





DOES GOLD PRICE LEAD OR LAGS ISLAMIC STOCK MARKET AND STRATEGY COMMODITY PRICE? A STUDY FROM MALAYSIA

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ABSTRACT

Article History

Received: 9 July 2018

Revised: 15 August 2018

Accepted: 21 September 2018

Published: 1 November 2018

Keywords:

Gold

Kijang gold

Malaysian gold

FTSE Bursa Malaysia

Islamic stock market

Crude palm oil

Crude oil price

Commodity market

Macroeconomic variables

Lead-lag analysis.

JEL Classification:

E44, G11.

There is a few claimed in literature and financial media that gold, Islamic stock and commodity market provide as hedging tool against inflation. Therefore, derive from this similarity characteristic, we are interested to know which among of this investment variety are the leader and laggard in the Malaysian market. Among of them, numerous studies have been done on gold as a hedge against inflation, but almost non-existence amount of research endeavor to analyze the lead-lag of this precious metal with other investment avenues. Thus, several methods are employed to answer the issue of this study which are unit root tests and Johansen's cointegration test, followed by long-run structural modelling (LRSM) and vector error-correction modelling (VECM), variance decompositions (VDCs), impulse response functions (IRFs) and persistence profile (PP). The results showed that spot Kijang Gold lags all investment avenues in Malaysia. It indicated that the performance of the Kijang Gold is dependent on FTSE Bursa Malaysia Emas Shariah Index, macroeconomic variables and strategic commodities. This provides some important policy implications in the regulation of the Kijang Gold itself whereby FTSE Bursa Malaysia Emas Shariah Index performance and other variables are among the key predictive inputs on the expected performance of the Kijang Gold. Hence, we humbly suggest to the investors and investment portfolio managers to include Islamic shariah equities, crude palm oil and crude oil commodities as part of their investment portfolios as may act as diversification and hedging tool especially for an investment portfolio which consists of Kijang Gold and forex, as we had identified these latter investment avenues as the most follower (endogenous) variables.

Contribution/Originality: This study is one of very few studies which have investigated the lead-lag analysis among these three-investment avenues by using VECM, VDCs and other related techniques. Furthermore, this study attempts to fill the gap in empirical studies and associated theory which remains unexplored and not broadly discussed in the literature.

1. INTRODUCTION

There is nearly common feature among gold, Islamic stock and commodity market which have been claimed as hedging tool against inflation. However, the claim has rarely been tested in the literature especially in Malaysia and not many people know the direction sequence among them, which of them is lag or lead the others. Does gold really lead the other market in investment avenue or it lags the others? One more question should be addressed more in

literature is whether gold, Islamic stock and specific commodity provide a characteristic of diversification or hedge tool in investment during inflation? These two terms are acquiring different meaning and for investor and fund manager, this will attract them to invest as they need to well informed to plan on their investment portfolio. Among the decision that they need to do is to determine the portion or weightage of asset that should be included in the investment portfolio. Therefore, these three investment avenues should be clearly identified whether is it true they can be claimed as hedging tool or can just provide diversification in optimum portfolio under Malaysian market. Should they put them a heavy weight in portfolio? The theory given by Markowitz in 1952 in the context of investment portfolio suggests not to 'put all your eggs in one basket'. Markowitz further explains that the investment portfolio must be a combination of assets which were imperfectly correlated with one another in order to create diversification.

Our study is therefore justified by the neglect of the combination of these three investment avenues through lead-lag analysis by using VECM and VDCs and fill the gap in literature by identifying the characteristic of them whether provide as a hedge of inflation or as a tool of diversification in the Malaysian market. In addition, the limited number of academic studies and theory provided about this issue remain unclear especially on lead-lag analysis among these three-investment avenues. We also endeavor in using a methodology like Long-Run Structural Modelling (LRSM) as to estimate theoretically meaningful long run relations by imposing on those long run relations both identifying and overidentifying restriction based on theories and *a priori* information of the economies. Owing to the lack amount of research on this topic, it is therefore convenient to fill this gap and the fact that the dynamic relationship between these variables including gold, Islamic stock market, strategy commodities like in emerging market such as Malaysia, remains unexplored and not widely discussed in the literature.

Using secondary data which mostly extracted from data stream, we found that strategic commodities (i.e. crude oil price and palm oil) lead Islamic stock market and gold which indicates as the most (exogenous) variable that depends mostly on itself consistently compared to another variable. They also serve as a hedging tool during inflation. The Islamic stock market receive less impact during inflation, but it still can be considered as good to be invest as a diversification tool since move in opposite way with gold market and mostly receive impact from its own past lags. Here, the most dependent variable is gold (we used Kijang Gold as our proxy for gold in Malaysia) and based on our finding, the Kijang Gold is not a hedge against inflation rather serve as a diversification with other asset such as crude oil price, crude palm oil and Islamic stock market since its move in different way with others. Thus, we may humbly suggest to investor or investment portfolio manager to add some percentage of crude oil price, crude palm oil and Islamic equity in investment portfolio due to serve as a hedge and diversification asset especially for an investment portfolio which consists of gold (Kijang Gold) and forex, as we had identified these investment avenues as the most follower (endogenous) variables.

This paper divided into several sections and the outline is as follows: section 2 will provide an explanation of issue in our study; section 3 will identify theoretical underpinning about this issue; section 4 will review of previous literature on the gold, strategic commodity, Islamic stock market and macroeconomic variables; section 5 will highlights the data used in this study and the estimation technique applied to analyze the said data; section 6 will discusses the estimation results; section 7 will concludes the findings; section 8 will give suggestion to policy maker, investor or fund manager and last section will reveal our limitation of this study.

1.1. The Issue of Study

Recent studies find that gold can serve as a profitability investment whether in emerging or developed markets. Based on the research done by Van Hoang *et al.* (2016) gold can be hedge against inflation only in short run in the UK, USA and India. This study also revealed that the gold is not a hedge against inflation in long run in all cases. Then, according to Newberry (1992) market participants tend to change their investments from common stocks, bonds or equities to commodity markets in order to face the expected inflation. In addition, Hussin *et al.* (2013)

opine that gold is often thought to adjust quickly to the inflation rate and thus it has a value-preserving ability. While other than gold, another investment avenue such as Islamic stock market also has equivalent characteristic as a hedging tool as according to Hussin and Borhan (2009) Islamic stock market can be seen as suitable place in avoiding inflation and one of the vital economic development indicators for a country. Couple by these three investment tools which have similar attribute as safety place to invest during inflation, therefore we decided to analyse which of them lead or lag each other and whether they can be put under one portfolio as diversification purpose under Malaysian market. As far as our concern and based on our limited knowledge to justify, we found that almost non-existent or very few amounts of research and tested of theory on this topic. Just name a few, most of the studies stress on determinant of gold prices (Toraman *et al.*, 2011; Ibrahim *et al.*, 2014) gold as hedge of inflation (Artigas, 2010; Shahbaz *et al.*, 2014; Bampinas and Panagiotidis, 2015; Van Hoang *et al.*, 2016) dynamic relationship between gold with other commodities and stock market (Ahmed *et al.*, 2017) and other related study on gold investment (Baur and McDermott, 2010; Ibrahim, 2012). Therefore, derive by similar attribute as hedging tool against inflation, this study attempts to fill some gap especially by taking Islamic stock market price and strategic commodities as our variables. Thus, does the gold price lead or lag Islamic stock market price and strategic commodities in Malaysia?

