RELATIONSHIP BETWEEN GOLD PRICE AND DETERMINANTS OF GOLD PRICE IN SRI LANKA

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Abstract

Gold is considered as a good investment especially when there is an economic crisis with high inflation rate, devalue of the exchange rate & bank collapsing. Because gold has stable purchasing power. Still there is no clear idea how long drivers of which affect to decide gold price exactly. To date there is no advance theory to show how major factors affect to the gold price. To make good investments in gold, investor should identify the relationship between gold & factors which are affected to the gold price. This study is basically based on the six factors which are inflation rate, silver price, Brent crude oil price, Stock return, Interest rate & USD dollar index. The study has used EViews 8 data analysis package to develop simple liner regression & multiple liner regression models to identify significance of the relationship between gold price & the factors (use data from January 2007 to October 207). The study tries to explain relationship exists between gold price & it's above stated major factors.

Key Words

Gold price, Inflation, Exchange rate, Crude oil price, Stock return, Interest rate and Silver price

1. Introduction

Gold is being used around the world. It has a lot of usages by means of using as jewelry and crafts, medicine, electronics, investment, etc... Government, institutional in private sectors invest in gold for lot of reasons, of which the main reason is to keep as security against inflation. Gold is always treated as a substitute to the property market and stock market. Investors could be earned higher return by trading shares. While economic recession, the share value goes to decline, where the, investors may be selling shares and buying security from gold market. Within the recession period gold price may increase due to investors shift their security into gold from more risk enabled stock market. Similarly, property investors & real estate investors are often going to the gold market because when they assume that the property market would not succeed in the future.

Increase of the gold prices in the short run can be caused by two factors. Firstly, Investors shift their investment funds more securely from a volatile financial market to gold market, due to the lack of confidence in the security markets during the economic crisis. The gold market can be concluded as an insurance instrument against fluctuations in prices of the other investment (Bohl, Stephan and Wisniewski, 2014). Secondly, the depreciation of the US dollar exchange rate against other currencies, and High fuel prices is the reason for international inflation why larger companies hedge gold against fluctuations between the US dollar and inflation (Shen, 2014).Due to that reason gold demand would increase.

There are a number of recent studies on gold involving gold supplemental role has been carried out as a defense of financial loss and gold despite of its traditional role which acted as a value protection of money and inflation hedge (Baur, 2011). Other than, Researchers suggested that gold prices could be set according to the crude oil prices (Rahman and Mustafa, 2018) and silver (Escribano and Granger, 1998). Because both of these items had a high level of connection with gold prices. Furthermore, Azar (2015) contributed to research regarding strange behavior between the gold and the US dollar. In addition to Lee and Lin (2011) had done a research between short run and long run inflation hedging effectiveness of gold in United States and Japan. The Letter has verified the efficiency of gold hedge against expected inflation in the short term and long term.

In the context of the developed countries, there are many studies that have been attempting to explain fluctuation of gold prices, According to the best of knowledge, Due to Insufficient quantitative method studies in Sri Lanka, Unable to understand the gold prices fluctuation in the Sri Lankan market .So this study aims to fulfil this gap.

1.1 Research Problem

Most of the investors have turned their investments into gold to protect investment values stability. The gold price has increased to Rs.194, 625.00 per ounce in May 2017 (www.cbsl.gov.lk) due to increased demand in gold. The gold demand in the 1st quarter of 2017 was tones 1,177.7, since 2005 there was a

price increasing trend of gold (Global gold demand trend report, 2015). In the 2017 gold price has increased by 4% when comparing the gold price of 4th quarter in 2016 (Global gold demand, 2015/2016). The main reason of the increased gold demand was increasing the gold demand of central bank and other institutions. The Demand for gold of central bank and other institutions were increased annually by 25%. It has influenced to increase gold demand in gold market. (Global gold demand, 2015). Gold production is limited because gold is limited natural source. This excessive demand and limitation of gold production is increased the price of gold.

On the other hand, the growth of gold price was more attracted for investors to compare with their other investments. Gold investors can study long-term trends of gold price fluctuation to take decision regarding investment in gold market. This study will advise to the financial planners and investors to how to take a better understanding of the possible variables which were affected to the gold price. As well as this study could help to gold investors to get better decision regarding investment in the gold market.

1.2 Research Objectives

i. To investigate the relationship between gold price and inflation.
ii. To investigate the relationship between gold price and crude oil price.
iii. To determine the relationship between gold price and exchange rate.
iv. To investigate the relationship between gold price and silver price.
v. To identify the relationship between gold price and Stock return.
vi. To determine the relationship between gold price and interest rate.
vii. To examine the relationship between above six determinants as whole and gold price.

1.3 Research Questions

This research intends to test the impact of determinants affecting gold price in Sri Lankan market. The study attempts to answer the following research questions.

i. What are relationships exists between gold price and selected determinants of gold price such as inflation, crude oil price, exchange rate, stock return, interest rate and silver price in Sri Lanka?
ii. What extend do they affect gold price in Sri Lankan market?

1.4 Significance of Study

The primary objectives of this research are to study the relationship between gold price and its determinants, such as inflation rate, exchange rate, crude oil price, silver price, stock returns and interest rate by using monthly data ranging from January 2007 to October 2017.

Early researchers, such as Sindhu (2013) and Escribano and Granger (1998), have focused to identify the connection between gold price & one factor which affected to the gold price. On the other hand,

Escribano and Granger (1998) have carried out their research to check the relationship between silver and gold prices. However, in reality, does not affect the price of gold by one single factor alone. Therefore, the gold price to determine in accurately & comprehensive the model of research analysis will be used detailed study which captured six different factors. In the study, inflation, silver price, exchange rate, stock return, interest rate and oil price will be used as independent variables with gold price to identify gold price fluctuation.

In the economy crisis, Investors often replace their investments from security market investment into the gold market to secure their investment value. However, increasing trend of Gold always does not tend to increase in economic crisis, while demand for gold can be increased by speculative demand. Because of the above, gold market may be collapsing after the eruption of a gold bubble in the market. Due to the case, many investors who invested in gold market can suffer losses. Therefore, this study looks at the important factors that considerably affected to decide gold prices and will assist, investors and policymakers with vital information to maintain a better decision-making framework in dealing with the gold market.

