is an important tool in determining monetary policy of a country's central bank and always taken into account along with other macroeconomic variables. Generally, central bank tends to lower the interest rate when they aim to increase investment, consumption and eventually accelerate the economic growth of the respective country. Conversely, central bank tends to raise the interest rate when they aim to reduce investment and consumption and eventually decelerate the economic growth. However, low interest rate can be risky and may lead to the creation of an economic bubble, where large amounts of investment poured into property marketsor intostock markets. Thus, central banks have to carefully made interest rate adjustment, only after a thorough evaluation of all relevant indicators, in order to keep inflation rate within a certain range and maintain the economic health. Some central banks may also limit interest rates at a certain level, to keep pace with the economic growth and maintaining the economic momentum.

Of all central banks in the world, the US central bank, better known as The Federal Reserve System or 'The Fed' is the largest and recognized as the most influential bank in the world hence the Fed Funds Rate is chosen as the Interest Rate variable used in this research, measured in percentage (%).

Inflation Rate. Briefly defined, inflation is an increase in general prices of goods and services in an economy in a certain period. As prices increase, consequently each unit of currency can buy fewer goods and services. Inflation thus reflects a reduction in the purchasing power per unit of a currency, or a loss in the absolute value of the medium of exchange in an economy. Generally, a high inflation rate means that the economy is growing and vice versa. However, inflation rate fluctuation is far more complex and affected by many other macroeconomic variables.

As previously described, US inflation rate is used as a variable in this research because the US is the most dominant economic power to date with the proportion of national GDP about a quarter of world GDP. Inflation rate measured in percentage (%).

Stock Market Index. In financial markets, the stock market index consists of a hypothetical portfolio of a number of securities that represent a particular market. Each index related to the stock market has its own calculation methodology. It is widely acknowledged that stock market(s) index of a country mirror its economic condition. When the stock market is bullish means that the economy is thriving. On the contrary, when the stock market is bearish means that the economy is deteriorating.

The Dow Jones Industrial Average (DJIA) is a price-weighted average of the 30 most significant stocks traded on the New York Stock Exchange (NYSE), designed to provide the most closely related picture of the US economy as a whole. It is also one of the oldest indexes and the most observed index in the world. When news sites mentions that "the market is on the rise today", they generally refer to the DJIA Index Price. Therefore, DJIA is selected to represent stock market index variable in this research, measured in USD.

Oil Price. Throughout the twentieth and into the twenty-first centuries, crude oil commodity has a very significant and ever-increasing role in the world economy. This is due to the fact, that crude oil is used as amain energy source and traded as one of the world's major commodity, therefore its price movements are greatly influenced by world geopolitical conditions. From the beginning of its mass productions, various countries and organizations were competing to gain influence in determining benchmark prices. For instance, the US and North America with reference to West Texas Intermediate (WTI), Organization of Petroleum Exporting Countries (OPEC) with reference to the OPEC Basket Price, countries around the Persian Gulf with reference to Dubai Crude and countries around the North Sea by reference to the Brent Crude Price. Currently,most market participants accept the Brent Crude Price as a price benchmark for oil trading around the world, considering that the Brent Blend includes more than half of the world's crude oil volume. However, the historical data of Brent

Crude Price has been available only since 1980s hence it is not suitable for use in this study. On the other hand, WTI – which is the underlying commodity in the oil futures contract on the New York Mercantile Exchange (NYMEX), and represents about 25% of the world's crude oil volume, has historical data since 1915.

Considering the above-mentioned conditions, WTI is chosen as crude oil price variable to be used in this research, measured in USD/barrel.

