

MACROECONOMIC VARIABLES AFFECTING THE VOLATILITY OF GOLD PRICE

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Abstract

This study analyses the macroeconomic factors influencing gold prices of the largest gold consumer in the world (India, China, United States, Turkey and Saudi Arabia). Statistical Package for Social Sciences (SPSS) was used to assess the prospective relationships between the gold prices and inflation rates, real interest rates, exchange rates, crude oil prices and gross domestic product. Annually data employed for 20 years from year 1996 until 2015. The findings showed there were positive relationship between crude oil prices with gold price besides the negative relationship could be observed between inflation rate, GDP, real interest rate, exchange rate and gold price. From the regression result, it showed that independent variables other than exchange rate were have significant impact on the gold price.

Keywords: Gold prices, macroeconomic factors

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Introduction

Gold has been a symbol of wealth and prosperity since thousands years ago. Gold was used as a currency even before fiat money was created and currently it is used as an investment both in computer and jewelry. Basically investors who buy gold mainly to hedge against political unrest and inflation for their investment because gold could lower portfolio risk as a commodities. Thus, most of investment advisors recommend investors to have a strategic portfolio allocation in commodities. The sharp increasing trend of gold price since the year 2005 had pulled the attention from researchers and investors. In 2005, gold price were only at the average price of USD 444.84 per ounce and then it had dramatically increased to USD 1384 per ounce in the first quarter of 2011. Gold has a characteristic that served as the inflation hedge, which means the gold price will increase as the inflation rate increase. In other words, gold preserved its value even though inflation happened and shows a direct relationship. There are two reasons that can be a result in rising inflation where both may have an effect on the gold price.

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Besides, inflation also would increase consumer wealth and boost the demand for luxury goods like jewelry. Under economic distress, money supply may increase as inflation relaxing the monetary policy. Moreover, gold also served as an effective hedge against US Dollar exchange rate. Since the US Dollar is usually used as the world's main trading currency, it is considered as a good hedge when the Dollar weakens respective to other currencies. Gold also has a safe haven potential where historically, gold shown a steady position of its value during times of economic or political uncertainty. Even during equity markets are struggling, investors are retreated to gold with a safe haven and a store of value. In the short run, gold price were drive by two factors. First, during economic crisis, most of investors lost their confidence with the security market. Therefore, they tend to switch their investment funds to gold market which believed to be more insurable and less risky from the unstable financial market. As for company especially multinational companies, they were often exposed to currency exchange risk transactions were held between subsidiaries and parent company. Therefore, big corporate often employ gold to hedge against the fluctuation of US dollar against other currencies. Same goes in the long run, there are also two factors which led to the increasing of gold price. Firstly, the increased in mining costs. As the costs to supply gold has increased, it will lead to the increasing in the gold price too. Secondly, gold price would increase because of market uncertainty. in order to ensure the safety return regardless the condition of economy, investors tend to allocate gold as part of the investment. Since it is held the characteristic of high liquidity, gold served as an insurance against economic uncertainty and thus, enabled gold to be marketable even in unstable financial markets.

The gold price had hysterically increased from USD 38.50 per ounce ever since 1971 to USD 631.10 per ounce at first quarter of 1980. This trend continued to grow until August, 2011 where gold price hit the peak level. During that time, the gold price had recorded the highest price of USD 1917.90 per ounce. The reason of gold break through its highest price was due to the downgrade of the S&P rating on US Treasury bond from AAA to AA+. As a result from that, many investors lost their confidence in US paper currency, therefore they shifted their investment in gold to protect their investment and instantly boosted the gold demand together with the gold price.

This paper is mainly to identify the significant relationship between the macroeconomic factors and gold price. In addition, researcher want to examine the impact of those factors on the gold price besides find out the most significant factor that affects the gold price. This study has a central idea to examine the important factors that significantly affect the gold price which provided financial planners, investors, and policymakers with crucial information to hold a better decision framework when dealing with gold market.