2. THEORETICAL REVIEW

There are not many theories that related to the valuation of the stock market and the commodity market. One of the key theories is the arbitrage pricing theory (APT) advocated by Ross (1976) which relates changes in returns on investment to unanticipated changes in a range of key drivers for these investments. Therefore, as refer to this theory, we decided to examine the dynamic relationship between these variables. Which variable lead or lag in the investment avenues? And which variable more appropriate as a hedging tool during inflation? Thus, although our focus is lead-lag relationship between gold price and other investment markets, but these variables also interact with macroeconomic variables (i.e. Inflation rate and real effective exchange rate). Therefore, we try to reveal the theory underpinning behind these variables' interaction. Another theory that seem related with our study is the theory of Markowitz 1952 in the context of investment portfolio urged the investor 'not to put all eggs in one basket' implying to diversify their investment portfolio as a mechanism to minimize the risk. Markowitz further explains that the best combination of asset is when both assets acquire perfectly negative correlation in investment portfolio. However, negative or zero correlation also can be considered as good to be put in portfolio of investment. Thus, the fund manager and investor should expand the door to other investment mechanism beside gold like Islamic equities, forex and other commodity especially for those assets which can avoid against inflation.

Theoretically, gold is a precious metal which mankind that has a long and renowned relation and continues to do so. Gold served as money until other forms of currency were devised and even now gold is bought as an investment (Michael, 2007). The gold is said to be a safe haven¹ investment and be categorized as a precious metal as people especially investor believed that it is one of the risk management tools that can be used to avoid high risk in financial market and though to be adjusted quickly to the inflation. Therefore, for those who holding the gold, they have faith in that the gold has value-preserve ability and can be used for hedging when there is a bad condition in our global economy.

Thus, same weight goes to the shariah stock market when it can be seeming as a right place for investors in mitigating inflation. In the time of crisis, economic theory suggests that as equity prices fall the price of gold will increase. Likewise, the figure 1 shows the movement between Kijang Gold prices and FTSE Bursa Malaysia Emas Shariah Index for period taken from year 2008 to 2017. It seems like they move in opposite way and for the investor as they believe the gold itself as a safe haven, this precious metal provide diversification characteristic with Islamic

¹Gold does not only protect us against a weakening local currency but it also protects us against the ups and downs of the global economy.

stock market which therefore must be owned in portfolio investment. Unlike other main avenues of investment like equity and debt market, the gold market price is mostly dependent on demand and supply of it in all over the world (Abdul and Puasa, 2013). Therefore, when there is more money available to buy roughly the amount of gold, the price of gold naturally becomes higher.

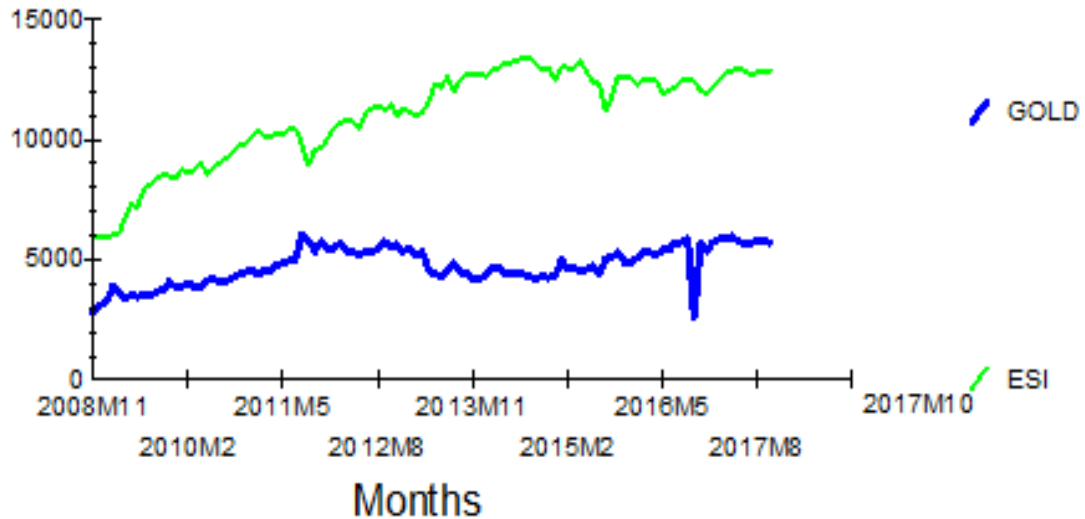


Figure-1. Kijang Gold prices versus FTSE Bursa Malaysia Emas Shariah Index

Source: http://www.bnm.gov.my/index.php?ch=statistic&pg=statistic_kijangemas and <https://www.investing.com/indices/ftse-malaysia-emas-shariah>

There is increasing in investor's interest to invest and hold the gold for the long-term period as to avoid the impact of weaken currency. The investors believed that gold as one of the investment instruments that must be put in portfolio as to diversify the risk and become less susceptible to exchange rate fluctuation.

According to Bodie (1976) there are three possible definition of an asset can be used as inflation hedge; firstly, an asset itself which able to eliminate or reduce the possibility to have negative real return. Secondly, an asset which can reduces the variance of the real returns when being combined with other assets and lastly, an asset which is correlated positively with inflation. The gold and Islamic stock market can be used as an investment tools to hedge for inflation. On the other hand, investment in gold and stock market need a certain time to bring the price rise back. This is because changes in inflation rate move in slowly mode and each country take their own mechanism to control inflation. If there is no any action to govern the inflation, it will slow down the economic growth for each country. Theoretically, inflation is detrimental to the stock prices. Higher inflation leads to higher interest rates and lower price earnings multiples and generally makes equity securities less attractive. Then people tend to change their preferences to other investment avenues.

Meanwhile, in the context of stock market and exchange rate, if the stock market and exchange rate related to each other, then the investors can use information of one to envisage the behaviour of another. There is one theoretical argument on portfolio adjustment between exchange rate and stock price which this adjustment occurs whenever the price of the stock is changes. If the stock prices are on increase and stock returns are higher, it will attract more foreign capital and also local investors who will sell their asset abroad to make an opportunity gains in local market. This conversion will increase the demand of local currency and tend to increase its price. However, when there is a decline in stock price, it is not only will reduce the wealth of individual firm, but the same impact goes to country's wealth.

Furthermore, there are some reasons for conducting this study in the case of Malaysian crude palm oil (CPO) markets. As Malaysia is one of the world's largest palm oil exporter and currently accounts for 39 % of world palm oil production and 44% of world exports, here as we can see there is a growing demand for Malaysia to export CPO

in form of biofuel and food to other emerging markets. If considered of other oils & fats produced in the country, Malaysia accounts for 12% and 27% of the world's total production and exports of oils and fats (Malaysian Palm Oil Council, n.d)². Therefore, we inclined that crude palm oil can be a hedge tool against inflation since Malaysia is currently among the larger producer of crude palm oil after Indonesia and this strategic commodity is also suitable investment for investor as diversification purpose.

