Is gold a better choice as reserve currency for smaller market economies?

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Abstract

The objective of this paper is to statistically analyze whether gold is a better choice as reserve currency for smaller market economies using the Vector Auto Regression (VAR) model. This study involves the gold price movement relative to 5 selected equity indices price movement namely 3 in major market economies –DJIA in US, FTSE in UK, and NIKK in Japan – and 2 from the smaller emerging market economies – KLCI in Malaysia, and IRTS in Russia for a span of 15 years. This paper also attempts to identify the endogeneity and exogeneity of the variables under study. The policy implication from our study, in fact, answers our main research objective that YES, gold is a better currency in reserve baskets. And for this very reason also, there is a need to restore gold as the standard international payment system (Askari and Krichene, 2014). The usage of gold in the international Islamic gold standard serves as the natural foundation of money which safeguards against governments' debasement of money and inflationary deficits. It removes the major source of instability, which is interest-based credit and the major cycles of crisis it brings. Hence, only risk and uncertainty which are a part of nature, enterprise and investment remains.

Key words: Vector Auto Regression (VAR), gold, reserve currency, Dow Jones Industrial Average Index, FTSE 100 Index, Nikkei 225, Kuala Lumpur Composite Index, Malaysia

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1.0 Introduction: The Issue Motivating the Study

On September 18th 2015, Bloomberg news reported that Russia has increased its gold holdings to 42.4 million ounces from 41.4 million ounces in July this year. The news agency also reported that Russia has been "…steadily buying bullion even as international sanctions over the Ukrainian conflict and a plunge in oil prices contributed to a collapse in the ruble. Gold priced in rubles jumped 60 percent in the past year".

The above news led us to research for the gold reserve data from the World Bank database and to see for ourselves the growth of gold holdings by the Bank of Russia (RU). In addition, for the sake of comparison we extracted reserve data for 3 central banks of major advance economies, namely the Federal Reserve (US), Bank of England (UK) and Bank of Japan (JP), and 2 central banks of emerging market namely Bank Negara Malaysia (MY) and People's Bank of China (CN). The World Bank database gives us yearly data for Total reserves (includes gold, current US$) and Total reserves minus gold (current US$). By subtracting the former by the later we will get the gold reserve in current US$ value but in order to get the size of holding in troy ounce, we further divide the value by the year end closing price of gold provided by Thomson Reuters Eikon. Although some data dates back to the 60s, we are only interested to look at the growth of Gold in central bank reserves for the past 15 years. Below are the derived statistics we found.