In this study, the research is conducted in term to study the correlation of inflation rate, gross domestic product, real interest rate, crude oil price and exchange rate as factors that affecting the price of gold by using five largest gold consumer countries as an evidence. These founding members and report of data, which comprises year of the study from 1996 until 2015, as in these countries. Subsequently is the clear explanation to the model specification, which, the sign of the coefficient is affirmed based to earlier theoretical frameworks.

This paper has been organized into a few chapters. Chapter One would be the introduction of this paper. It consists of the introduction of the gold market overview and factors that influencing the fluctuation of gold prices. Besides that, this chapter recites the purpose and outline of the significance to this investigation. Chapter Two reviews the theoretical and empirical works done in previous studies. The literature reviews summarize related studies and analysis to provide a better understanding as well as increase breadth of knowledge in undertaking the study. Chapter Three discussed a brief description of the data and empirical methodology employed in the study such as the gold price, theoretical framework and statistical test of the selected period to obtain results from the study. Chapter Four of this paper is about the results interpretations of the study that has been conducted in the previous chapter. The result will be explained in the form of texts, figures and tables. Chapter Five concludes the study by answering the research objectives and research questions. Together with that, in this chapter also will discussed the recommendations for future research based on the evidence obtain from the study.

Literature Review

The study done by Toraman, Basarir, & Bayramoglu (2011) to determine factors affecting the gold prices, which include monthly data between months of June 1992 to March 2010. The authors used MGARCH model to analyze the data which include oil prices, USA exchange rate, USA inflation rate and USA real interest rate data in the model as independent variables. The empirical findings shown that highest correlation found between gold prices and USA exchange rate negatively. However, gold prices and oil prices concluded to have positive correlation between each other. A review on the effect of gold price volatility of stock returns of Turkey was done by Contuk, Burucu, & Gungor (2013). The study analyses the effect of fluctuations in gold prices on ISE 100 index using daily prices and the index data from 2009 to 2012. Researchers want to determine whether heteroscedasticity test is appropriate or not to use in the GARCH model and the result found that there was an ARCH effect in both variables then GARCH models could be used. Thus, from MGARCH model, it shows that gold and stock exchange yields have been influenced both by their own vibrations.

Shafiee & (Contuk, Burucu, & Gungor, 2013) Topal (2010) studied on global gold market and gold price forecasting. They arranged the study by two sections whereby the first section examined the demand, supply and price of the gold market from January 1968 to December 2008. Later followed by an analysis into the relationship between gold price and other key affecting variables, such as oil price and global inflation over the last 40 years. While the second part is the study on the gold price forecasting. The results specified that, assuming the current price jump initiated in 2007 behaves in the same manner as that experienced in 1978, the gold price would stay abnormally high up to the end of 2014. Christie, Chaudhry, & Koch (2000) used intraday data over a span of 4 years (1992-1995) to study the impact of macroeconomics news releases on gold and silver prices. Twenty-three monthly macroeconomic news releases were tested and shown that both metals respond toughly to the release of Capacity Utilization. Gold found to have a strong response to the release of the CPI. Besides, the unemployment rate also does affect both gold and silver, whereas the gross domestic product and PPI have significant effects on gold. Weak responses by gold to the release of the Federal Deficit and silver to the release of the CPI, Hourly Wages, Business Inventories and Construction spending are also noted by the researcher.

Bapna et al. (2012) investigated on the dynamics of macroeconomic variables affecting price innovation in gold. The essential target of this study is to examine the causal impacts of macroeconomic variables on gold prices using the unit root test, regression and granger causality test which will further describe the probability of change in the variables studied. Thus, this study found that, exchange rate, fiscal deficit, the forex reserve inflation rate is independently affecting gold prices at large, but, growth rate, GDP, BSE Sensex and NSE Index are having a very low impact on gold prices independently and commonly all these variables determine gold prices. Tufail & Batool (2013) studied the relationship between inflation and gold prices with evidence from Pakistan where researchers want to determine the inflation-hedging properties of gold contrast to other assets such as real estate, stock exchange securities and foreign currency holdings. They used time series data for 1960 to 2010 and apply co-integration and VECMs to assess the determinants of inflation and the inflation-hedging properties of different assets. The findings reveal that gold prices are positively and significantly related to inflation in Pakistan.

