

The Impact of the United States Macroeconomics on the Price of Gold

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Abstract

In the last few years, a sharp increase in the price of gold has been observed. Since gold has numerous functions, it provides macroeconomic safety and also is used as a hedge against inflation. The purpose of this research is to examine the impact of some the United states (US) macroeconomic variables such as the rate of inflation, the interest rate, the unemployment rate, real Gross Domestic Product (GDP), and the US dollar Index on gold prices in the international market. This study employs the Generalized Method of Moment (GMM) model, using annual time-series data for the period 1971 to 2021. The findings of this research shows that all variables have a statistically significant, with a one percent significance level except the unemployment rate which is statistically significant at a 5 percent level. Both the inflation rate and unemployment rate have a positive effect on the price of gold which is consistent with economic theory. Thus, it is shown that when the inflation rate increases by one percent, the gold price will increase by 1.32 percent. On the other hand, the gold price will increase by about 0.89 percent, when the rate of US unemployment increases by one percent. While the rest of the explanatory variables namely the interest rate, real Gross Domestic Product (GDP), and the United states (US) dollar index have a negative impact on the price of gold. The increase in the interest rate, real Gross Domestic Product (GDP), and US dollar index by one percent, lead to a decrease in the gold price by 0.39, 1.91, and 2.21 percent respectively.

Keywords: General Method of Moment, Gold, US Dollar.

1. Introduction

Gold has been used as a store of value since ancient times and also it has been formally traded over the counter in London since the seventeenth century (Joy 2011). By the nineteenth century, it underpinned the largest fixed exchange rate system which was called the Gold Standard, which relatively prevented significant volatility in exchange rates between currencies during that time (Baraviera et al 2019). In the twentieth century, however, it was again used as support for an exchange rate mechanism (Bretton Woods system). The Bretton Woods System was established at the end of the second world war and was a new monetary system. Based on the new monetary system, all currencies were tied to the United States (US) dollar, at the same time the United states dollar was tied to gold (Kalsum et al., 2020). At the beginning of the new monetary system, the value of the United states dollar was established at 35 US dollars was equal to one ounce of gold. After nearly 27 years, the system collapsed because the US kept on printing dollars to finance its war in Vietnam. This caused other countries to lose their trust in the maintainability of the parity (Bampinas and Panagiotidis 2015).

Since that time, the gold price has increased rapidly with the large increase in the amount of the United states dollars (Ghosh et al 2004). Several scholars have observed that the price of gold is directly linked to the US economy, particularly some macroeconomic variables such as the rate of US inflation, the US unemployment rate, the level of Gross Domestic Product, the rate of interest rate, and also some other macroeconomic variables. Many scholars started to investigate how the gold price was linked to the United States Gross Domestic Product, rate of inflation, the US dollar index, the United states stock markets (the Dow Jones Industrial Average or Nasdaq) and other macroeconomic variables, and even the connection between the price of gold and crude oil price, in an attempt to find a general relationship (Baraviera et al 2019).

The aim of this study is to identify the main factors which in an economically and statistically significant way affect the gold price in global markets. This research study adopted the following hypothesis: the main factors determining the gold price in international markets include: The US dollar index, the rate of the United states inflation, the rate of US interest rate, the unemployment rate in the United states economy, and the real Gross Domestic Product. This hypothesis was established based on conclusions drawn from the previous economic and financial theories as well as on the basis of a critical analysis of literature on the topic. In order to prove the above-mentioned hypothesis, we employed a statistical and econometric analysis. An econometric model like the General Method of Moment (GMM) was used to achieve the best possible outcomes. This paper is organized as follows: section 2 contains the objective and contribution of the study. Section 3 is devoted to the literature review. Section 4, is made up of four sub-section which contain the analytical Framework, the model, the data, discuss the empirical methodology and findings. Section 5 provides a brief conclusion.

2. The objective, and contribution of this study,

The purpose of the study whose outcomes are shown in the following paper is to what extent the United states macroeconomic variables affect the international price of gold. In some points, this study differs from previous gold studies. For instance, in this study, the researcher concentrates only on the Gross Domestic Product macroeconomic variables, while in almost all previous studies, the global factor that affects gold price has been included. Therefore, the researcher added to the literature in the sense of examining only the US macroeconomic variables. Another important point is related to the most recent data used in this study, from 1971 to 2021 with 51 observations which will deliver the most recent estimates. This is also an addition to the literature, particularly after COVID-19, Gross Domestic Product macroeconomics has significantly changed which led to a change price of gold in the international market.