As we all aware, oil is one of the most traded commodities in the world, not only can be seen as the major world development but also as a trigger for economic inflation and recession. The impact of oil price is depending on the importance of oil to the country whether the country is oil importer or oil exporter. Theoretically, when crude oil price increases, it will fade the economic globally and tend to decrease the growth rate and makes stock price in declining stage. Then, among the reasons why stock price decrease is because when crude oil price increase, it will make a company (especially for company which depends more on that commodity in their daily operation) tend to face with decline in profitability due to high cost and furthermore will reduce their wealth which will reflect in its stock price. Then, the impact is the investors will find other investment instrument such as gold as to reduce their risk. Gold and oil usually rise and fall in tandem. Conventional wisdom is that rising oil prices push up inflation increasing demand for gold as a hedge. For investor, it's better to manage well their portfolio and diversify more on defensive instruments such as gold. This scenario can be seen in the year late 1970s when oil cartel like OPEC reduced their supply of crude oil that significantly increased the price of this commodity. Subsequently, the gold price also increased in the market and was moving in parallel basis with crude oil price at that time (refer figure 2 below). Therefore, as refer to this scenario, the crude oil price has indirect impact toward gold price.

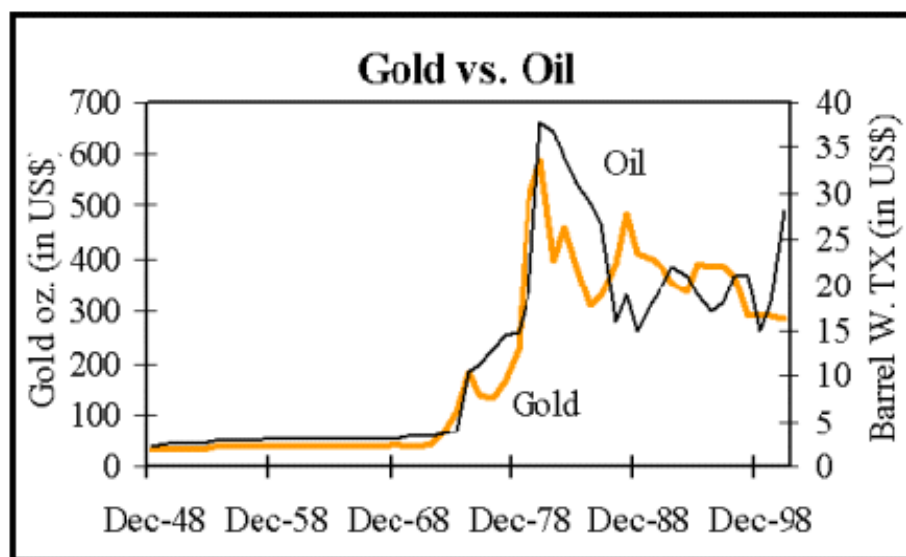


Figure-2. Gold and Oil price movement from year 1948 to 1998

Source: Wilson (2016)

Based on our humble view and limited knowledge, the theory remains inconclusive and unresolved to answer our question. Therefore, we will further examine and support our study by looking information from empirical sources in the next section.

3. LITERATURE REVIEW

As abovementioned, based on our limited knowledge, there is no ample study about lead-lag analysis between gold prices with Islamic stock market prices and strategic commodity prices in the literature. In addition, only few

² Malaysian Palm Oil Council, n.d. Market statistics and price. Available from <http://www.mpoc.org.my/Market>.

formal studies have been conducted on the gold and stock price relationship and several researches finding in the literature have mentioned that there is no co-integration and causal relationship between gold and Islamic stock market (Hussin *et al.*, 2013). For investor it is such a good opportunity as these two investment tools can suit together in asset mix classification under one investment portfolio due to absence of co-integration will create diversification.

However, for our study, we intend to analyse whether our focus variable which here is the gold price lead or lag other investment variety as a hedge against inflation, therefore we include another focus variable such inflation rate (CPI) which we believe this variable interact with these control variables.

According to the study done by Iqbal (2017) there are robust evidence has been found that the investment in gold is performing better than investment in forex market especially for India and Pakistan. Meanwhile, it has to be believed that during crisis, the countries affected witness uncertainty in currency and stock market, thus will change the portfolio more to gold market or can used exchange rate to hit the unfavourable stock market. According to Ahmed *et al.* (2017) if there is a relation in stock market and exchange rates then the crises of stock market can be prevented by controlling the exchange rate or can use information of one to predict the behaviour of other.

The literature about gold and inflation received various attention but the empirical evidence is not always conclusive. As abovementioned under theory part on inflation, there are three possible definitions of asset that can be classified as inflation hedge which given by Bodie (1976). Then from here, Arnold and Auer (2015) give further argument on the third definition by mentioned that when correlation is equal to 1, the asset is perfectly inflation hedge. The reason behind this is when inflation increases, it is perfectly compensated by the increases of asset's price. However, they also argue that if the asset does not provide a perfect hedge which is correlation being positive but lower than 1, the asset still can be considered as valuable due to its stability and positive relation with inflation. The study done by Ibrahim *et al.* (2017) disclosed that the gold price and Islamic stock market in Malaysia are positive correlated with inflation (the amount indicated at less than 1). Therefore, we believe that both investment mechanisms consider good to be invest. In addition, the study done by several studies reveal that precious metal like gold is suitable for a good investment since its can be used as hedging tool during inflation as it moves in opposite way with shares and bonds. According to Baur and Lucey (2010) investors should buy gold on days of extreme negative return and sell it when market participants regain confidence and in lower volatility. The gold itself as a safe haven to investor, and it will become more attractive investment tool when the time of negative stock market returns. There are several studies mentioned that gold can be hedge against inflation in long-run and some studies reveal that it only effective for hedging in short run. The study by Zhang and Wei (2010) shows that the rising movement of gold price can be used as an effective hedge against inflation in the long run, indicating that an increase in expected inflation will encourage more people tend to invest in the gold. This leads to increase in gold price and eventually influences the price movement of other commodities in the short run. Meanwhile, other study like (Van Hoang *et al.*, 2016) revealed that in all cases the gold is not a hedge against inflation in the long run. The study covers a period ranging from 1955 to 2015 which applied in China, India, Japan, France, the United Kingdom and the United States of America as their focus group. The result shows that the gold can be used as hedge toward inflation in short run but only in certain country such as UK, USA and India. Furthermore, there is also no long-run equilibrium between gold prices and the CPI in country like China, India and France. They opined that this difference behaviour maybe because of traditional aspects of gold and custom controls for gold trade in these focus group countries. Therefore, based on this theory, we believe that there is positive relationship between gold and inflation rate especially in Malaysian market (in this study we used CPI as proxy of inflation rate).