A study conducted by Pushpa & Muruganandam (2014) used fuzzy multiple linear regression for the estimation of the relation between financial variables and gold price. This study was directed because of uncertainty in the world economy and stock markets where there is an increasing interest in gold from investors and the current bull market in gold. Thus, this study was done to see what is the financial variables that may result in expand in the gold price. The outcomes uncovered that a decline in GDP growth rate increases the gold price. In addition, Abdullah & Abu Bakar (2015) aimed to ascertain a forecasting model of the price of gold in connection to the rate of interest from 1971 until 2013 that would serve managers' wealthiest in their forward clarification of capital market expectations. The outcome of the research found that the price of gold and real interest rate are oppositely related. Choong et al. (2012) investigated on the determinants of the gold price by using simple and multiple linear regression. It was conducted to study the determinants of the gold price by investigating the four keys influencing variables affecting gold price, such as inflation, silver price, USA dollar trade weighted index and Brent crude oil price. The data were obtained quarterly for the period of 1971 to first quarter of 2011 sourced from International Financial Statistics (IFS) and Global Financial Data (GFD). The results showed there were positive correlation between inflation, silver price and Brent crude oil price with gold prices.

Zakaria et al. (2015) studied the factors affecting the price of gold in Malaysia and conducted to determine the elements influencing gold prices in Malaysia. Researcher used Stata software to assess the prospective relationships between the dependent variable which is gold prices and the independent variables that are inflation rate, interest rate and exchange rate by using Pooled Ordinary Least Squares (POLS) methodology. The monthly data was employed in this study spans across 14 years period from 2000 until 2013. The results revealed that the rates of inflation, exchange and interest were significantly related with gold prices in Malaysia in different magnitude and direction. It is empirically proven that any change in the rates of these three variables will likely pose a change of gold prices in the country.

Methodology

The source and description of data which includes gold prices from the year 1996 until 2015 of the largest gold consumer countries as well as the factors that influenced the gold price volatility. Subsequently, the explanation to the model specification, where the sign of coefficient is stated based on earlier theoretical frameworks. SPSS software is employed and the statistical techniques that will be conducted in this study are descriptive statistic, correlation coefficient and multiple regression analysis. The specific largest gold consumer countries to be include in this study is based on the ranking number in a world, which are India, China, United States, Turkey and Saudi Arabia respectively. All the variables are selected based on the previous researches done by other researchers. The choice is sometimes limited, however, due to lack of relevant data.

Dependent Variable

Gold price are influenced by many factors. As central banks held large positions in gold, as a result, announcements and activities by those banks will affect the supply and demand of gold. Other than macroeconomic factors, political uncertainties, economic concerns around the world, hedging activities by gold producers and trading activities of speculators also help drive the gold price.

Independent Variables

Inflation rate is related to gold prices because gold usually has a direct relationship with inflation. When inflation is high, the value of paper currency falls in terms of the goods and services it can buy. Thus, demand for gold increases as inflation increases and vice versa.

Gross domestic product (GDP) shows when the economy grows fast, as opposed to slowly or declining, there will be rising on people's incomes and purchasing power, so does the demand for gold. However, the gold price is not significantly driven by the consumer demand, but by investment demand because consumers are price takers, not price setters, hence they buy more when the prices decrease and vice versa.

Interest rate, where rising interest rates may even have a bullish effect on gold prices. Bonds and dividend paying stocks typically pay higher rates as the Fed raises its key interest rate. However, because gold doesn't pay income, higher rates increase the opportunity cost of owning gold.