3. Literature Review

In the previous literature, different research studies have been conducted that tried to clarify the price of gold and its determinants. Tandon and Urich (1987) conducted an empirical study that unexpected changes in the US monetary policy had a positive effect on the price of gold. Sherman (1983) conducted a study to identify the important determinants of the price of gold. The result showed that the level of R^2 was nearly 0.76. Sherman used some important variables such as the US trade-weighted rate of exchange, the interest rate, the growth rate of the United states Gross Domestic Product and the unanticipated inflation were significant drivers for the gold price. However, when Sherman tried to correct the serial correlation via an adjustment procedure, some variables became insignificant, like the tension index, whereas others became more significant, like the inflation rate. The role of the US dollar is also the most important factor that affects the financial markets; for example, if the interest rate is low in the United States compared to the rate of interest in other major trade partners like Japan, the European Union, and United Kingdom investors earn a lower return using embracing the dollar bonds rather than investing, which lead to depreciate US dollar. Central banks hold reserves that contain the inventories of US dollars and gold to sell what they want to intervene in the foreign exchange market. Sjaastad and Scacciallani (1996) examined the correlation between the exchange rate and the price of gold for the period 1982-1990. The main outcome of their research is the substantial effect of a depreciation or appreciation of the united states dollar on the price of gold. According to this research study, fluctuations in the real exchange rates among the major currencies explain almost half of the variation in the international price of gold.

Moreover, Kolluri (1981) conducted some empirical research to observe the role of gold in inflation hedging. In order to reach the appropriate result, Kolluri followed two different types of methods. The first method is related to the relationship between the return on gold investments and the predicted inflation. For this, Kolluri employed monthly prices of gold from 1968-1980. While in the second method, the model is related to the return of shares and

bonds between 1926-1978, which Kolluri then employed as the minimum required return for gold investments. Kolluri concluded that gold was a good hedge against inflation in the period 1968-1980. Furthermore, Moore (1990) showed in his study that there is strong evidence that gold prices positively are significantly affected by the inflation rate in the US economy.

Apart from the above arguments, tightening monetary policy is generally reflected in the higher rate of interest. Increases in the rate of interest cause the cart holding gold to rise. This should weaken the demand for inventory. At the same time, the Federal Reserve rate hikes will rise the yield of US dollar assets. This eventually leads to international funds flowing to dollar bonds and other assets, which will bring about a decline in gold prices. In contrast, loose monetary policy is manifested in a low rate of interest. This decreases the cart of holding gold and increases the demand for gold, leading to a surge in the gold price. The impact of interest rates on the gold price has been reported by a number of authors. Wang and Chueh (2013) confirmed the dynamic relationships between the interest rate, the US dollar on one hand, and gold prices on the other hand. Outcomes showed that if interest rates are reduced, it affects strongly investor expectations leading to depreciation in the United states dollar. Investors then could adopt to move the capital to gold leading to an increase in the price of gold. One of the recent studies is an article by Batten et al., (2014) who find strong evidence for time-variation in the inflation/gold correlation and that changes in the rate of interest are the main responsible for gold's sensitivity to inflation. Furthermore, Bampinas and Panagiotidis (2015) studied the relationship between gold and the inflation rate over two hundred years and they found that gold was an inflation hedge in the long run in both the United States of America (USA) and the United Kingdom (UK). A more recent study by Lin et al., (2016) found in their study found that the Federal Reserve monetary policy is the driver of the correlations between the gold price and the US dollar. Therefore, since increasing the rate of interest make US bonds more attractive, and increases the opportunity cost of holding gold which causes portfolio shifting, weakness in gold should follow. Moreover, an increase in the rate of interest brings about an increase in the US dollar value pushing the price of gold downwards.

Ghosh et al., (2004) presented that there is a significant economic and statistical correlation between the rate of inflation and the international price of gold. They found that an increased rate of inflation brings about an increase in the gold price which results from a lower real interest rate and a lesser attractiveness of an alternative to safe gold investment. However, it is notable that lower real interest rates do necessarily lead to lower real returns on stock indices. Ranson (2005) conducted a research study to find either gold can be considered a hedge against inflation. Ranson found that gold was the best hedge against inflation. His research also proved that an increase in the gold price is on average three times greater than an increase in the rate of inflation. Based on the study of Ranson the optimal amount to hedge your portfolio against the rate of inflation was to invest 18% of your portfolio in gold. However, the only weakness could be a reduction in inflation or deflation, which could