2. Review of Literature

The objective of this research study is to recognize the determinants of the price of gold in Sri Lanka. The research problem has been presented in the previous section by discovering the existing knowledge gaps. Even though the relationship between gold price and the above mentioned variables had been well studied by in the past, less concern was given to the studies on Sri Lankan gold market. Consequently, this section critically reviews the literature accumulated from various disciplines.

2.1 Theoretical Literature

2.1.1 The Role of Gold in History

According to Goodman (1941) supported with Solt and Swanson, (1981), gold has some comparable qualities with money & gold act as a store of wealth, medium of exchange and a unit of significant worth. There are some inherent characteristics of gold such as indestructibility, beauty and rareness compared with other metal (Mani and Vuyyuri, 2003).It was a malleable metal that could be hammered cold into a thin and its color was sheen naturally equated it with the sun, so using gold is a symbol of wealth and power.

2.1.2 The Role of Central Bank on Gold Market

Meltzer (1951) indicated that Central Banks has generally three main objectives and roles: as follows,

- To maintain price stability,
- To maintain financial stability,
- To support the State's financing needs at times of crisis, but in normal times to constrain misuse of the State's financial powers.

2.1.3 London Gold Market Fixing

Since 12 September 1919, London is the center in the world for fixing the gold price. The London gold fixing is the procedure by which the price of gold is determined twice each business day on the London. It is used as a benchmark for pricing the majority of gold products and derivatives throughout the world's markets (World Gold Council, 2007).

There are five members of the London Bullion Market Association, These members are, Deutsche Bank, HSBC, Scotia Mocatta, Societe Generale and Barclay Capital. Another market participant wishing to trade is required to do so through one of these five sales dealers. Gold prices have been set twice for each business day, with USD $ (US), Pound Sterling (GBP) and European Euro (Euro). (LBMA, 2008).

2.1.4 Supply of Gold

Gold is very rare. There are three major sources of gold entering to the market. The sources are mining, recycling and sales in the official sector (Ogier, Ambler and Teow, 2013). The largest mining source is the Newton mineral in the United States; six are from Canada two from South Africa, one from Australia, Peru and Russia.

2.1.5 Demand of Gold

i. Reserve Demand for Gold of Central Bank:

The single largest gold holder in the world are Central banks of the country, International entities (Monetary Fund) and governments. (Temjanovski, Svrtinov and Gorgieva, 1857)

ii. Gold demand as hedge instrument:

When there was a financial & political turmoil, the role of gold is very important. When there is financially or politically unstable, investors may buy the gold as a safe haven, with a low credit risk, which is very liquid in times of crisis. (Mamcarz, 2015)

iii. Industry Demand for Gold:

Ghosh et al. (2002) has specified that the industrial gold demand is negatively related to the price of gold, as it also becomes less attractive to purchase gold. Unfortunately, the literature and available data about industrial demand is not very extensive which constrains the possibility to research relations between movements in both the demand and price of gold.

iv. Jewellery Demand for Gold:

Over 6,000 years, Gold has been used for jewellery. The reason is its rarity, mechanical design, corrosion resistance and its colour. Further gold has used as gold foil (Gold foil is thin than visible light wave), Frames, books, and furniture and also can be used for non-metallic surfaces and architectural elements. (World Gold Council, 2018)

2.2 Factors Affecting Gold Price - Empirical Literature

In recent years, gold price has triggered the attention from the academic researchers due to the high price in the market. Many researches have been done related to gold in the past such as the role of gold,

gold as the inflationary hedge, the existence of gold bubble and so on. Besides, there is also number of empirical studies related to gold price forecasting encompassed in the previous studies.

2.2.1 Gold Price and Inflation

According to previous research's findings, they found negative and positive relationships between gold price and inflation. Several researchers have suggested that gold was used to protect currency inflation. These investors suggest that there was a positive relationship between gold price and inflation. As an example, Tufail and Batool (2013) and Ismail, Yahya and Shabri (2009) have been found to have a statistically significant and positive relationship between gold prices and inflation. It has found that there was a long term relationship between gold price and general price level (Worthington, 2006).

On the contrary, some researchers have found that there was a negative relationship between gold and inflation. Baur (2011) has found that there was a negative relationship between gold price and inflation by using the Multiple Linear Regression. Furthermore, Sjaastad (2008), Gold price had a negative impact on price inflation.

Another aspect, some studies have pointed out that there was no significant relationship between gold and inflation. For example, Shafiee and Topal (2010) has declared that the incensement of nominal gold price was not significantly influenced to the inflation. Similarly, Tully and Lucey (2007), there was an insignificant relationship between inflation and gold prices, have been discovered using a power GARCH approach.

2.2.2 Gold Price and Silver Price

Previous researchers have done number of tests to investigate relationship between gold prices and silver prices. For example, Ciner (2001) had reported about the disappearance of a long-run relationship between the gold and silver price of the Tokyo Commodity exchange in the 1990s, the researcher said gold and silver had their own markets as they were considered to have various economic items.

According to Figuerola-Ferretti and Gonzalo (2010), their study sought to replace gold and silver as substitutes When the economic uncertainties and low active of US dollar. Besides Lee and Lin (2011) found gold and silver as substitutes to each other. According to them the relationship between gold and silver in the study is very strong. Therefore, the study has indicated that it can act as a substitute for a protective substitute against similar risks.

According to the former researchers there was a mixed relationship between the gold & silver. Until present there is a problem regarding short run and long run relationship between gold and silver? Therefore, the ambition of the study is to examine the connection between silver and gold.

2.2.3 Gold price and Exchange Rate

According to the previous researchers' findings. Gold prices and the exchange rate of the US dollar have not been accurately measured. According to Fei and Adibe (2009) One-sided relations can be

observed in his model. These findings suggest that the US dollar's exchange rate could be predicted for the gold market. Gold can be used as hedge against the US dollar's exchange rate. The negative relationship indicated between gold price & US dollar exchange rate during the currency crisis and it was able to Protecting from diversified investments. Besides, Ismail, Yahya and Shabri (2009) used a variety of comprehensive counteraction regression techniques to investigate the main criteria of the gold price. The authors discovered with the changes in the US dollar trade weighted exchange rate and the gold lease rates, weightily, there was a statistically significant negative relationship between the changes in gold prices.