Theoretical Framework of this research can be presented as follows:

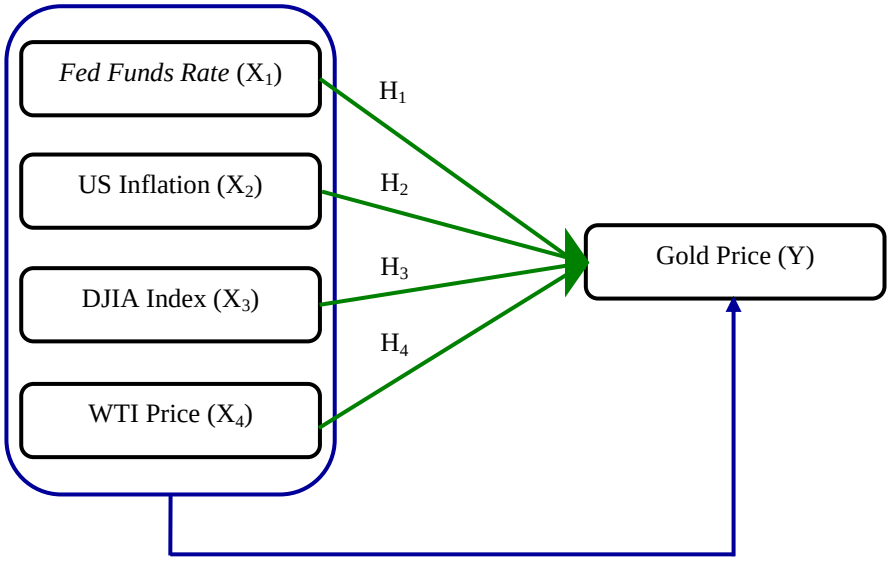


Figure 2: Theoretical Framework

Hypotheses. Based on background information, literature review and the above theoretical framework, hypotheses can be drawn as follows:

H_1: The Fed Funds Rate has a negative-significant effect on gold price
H_2: US inflation rate has a positive-significant effect on gold price
H_3: DJIA index has a positive-significant effect on gold price
H_4: WTI price has a positive-significant effect on gold

III. Material And Methods

Objectives. This study is empirical, aims to analyze the effects of selected macroeconomics variables, which are the Fed Funds Rate, US Inflation Rate, DJIA Index Price and WTI Price (as independent variables) on the gold price (as dependent variable), either individually or simultaneously.

Type and sourceof data. The population examined are monthly data intervals, throughout the period of January 1971 to December 2019. Thus, the total number of data is 588 for each independent and dependent variables. All data are quantitative in the form of panel data so that no specific sampling technique is required. Furthermore, all data are secondary, obtained from various reliable sources, including from www.tradingeconomics.com, www.goldprice.com, www.macrotrends.net and the US Bureau of Labor Statistics.

Data analysis method is by means of Multiple Linear Regression (MLR) Analysis, after first working out the Classical Assumption Test, which includes the Normality Test, Heteroscedasticity Test, Multicollinearity Test and Autocorrelation Test. Furthermore, Goodness of Fit test is performed through coefficient of determination (R-square) analysis. Lastly, Hypotheses Tests are carried out by, Overall Significance Test (F-test) and Individual Parameter Significance Test (t-test). The software used in data processing is IBM SPSS Statistics Data Editor Version 24.

Multiple Linear Regression equation model is as follows:

$$\boldsymbol{Y_t = a_0 + a_1 X_{1t} + a_2 X_{1t} + a_3 X_{3t} + a_4 X_{4t} + e_t}$$

Where:

Y_t = Gold Price
X_{1t} = The *Fed Funds Rate*
X_{2t} = US Inflation Rate
X_{3t} = DJIA Index Price
X_{4t} = WTI Price

a_0 = Constanta
e_t = Error
a_1, a_2, a_3, a_4 = Regression Coefficent

IV. Results

Descriptive Statistics. A descriptive statistics analysis isconducted to describe values distribution of independent variables and the dependent variable within the predetermined period from January 1971 to December 2019, as summarized below:

Table 1: Descriptive Statistics Results

Statistics						
		Fed Funds Rate	**US Inflation Rate**	**DJIA Index Price**	**WTI Price**	**Gold Price**
N	Valid	588	588	588	588	588
	Missing	0	0	0	0	0
Mean		5.12	0.32	7,293.37	36.75	564.87
Median		5.21	0.29	4,583.33	27.30	384.96
Std. Deviation		3.94	0.37	6,826.29	27.83	439.63
Minimum		0.07	-1.92	607.87	3.56	37.87
Maximum		19.10	1.81	28,538.44	140.00	1,780.65
Sum		3,008.53	187.27	4,288,502.26	21,610.66	332,146.73

Source: SPSS Data Processing

Table 1 above shows that data populationof this research consists of 588 specimensfor each of the analyzed variables, which are monthly data intervals throughout the period of January 1971 to December 2019. All data are valid and no missing data.