influence your return on the whole portfolio. Levin & Wright (2006) showed that there was a long-run relationship between the price of gold and consumer price index (CPI) in the US for the period 1975-2006. They confirmed that an increase in the US CPI by 1% caused an increase in the price of gold by 1% as well. Based on their study some variables such as inflation volatility, the interest rate to lease gold, credit risk, and the US trade-weighted exchange rate are the most important variables that are the most powerfully variable that affect the international price of gold at least in the short-run. Lampinen (2007) attempted to approve the outcomes from the research study of Levin and Wright (2006) but he extends the study period to one year. Despite Lampinen included more time dummy variables. Lampinen needed 19-time dummy variables, whereas, Levin and Wright (2006) used only 10-time dummy variables whereas. These time dummy variables were included so as to avoid autocorrelation in the residuals. Despite that, the result of Lampinen's study was similar to the study of Levin and Wright.

The United States Dollar Index (USDI) is an indicator of the exchange rate of the US dollar in the international foreign exchange market, which is negatively linked with the international price of gold. An increase in the United States Dollar Index means the US dollar appreciates and the value of gold decreases, investors sell gold which increases the demand for the United states dollar. This will lead to decreasing demand for gold and vice versa. Joy (2011) analyzed the impact of the US dollar index on the price of gold, the sample of the study was about 25 years. The results via a multivariate Generalized Autoregressive conditional heteroscedasticity (GARCH) model showed a negative correlation between these two variables. This outcome suggests that gold plays a vital role as an investment hedge against the United states dollar. Moreover, Samanta and Zadeh (2012) examined the relationships between the United states dollar index and the price of gold. They concluded that the long-run co-integration between these two variables is negatively correlated, when the US dollar index increases, the price of gold decreases. Reboredo (2013) also investigated the relationship between the US dollar and gold price to check either gold could act as a safe haven for the US dollar. The outcome confirmed that the two variables are negatively correlated, and gold can hedge against the United states dollar. The relationship between the price of gold and the US dollar is further examined in evaluating numerous empirical studies.

4. Source of Data and Methodology

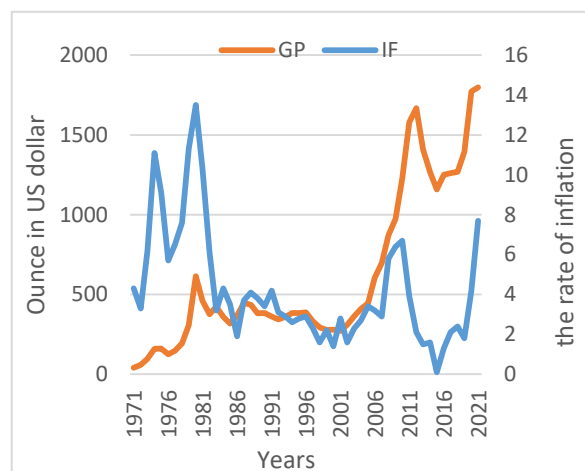
4.1 Analytical Framework

In this section, the theoretical framework will be briefly provided. The price of gold is affected by various factors. In previous literature numerous variables are mentioned as determinants of the gold price, for instance, the rate of inflation, interest rate, the US dollar index, the rate of interest rate, etc. Although the literature, has identified many variables that significantly affect the price of gold, in this study, only the US macroeconomics are selected. Examples of the variables are the rate of inflation, Gross Domestic Product, interest rate, unemployment rate, real gross domestic product, and the US dollar index. Before moving to

the gold model, it is important to show some figures that demonstrate the relationship between all selected explanatory variables and the price of gold.

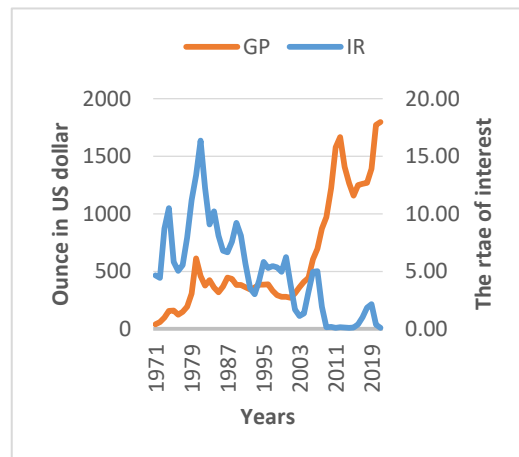
Figure 1, shows that two variables (the rate of inflation and the international price of gold) move together in the same direction. If the US inflation rate is high, the gold price should also be high (as shown in figure 1). Although in most periods the positive relationship holds true, in other few periods, however, there is no evidence of such a relationship (see figure 1). But in general, the positive relationship is shown in figure 1. Figure 2, shows, there is a negative relationship between the rate of interest and the gold prices. If the rate of interest is low in the US, investors gain a lower return using embracing the dollar bonds instead of investing, which leads to a devaluation US dollar against other major currencies. Therefore, as Gale (2009) clarifies that a decrease in the rate of interest leads to increases in the demand for gold, and eventually the international price of gold increases.