Based on research done by Mohammad Nor and Masih (2016) about to investigate the dynamic relationship between spot and futures palm oil prices and stock market prices of a major palm oil producer. The results showed

that stock market prices lead spot and futures palm oil prices rather than vice versa for the Malaysian markets. This is contradicted with our intuitive in theory discuss in previous section before, thus, we keep our opinion by depends on result in the next section. Meanwhile, according to [Go and Lau \(2017\)](#) there is yet to be a study on the CPO spot-futures relationship under the inflationary expectation of gold price, and they mentioned that when market participants are bullish on gold price, most of them will use the commodity as an inflation hedge, and this put speculative pressure on future CPO price.

Studies that directly examine the relationship between oil and gold markets are few. In this part we briefly review several paper links with these two commodities. According to [Baffes \(2007\)](#) he found that the price of precious metals, gold, responded strongly to the crude oil price. In addition, [Narayan et al. \(2010\)](#) examined the long-term relationship between gold and oil prices whether in spot and futures at different maturities, the finding also revealed that investors used gold as a hedge against inflation and these oil and gold could be used to mutually predict prices. Meanwhile, in the sense of stock market, according to [Hussin et al. \(2013\)](#) many studies have been carried out on the relationship between stock returns and macro variables, though not with gold and oil prices. These two commodities owing a special features and roles which is practically significant to investigate how they can influence each other or other variables in the market. Due to the almost non-existent amount of research on the topic, it is useful to fill this gap.

In conclusive, neither theoretical and empirical sources solve this issue. The theory and previous research done in literature unable to give the clear answer, therefore we will further to methodology to answer our humble question.

4. DATA AND METHODOLOGY

This study covers over a period of 9 years and used monthly data started from November 2008 to October 2017 (98 monthly observation). The data was collected and extracted from various available database including DataStream, Crude palm oil official website and Monthly Statistical of Bank Negara Malaysia. As discussed earlier, we used the following variables for lead-lag analysis which are gold prices and inflation rate as our focus variables. These two variables interact also through some other control variables such as macroeconomic variables and strategic commodities. Thus, these six (6) variables taken are Kijang Gold Price (GOLD) as a proxy for Malaysian gold price, FTSE Bursa Malaysia Emas Shariah Index (ESI) as a proxy of Malaysian Islamic Stock Market, Real Effective Exchange Rate (only this variable is I (1) compared to other types of exchange rate in Malaysia), Consumer Price Index(CPI) as a proxy for inflation, Crude Palm Oil (CPO) as a proxy for main commodities produce by Malaysia and Crude Oil Price (COP) as a proxy for strategic commodities. In the analyses, all data are expressed in natural logarithm and Micro fit 4.1 software was used to conduct the analysis process.

Based on our humble effort and limited knowledge to solve this issue about does the gold price leads or lags Islamic shariah index and strategic commodity prices in Malaysia, we applied standard time series technique to solve the issue which not solve in theory and other empirical study. This time series technique is unique in the sense of the data will assist us to determine which variables is exogeneous (i.e., independent) and which variables are endogenous (i.e., dependent) as oppose to the predetermined theoretical assumption in the classical regression model. The data analysis that we used for our study is the combination of 8 steps procedure which is summarized by [Masih et al. \(2009\)](#). This data analysis employed are unit root tests, Order of VAR and Johansen's cointegration test, followed by long-run structural modelling (LRSM) and vector error-correction modelling (VECM), variance decompositions (VDCs), impulse response functions (IRFs) and persistence profile (PP).

4.1. Statistical Analysis and Interpretation of Result

Below we present the result and findings for the 8 steps procedures.

i) Unit roots test

Firstly, as a requirement for the standard time series analysis, it is an essential to identify the property of time series, which is, the stationary property. This is very important as to avoid spurious regression. The variable is stationary if it always has constant mean, variance and covariance throughout the time. The test can be done by using the Augmented Dickey-Fuller (ADF) test and this test has been corrected for residual autocorrelation. Based on highest level of Akaike Information Criteria (AIC) and Schwarz Bayesian Criterion (SBC), the corresponding test statistic (t-statistic) of each variable is compared against its respective 95% critical value(c-value) of ADF statistic. The null hypothesis in the ADF test is that variables are non-stationary (t-statistic<c-value). The table 1 shows the summarize of results.

Table-1. The result of Augmented Dickey Fuller (ADF) test conducted to level form and first differenced form of variables

Variable	Test statistic	Critical value	Implication
Variables in the Level Form			
LGOLD	-1.8336	-3.4581	Non-Stationary
LESI	-1.7186		Non-Stationary
LREER	-2.2049		Non-Stationary
LCPI	-2.5116		Non-Stationary
LCPO	-1.2748		Non-Stationary
LCOP	-1.9927		Non-Stationary
Variables in the Differenced Form			
DGOLD	-8.3998	-2.8929	Stationary
DESI	-6.5736		Stationary
DREER	-6.7782		Stationary
DCPI	-6.2427		Stationary
DCPO	-6.3890		Stationary
DCOP	-6.6376		Stationary

Source: Output from Micro fit 4.1 software

In order to proceed with the cointegration test later, the variables above should be in I (1) form which means that in their level forms are non-stationary but in differenced form are stationary. The result shows that in the level form, we failed to reject null hypothesis, therefore variables are non-stationary. On the other hand, all variables in the differenced form have higher t-statistic than c-value, thus we can reject the null and conclude that variables are stationary at differenced form. Therefore, the conclusion can be made is all variables in this analysis are I (1) and we can proceed with testing of cointegration after identifying the lag order in the next step.

ii) VAR (lag) Order

The determination of the lag order of the VAR model is a pre-requisite for the cointegration test using the Johansen procedure. To ascertain the order of the integration of the variables in presence case, we are using 6 as our maximum order for VAR. ADF test revealed AIC and SBC which assist in the prediction of the best order of lags. AIC tends to choose higher order of lags as it is less concerned on over-parameter and tries to solve for autocorrelation while SBC is likely to choose lower order of lags as tries to avoid over-parameterization and lower loss in the degree of freedom. The table 2 shows the result obtained.

Table-2. Order of VAR Model

Choice criteria	Optimal Order
AIC	1
SBC	1

Source: Output from Micro fit 4.1 software

We select the optimum lag corresponding to the highest value of AIC and SBC as the selection criteria. From the above table, the result shows that there is no conflicting optimum order given by highest value of AIC and SBC. Thus, on this basis, we choose lag order 1 as the optimum lag order of VAR.

iii) Cointegration test

Cointegration indicates that the relationship among variables is not spurious. There is theoretical relationship among the variables and they are in the equilibrium in the long run, although they might move differently in short-run. It also implies that each of variables contain some information in predicting other variables. In this analysis, we have performed two tests to identify the cointegration between the variables which are the residual-based (Engle and Granger, 1987) and VAR-based test of Johansen (1988). The Johansen method uses maximum likelihood which is eigenvalue and trace and able to identify more than one (1) cointegration vectors compare to Engle-Granger method that can only show one (1) cointegrating vector. For Engle-Granger method, the result was made by comparing test statistic (t-statistic) of the highest value of AIC and SBC with Dickey-Fuller (DF) critical value (c-value) at 95%. The table 3 below shows the result of Engle- Granger method.