According to the previous researchers, mixed results have been produced between gold price and US dollar exchange rate. Therefore, the relationship between variables is still blurred. These fuzzy conditions can motivate to investigate the relationship between gold price and silver price.

2.2.4 Gold price and Crude Oil Price

In recent years, the largest portion of commodity trading, which made up gold and crude oil, was no longer determined by the traditional impact of demand and supply. In fact, factors that affect two commodity prices may be other factors. Based on past research, there was positive correlation between gold price and Brent crude was discovered. In addition, there were some studies of bilateral and unilateral relationship existed among them. According to the Shafiee and Topal (2010) Gold and crude oil prices have been identified as positive correlations. Gold and Brent Crude oil prices are extremely high, which could result in an increase in fuel prices. Two oil shocks took place between 1979 and 1980, while gold prices jump as well and another in middle of year 2007. Nominal oil and gold prices increased by 23 and 16 times respectively from January to December 1968.

Therefore, these Studies focused on changing the price of oil with gold price, led these studies to guide investors to track changes in gold prices. Finally, various researchers have produced mixed results in the formulation of unilateral and bilateral relations between gold price & oil price.

2.2.5 Gold price and Stock Return

Kaliyamoorthy and Parithi (2012) used Chi-square analysis to study the relationship between gold price and Bombay Stock Exchange Sensex index from India. The reason for using the gold price to study the stock index is that most of the people have an impression that changes in gold price may be caused by market fear from investors. However, author’s finding was inconsistent with their prediction. Through the Chi-Square analysis, they found that there was no relationship between gold price and BSE Sensex index. However, Joshi (2012) disagreed with the result as there was a negative relationship between gold price and stock index for the same country.

2.2.6 Gold Price and Interest Rate

The risk free interest rate is known as the rate that is adjusted to remove the possibility of risk in the return which is normally guaranteed by the government. This is to reflect the risk free yield to the lender.

Previous studies demonstrate that there is a negative relationship between the real interest rate and gold prices. According to Toraman, Basarır and Bayramogluc (2011), interest rates in the US may lose some of their conventionally strong influence over gold prices in the coming decade or so, as inflation rates and physical demand in emerging markets are getting higher.

3. Research Methodology

This section explains the research methodology of the current study, where it justifies rationale of the perspectives and legitimate methods used to produce knowledge. The section starts with the conceptual framework followed by the research hypotheses which are developed based on the research objectives. The next session elaborates on the methods of the study such as data collection methods, sample size and the ratios used to measure the dependent and independent variables. Further, comprehensive investigation on the econometric models and specification tests are employed in this study.

3.1 Conceptual Framework

The research problem has been gestated based on the critically reviewed literature in the previous section, along with the support of the proposed conceptual framework for the research study, where it brings together the effects of inflation rate, exchange rate, interest rate, crude oil price, stock returns and silver price on gold price in Sri Lanka. Base on the literature review we assumed below hypothesis,

3.1.1 Gold Price and Inflation Rate

Inflation rate is considered as one of the main factors that affects the gold market (Tully & Lucy, 2006). Conventional wisdom suggests that a positive relationship exists between gold price and inflation. In the presence of inflation, the gold price would drift in increasing pattern as gold becomes a better option for investors during inflation times. During economy uncertainties, for instance inflation, when the cost of living increases, the investor would prefer to hold gold as a hedge against inflation since gold serves as a store of value. Therefore, a positive relationship is evident between gold price and inflation rate.

H1: There is positive relationship between gold price & inflation

3.1.2 Gold Price and Crude Oil Price

Both crude oil and gold play similar roles as the limited resources in an economy. According to Polyus (2003), crude oil has been used to replace diesel fuel as a power generation to produce heat during the production of gold mining. So, when crude oil price increases, the cost to mine gold also ascends. Therefore, gold would be sold at a higher price. Based on the reasons stated above, it can be presumed that there is a positive relationship between gold price and crude oil price.

H2: There is positive relationship between gold price & Crude oil price

3.1.3 Gold Price and Silver Price

When gold prices are too high, the demand of silver sought to increase. Thus, the silver tends to escalate in value where the gold price would drop in value. In conclusion, as gold and silver are being mutually substitutable, an increase in gold price, leads to the mounting of the silver price.

Silver often assents with gold, as a safe haven asset to hedge against any economic, political, or currency crises. This phenomenon caused those investors to seek silver that has similar characteristics as gold, as an alternative good to invest in. Based on the reasons stated above, a negative relationship is assumed between gold price and silver price.

H3: There is positive relationship between gold price & Silver price

3.1.4 Gold Price and Stock Returns

According to a study published by Moore (1990), it was found out that a negative relationship existed between gold and stock indices and whenever the price of stock moved upwards the gold prices moved downwards. Gold is still being considered as a store of value "without escalation" whereas stocks are regarded as a return on value escalation from the probable real price increase plus dividends (Wogan, 2010). The recent crisis of economic climates has changed the opinion of investors, and once again investors are converging in gold investments. This change was witnessed after the global crisis in 2007. Prior the crisis the gold prices were very constant and no such increases in value were observed. This conclusion also gave a foundation to the theory that during turmoil period or in a recession, people tend to invest maximum capital in gold and consider it is a safe haven (Irshad, Bhatti, Qayyum, & Hussain, 2012).Base on that we assumed there is negative relationships between those two factor,

H4: There is negative relationship between gold price & US dollar index

3.1.5 Gold Price and Exchange Rate

Over the years, gold has been used to hedge against devaluation of currencies in Sri Lanka as gold serves as a reserve asset in central bank and exchange rate is believed to have a predictive power over gold market. The Exchange Rate is a measurement of LKR value against the USD. An increase in LKR value against the USD means the depreciation of LKR against USD and vice versa. USD and gold price are closely related to each other since most of the transactions of gold across the countries are priced in USD. Base on that we assumed there is negative relationships between gold & exchange rate