Figure 1: inflation rate vs Gold Price



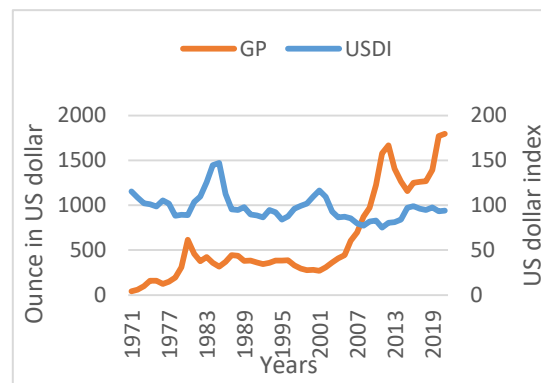
Source: Authors' calculations using E-view

Figure 2: Interest rate vs Gold Price



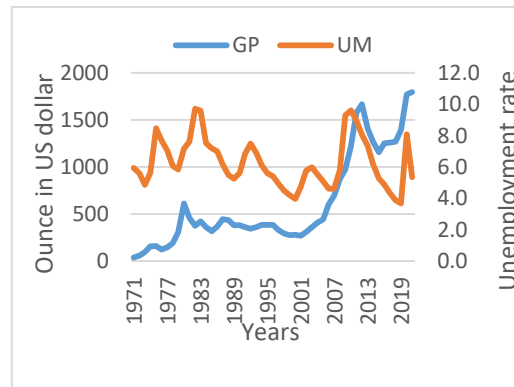
Source: Authors' calculations using E-view

Figure 3: US dollar index vs Gold Price



Authors' calculations using E-view

Figure 4: Unemployment rate vs Gold Price

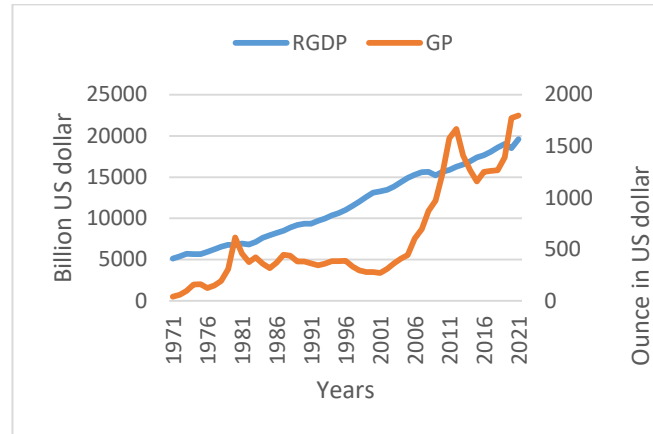


Source: Authors' calculations using E-view

Figure 3 shows the negative relationship between the price of gold and the US dollar. This means that when the US dollar appreciates against a basket of six influential currencies. In this situation, the demand for the United states dollar increases, and the US dollar index increases, then lead to decreasing the price of gold in the international market. It can be seen from figure 3, that the movement of the United states dollar index relatively has an inverse relationship against the price of gold. On the other hand, figure 4, shows the rate of the United states unemployment considers one of the main indicators which affect the price of gold. the rate of unemployment is countercyclical. Thus, the unemployment rate is negatively correlated to the gold price. This meant that when economic activity slows, the rate of unemployment increases and, eventually the price of gold increases. Therefore, with the increase in the rate of unemployment, the international price of gold increases. Figure 4, shows that there is a positive relationship between the United states unemployment rate and the international price of gold throughout the period from 1971 to 2021.

Figure 5 demonstrates the relationship between the United states real Gross Domestic Product and the international price of gold, therefore it is expected to have a negative sign from the regression analyses which will be run in the next section. Having a negative relationship between these two variables is related to the fact that when the real Gross Domestic Product increases mean the economic situation is in good condition. This means that when the economy is performing successfully in terms of a high growth rate in Gross Domestic Product, then investors support real estate, stock markets, and even bonds. In this situation, the demand for yellow metal will decrease, and also its price will decrease as well.