Table-3. Engle-Granger Test Result

Variable	Test Statistic	Critical Value	Result
Residual ADF (1)	-4.3289	-4.8943	Variable is non-stationary

Source: Output from Micro fit 4.1 software

The null hypothesis means there is no cointegration exist between variables. This result indicates that at lag 1, test statistic of -4.3289 is smaller than the 95% critical value of -4.8943 which failed to reject null hypothesis. Therefore, we couldn't find cointegration among variables by using this method. Meanwhile, according to Johansen method, we able to identify one cointegrating relationship among the variables at 95% significant level on the basis of maximal eigenvalue and trace test statistic. The result of Johansen test shows in table 4 below.

Table-4. Johansen Test Result

Null	Alternative	Statistic	95% Critical	90% Critical
Maximal Eigenvalue statistics				
r = 0	r = 1	46.9796	43.6100	40.7600
r <= 1	r = 2	25.7762	37.8600	35.0400
Trace statistics				
r = 0	r >= 1	116.7765	115.8500	110.6000
r <= 1	r >= 2	69.7969	87.1700	82.8800

Source: Output from Micro fit 4.1 software

Therefore, from this result, there is a common force that brings variables together in the long term and the relationship is not spurious. At this point, it is therefore safe to proceed to the next stage owing to the existence of a cointegration.

iv) Long run structural modelling (LRSM)

According to Masih *et al.* (2009) in order to make the coefficient of the cointegrating vector consistent with the theoretical and a *priori* information of the economy, we need to apply LRSM. In other word, once the number of cointegrating vectors have been determined in the previous step, the LRSM is conducted in regard to our attempt to quantify the theoretical (or intuitive) relationship which is actually derived from economic theories under review between the variables. This means that for the cointegration analysis to be theoretically meaningful in the long-run, the gold prices need to contribute significantly to the long-run relationship. Since our main focus is to identify the direction of causality between gold (Kijang Gold) price, Islamic stock market (ESI) price, strategic commodities (CPO and COP) and macroeconomic variables (CPI and REER), therefore we firstly imposed a normalizing restriction unity on the gold variable at the exactly identifying stage in Table 5(refer Panel A).

The output above shows the maximum likelihood estimates subject to exactly identify (Panel A) and over-identifying (Panel B and C). The Panel A estimates show that only two variables are significant (i.e. real effective exchange rate (REER) and inflation rate (CPI)) which means these two variables effect normalized variable (Kijang

gold prices), therefore we can keep these variables in the equation. However, FTSE Bursa Malaysia Emas Shariah Index (ESI), crude palm oil and oil prices are insignificant. Thus, we decided to further the test of the significance of ESI and the over-identifying restriction is applied on ESI with $A_2=0$ which depicted in Panel B. With this restriction, REER and CPI remain significant, but it was rejected by the Chi-squared statistic (Panel B) with p-value is less than 10%, which means the restriction is not correct.

Table-5. Exact and Over Identifying Restrictions on the Cointegrating Vector

Variable	Panel A	Panel B	Panel C
LGOLD	1.000 (*NONE*)	1.000 (*NONE*)	1.000 (*NONE*)
LESI	0.756450 (0.43176)	0.00 (*NONE*)	0.00 (*NONE*)
LREER	0.099803* (0.032096)	0.049238* (0.014048)	0.050904* 0.014351
LCPI	-1.14580* (0.58602)	-1.1438* (0.57880)	-0.99650 (0.57565)
LCPO	-0.035910 (0.035600)	-0.0073555 (0.031373)	0.00 (*NONE*)
LCOP	-0.032944 (0.023129)	-0.034756 (0.022811)	0.00 (*NONE*)
Trend	-0.0020633 (0.0024902)	0.0009985 (0.0017629)	0.0019660 0.0018179
Chi-Square	None	3.5429 [.060]	6.5989 [.086]

*Indicate significance at 5%
The standard error is in parentheses, while in the Chi-Square statistic, the p-value are in brackets.

Then, interestingly, when we made the over-identifying restriction all at once, that is, testing the null hypothesis which are ESI, CPO and COP were all insignificant, the null hypothesis is also rejected ($p < 0.10$) or in other words, that the set of restriction is incorrect. As a result, we proceeded with Panel A by also taking consideration of one cointegration exist in previous step, therefore we keep all variables as we inclined there is theoretical reason behind this. From the above analysis, we arrive at the following cointegration equation (numbers in parentheses are standard deviations):

GOLD + 0.76ESI + 0.09REER - 1.15CPI -0.04CPO – 0.03COP (0.43) (0.03) (0.59) (0.04) (0.02)
--

Cointegration, however cannot tell us the direction of Granger causality as to which variable is leading and which variable is lagging (which variable is exogenous and which variable is endogenous). In order to identify the endogeneity/exogeneity of variable, we will apply the vector error correction model (VECM) in next step.

v) Vector error correction model (VECM)

From our study thus far, we have established that six (6) variables are cointegrated to a significant degree which are GOLD, ESI, REER, CPI, CPO and COP. However, like our mentioned just now in previous step, the cointegrating equation reveals nothing about causality that which is leading variable, and which is the laggard variable. Thus, the information under this step is useful for investors and fund managers of portfolio to diversify their risk in investment. Typically, the investors and fund managers of portfolio would be interested to know which investment avenue or macroeconomic indicator the exogenous variable is because then they can monitor closely the performance of this variable as it would have significant bearing on the expected movement of other variables in which they have invested.

VECM allows us to ascertain which variables are in fact exogeneous and which are endogenous. Here, at least one of the ECM terms (e_{t-1}) should be significant for the validity of the cointegrating relationship among the

variables in the long term. If the error correction coefficient is insignificant, it implies that the corresponding dependent variable of that equation is exogenous. It gives meaning that this variable does not depend on the deviation of other variables and become a leading variable which initially receives the exogenous shocks resulting in deviation from equilibrium and thus transmits the shocks to other variables. However, if the coefficient is significant, it indicates that the corresponding dependent variable is endogenous. Thus, this variable depends on the deviation of other variables and bear the brunt of short-run adjustment to bring about long-term equilibrium among the cointegrating variables. On the other hand, the size of the coefficient of error correction term is also represent the proportion by which disequilibrium in the dependent variable in being corrected in each short period. Therefore, starting this step and onwards, the statistical result generated from these steps will be welcomed by policy market, fund managers of portfolio investment and potential/current investors.

As indicates in Table 6, by checking the ECM terms (e_{t-1}) for each variable, we found two (2) endogenous variables (i.e. GOLD and REER) and four (4) exogenous variables (i.e. ESI, CPI, CPO and COP) in our study.