The Fed Funds Rate as the independent variable X_1, has a mean result of 5.12 with a standard deviation of 3.94 and a median of 5.21. The highest value is 19.10 in the period of June 1981, while the lowest value is 0.07 in the period of July, October and December 2011, and also in the period of January and February 2014. As for the total value of the Fed Funds Rate is 3,008.53.

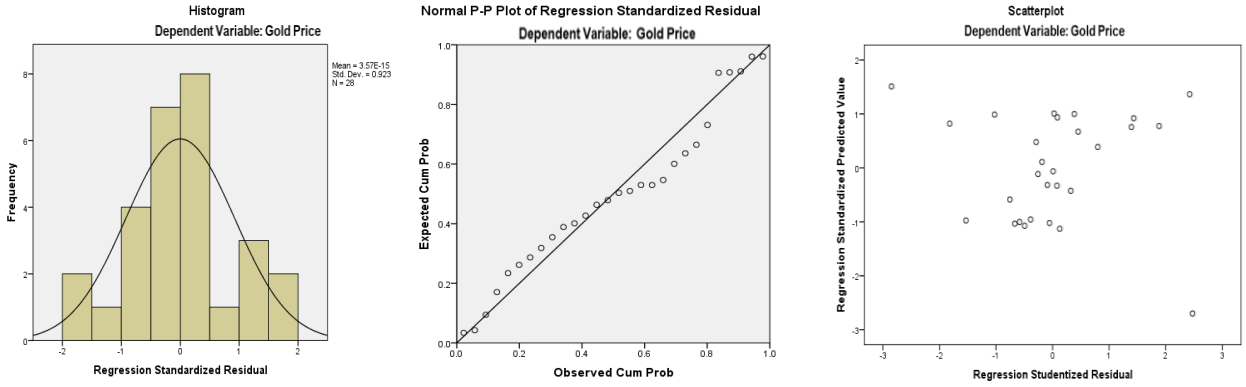
The US inflation rate as the independent variable X_2, has a mean result of 0.32 with a standard deviation of 0.37 and a median of 0.29. The highest value is 1.81 in the period of August 1973, while the lowest value is -1.92 in the period of November 2008. Meanwhile, the total value of the US inflation rate is 187.27.

Meanwhile, the DJIA index price as the independent variable X_3, has a mean result of 7,293.37 with a standard deviation of 6,826.29 and a median of 4,583.33. The highest value is 28,538.44 in the period of December 2019, while the lowest value is 607.87 in the period of September 1974. Meanwhile the total value of the DJIA index is 4,288,502.26.

WTI price as the independent variable X_4, has a mean result of 36.75 with a standard deviation of 27.83 and a median of 27.30. The highest value is 140.00 in the period of June 2008, while the lowest value is 3.56 in the period January-December 1971, January to December 1972 and January to July 1973. Meanwhile, the total value of WTI price is 21,610.66.

Lastly, the Gold price as the dependent variable Y, has a mean result of 564.87 with a standard deviation of 439.63 and a median of 384.96. The highest value is 1,780.65 in the period of September 2011, while the lowest value was 37.87 in the period of January 1971. Meanwhile, the total value of the gold price is 332,146.73.

Classical Assumption Tests,namely **Normality Test** and **Heteroscedasticity Test** results can be presented on the below figures:



3A **3B** **3C**

Figure 3: Normality and Heteroscedasticity Tests Results
Source: Source: SPSS Data Processing

On the figure 3A above, the Histogram graph shows a distribution pattern that deviates to the right and the histogram is bell-shaped, thus it can be stated that all data are normally distributed. Meanwhile, the Normal Probability Plot on figure 3B shows that all dots are plotted around and trailing along the direction of the diagonal line, therefore it can be stated that all data are normally distributed.

Moreover, based on the scatterplot graphic on figure 3C above, the scattered dots do not form any pattern or are randomly and evenly distributed to the left and right of 0 value on the X-axis as well as above and below 0 value on the Y-axis, hence it can be stated thatthere is no heteroscedasticity in the regression model.