Figure 5: Real GDP vs Gold Price



Source: Authors' calculations using E-view

4.2 The Model and Discussions

An econometric model has been constructed which describes relationships between the gold price which is considered in this study as a dependent variable. On the other hand, the explanatory variables which are related only to the US economy are the inflation rate, interest rate, unemployment rate, United States of real GDP, and United States dollar index. The model looks as follows:

$$\ln GOLD_t = \alpha_t + \beta_t \ln IF_t + \gamma_t \ln IR_t + \theta_t \ln UM_t + \rho_t \ln GDP_t + \vartheta_t \ln USDI_t + \varepsilon_t$$

The following symbols were adopted for the model:

$GOLD_t$ stands for gold price

IF_t stands for the US rate of inflation

IR_t stands for the US real interest rate

UM_t stands for the US unemployment rate

$RGDP_t$ stands for US real gross domestic product

$USDI_t$ stands for US dollar index,

ε_t stands for the error term

The explanatory variables were selected on the basis of previous studies that have been analyzed in the literature review. Although there are plenty of variables related to US macroeconomics, the researcher has only selected the explanatory variables that were most correlated with the gold price or the most powerful variables that affect the price of gold.

in Table 1: The theoretically expected signs of the above variables on the price of gold are summarized

Explanatory variables	Signs
Inflation rate	+
Interest rate	-
Unemployment rate	+
Real Gross Domestic Product	-
US dollar index	-

Source: Theoretically Expected

4.3 Data

Time series databases are collected from numerous economic statistical data such as the Federal Reserve, World Gold Council, and the World bank. These two sources are the most useful source of data that has been used in this study. The data consists of annual observations of gold, and a set of the United States macroeconomic variables, over the period of 1971–2021. It is also important to mention that; all variables are converted into a log form. Table 2 clearly denotes the descriptive statistics of both dependent and independent variables in which 51 yearly observations from 1971 to 2021 have been included in the research.

Table 2: Summary of descriptive statistics

	GP	IF	IR	RGDP	UM	USDI
Mean	6.08	1.21	0.92	9.28	1.801	4.56
Median	5.95	1.19	1.60	9.30	1.77	4.552
Maximum	7.49	2.60	2.79	9.88	2.27	4.99
Minimum	3.68	-2.30	-2.52	8.54	1.30	4.31
Std. Dev.	0.86	0.77	1.54	0.41	0.24	0.14
Skewness	0.36	0.59	-0.11	-0.22	0.12	-0.93
Kurtosis	1.18	0.71	1.89	1.70	0.29	0.26
Jarque-Bera	21.22	117.3	10.54	11.01	15.18	10.86
Probability	0.01	0.01	0.10	0.14	0.12	0.17
Sum	310.54	61.71	47.39	473.37	91.97	232.87
Sum Sq. Dev.	37.28	29.69	119.6	8.45	3.06	0.98
Observations	51	51	51	51	51	51

Source: Author calculations using E-Views

Regarding satisfaction of time series data, it is vital to satisfy the properties of time series via examining multicollinearity. Thus, the variance inflation factor (VIF) is the most common way to test multicollinearity. The variance inflation factor (VIF) measures how much the variance of an estimated regression coefficient increases when explanatory variables are correlated. Based on the VIF rules, if no factors are correlated, the VIFs (Centered VIF) will all be equal to one. That means, there is no multicollinearity among explanatory variables. If the result of Centered VIF is greater than one but smaller than 5, the explanatory variables have some correlation with each other, this is called moderately correlated. However, if the outcome of Centered VIF is between 5 and 10, this indicates a very high correlation between the regressors that may be problematic (Alauddin & Nghiem 2010). It can be seen from table 1, that the explanatory variables against each other are less than 5, which indicates that there is a weak correlation between independent variables. This is a sufficient condition for time series data.

Table 3 The variance inflation factor (VIF) outcomes

IF	Centered VIF	IR	Centered VIF	UM	Centered VIF	RGDP	Centered VIF	USDI	Centered VIF
IR	3.23	IF	1.89	IF	1.86	IF	2.25	IF	1.81
UM	3.46	UM	1.19	IR	2.21	IR	2.54	IR	3.53
RGDP	1.72	RGDP	2.32	RGDP	2.81	UM	1.68	UM	3.36
USDI	1.35	USDI	1.54	USDI	1.67	USDI	1.63	RGDP	2.07

Source: Author calculations using E-Views

4.4 Econometric Methodology

At present time, the General Method of Moments (GMM) has been employed successfully to estimate some nonlinear models with endogenous problems that do not appear in an equation. The GMM was first introduced by Hansen (1982) with time series data, thus it is predicted that GMM is relatively advantageous for the time series model. In linear time series data, serial correlation in the errors is a vital departure from common assumptions. This raises the opportunity of allowing the GMM weighting matrix to account for the serial correlation of unidentified form, and the heteroscedasticity issue, as debated by Hansen (1982).