Table-6. Error correction model

Variable	ECM (-1) t-ratio [p-value]	Implication
LGOLD	-5.995700 [.000]	endogenous
LESI	0.298560 [.766]	exogenous
LRER	-2.716000 [.008]	endogenous
LCPI	-0.001943 [.998]	exogenous
LCPO	0.981630 [.329]	exogenous
LCOP	0.256480 [.798]	exogenous

Source: Output from Micro fit 4.1 software

This result means that, as exogeneous variable, when ESI, CPI, CPO and COP receive market shocks, other variables such as REER and GOLD will be affected by the shocks. Intuitively, the mechanics behind the VECM results implied that FTSE Bursa Malaysia Emas Shariah Index (ESI), consumer price index (CPI), spot crude palm oil prices (CPO) and crude oil price (COP) are the initial receptors of an exogenous shock to the long-term equilibrium relationship while real effective exchange rate (REER) and Kijang Gold Price(GOLD) had to bear the burden of short-run adjustment endogenously in different proportions to bring back the system to its long-term equilibrium. The coefficient represents of proportion imbalance corrected each period. Meanwhile, since VECM does not give an information of relative/ranking of exogeneity and endogeneity, we will have to perform the next step to identify the ranking of the variables.

vi) Variance decompositions (VDCs)

After identifying which variables are exogenous and which variable are endogenous, these variables now subjected to VDCs to determine which of the exogenous variables is the most exogenous and which of endogenous variables is the most endogenous. The VDCs test will help us to ascertain the relative/ranking degree of endogeneity among those variables. VDCs decomposes the variance of forecast error of each variable into proportion attributable to shocks from each variable in the system, including its own past variation. The more it depends on its own past, the more exogenous or less endogenous it is.

The relative exogeneity and endogeneity of the variables are given by VDC results in Table 7(a), 7(b) and 7(c) in different horizon. We decided to use generalized VDC compared to the another one (orthogonalized VDC) due to the nature of orthogonalized VDC is not unique and depend on the particular ordering of the variable in the VAR and assumes that the other variables in the system are switched off when a particular variable is shocked. In contrast, the generalized VDC does not have such restrictions.

Table-7(a). Generalised Variance Decomposition (Forecast at Horizon =3 months)

	Horizon	LGOLD	LESI	LREER	LCPI	LCPO	LCOP	TOTAL	SELF-DEP	RANKING
LGOLD	3	70.7062	4.19009	20.0217	2.52128	1.76173	0.79908	100%	70.70617	6
LESI	3	1.67006	91.8116	0.06455	5.75622	0.66848	0.02909	100%	91.8116	4
LREER	3	17.4916	1.50359	78.2898	2.29961	0.10675	0.31135	100%	78.28978	5
LCPI	3	0.02798	5.59629	1.15354	93.1104	6.6E-05	0.00872	100%	93.1104	3
LCPO	3	3.28081	0.31767	0.28857	0.0458	95.9195	0.14767	100%	95.91948	2
LCOP	3	0.0559	0.00716	0.14277	0.02164	0.08773	99.6848	100%	99.6848	1

Source: Output from Micro fit 4.1 software

Table-7(b). Generalised Variance Decomposition (Forecast at Horizon =6 months)

	Horizon	LGOLD	LESI	LREER	LCPI	LCPO	LCOP	TOTAL	SELF-DEP	RANKING
LGOLD	6	56.106	7.46573	28.5054	4.46509	2.07394	1.38381	100%	56.10604	6
LESI	6	1.80972	91.6552	0.05818	5.78355	0.6621	0.03127	100%	91.65518	4
LREER	6	21.0324	1.95059	73.966	2.5866	0.09745	0.36697	100%	73.96602	5
LCPI	6	0.02811	5.69991	1.15335	93.1099	6.6E-05	0.00871	100%	93.10986	3
LCPO	6	3.95958	0.22594	0.32887	0.06347	95.2575	0.16463	100%	95.2575	2
LCOP	6	0.07827	0.00417	0.15103	0.0254	0.08725	99.6539	100%	99.65389	1

Source: Output from Micro fit 4.1 software

Table-7(c). Generalised Variance Decomposition (Forecast at Horizon =12 months)

	Horizon	LGOLD	LESI	LREER	LCPI	LCPO	LCOP	TOTAL	SELF-DEP	RANKING
LGOLD	12	42.6914	10.5587	36.2046	6.27105	2.3493	1.92495	100%	42.69138	6
LESI	12	1.89909	91.5551	0.05414	5.80097	0.65804	0.03266	100%	91.5551	4
LREER	12	23.2174	2.22873	71.2867	2.76422	0.09174	0.40122	100%	71.2967	5
LCPI	12	0.02819	5.70035	1.15325	93.1094	6.6E-05	0.0087	100%	93.10944	3
LCPO	12	4.39616	0.16854	0.35467	0.075	94.8302	0.17548	100%	94.83016	2
LCOP	12	0.09307	0.00231	0.15637	0.02784	0.08695	99.6335	100%	99.63346	1

Source: Output from Micro fit 4.1 software

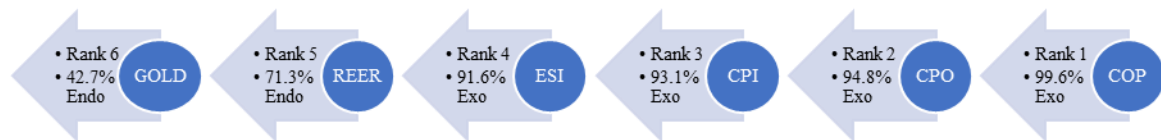


Figure-3. Direction of Causality from right to left

Source: Output from Micro fit 4.1 software

Initially, our results from VDC appears not to be conflicting with those from the VECM approach. Overall, the figure 3 suggest that for crude oil price (COP) variable, about 99.6% of the forecast error variance of COP is explained by its own shock, followed by crude palm oil (CPO) at 94.8%, inflation (CPI) at 93.1%, Islamic stock market (ESI) at 91.6%, real effective exchange rate (REER) at 71.3% and finally Kijang Gold (GOLD) price at 42.7%. The findings can be interpreted as COP being the most exogenous followed by CPO, CPI and ESI as the initial receptors to exogenous shocks while REER and GOLD price seemed to bear the burden of short-run adjustment endogenously to bring back the system to its long-term equilibrium. At this instance, the result suggest that COP is the most exogenous variable while GOLD is the least endogenous. This result supported by research done by [Reboredo \(2013\)](#) which would indicate that gold cannot hedge against oil price movements.

It should be noted that the COP variable is the most exogenous among all six (6) variables indicating COP rely on its own self and the rest depends on COP in this respect. This result is in line with our expectation of result, since the world crude oil has predictive power over other variables. Meanwhile, since Malaysia is the one of the main producer CPO (crude palm oil) in the world, we also expect equivalent result. The crude oil price and palm oil in our study are among the strongest exogeneous rather than inflation (we used CPI as our proxy) and this result is in line with the study by [Mahdavi and Zhou \(1997\)](#) when they find that commodity prices are often thought to incorporate arrival of new information faster than consumer prices.