H5: There is negative relationship between gold price & exchange rate

3.1.6 Gold Price and Interest Rate

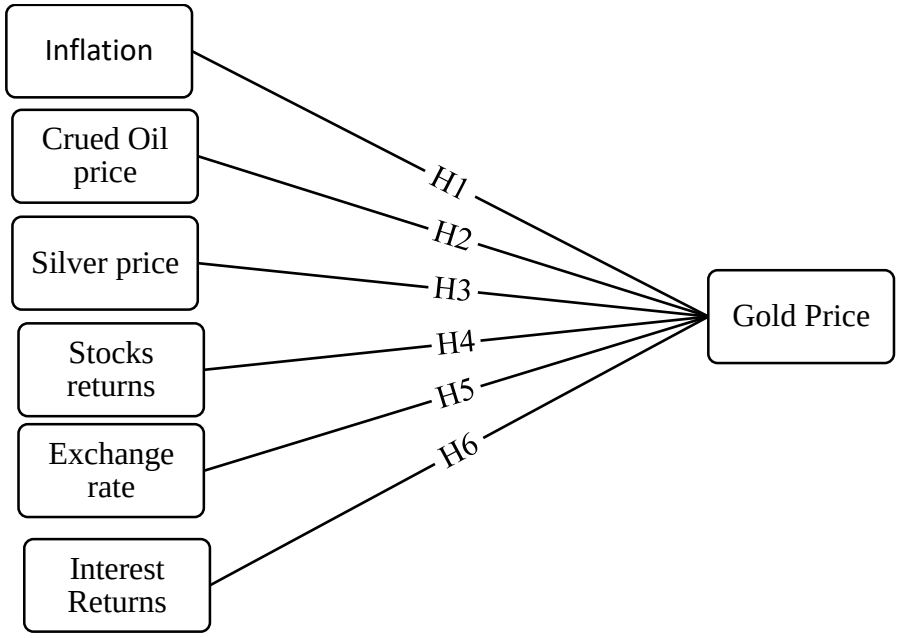
Generally, interest rates are negatively related with the price of gold as hiking interest rates adversely impact the yellow metal. Erb and Harvey (2013) found very strong negative correlation between interest rates and gold prices (from 1997 to 2012). The intuition behind this is that higher interest rates mean

higher opportunity costs of holding non-interest bearing assets such as precious metals, making them relatively less attractive. Basically, gold pays neither dividend nor interest. However, it is relatively expensive to hold in the portfolio when real interest rates are high, and relatively cheap when real interest rates are low. In other words, the higher the interest rates are, the higher are carrying costs. Base on that we assumed there is negative relationships between gold & interest rate

H5: There is negative relationship between gold price & interest rate

According to the Figure 1, it illustrates the determinants of gold price such as, inflation rate, exchange rate, interest rate, crude oil price, stock returns and silver price as factors input. It is hypothesized that either there is positive or negative relationship between gold price and inflation; gold price and Brent crude oil price; gold price and exchange rate & gold price and silver price.

Figure 1: Proposed Conceptual Framework



Source: Author (Developed for Research)

3.2 Data Description

The Table 3.1 recapitulates the details of the variables, their unit measures and the sources of secondary data from which the data were procured. For this study, time series data of gold price, inflation rate, exchange rate, interest rate, crude oil price, stock returns and silver price are employed starting from January 2007 to October 2017, with total monthly observations of 130 for each variable. The main reason of using secondary data is to ensure reliability and quality is assured as they have been obtained from authorized sources.

Table 1: Sources of Secondary Data

Data	Variable	Acronym	Unit Measurement	Sourced
Gold Price	Dependent	GP	LKR per Ounce	Central Bank of Sri Lanka (www.cbsl.gov.lk)
Crude Oil Price	Independent	CO	LKR per Barrel	Bloomberg
Silver Price	Independent	SP	LKR per Ounce	New York Mercantile Exchange
Exchange Rate	Independent	ER	LKR per USD	Central Bank of Sri Lanka (www.cbsl.gov.lk)
Stock Return	Independent	ASPI	All Share Price Index	Colombo Stock Exchange (www.cse.lk)
Interest Rate	Independent	TB	3 Month Treasury Bill Yield	Central Bank of Sri Lanka (www.cbsl.gov.lk)

Source: Author (Developed for Research)

3.2.1 Gold Price

The gold price is measured by the monthly average selling price of Central Bank of Sri Lanka which is denominated in LKR per ounce. The reason to choose the price quoted for gold by Central Bank of Sri Lanka, as proxy for gold price in Sri Lanka is because Central Bank of Sri Lanka, the seller, is a monopoly body in the management of gold bars and an authentic seller within Sri Lanka. The gold possessed by the Central Bank of Sri Lanka is the purest gold available in the market. This variable is obtained from the administrative records of Central Bank of Sri Lanka.

3.2.2 Crude Oil Price

Sri Lankan crude oil price is based on the international price but adjusted by the Government of Sri Lanka in line with global crude oil price considering the pressures from both public and politics in Sri Lanka. Crude oil price is based on world oil prices which are the average real oil prices obtained from three main benchmark oil prices used in world trade, namely West International or WTI and Brent (Ismail et al., 2009). In this study, the crude oil price data will follow the Brent which is also used by Sri Lanka and being the pricing benchmark for Asia Pacific crude oil price (Sukri, Zain, & Abidin, 2015). The data of crude oil price is obtained from Bloomberg.

3.2.3 LKR/USD Exchange rate

Most gold in Sri Lanka is imported while the gold prices in world trade are quoted mainly by US dollar. The exchange rate between Sri Lankan Rupee and US Dollar were collected from Central Bank of Sri Lanka. The Central Bank of Sri Lanka provides a valid data for Sri Lankan Rupee currency since it is

the authoritative body to hold and manage the Sri Lankan Rupee currency. Sri Lankan Rupee currency data were collected based on USD $1.

3.2.4 Inflation Rate

The inflation rate data for this study was taken from the Central Bank of Sri Lanka which is a government organization that has authority and responsibility for the valid and reliable data on inflation rates in Sri Lanka. The inflation rate is calculated based on the movement of consumer price index.