Meanwhile, for the subsequent Classical Assumption Tests – **the Multicollinearity Test** results are summarized as follows:

Table 2: Multicollinearity Test Results

Coefficients[a]			
Model		**Collinearity Statistics**	
		Tolerance	**VIF**
1	The Fed Funds Rate	0.466	2.145
	US inflation rate	0.759	1.318
	DJIA Index Price	0.400	2.500
	WTI Price	0.553	1.809

[a] = Dependent Variable: Gold Price
Source: Source: SPSS Data Processing

On Table 2 above, collinearity statistics results shows that all independent variables have a tolerance value above 0.1 and a VIF value below 10, thus it can be stated that there is no multicollinearity in the regression model.

For the last Classical Assumption Test – **the Autocorrelation Test**, found that the dw result is 1.876, which is then compared with dl and du from the Durbin Watson table, where n = 588 and k = 4. It is found that the dl is 1.855 and du is 1.875. As the results meet the criteria du <dw <(4-du), where 1.875 < 1.876 <2.125, thus it can be stated that there is no autocorrelation in the regression model.

Subsequently, the **Multiple Linear Regression (MLR) Analysis** results are summarized as follows:

Table 3: Multiple Linear Regression Analysis Result

Coefficients[a]						
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**T**	**Sig.**
		B	**Std. Error**	**Beta**		
1	(Constant)	60.871	27.036	-	2.251	0.025
	The Fed Funds Rate	-1.716	3.040	-0.015	-0.565	0.573
	US inflation rate	-12.241	25.134	-0.010	-0.487	0.626
	DJIA Index Price	0.024	0.002	0.379	12.886	0.000
	WTI Price	9.212	0.395	0.583	23.296	0.000

[a] = Dependent Variable: Gold Price

Source: SPSS Data Processing

Based on Table 3 above, the result of the multiple linear regression equation is presented as follows:

$$\boldsymbol{Y_t = a_0 + a_1 X_{1t} + a_2 X_{1t} + a_3 X_{3t} + a_4 X_{4t} + e_t}$$

$$\boldsymbol{Y_t = 60,871 - 1,716 X_{1t} - 12,241 X_{2t} + 0,024 X_{3t} + 9,212 X_{4t} + e_t}$$

The above multiple linear regression equation can be interpreted as follows:

1. The Constant of 60.871 means that if the Fed Funds Rate, the US Inflation Rate, DJIA Index Price and WTI price are all ignored or equal to 0, then the gold price will remains at 60.871.
2. Moreover, the regression coefficient of the Fed Funds Rate of -1.716, which is negative, means that if the Fed Funds Rate increases by one-unit, while the other independent variables are constant, then the gold price will decreases by -1.716.
3. Likewise, the regression coefficient of the US inflation rate of -12,241, which is negative, means that if the US inflation rate increases by one-unit, while the other independent variables are constant, then the gold price will decreases by -12,241.
4. Meanwhile, the regression coefficient of the DJIA index price of 0.024, which is positive, means that if the DJIA index price increases by one-unit, while the other independent variables are constant, then the gold price will increases by 0.024.
5. Lastly, the regression coefficient of WTI price of 9,212, which is positive, means that if the WTI price increases by one-unit, while the other independent variables are constant, then the gold price will increases by 9,212.

Consecutively, **Goodness of Fit Test** results through the coefficient of determination (R-square) analysis are summarized as follows:

Table 4: Coefficient of Determination Analysis Result

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	0,893[a]	0.798	0.797	198.24698

[a] = Predictors: (Constant), The Fed Funds Rate, US inflation rate, DJIA Index Price, WTI Price

Source: SPSS Data Processing

Based on Table 4 above, the coefficient of determination (R Square) of the regression is 0.798. This signifies that there is a total contribution of 79.8% by the Fed Funds Rate, the US Inflation Rate, the DJIA Index Price and the WTI Oil Price in determining the gold price.