Then based on the direction of Granger-causality above, how REER reacted by hit from the stock market? If the stock prices are on increase and stock returns are higher, it will attract more foreign capital and also local investors who will sell their asset abroad to make an opportunity gains in local market. This conversion will increase the demand of local currency and tend to increase its price. Nevertheless, the Kijang gold also received the impact from REER, as according to Ibrahim (2012) the Malaysian gold price may have depended on the global gold price, additionally, the use of gold price quoted domestically in ringgit give out potential confounding effect of exchange rate movement and currency conversion. In other word, it means that the global price of gold is set in USD and as the USD loses its value against gold, this will make the MYR loses its value against USD.

Meanwhile, from the perspective of the Kijang Gold prices and Islamic stock market prices (FTSE Bursa Malaysia Emas Shariah Index), the Islamic stock market prices appeared to be leading spot prices of Kijang Gold and lagging inflation, crude palm oil and crude oil price. Our study is in line with Ghazali et al. (2013) when their results show that gold returns (Kijang Gold) are negatively correlated with stock returns on average. However, they continued their point by mentioned that this gold returns are mixed correlated with stock returns during financial stress, suggesting that the gold is a weak safe haven for stockholders. Meanwhile, in perspective of whether gold is hedging tool against inflation, our result failed to prove that feature and it means an investment in Kijang gold is not a reliable hedge. Here, Kijang gold is lagging the inflation and obviously, it is not hedge against inflation. Our result supported by Ghazali et al. (2015) and their finding suggests that a domestic gold price (here they used Kijang gold as proxy of Malaysian gold) is not a good hedge against inflation.

Thus, from here, we can conclude that the spot Kijang Gold prices is the less exogenous and lagging real effective exchange rate, Islamic stock market prices, inflation rate, crude palm oil and crude oil price. This means that the Kijang Gold prices are lagging and mainly influenced by Islamic stock market, macroeconomic fundamentals and strategic commodities respectively.

vii) Impulse response functions (IRFs)

The Impulse Response Functions (IRF) essentially produce the same information as per the VDCs, excepting that the results have been presented in graphical form (refer Figure 4, 5 and 6). Here, we can identify the impact of one variable on others, their degree of response and how long it will take to normalize.

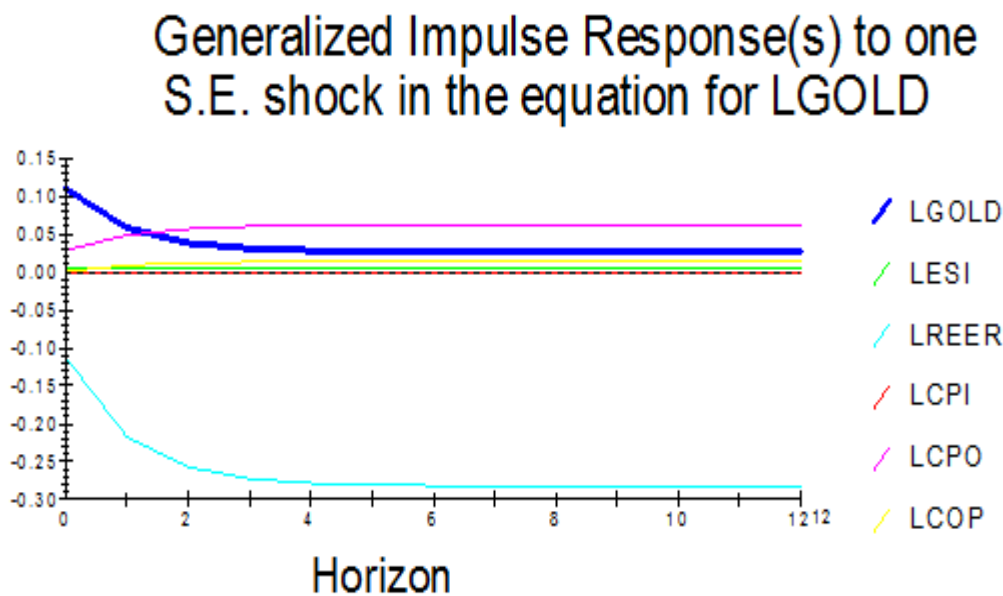


Figure-4. Generalized impulse response(s) to one SE shock in the equation for LGOLD
 Source: Output from Micro fit 4.1 software

Generalized Impulse Response(s) to one S.E. shock in the equation for LESI

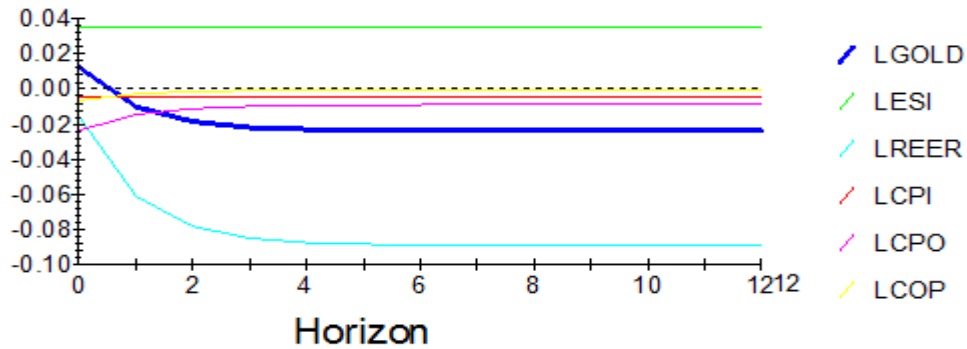


Figure-5. Generalized impulse response(s) to one SE shock in the equation for LESI

Source: Output from Micro fit 4.1 software

Generalized Impulse Response(s) to one S.E. shock in the equation for LCOP

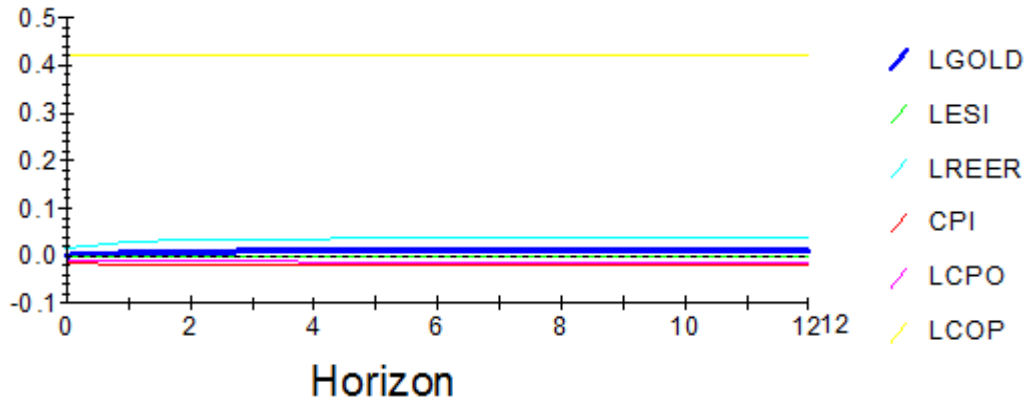


Figure-6. Generalized impulse response(s) to one SE shock in the equation for LCOP

Source: Output from Micro fit 4.1 software

viii) Persistence Profile (PP)

The step illustrates the situation if the entire co-integrating equation is shocked, then the speed of adjustment or the time horizon required for the system to get back to equilibrium. Therefore, in this situation, we allow the effects of system wide shock on the long run relations, instead of a variable specific shock in the case of IRF. In order to see how its work, the graph below shows the persistence profile of the cointegrating system.