3.2.5 All Share Price Index

The study uses the movements of the all share price index which captures the stock returns of the companies which are listed in the Colombo Stock Exchange. The data related to all share price index was obtained from the Colombo Stock Exchange.

3.2.6 Interest rate

In Sri Lanka, interest rates decisions are taken by the Central Bank of Sri Lanka. The official interest rate that the study assumed is the three-month Treasury bill yield as it is risk free and demonstrates higher liquidity in terms of secondary market. Interest rate data was collected from the Central Bank of Sri Lanka.

3.2.7 Silver Price

London persists to be the centre of the physical silver trade in the world. However, the COMEX division of the New York Mercantile Exchange is the most significant paper contracts trading market for silver. Silver's spot price is the current price of silver that reflects market variables and the expectations are determined by the COMEX (Commodity Exchange, Inc.). The historical data was obtained from the New York Mercantile Exchange.

3.3 Method of Analysis

In here we used EViews 8 data analysis software to analysis the secondary data, because that software enhanced accuracy of the secondary data analysis to take reliable output. So base on that we have run below analysis to check whether above hypothesis are in line with our assumption or not in Sri Lanka context.

3.3.1 Correlation Analysis

Correlation analysis is done to measure the effect that comes from the independent variables to the dependent variable. In Sekaran and Bougie (2010), they referred to the correlation matrix and consider correlations of 0.70 and above as high. Seemuang, Romprsert (2013) used correlation analysis to explore the relationship on the movement of gold value and dynamic macroeconomic variables in United States. Similarly, this study will also use correlation analysis.

3.3.2 Regressions Models

3.3.2.1 Ordinary Least Square (OLS) Model

Ordinary Least Square (OLS) model is well known statistical model which is widely used by various researchers as it is easy to understand, analyse and interpret. The model is employed in the study to identify the short run relationship among the variables. It is a generalized linear modelling technique which is used to examine the responses of variables that have been recorded on an interval scale (Hutcheson, 2011). In other words, OLS model can provide how dependent variable will change on an average, in response to the changes on average in independent variables.

According to Gujarati and Porter (2009), there are seven fundamental assumptions in OLS model. First and foremost, the model is linear regression, the number of sample size is greater than independent variable, the value of independent variable is fixed and residual has zero mean value. Moreover, the error term must have constant variance, there are no autocorrelation and the last assumption is that there is positive number for variance of independent variable and no outlier.

3.3.2.2 Simple Linear Regression

The reason of running simple linear regression for each independent variable is to determine how well the gold price movement could be explained by different independent variables such as inflation rate, silver price, exchange rate, interest rate, stock returns and crude oil price. Besides, another reason to construct simple linear regression is to check the consistency of result in terms of expected sign with multiple linear regressions.

Equation 01:

$$\mathbf{Y_t = \beta_0 + \beta_1 X_{it}}$$

Where,

Y_t = Gold price

T = Monthly period (January 2007 – October 2017)

I = 1, 2, 3, 4…

X_1 = Inflation Rate

X_2 = Silver price

X_3 = Exchange Rate

X_4 = Brent Crude oil price

X_5 = 3 Month Treasury Bill Yield

X_6 = All Share Price Index

(i) Hypothesis Testing

The statistical significance test of the parameters of the independent variables using t-statistic and critical value that provides an interpretation to the test results.

Individual significant test:

For any parameter β:

H0: $\beta_i = 0$. The variable is not relevant to explain Y (Gold price).

H1: $\beta_i \neq 0$. The variable is relevant to explain Y (Gold price).

Decision rule: Reject H0 if t-statistic is larger than positive critical value or smaller than negative critical value, otherwise do not reject H0.

3.3.2.3 Multiple Linear Regression

The reason to construct multiple linear regression in this research is to capture the possible different factors which could affect the gold price at once. The multiple linear regression that consisted of six independent variables could provide a comprehensible picture on several factors which could influence gold price movement. Also, the consistency of the result especially the expected sign produced by multiple linear regressions are compared to simple linear regression. In other words, the study would examine the changes on the solely impact of each independent variable on dependent variable if more independent variables were taken into account in the multiple linear regression model.

Equation 02:

Gold Price = f (Inflation Rate, Silver Price, Exchange Rate, Brent Crude Oil Price, Interest Rate, Stock Return)

Equation 03:

$$\mathbf{GP_t = \beta_0 + \beta_1 IR_t + \beta_2 SP_t + \beta_3 ER_t + \beta_4 TB_t + \beta_5 CP_t + \beta_6 ASPI_t + E_t}$$

Where,

GP_t = Gold Price

IR_t = Inflation Rate

SP_t = Silver Price

ER_t = Exchange Rate

CP_t = Brent Crude Oil Price

TB_t = Interest Rate

$ASPI_t$ = Stock Return

(i) Hypothesis Testing

Test on the significance of individual independent variable (t - test)

T-test statistic is carried out to test the significance of the six selected individual independent variables on gold price. The hypothesis testing for t-test in each of the individual independent variable is similar to the simple linear regression model that has been discussed earlier.

Test on the overall significance of Multiple Linear Regression Model (F - test)

H0: $\beta_1 = \beta_2 = \beta_3 = \beta_4$

H_1: at least one β is not equal to zero

Decision rule: Reject H0 if F-statistics is larger than critical value, otherwise do not reject H0.

In order to test for the overall significance of the model, F-test statistic is obtained from the estimation output to identify whether the model is significant enough in explaining the gold price movement.

4. Findings & Discussion

This Section will focus on reporting, analysing and interpreting the empirical results generated from EViews 8 software. The empirical results are based on Unit Root Test, Correlation Analysis. The subsequent phase will be followed by OLS model and Hypothesis Testing. Comprehensive explanations will be given under each of the session in this section.

4.1 Results and Discussion

4.1.1 Pre-test Results

4.1.1.1 The Unit Root Test of Time Series Data

The stationary of series is the essential step as it can avoid the spurious result (Brooks, 2008). According to Cheung and Lai (1995), if the variables are in stationary form, the effect of lag order on critical value can reduce to zero, when increasing the sample size. For the current study, the stationary status for each of the variables is examined by using Augmented Dickey Fuller Test (ADF).