Hypotheses Test by **Overall Significance Test (F-test)** results are summarized as follows:

Table 5: The F-Test

ANOVA[a]					
Model	**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**

1	Regression	90,539,571.610	4	22,634,892.900	575.924	0,000[b]
	Residual	22,912,986.400	583	39,301.863		
	Total	113,452,558.000	587			

[a] = Dependent Variable: Gold Price

[b] = Predictors: (Constant), The Fed Funds Rate, US inflation rate, DJIA Index Price, WTI Price

Source: SPSS Data Processing

As seen on Table 5 above, the f-test result is 575,924 with a significance level of 0,000. Subsequently, the f-test is compared with the f-table value, by inputting 5% probability, df1 = 4 and df2 = 588-1 = 587. It is found that the f-table is 2.387. As the results of f-test > f-table (575,924 > 2,387) and the significance of 0,000< 0.05, it means that H_0 is rejected and H_a is accepted. Thus it can be stated that The Fed Funds Rate, the US Inflation Rate, DJIA Index Price and WTI Price, simultaneously have a positive-significant effect on gold price.

Hypotheses Test by Individual Parameter Significance Test (t-test), based on data processing output as presented in Table 3: Multiple Linear Regression Analysis Result above, obtained a summarized results as follows:

1. T-test of each variable is compared with the t-table, with a probability of 5%, and df = 588-1 = 587. Thus found the t-table is 1.964.
2. The Fed Funds Rate variable obtains the t-test of -0.565 with a significance level of 0.573. As the t-test<t-table (-0.565<1.964) and the significance of 0.573>0.05, then H_0 is accepted and H_a is rejected. Hence, it can be stated that the Fed Funds Rate has no significant effect on gold price.
3. The US Inflation Rate variable obtains the t-test of -0.487, with a significance level of 0.626. As the t-test<t-table (-0.487<1.964) and the significance of 0.626>0.05, then H_0 is accepted and H_a is rejected. Hence, it can be stated that the US Inflation Rate has no significant effect on gold price.
4. The DJIA Index Price variable obtains the t-test of 12,886, with a significance level of 0,000. As the t-test>t table (12,886>1,964) and the significance of 0,000<0.05, then H_0 is rejected and H_a is accepted. Hence, it can be stated that the DJIA Index Price has a positive-significant effect on gold prices.
5. The WTI Price variable obtains the t-test of 23.296, with a significance level of 0.000. As the t-test>t-table (23.296>1.964) and the significance of 0.000<0.05, then H_0 is rejected and H_a is accepted. Hence, it can be stated that the WTI Price has a positive-significant effect on gold price.

Table 6: Summary of Independent Variables Effects on Dependent Variable

Independent Variables	Hypotheses (H_a)	Regression Result
The Fed Funds Rate	Negative-significant	No Effect
US Inflation Rate	Positive-significant	No Effect
DJIA Index Price	Positive-significant	Positive-significant
WTI Price	Positive-significant	Positive-significant

V. Discussion

Regression result of the Fed Funds Rate reveals that it has no effect on gold price. This result is consistent with previous researches conducted by Toraman et al (2011), Sindhu (2013), Kamran et al (2014), Erdogdu (2017), Liberda (2017) and Zulaikha et al (2018) who also stated that the interest rates had no effect on the gold price. On the contrary, the result of this study is not in line with previous researches conducted by Theloosen (2010) and Gnanendra & Nishta (2018) who stated that interest rates had a positive effect on gold prices. Likewise, the result of this study is also not in line with previous researches conducted by Seemuang & Romprsert (2013), Bishnoi & Lan (2014), Choueiri & Kawarani (2014), Young & Malelak (2015), Hashim et al (2017), Nylund (2017)) and Zizun (2017) who stated that the interest rate has a negative effect on the gold price.

Regression result of the US inflation rate reveals that it has no effect on the gold price. This result is consistent with previous researches conducted by Toraman et al (2011), Kamran et al (2014), Anuar bin Sukri et al (2015), Young & Malelak (2015), Erdogdu (2017) and Liberda (2017) who also stated that the inflation rate has no effect on the price of gold. However on the contrary, the result of this study is not in line with previous researches conducted by Choong et al (2012), Sindhu (2013), Seemuang & Romprsert (2013), Choueiri & Kawarani (2014), Nadeem et al (2014), Nylund (2017), Zizun (2017) and Zulaikha et al (2018) who stated that the inflation rate had a positive effect on gold price. Likewise, the result of this study is also not in line with

previous researches conducted by Sipkova & Sipko (2014), Bishnoi & Lan (2014), Srithar et al (2016) and Hashim et al (2017) who stated that the inflation rate has a negative effect on gold price.