Crude palm oil, as according to Choong et al. (2012), when price of crude oil price increase, gold price also will be increase. This is because, crude oil served as the main source in gold mining. Hence, gold price will increase as the cost of gold mining is increase.

Exchange rate, even though gold is no longer used as a primary form of currency in developed countries, it still continue to have an impact on the currency's value. Besides, there is a strong relationship between its value and the strength of currencies trading on foreign exchanges.

Research Hypothesis

Correlation of Coefficient

H₀ : There is no significant relationship between the factors and gold price.

H₁ : There is a significant relationship between the factors and gold price.

Multiple Linear Regression

H₀ : There is no significant impact of the factors on the gold price.

H₁ : There is a significant impact of the factors on the gold price.

Model Equation

$$PGOLD = \alpha + \beta_1CPI + \beta_2GDP + \beta_3RINTR + \beta_4POIL + \beta_5EXR + \varepsilon$$

Where:

PGOLD = Price of gold

α = Constant

β = Coefficient

CPI = Inflation rate

GDP = Gross Domestic Product

RINTR = Real interest rate

POIL = Price of crude oil

EXR = Exchange rate

ε = Error

Result and Discussion

Descriptive Statistics

Table 4.1:Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Gold Price	100	274.393	1742.098	762.20374	467.557373
Inflation Rate	100	-1.30	99.09	8.3830	17.02613
Gross Domestic Product	100	-5.70	14.20	5.4660	3.69841
Real Interest Rate	100	-2.30	80.80	9.4230	16.89559
Crude Oil Price	100	17.57	108.33	59.7590	29.08754
Exchange Rate	100	.081	64.152	12.12090	18.006631
Valid N (listwise)	100				

Table 4.1 shows the descriptive statistics for the output which comprises of six variables data for 20 years from year 1996 until 2015. From the table, it can be seen that the mean value of gold is 762.20 with standard deviation of 467.56 and indicates that the lowest price of gold is USD 274.39, while the highest price of gold is USD 1,742.90. Inflation rate shown mean and standard deviation is 8.38 and 17.03 respectively. The highest inflation rate was recorded at 99.09% whereas the lowest inflation rate was at -1.30%. The mean and standard deviation for gross domestic product are 5.47 and 3.70 respectively. The lowest gross domestic product is -5.70%, while the highest gross domestic product growth is 14.20%. Mean and standard deviation for interest rate are 9.42 and 16.90 respectively. The

lowest real interest rate is -2.30%, while the highest is 80.80%. Crude oil price recorded 59.76 for mean and 29.09 for standard deviation. The maximum crude oil price is USD 108.33 and the lowest is USD 17.57. Lastly, the variable of exchange rate which the mean and standard deviation are 12.12 and 18.01 respectively. Exchange rate maximum at USD64.15, while minimum at USD0.08.

Correlation of Coefficient Analysis

From table 4.2, inflation rate, gross domestic product, real interest rate and exchange rate have relatively low correlation with gold price. While gross domestic product, crude oil price and exchange rate showed a positive correlation, inflation rate and real interest rate have negative correlation.

Table 4.2: Correlations Result

		Gold Price	Inflation Rate	Gross Domestic Product	Real Interest Rate	Crude Oil Price	Exchange Rate
Gold Price	Pearson Correlation	1	-.136	.009	-.280**	.724**	.047
	Sig. (2-tailed)		.176	.928	.005	.000	.644
	N	100	100	100	100	100	100
Inflation Rate	Pearson Correlation	-.136	1	-.142	.951**	-.196	-.084
	Sig. (2-tailed)	.176		.159	.000	.051	.407
	N	100	100	100	100	100	100
Gross Domestic Product	Pearson Correlation	.009	-.142	1	-.192	.154	.273**
	Sig. (2-tailed)	.928	.159		.056	.127	.006
	N	100	100	100	100	100	100
Real Interest Rate	Pearson Correlation	-.280**	.951**	-.192	1	-.311**	-.152
	Sig. (2-tailed)	.005	.000	.056		.002	.131
	N	100	100	100	100	100	100
Crude Oil Price	Pearson Correlation	.724**	-.196	.154	-.311**	1	.014
	Sig. (2-tailed)	.000	.051	.127	.002		.888
	N	100	100	100	100	100	100
Exchange Rate	Pearson Correlation	.047	-.084	.273**	-.152	.014	1
	Sig. (2-tailed)	.644	.407	.006	.131	.888	
	N	100	100	100	100	100	100