As depicted in the following Table 2, the results from ADF unit root test are unable to reject the null hypothesis of all variables except inflation rate at level form. This is because; the test statistics of ADF is less than critical value at 5% level of significant. When proceeding to the first difference, the ADF result for all the variables are able to reject the null hypothesis of unit root test except inflation rate at first difference. This is because the test statistic of ADF is greater than critical value at 5% level of significant. Thus, it has sufficient evidence to conclude that all the variables are stationary at first difference except inflation rate which is stationary at level and do not have unit root at 5% level of significant.

Table 2: Summary of Unit Root Tests

Variables	Level I (0)		First Difference I (1)	
	ADF t-Statistic	P Value	ADF t-Statistic	P Value
Gold Price	-1.3839	0.8613	-9.1743**	0.0000
Three Month Treasury Bill Yield	-2.5908	0.2853	-4.2230**	0.0056
Inflation Rate	-3.5678**	0.0367		
Exchange Rate	-3.0489	0.1234	-7.3466**	0.0000
Crude Oil Price	-2.2864	0.4379	-7.0322**	0.0000
Silver Price	-1.7364	0.7293	-9.0380**	0.0000
All Share Price Index	-1.2810	0.8881	-10.4029**	0.0000
** denotes rejection at 5% significance level				

Source: Author (Developed for Research by using EViews 8)

The Inflation Rate is stationary at level and all other variables are stationary at first difference. Therefore, Inflation Rate is I (0) variable and all other are I (1) variables. This means that except Inflation Rate others are integrated variables. The researcher converted all the variables except inflation rate into stationary before addressing the objectives. After variables are converted into stationary, the researcher constructed the OLS model to determine the factors which influence on Gold Price.

4.1.1.2 Correlation Analysis

The correlation coefficient is a statistical measure of the degree to which changes to the value of one variable predicts change to the value of another. In positively correlated variables, the value of one increase as the value of the other increases while in negatively correlated variables, the value of one increase as the value of the other decreases. The correlation matrix for explanatory variables is provided in Table 3.

Table 3: Correlation matrix of independent factors

Variables	DGP	DTB	IR	DER	DCO	DSP	DASPI
DGP	1.0000						
DTB	0.0622	1.0000					
IR	-0.0275	0.0726	1.0000				
DER	0.1579	0.2111**	-0.1275	1.0000			
DCO	0.2204	0.0101	-0.0056	0.0947	1.0000		
DSP	0.7505**	0.0153	-0.0427	0.0459	0.3896**	1.0000	
DASPI	0.0221	0.1820**	-0.0942	-0.1483	0.0732	0.1396	1.0000
** Correlation is significant at the 0.05 level							

Source: Author (Developed for Research by using EViews 8)

Gujarati and Porter (2009) suggest that correlation value of less than 0.7 indicates, there is no cause for multicollinearity. Further, they stated that if the value of cross correlation is greater than 0.7, there would be cause for concern. Therefore, according to the Table 3, a relatively low correlation is observed between variables except silver price and gold price.

4.1.2 Results of Ordinary Least Square Model: Determinants of Gold Price

4.1.2.1 Results of Simple Linear Regression Model

The relationship between each independent variable and gold price are observed in simple linear regression model. This regression model with one selected independent variable is regressed by OLS estimation procedure. The estimation output for simple linear regression model is presented in Table 4.

Table 4: Determinants of Gold Price using Simple Linear Regression model

Variables	Co-Efficient	t-Statistic	Std. Error	Prob.	R-squared	Adjusted R-squared	S.E. of regression	Durbin-Watson stat
DER	688.9476	1.8022	382.2710	0.0739	0.0249	0.0173	5686.7170	1.6035
DSP	21.0567	12.7975**	1.6454	0.0000	0.5632	0.5598	3806.0010	1.6650
IR	-24.6809	-0.3098	79.6590	0.7572	0.0008	-0.0071	5756.8030	1.6016
DCO	1.5866	2.5459**	0.6232	0.0121	0.0486	0.0411	5617.4150	1.6720
DTB	508.3544	0.7026	723.5480	0.4836	0.0039	-0.0040	5747.8180	1.6137
DASPI	0.4519	0.2496	1.8107	0.8033	0.0005	-0.0074	5757.5660	1.5939
** denotes rejection at 5% significance level								

Source: Author (Developed for Research by using EViews 8)

The regression results of simple linear regression model are presented in Table 4. The OLS procedure has been used to estimate the regression models in this study. From the estimation result, the positive coefficient of 688.95 indicates that, when there is one unit increase in LKR/USD, on average, gold price will increase by LKR 688.95. The results signified when LKR depreciated against other currencies, eventually it led to increase in the gold price, as gold is mainly imported from international market. Therefore, positive relationship is found between gold price and exchange rate. Besides, the t-statistic generated (1.80) is smaller than critical t-value (1.98). Thus, the result concludes that there is no significant relationship between gold price and exchange rate. On the other hand, this model is not overall significant since the F-statistic value for LKR/USD (3.25) is less than the F-statistics critical value (3.92), at 5% of significance level. In conclusion, there is no significant relationship existing between gold price and exchange rate.

The silver price is positively related to gold price. Since the t-statistic, 12.80 is larger than the t-critical value (1.98) at 5% of significant level, the result concludes that gold and silver prices are statistically significant at 5 % significant level. Therefore, the study concludes that the overall model of silver and gold price is statistically significant.

The negative sign of coefficient -24.68 implies that when there is an additional unit increase in the inflation rate, on average the gold price would decrease by LKR 24.68 per ounce. Therefore, it can be concluded that there is a negative linear relationship between gold price and inflation. This indicates that gold price increases as inflation decreases and vice versa. In addition, t-statistic test has been used to identify the significance relationship between gold price and independent variables. From the estimation results shown, it depicted that t-statistic for inflation is below the tabulated t-statistic critical value (-1.98) at 5% of significance level. Therefore, it is evident that there is no significant relationship between gold price and inflation.