Regression result of the DJIA index price reveals that it has a positive-significant effect on gold price. This result is consistent with previous researches conducted by Kamran et al (2014), Sipkova & Sipko (2014), Young & Malelak (2015), Akgul et al (2015), Mohith et al (2016) and Gnanendra & Nishta (2018).) who stated that the stock market index had a positive effect on the gold price. On the contrary, the result of this study is not in line with previous researches conducted by Tripathi et al (2014), Choueiri & Kawarani (2014), Nadeem et al (2014) Srithar et al (2016) and Liberda (2017) who stated that the stock market index had a negative effect on the gold price. Likewise, the result of this study is also not in line with previous researches conducted by Toraman et al (2011), Erdogdu (2017) and Nylund (2017) who stated that the stock price index has no effect on gold prices.

Regression result of WTI price reveals that it has a positive-significant effect on gold price. This result is consistent with previous researches conducted by Toraman et al (2011), Choong et al (2012), Sindhu (2013), Sipkova & Sipko (2014), Bishnoi & Lan (2014), Nadeem et al (2014), Anuar Bin Sukri et al (2015), Young & Malelak (2015), Akgul et al (2015), Srithar et al (2016), Mohith et al (2016), Erdogdu (2017) and Hashim et al (2017), who stated that oil price has a positive effect on gold price. However on the contrary, the result of this study is not in line with previous researches conducted by Tripathi et al (2014), Liberda (2017) and Zulaikha et al (2018) who stated that oil prices has a negative effect on gold price. Likewise, this study result is also not in line with previous researches by Zizun (2017) and Gnanendra & Nishta (2018), who stated that oil prices have no effect on gold price.

Dissimilarities of this study results compared with previous researches, might be due to differences of examined data time span,which were broadly vary, ranging from five to forty eight years period. In addition, the data measurement also vary from daily, weekly, monthly, quarterly and even annual intervals. Other factors that might amplify such variations are particular historical events – mostly related to economic recessions or geopolitical turbulences, at which time the gold price fluctuation deviates fromgenerally accepted patterns. Hence, some of the previous research conclusions might be accurate and practical for specific period only. For instance,the use of certain researches conclusions, which analyze data at the time economic recessions, may be suitable for next anticipated economic recessions.

Nonetheless, a distinctive characteristic presented by this study is that the examined data encompasses gold historical prices, as well as the selected macroeconomic factors' figures, since January 1971 – a few months before the end of gold standard on 15 August 1971, to the end of 2019. Thus, the observed data covers the beginning of gold's significant price fluctuations and include numerous economic recessions or geopolitical turbulences in the past forty-eight years. Moreover, by selecting monthly interval data, totaled 588 specimens for each variables, the examined population are both richer in variance as well as longer time span. Hence, the performed analysis offers more robust and expectedly more applicable results.

VI. Conclusion

Conclusion. Referring to the results of regression analysis and discussions above, a brief conclusion can be drawn as follows:

1. All independent variables, namely the Fed Funds Rate, the US Inflation Rate, the DJIA Index Price and the WTI Price simultaneously have a positive-significant effect onthe gold price.
2. The Fed Funds Rate has no effect on the gold price.
3. The US Inflation Rate has no effect on the gold price.
4. The DJIA Index has a significant positive effect on the gold price.
5. The WTI Oil Price has a significant positive effect on the gold price.

The implication of this study is that all gold stakeholders are recommended to pay closer attention on the DJIA Index Price and the WTI Price fluctuations prior to making decision to Buy or Sell gold. However, this does not means that the Fed Funds Rate and the US Inflation Rate can be entirely neglected. As previous studies and observations revealed, these two variables have certain effects on gold price, although they might only be applicable for a specific period or a specific economic cycle. Frankly, gold price determinants are far more complex than the scope of this study, hence gold stakeholders are advised to do a more comprehensive analysis of other macroeconomics factors. In fact, for those who wish to retain gold for a longer period are also suggested to pay close attention on physical-gold's supply-demand data, which is the undisputed long-term determinant of the gold price.

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