In order to attain a further efficient estimator than ordinary least squares and two-stage least squares, one must have over-identifying restrictions. In the time series method, the researcher may be able to add moment conditions by assuming that past values of dependent and independent variables are uncorrelated with the error term, though they do not detect in the model. For instance, if one researcher starts with a static equation, for example, a Phillips curve with inflation as the dependent variable, the GMM can be applied by employing lagged unemployment as the instrumental variable.

Using lagged values of explanatory and dependent variables makes sense in the context of models estimated under rational expectations. In this situation, the error term is uncorrelated with all explanatory and dependent variables dated at past time periods. Campbell and Mankiw., (1990) employ an instrumental variables (IV) method to estimate the permanent income hypothesis. They also examine the fraction of consumers who consume previous time, rather than permanent income, by estimating a simple equation relating consumption changes to income changes. Campbell and Mankiw (1990) employ lags of consumption and income for IV, as they are worried about serial correlation in the errors. Campbell and Mankiw., (1990) account for serial correlation by two stages least square. Furthermore, a similar problem is faced by Clarida et al., (2000) who studied forward-looking policy reaction functions for the Federal Reserve. In a model with the federal funds' interest rate as the dependent variable, Clarida et al., (2000) confirm that the errors will follow a moving average process if the Fed's target horizon for inflation. So as to resolve the problem of endogeneity. Clarida et al, (2000) employed the GMM estimators since this method can control for the endogeneity. Thus, lagged values of the variables are employed as instruments. It is also argued that the GMM method is asymptotically efficient with large

sample data, whereas less efficient if the sample data is small. this study used a large sample size for its data which is 51 years (51 observations) which is a relatively large size of data and employing the GMM method would be more efficient for estimating models.

The hypotheses have been set as follows,

H0. There is no relationship between selected macroeconomic variables and the price of gold.

H1. There is a relationship between the US rate of inflation and the price of gold.

H2. There is a relationship between the US interest rate and the price of gold.

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

H4. There is a relationship between the US real GDP and the price of gold.

H5. There is a relationship between the US dollar index and the gold price.

4.5 Discussion Finding and Result

This study seems to show that there was always a volatile presence of in relation to the United States macroeconomic variables and the Gold Price in international market. As the GARCH analysis has proved in Table 4 that all explanatory variables positively affect volatility of gold price in international market. In our model, the endogeneity problem is likely to arise as explained in the previous section. Therefore, to estimate the model General Method of Moment (GMM) estimation technique is employed. The corresponding regression is reported in Table 4. The t-statistics on the rate of inflation (3.355) indicate that there is a statistically significant positive relationship between the rate of US inflation and the price of gold. The coefficient for the inflation rate stood at 1.32, which means that a one percent increase in the rate of inflation leads to an increase in the price of gold by 1.32 percent, so linear regression rejects null hypotheses (H0) and accepts H1. This outcome is consistent with the predictions made previously by other scholars such as Bouoiyour et al., (2019) and Alameer et al., (2019) on the type of relationship between both variables.

Another explanatory variable that can influence the price of gold, and to large extent is linked to the rate of inflation, is the level of real interest rates. In this study real rate of interest rate considers the second factor in determining gold price. The result shows that there is a negative relationship between the rate of interest and gold price. A one percent increase in the rate of interest causes the gold price to decrease by 0.39 percent and vice versa. The coefficient has the right sign and is statistically significant at one percent. This demonstrates that the US monetary policy remains an important determinant of the international gold price. As yellow metal deficiencies a yield of its own, the opportunity cost of holding yellow metal decreases with a reduction in real interest rates and also increases with a real interest rate increase. For instance, a period of negative real interest rates should be particularly positive for the yellow metal, and this argument is supported by many scholars when real interest rates were considered negative for a long time of period during the 1970s. on the other hand, the early 1980s saw significantly positive real interest rates because of a determined effort by central banks from industrial countries to squeeze out inflationary pressures. Thus, gold price

dropped from its 1980 highest level with some funds diverted into other assets such as government bonds.