** . Correlation is significant at the 0.01 level (2-tailed).

The relationship between dependent variable which is gold price and independent variable are shown in Table 4.3.

Table 4.3: Discussion of Correlation

Dependent Variable	Independent Variables	Result	Hypothesis
Gold price	Inflation rate	Insignificant negative relationship	Reject H ₀
	Gross domestic product	Insignificant positive relationship	Reject H ₀
	Real interest rate	Significant positive relationship	Fail to reject H ₀
	Crude oil price	Significant positive relationship	Fail to reject H ₀
	Exchange rate	Insignificant positive relationship	Reject H ₀

Multiple Regression Analysis

Table 4.4: Regression Result

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	283.704	100.879		2.812	.006		
Inflation Rate	20.261	6.444	.738	3.144	.002	.080	12.521
Gross Domestic Product	-18.146	8.894	-.144	-2.040	.044	.889	1.125
Real Interest Rate	-22.349	6.774	-.808	-3.299	.001	.073	13.626
Crude Oil Price	10.265	1.205	.639	8.516	.000	.782	1.279
Exchange Rate	.413	1.843	.016	.224	.823	.873	1.145
R-squared	0.587						
Adjusted R-squared	0.565						
Sig	0.000						

a. Dependent Variable: Gold Price

Table 4.4 shows the results of the Multiple Linear Regressions. From this table, the R square (R²) was 0.587. this result indicates that 0.587 of the variance in gold prices was significantly explained by the six independent variables which are inflation rate, gross domestic product, real interest rate, crude oil price and exchange price. The five variables are able to explain 58.7% of the variation in the dependent variables, while leaving only 41.3% of the variation were explained by other factor that not including in this study. The study also

shown that there are quite strong correlations between the variance since R² is almost 100%. In addition to that, the value of F-stat registered at 26.674 and P-value was 0.000. The result implies that the model is fitted and the independent variables are significantly have relationship with the gold price. These results suggest that the inflation rate, gross domestic product, real interest rate, crude oil price and exchange rate possess a very strong power to dictate the movement of gold prices. Thus, the finding will reject the null hypothesis.

$$PGOLD = 283.70 + 20.26CPI - 18.15GDP - 22.35RINTR + 10.27POIL + 0.413EXR + \epsilon$$

As presented by the model, the regression showed some information of which factors that has impact on the volatility of gold price. This study found that there is significant impact between gold price and CPI with the significant value stand at 0.002 of 5% significant level. Positive relationship means that, when 1% of inflation rate increase, it will increase gold price by USD 20.26. Meanwhile, this study found that there is significant impact between gold price and gross domestic product (GDP) with t-stat value is -2.040. While the significant value stand at 0.044 of 5% significant level. This is means that, when GDP increase by 1%, gold price will reduce by USD 18.146. 29. Real interest rate shows to be significant impact on gold price with significant value stand at 0.001 of 5% significant level. From the result, it means that when interest rate increase by 1%, gold price will reduce by USD 22.349. In addition, there is a significant impact between crude oil price and gold price where the significant value stand at 0.000 of 5% significant level. Increase in crude oil price by USD 1, gold price will increase by USD 10.265. Lastly, the result also found that there is no significant impact between gold price and exchange rate with t-stat value is 0.224. While the significant value stand at 0.823 of 5% significant level. This is means that, even if exchange rate increased by USD 1, it will not affect the gold price.