The positive coefficient of 1.59 implies that, when crude oil price increases by additional unit, the gold price will increase by LKR 1.59 per ounce in gold price on average. In other words, an increase in crude oil price will lead to an increase in gold price. Therefore, the estimation results above show that the Brent crude oil price has a strong positive linear relationship towards gold price. Moreover, the t-statistic (2.55) is larger than the critical t-value (1.98). This result proves that Brent crude oil price is statistically significant to gold price at 5% of significance level.

The positive coefficient of 508.35 indicates that, when three-month Treasury bill yield increases by additional unit, the gold price will increase by LKR 508.35 per ounce in gold price on average. In other words, an increase in three-month Treasury bill yield will lead to an increase in gold price. Therefore, the results above prove that the three-month Treasury bill yield has a positive linear relationship towards gold price. Moreover, the t-statistic (0.70) is less than the critical t-value (1.98). This result proves that three-month Treasury bill yield is statistically insignificant to gold price at 5% of significance level.

Finally, the positive coefficient of 0.45 infers that, when All Share Price Index increases by one unit, gold price will increase by LKR 0.45 per ounce in gold price on average. In other words, an increase in All Share Price Index will lead to an increase in the gold price. Thus, the estimation results above show the All Share Price Index has a positive linear relationship towards gold price. Moreover, the t-statistic (0.25) is less than the critical t-value (1.98). This result proves that All Share Price Index is statistically insignificant to gold price at 5% of significance level. Therefore, the finding shows that the model is not significant to explain the gold price.

4.1.2.2 Results of Multiple Linear Regression Model

The relationship between inflation rate, silver price, exchange rate, interest rate, stock returns and crude oil price with gold price are observed in multiple linear regression model. The regression model with six selected independent variables is regressed by OLS estimation procedure. The estimation output for multiple linear regression model is presented in Table 5.

Table 5: Determinants of Gold Price using Multiple Linear Regression model

Dependent Variable: D(GP)				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	478.8234	564.1580	0.8487	0.3977
DTB	95.0505	492.5078	0.1930	0.8473
IR	13.2114	53.0368	0.2491	0.8037
DER	528.4730	265.1792	1.9929**	0.0485
DCO	-0.6808	0.4551	-1.4959	0.1373
DSP	22.1816	1.7809	12.4554**	0.0000
DASPI	-1.2219	1.2307	-0.9929	0.3227
R-squared	0.1315	Durbin-Watson stat		1.9396
Adjusted R-squared	0.0239	F-statistic		1.2217
S.E. of regression	3759.5430	Prob (F-statistic)		0.2695
** denotes rejection at 5% significance level				

Source: Author (Developed for Research by using EViews 8)

According to the Table 5, the F-statistic (29.33) is larger than F-critical value (2.17) at 5% significant level. Therefore, the result concludes that the overall multiple linear regression model is significant to explain on gold price. There is at least one independent variable that significantly affects gold price. Besides, adjusted R-square of 0.59 observed from the estimation indicates that approximately 60 percentage of the variation in gold price can be explained by the model at 95% confidence interval (5% significant level). In other words, this illustrates that the selected independent variables such as inflation, silver price, exchange rate, stock returns, interest rate and crude oil price are sufficient to explain the variation in gold price.

- **Gold Price and Exchange Rate**

Based on the estimation output stated in Table 5, exchange rate holds positive relationship towards gold price. Since the t-statistic value for exchange rate (1.99) is larger than critical value (1.98) at 5% significant level. This result concludes that there is significant relationship existing between gold price and exchange rate. This positive relationship indicates that exchange rate and gold price generally moved in the same direction. Accordingly, when LKR depreciates against USD over an extended period, it

would lead to an increase in the gold price. On contrary, if LKR appreciates against USD over an extended period, gold price would fall.

There is a relationship between the current study and the supported studies as they are indicating the same scenario of currency depreciation which led to increase in the gold price. The study also identifies the same argument as the variable is LKR/USD and if the variable increases, it means that the LKR depreciates against the USD. All the above findings had once again proved that the increased gold price tended to be associated with the depreciation of LKR against USD.

- **Gold Price and Silver Price**

Based on the estimation output in Table 5 The t-statistic value for silver price (12.46) has exceeded the critical value (1.98) at 5% significant level, the result concludes that there is significant relationship between gold price and silver price.

From the findings above, significant positive relationship is observed between silver price and gold price. This positive relationship indicates that silver price and gold price generally move in the same direction. The positive finding suggests that silver and gold did not act as substitute goods in the study.

- **Gold Price and Inflation Rate**

According to the Table 5 the t-statistic (0.25) has not exceeded the critical value (1.98) at 5% significant level, the relationship between gold price and inflation rate is insignificant.

The lack of relationship found between inflation rate and gold price in this research is consistent with the earlier studies conducted by previous researchers. According to Shafiee and Topal (2010), an increase in nominal gold price is not significantly caused by inflation. The study reported a low correlation which was around 9 percent, that existed between gold price and inflation.

- **Gold Price and Crude oil price**

Referring to the Table 5 the t-statistic value for crude oil price (-1.5) is higher than critical value (-1.98) at 5% significant value. The result concludes that there is no significant relationship existing between crude oil price and gold price. Gold is less volatile in the precious metal class while oil is a very volatile commodity. Thus, changes in oil price failed in predicting the fluctuation in gold price.

- **Gold price and Interest Rate**

The estimated coefficient for interest rate, 95.05 as indicated in Table 5, depicts that when interest rate increases by one unit, on average, gold price will increase by LKR 95.05 per ounce, holding another variables constant. The result suggests positive relationship between interest rate and gold price. The t-statistic value for interest rate (0.19) is lower than critical value (1.98) at 5% significant value. The result concludes that there is no significant relationship exists between interest rate and gold price.

There is lack of studies to support the results of the study as the previous findings had identified either positive or negative relationship where the current study acknowledges the lack of relationship between gold price and interest rates, as the opportunity cost of investing in gold is less due to the interest volatility.

- **Gold price and Stock Return**

From the result shown in Table 5, the estimated coefficient for All Share Price Index, -1.22 demonstrates that when All Share Price Index increases by one unit, on average, gold price would decrease by LKR 1.22 per ounce, holding other variables constant. The result has revealed a negative relationship between all share price index and gold price. The t-statistic value for -0.99 is higher than critical value (-1.98) at 5% significant value. The results identify that there is no significant relationship between All Share Price Index and gold price.