Furthermore, the result of the unemployment rate has a significant positive influence on the price of gold. The coefficient of the unemployment rate is also observed to be consistent with economic theory and statistically significant at five percent. With a one percent increase in the rate of unemployment in the US, the gold price will increase by about 0.89 percent. Regarding the result of the RGDP coefficient Based on the test outcomes in Table 5, The coefficient of RGDP has also a negative relationship with the international price of gold. The P is statistically significant at one percent. The outcome of the coefficient RGDP shows that a 1 percent decrease in the RGDP ceteris paribus, leads to an increase in the output of tradable goods by 1.9 percent. Thus, the null hypothesis of the coefficients of the RGDP can easily be rejected and the alternative hypothesis is accepted.

Table 4: Empirical Estimates of GMM

Variables	Coefficient	t-Statistic	Prob
IF	1.324215	3.355482	0.0180
IR	-0.392004	-4.970106	0.0000
UM	0.890389	2.155050	0.0367
RGDP	-1.915848	-6.310443	0.0000
USDI	-2.211256	-3.600721	0.0008

Source: Author calculations using EViews

R-squared 0.788908
Adjusted R-squared 0.764920
DW 1.9
J-statistic 10.647
Prob.(J-stat.) 0.000000
Instrument rank 6

The coefficient of the United States dollar index is negative and significant which means that when the US dollar index increases by 1 percent, the price of gold decreases by 2.21 percent with a significance level of one percent. Estimating these two variables (US dollar index and Gold price) has been found in previous studies such as (Zhu et al., 2017), (Baraviera et al., 2019), and (Kalsum et al., 2020). Since the US dollar index moved to a flexible exchange rates regime in 1971, the value of the US dollar has been a considerable effect on the short-term gold price. The IMF estimated in 2008 that approximately 40% of the moves in the price of gold since 2002 were US dollar-related. This relationship exists because of two main reasons: First, a falling US dollar increases the purchasing power of non-dollar area countries (Euro or British Pound) driving up prices of gold, and vice versa. Second, in periods of US dollar weakness, most investors look for an alternative store of value, which leads to an increase in the price of gold. This contains dollar-based investors' worries about the potential inflationary consequences of a weak US dollar.

In general, the estimated impact of selected explanatory variables on the gold price is robust with reasonable values of overall R-square (0.78) and Adjusted R-square (0.76). As Durbin

Watson (DW) value is nearly two, it indicates there is no autocorrelation problem. High p-values of J-statistics indicate that the instruments are valid.

5. Conclusion

The main goal was to examine the implications of the US macroeconomic factors on the gold price from 1971 to 2021 (annual data). This study has provided, identified, and quantified linkages that can let these implications clear. It provides quantitative measures of the macroeconomic factors that influence the gold price. The estimated outcomes support the researcher's argument that there is a significant linkage between selected macroeconomic variables and gold prices. The test outcomes of five explanatory variables (inflation rate, interest rate, unemployment rate, real GDP, and US dollar index) show consistency with economic theory. For this purpose, this study has estimated an econometric model using GMM estimation techniques. General Method of Moment (GMM) outcomes demonstrate that the rate of inflation and unemployment rate has a statistically significant positive impact on gold prices. As inflation increases, it increases uncertainty which encourages investors to convert their capital into a long-lasting product which is gold. This increases the demand for gold and eventually gold price increases in the international market. Whereas, the rate of interest, real Gross Domestic Product, and United States dollar index has a significant and negative impact on gold prices in the international market. All results from this study are supported by economic literature, however, the power of effecting selected explanatory variables is different. The results concluded that the selected US macroeconomic variables are the most significant indicator to track changes in the price of gold. The interesting point in this study is related to the USDI variable. It is noted that the impact of the United States dollar index is the most powerful variable among all explanatory variables.

Finally, some recommendations for upcoming studies can be made. A vital step would be to comprise cross-testing for all the different models so as to the different techniques can be compared in an objective way. It would also be motivated to study if non-linear machine learning techniques can be added to the regression analyses by trying to model the residuals coming from linear regression, employing the same variables that were employed in the linear model. The last point of additional improvement for future study is the possibility to include a political instability variable. Last but not least, this study was successful in testing a specification of the model, but more studies may develop the model because the price of gold has highly volatile. The researcher's idea was to find whether or not the employ of the US macroeconomic variables on an annual basis to examine the gold prices. What the researchers found is that as a result of the volatility of gold, annual data might not be a good fit for predicting gold prices. Therefore, it is suggested that the research paths might be taken that could improve the model.