All the results for regression analysis are supported by the previous researchers as tabulate in the below table.

Table 4.5: Discussion of Regression

Explanatory Variables	Results	Supporting Authors
Inflation rate	Significant positive impact	Tufail & Batool (2013)
Gross domestic product	Significant negative impact	Pushpa & Muruganandam (2014)
Real interest rate	Significant negative impact	Abdullah & Abu Bakar (2015)
Crude oil price	Significant positive impact	Choong et al. (2012)
Exchange rate	Insignificant positive impact	Bapna et al. (2012)

Conclusion

The main objective of this study was to examine the statistical relationship and impact between the selected variables and gold price. Correlation coefficient model were carried out to investigate the relationship between the independent variables and gold price, whereas multiple linear regression was carried out to investigate the impact of the independent variables towards the gold price. All the research objectives were achieved whereby researchers found insignificant relationship between inflation rate, gross domestic product

and exchange rate with gold price, while significant positive relationship real interest and crude oil price with gold price. Besides that, exchange rate found to be insignificant impact on gold price, whereas the other independent variables shown a significant impact on gold price, whereby real interest rate concluded to be the most significant factor that affect gold price.

Even though most of the variables shows a significant result with gold price, the result and trend will become more reliable if researcher can lengthen the period of study for 30 years for example for more accurate result. In addition, researchers recommended to explore different countries such as countries that supply gold like Ghana and how does it affect their economy. As this study only focusing on the macroeconomics factor like inflation rate, gross domestic product, real interest rate, crude oil price and exchange rate, future researcher may adding more factors such as unemployment rate, political risk or others. Lastly, on the next research also may use another qualitative method to increase the accuracy of the result such as GARCH or Stata software.

References

- Abdullah, A., & Abu Bakar, M. (2015). The Application of Gold Prices, Interest Rates and Inflation Expectations in Capital Market. *International Journal of Economics and Finance*, 293-302.
- Bapna, I., Sood, V., Totala, N., & Saluja, H. (2012). Dynamics of Macroeconomic Variables Affecting Price Innovation in Gold: A Relationship Analysis. *Pacific Business Review International*, 1-10.
- Choong, P., Kwoon, P., Piong, C., & Wong, W. (2012). Determinants of Gold Price: Using Simple and Multiple Linear Regression. *Universiti Tunku Abdul Rahman*, 1-99.
- Christie, D., Chaudhry, M., & Koch, T. (2000). Do Macroeconomics News Releases Affect Gold and Silver Prices? *Journal of Economics and Business*, 405-421.
- Contuk, F., Burucu, H., & Gungor, B. (2013). Effect of Gold Price Volatility on Stock Return: Example of Turkey. *International Journal of Economics and Finance Studies*, 5(1), 119-140.
- Contuk, F., Burucu, H., & Gungor, B. (2013). Effect of Gold Price Volatility on Stock Returns: Example of Turkey. *International Journal of Economics and Finance Studies*, 119-140.
- Pushpa, B., & Muruganandam, D. (2014). Estimation of Relation between Financial Variables and Gold Prices Using Fuzzy Multiple Linear Regression. *Journal of Business and Management*, 17-23.
- Shafiee, S., & Topal, E. (2010). An Overview of Global Gold Market and Gold Price Forecasting. *Resources Policy* 35, 179-189.
- Toraman, C., Basarir, C., & Bayramoglu, M. (2011). Determination of Factors Affecting the Price of Gold: A Study of MGARCH Model. *Business and Economics Research Journal*, 37-50.
- Tufail, S., & Batool, S. (2013). An Analysis of the Relationship between Inflation and Gold Prices: Evidence from Pakistan. *The Lahore Journal of Economics*, 1-35.
- Zakaria, H., Abdul Shukur, N., Affandi, S., & Wan Mahmood, W. (2015). Factors Affecting the Price of Gold in Malaysia. *Journal of Basic and Applied Scientific Research*, 41-46.