4.2 Hypothesis Testing

The following Table 5 displays the summary of hypotheses tested based on the above discussion related to the determinants of gold derived from OLS model.

Table 6: Testing of Hypotheses

Variable	OLS Model
	Gold Price
Exchange Rate	Accept $_{H1}$ since there is a significant influence of exchange rate on gold price.
Inflation rate	Rejects $_{H1}$ since there is no significant influence of inflation rate on gold price.
Crude Oil Price	Rejects $_{H1}$ since there is no significant influence of crude oil price on gold price.
Interest Rate	Rejects $_{H1}$ since there is no significant influence of Interest rate on gold price.
Silver Price	Accept $_{H1}$ since there is a significant influence of silver price on gold price.
Stock Returns	Rejects $_{H1}$ since there is no significant influence of stock returns on gold price.

Source: Author (Developed for Research)

5. Conclusion

This study has analysed the possible factors that would affect gold price in Sri Lanka. In this study, six independent variables have been employed such as inflation rate, silver price, exchange rate, interest rate, stock returns and crude oil price to test whether there is significant relationship with gold price and their short run and long run impact the layout of this section is organized as follows. Firstly, discussion on major findings is presented, followed by contributions of study, limitations of the study and recommendations for future research.

5.1 Discussion of Major Findings

The main objective of this research is to examine the relationship between the selected variables and gold price. EViews 8 software were utilized to investigate the relationship between the independent variables and gold price. There were 130 monthly observations from January 2007 to October 2017 which were obtained from secondary data sources.
According to the data analysis of EViews, exchange rate has proved a significant positive relationship with gold price.

In addition, silver price has also a significant positive relationship with gold price. Silver and gold served as substitute goods for each other.

The inflation expectations in Sri Lanka are not significant in the estimation of gold price. This will lead to the weakness in protecting investors from inflation.

Moreover, the empirical results of the study indicated that there is an insignificant relationship between crude oil price and gold price. This relationship can be explained as follows. When crude oil price increases, the cost of gold mining also increases which shows that the direct effect of crude oil price is insignificant, since Sri Lanka is a price taker from the international market.

Further, this study explained that there is no significant relationship between interest rate, stock return and gold price. It argues that people in Sri Lanka fail to consider gold and securities as substitute goods. Thus, any increase in the yield of the security will not give any impact to the price of gold.

In brief, the main drivers of gold price movement are discussed. This study has enhanced previous researchers' work by developing a more comprehensive model to investigate the gold price movement. Also, the research findings indicated that significant positive relationship has been established between silver price, and exchange rate with gold price while there is no relationship observed between the gold price and explanatory variables. Besides, the study has used more frequent and recent data in the study in order to provide a clearer and accurate depiction to researchers. The study will provide the researchers an additional reference in Sri Lankan context, whenever a research that is related to gold is carried out.

5.2 Contributions of Study

The trend of gold investment has been prominent in the recent studies because of the characteristic of the gold as the hedge against economic uncertainty. Accordingly, this study could provide market participants some hints of monitoring gold price movement. The relationship between inflation, silver price, exchange rate, interest rate, stock return and crude oil price with gold price were observed in this study and the respective findings can facilitate market participants to speculate on the gold price trend. For instance, the positive relationship between exchange rate and gold price indicated the central bank

and gold dealers to invest in gold when the LKR is depreciating against USD due to buy- low sell-high concept. If the LKR is appreciated against USD, gold price is moving downward. Thus, gold speculators should invest at low price and sell at higher price when the situation is favour to them.

Further, the relationship evidenced in the study can facilitate government institutions such as Central Bank and gold dealers for decision making with regard to the control in reserve management.

5.3 Limitations of study

There were several limitations that have prevented the researcher moving forward to obtain a better outcome.

i. The gold price is not solely affected by the six independent variables as proposed in this research. There are others factors such as macroeconomic news announcement and money supply also engaged in as an important factor in affecting the gold price.
ii. The study has used the data from secondary sources. Therefore, the inherent limitations associated with secondary data will ostensibly affect this study. In addition, there is a limitation of data availability for long period of time on a daily and weekly basis.
iii. The result from this research is applicable only in Sri Lankan market and only beneficial for Sri Lanka policy makers and participants in Sri Lankan market.

5.4 Suggestions for Future Research

The increasing trend of gold price and the uncertainty of economy in recent years have triggered many researchers to do further research in gold related topic. Therefore, this research study served as a reference for future researchers concerning with this issue.

Firstly, despite of the determinants affecting gold price proposed in this study, future researchers are encouraged to include others variables that significantly affect gold price. For instance, money supply, macroeconomic announcement and jewellery demand, to name a few. By including other important factors in the model, a complete picture of the factors affecting gold price could be captured. Since gold has the characteristics of safe haven asset and investment tool instead of security, policy makers might need a more detailed framework to justify their investment decision. Thereby, future researchers are encouraged to consider to examine gold in different contexts, such as the volatility of gold and gold return instead of gold price. The study will provide with additional and valuable insights into the price dynamics of individual assets and portfolios by studying the aspect of gold volatility structure. Therefore, better risk and portfolio management framework can be provided to the financial planners.

Secondly, future researchers are recommended to carry out the related issue in different economic conditions, especially an economy with crisis and economy without crisis. This is because different factors might be significantly affecting the gold price at different economic conditions. Thus, by executing a research in this manner, the future researchers may deliver more information on the factors affecting gold price at different economy situations. The respective factors captured in affecting gold price during different economic conditions might provide the planners with a different decision aid in the investment strategy.

Moreover, this study is only focusing on one country which is Sri Lanka. For the future research, it is preferable to have a wider perspective on different status of the countries ranging from developed, developing and emerging countries. For example, future researchers may select several countries to represent their own subsequent status. This would probably make the research more interesting as it would cover diverse regions that might provide different findings. As a result, it can contribute more meaning and relevant information for policy makers, economists and investors around the globe.

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