References

Alameer, Z., Abd Elaziz, M., Ewees, A. A., Ye, H., & Jianhua, Z. (2019). Forecasting gold price fluctuations using improved multilayer perceptron neural network and whale optimization algorithm. *Resources Policy*, 61, 250-260.

Alauddin, M., & Nghiem, H. S. (2010). Do instructional attributes pose multicollinearity problems? An empirical exploration. *Economic Analysis and Policy*, 40(3), 351-361.

Bampinas, G., & Panagiotidis, T. (2015). Are gold and silver a hedge against inflation? A two century perspective. *International Review of Financial Analysis*, 41, 267-276.

Bariviera, A. F., Font-Ferrer, A., Sorrosal-Forradellas, M. T., & Rosso, O. A. (2019). An information theory perspective on the informational efficiency of gold price. *The North American Journal of Economics and Finance*, 50, 101018.

Batten, J. A., Ciner, C., & Lucey, B. M. (2014). On the economic determinants of the gold–inflation relation. *Resources Policy*, 41, 101-108.

Campbell, J. Y., & Mankiw, N. G. (1990). Permanent income, current income, and consumption. *Journal of Business & Economic Statistics*, 8(3), 265-279.

Clarida, R., Gali, J., & Gertler, M. (2000). Monetary policy rules and macroeconomic stability: evidence and some theory. *The Quarterly journal of economics*, 115(1), 147-180.

Gale, W. G. (2019). Fiscal Policy with High Debt and Low-Interest Rates. *Maintaining the Strength of American Capitalism*, Melissa S. Kearney and Amy Ganz, eds. Aspen Institute Economic Strategy Group.

Ghosh, D., Levin, E. J., Macmillan, P., & Wright, R. E. (2004). Gold as an inflation hedge?. *Studies in Economics and Finance*.

Hansen, L. P. (1982). Large sample properties of generalized method of moments estimators. *Econometrica: Journal of the econometric society*, 50(4) 1029-1054.

Joy, M. (2011). Gold and the US dollar: Hedge or haven?. *Finance Research Letters*, 8(3), 120-131.

Kalsum, U., Hidayat, R., & Oktaviani, S. (2020). The effect of inflation, US dollar exchange rates, interest rates, and world oil prices on gold price fluctuations in Indonesia 2014–2019. *Journal of Business and Management Review*, 1(3), 155-171.

Kolluri, B. R. (1981). Gold as a hedge against inflation-an empirical-investigation. *Quarterly Review of Economics and Business*, 21(4), 13-24.

Lampinen, A. (2007). Gold investments and short-and long-run price determinants of the price of gold. Working paper, LUT, School of Business.

Levin, E. J., Montagnoli, A., & Wright, R. E. (2006). Short-run and long-run determinants of the price of gold. World Gold Council, London

Lin, F. L., Chen, Y. F., & Yang, S. Y. (2016). Does the value of US dollar matter with the price of oil and gold? A dynamic analysis from time–frequency space. *International Review of Economics & Finance*, 43, 59-71.

Moore, G. H. (1990). Gold prices and a leading index of inflation. *Challenge*, 33(4), 52.

Ranson, D., & Wainwright, H. C. (2005). Inflation protection: Why gold works better than “linkers”. London, World Gold Council.

Reboredo, J. C. (2013). Is gold a safe haven or a hedge for the US dollar? Implications for risk management. *Journal of Banking & Finance*, 37(8), 2665-2676.

Samanta, S. K., & Zadeh, A. H. (2012). Co-movements of oil, gold, the US dollar, and stocks. *Modern Economy*, 3, 111-117

Sherman, E. J. (1983). A gold pricing model. *The Journal of Portfolio Management*, 9(3), 68-70.

Sjaastad, L. A., & Scacciavillani, F. (1996). The price of gold and the exchange rate. *Journal of international Money and Finance*, 15(6), 879-897.

Tandon, K., & Urich, T. (1987). International market response to announcements of US macroeconomic data. *Journal of International Money and Finance*, 6(1), 71-83.

Wang, Y. S., & Chueh, Y. L. (2013). Dynamic transmission effects between the interest rate, the US dollar, and gold and crude oil prices. *Economic Modelling*, 30, 792-798.

Zhu, Y., Dickinson, D., & Li, J. (2017). Analysis on the influence factors of Bitcoin’s price based on VEC model. *Financial Innovation*, 3(1), 1-13.