Persistence Profile of the effect of a system-wide shock to CV'(s)

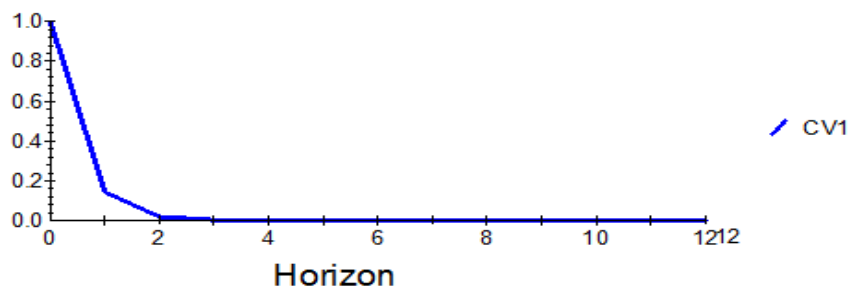


Figure-7. Persistence profile of the effect of a system-wide shock

Source: Output from Micro fit 4.1 software

The graph shows in figure 7 indicates that the cointegration will come back to equilibrium in approximately after three months, given external shocks to the cointegrating system.

5. CONCLUSION

Fluctuation in gold price especially like in our case study which we used Kijang Gold price is influence by global crude oil price, Malaysian crude palm oil, inflation rate, Malaysian Islamic stock market and real effective exchange rate. Then, the tendency of changes in global gold price are contributed by global inflation rate, exchange rate of US dollar, global crude oil price, global economic condition and demand and supply of this commodity itself. Therefore, for the future research, certain variables like global impact factors that not cover by us can be used to study in other perspective. Other than that, by using different analysis of data, incorporating longer sample period, covering other types of gold and Islamic stock markets and including other macroeconomic variables that may potentially affect gold price might enhance further analysis and implications of the study in this issue.

Overall, since the gold price will always increase in demand and the population of people increasing every year, therefore, it is worth to hold this precious metal as it contains an element of value-preserve asset. On the other hand, if the supply of the gold decrease as the gold is one of strategic commodity and be classified as precious metal, it is not impossible in future that this metal will become so expensive since the cost to get this metal is increasing from year to year.

As conclusion, our study will give contribution to the investors and investment portfolio managers that would fully benefit from the research in terms of selecting the investment avenue for their investment purpose. This is further to ensure that adding Islamic shariah equities and couple with commodities like crude oil price, crude palm oil in their investment portfolio will be more significant if they want to invest in Kijang Gold. Hence, in order to answer the question whether gold prices lead or lags Islamic stock market and others? And whether it can be used as hedging tool against inflation? The answer is the gold price lags the Islamic stock market in Malaysia and other variables included in our study and it unable to provide as a hedge against inflation rather than serve as diversification with crude oil price, Malaysian crude palm oil and Islamic stock market since move in opposite way with them (refer step 7 in appendix to see the graph depicted on each variables).

5.1. Policy Implication

According to Nicolau and Palomba (2015) the energy commodities are not only recognized as leading indicators of inflation (Pecchenino, 1992; Moosa, 1998; Browne and Cronin, 2010) but also for their role in formulating monetary policy (Awokuse and Yang, 2003). Theoretically, the role of gold is to hedge against inflation and exchange rate movements, and to diversify the risk in investment portfolios. However, in our study the result contradicts with the theory and the Kijang Gold prices is actually lags of all variables in the study. These findings reveal the answer on our question which is does the gold price leads or lags Islamic stock market and strategic commodity prices in Malaysia? Here, the Kijang Gold as a proxy of gold in Malaysia is lagging the Malaysian Islamic stock market (FTSE Bursa Malaysia Emas Shariah Index) and others. Then, since Kijang Gold prices lag other variables based on the less response on its own path and receive effect while market shock, it is more suitable to diversify it with Islamic stock market, crude palm oil and global crude oil price since strategic commodities (i.e. COP and CPO) able to hedge against inflation and Islamic stock market less influence by inflation.

In other way, Kijang Gold price move in opposite way with crude oil price, crude palm oil and Islamic stock market which can be more preferable for diversification in the short run since they will cointegrate in the long run based on our test in Johansen in previous step before. Thus, according to Baur and Lucey (2010) the market participants will buy gold on days of extreme negative returns and sell it quickly when they regain confidence and volatility is lower. They also concluded by opined that gold prices are supposed to become the attractive sector in time of negative stock market return. However, in our case, when there is market shock hit the Islamic stock market

(ESI), the large impact is only determined by their own lags and receive less impact from other variables, it also moves in opposite way with Kijang Gold and real effective exchange rate (REER) which is considering to be a good investment through diversification. Meanwhile, in respective of CPO and Kijang Gold price, one suggestion could be made here is, when market participants who have a bullish expectation on the CPO tend to expect that inflationary pressure will increase volatility in this type of gold price. Thus, they will turn their attention to CPO futures returns to predict CPO spot returns. In addition, based on our rigorous analysis, our humble suggestion to fund managers, current and potential investors of portfolio are they must consider all economic factors including Malaysia Islamic stock market (ESI) and strategic commodities (i.e. crude oil price and Malaysian palm oil) which able to influence Kijang Gold prices and forex market before making any investment decision.

5.2. Limitation of the Study

This study has limitations, specifically, it only focuses on spot Kijang Gold price as a proxy of gold price in Malaysia. Kijang Gold is among variety of investment avenues in Malaysia and we only selected certain variables as our focus and control variables to implement the lead-lag analysis and give suggestion on policy implication for this study. In reality there are several investment tools based on gold in Malaysia and each of it did not solely affect by similar factor. Different gold market price may come out with different variables that give or receive impact to or from each other. Another one more thing is, we also suffer from limited data availability and insufficient analysis for unit roots test as we only applied ADF test instead of couple with Philips-Perron (PP) test. Our limitation is because we used Micro fit 4.1 software which unable to provide PP test. The PP test tends to be more significant as it allows for corrections of possible autocorrelation and heteroscedasticity in the residuals of the regression on which test is based, which is normally found in time series technique. While ADF test only can correct the autocorrelation problem by removing the effect of autocorrelation. Therefore, we will take all of these constraints as our motivation to further this study beyond on our current particular scope as we believe different environment, will give different interesting findings.

Funding: This study received no specific financial support.

Competing Interests: The authors declare that they have no competing interests.

Contributors/Acknowledgement: We would like to extend our acknowledgment for the support given by Division of Research and Industrial Linkages, Universiti Teknologi MARA Melaka, Malaysia for supporting us with a guide and advice that make us capable of accomplishing this research paper.

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