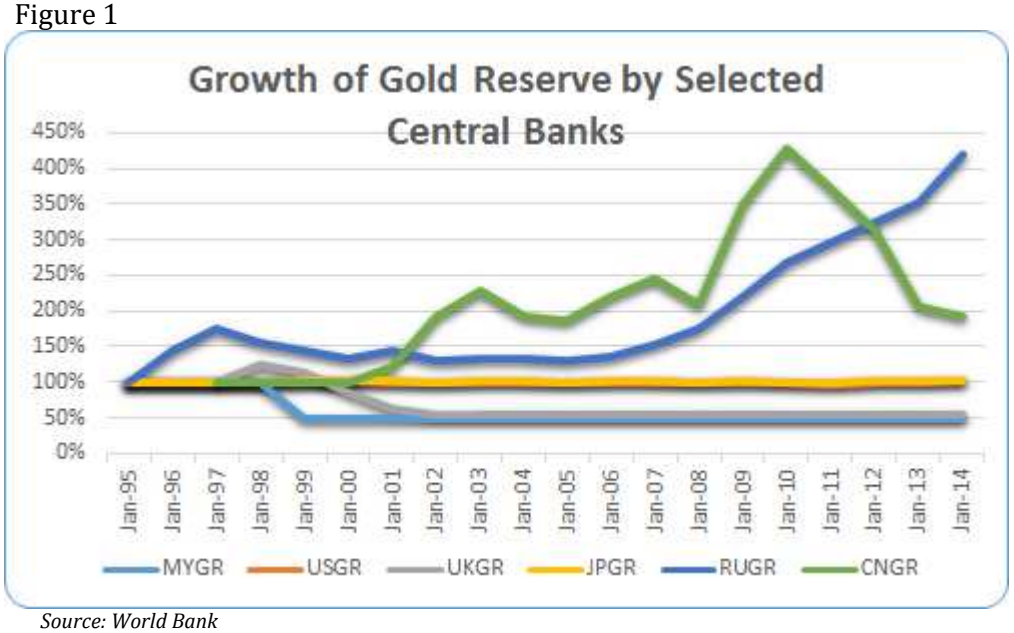
Table 1

COUNTRY	ITEM	1995	2014
US	Total reserves (includes gold, current US$)	175,995,515,363.47	434,416,453,479.96
	Gold Reserves (current US$)	101,214,022,000.00	315,367,705,033.38
	Gold/Total Reserve	57.5%	72.6%
	Gold Amount in Troy Ounce	261,636,350	266,459,131
UK	Total reserves (includes gold, current US$)	49,144,194,069.18	107,727,629,479.03
	Gold Reserves (current US$)	7,128,576,000.00	12,029,850,000.00
	Gold/Total Reserve	14.5%	11.2%
	Gold Amount in Troy Ounce	**18,427,235**	**10,164,209**
JP	Total reserves (includes gold, current US$)	192,619,745,041.46	1,260,680,415,997.38
	Gold Reserves (current US$)	9,369,935,312.75	29,670,542,929.25
	Gold/Total Reserve	4.9%	2.4%
	Gold Amount in Troy Ounce	24,221,107.00	25,069,108.00
RU	Total reserves (includes gold, current US$)	18,023,641,116.05	386,216,377,124.80
	Gold Reserves (current US$)	3,640,864,500.00	46,846,415,213.36
	Gold/Total Reserve	20.2%	12.1%
	Gold Amount in Troy Ounce	9,411,566.00	39,581,273.00
CN	Total reserves (includes gold, current US$)*	80,288,434,062.09	3,900,039,358,441.22
	Gold Reserves (current US$)	4,911,725,000.00	40,871,340,000.00
	Gold/Total Reserve	6.1%	1.0%
	Gold Amount in Troy Ounce	12,696,717.00	24,410,418.00
	** Data for China starts from 1997*		
MY	Total reserves (includes gold, current US$)	24,698,753,698.55	115,958,884,711.90
	Gold Reserves (current US$)	924,332,500.00	1,386,900,000.00
	Gold/Total Reserve	3.7%	1.2%
	Gold Amount in Troy Ounce	**2,389,382.00**	**1,171,814.00**

From the above table, it is evidenced that Russia and China have been accumulating their gold reserves for the past 15 years. The gold reserves for UK and Malaysia have been on a declining trend whilst no change in gold reserves have been observed for the US and Japan.

The normalised data for the gold reserves in troy ounce is best described by Figure 1 below. Although the amount of gold kept by the Bank of Russia is small compared to the Fed and BOJ, the fact that it has been increasing by more than 400% for the past 15 years motivates us to study the performance of gold against selected countries in major economies and emerging market economies.

Figure 1



Source: World Bank

This paper is organized as follows. Section 2 states the objective of this study. Section 3 presents the literature review associated with gold. Section 4 describes the data and methodology used. Section 5 discusses on the empirical results and lastly, Section 6 presents the concluding remark of this study.

2.0 The Objective of the Study

The main objective of this study is to find out if gold is a better choice as reserve currency in smaller market economies. Our study involves the gold price movement relative to 5 selected equity indices price movement namely 3 in major market economies –DJIA in US, FTSE in UK, and NIKK in Japan – and 2 from the smaller emerging market economies – KLCI in Malaysia, and IRTS in Russia. This study hopes to address the following additional questions:

- Is there a long-term theoretical relationship between gold and the selected indices?

- Is gold exogenous or endogenous?
- Which one of the indices are exogenous and which one are endogenous?

3.0 Literature Review

The Modern Portfolio Theory advocates blending asset classes to maximize expected return and minimize portfolio volatility. Portfolios constructed according to these specifications have their risk-return ratio on the Efficient Frontier, a curve depicting the best possible risk-return combinations of asset allocations. Unfortunately, assets with low expected returns and high volatility such as gold are not part of the efficient frontier. Accordingly, gold is seen as a store of value instead of an investment. It rises and fall with global fears. Below are the various research we found in relation to gold.

Malliaris and Malliaris (2011) studied the relationship between oil, gold and the euro employing 2 different techniques – VAR and Neural Network methodology - to determine if there is any long term causality between the three. Under the VAR model they failed to prove any relationship implying that all the three markets are interdependent of each other. Interestingly however, they managed to prove that there exist a relationship between the three variables. Gold is found as the best predicting variable for the euro in addition to its (euro) lagged values.

Ibrahim, M. (2012) examined the relationship between gold return and stock market return of Malaysia and whether its relation changes in times of consecutive negative market returns. He found that there is a "significant positive relation between gold return and once-lagged stock return" and that "the coefficient of the once-lagged stock return in the gold return equation is small and far from unity." He also discovered that the positive co-movement of gold and stock returns reverses itself in four consecutive stock market returns within his study horizon.

Yang and Hamori (2014) conducted a research on the relationship of gold and 3 currencies namely, GBP, EUR and JPY. The finding suggests that the dependence structure between the gold price and the exchange rate is asymmetric. A rise in the gold price will depreciate a currency's value more compared to the appreciation in the currency's value due to a decrease in the gold price.

Wang et al. (2013) conducted a study to find out if gold can act as inflation hedge in the US and Japan. They found that in the long-run gold effectively hedges against inflation in the US but only partially hedge against inflation in Japan when price adjustment is in the high-momentum regime. When price adjustment is in the low momentum, gold is unable to hedge against inflation for both countries.

Singh and Kishore (2014) investigated on the relationship of gold price movement with the Indian Nifty Index. The correlation and co-integration test conducted by them established that there is no relation between gold prices and stock returns in the long-run period. The high gold price and falling stock market have no connection, as the rise of one and fall of the other may be due to other reasons and that the movement is just a coincidence.

Gutiérrez et al. (2013) research on the gold price cycle revealed that gold prices behave cyclically in relation to stock market indexes, as was seen in the case of the Dow Gold ratio or DJIA/GF. They mentioned that gold are very volatile to be predicted with accuracy in the long term.

Baur and Mcdermott (2010) researched on the role of gold as safe haven. They used a sample data spanning a 30 year period from 1979-2009 which revealed that gold is both a hedge and a safe haven for major European stock markets and the US but not for Australia, Canada, Japan and large emerging markets such as the BRIC countries.

Miyazaki and Hamori (2014) investigates the causal relationships between gold and S&P 500 stock market performance or uncertainty by employing non-uniform weighting cross-correlations. They made an interesting finding that there exist unidirectional causality in mean from stock to gold, but no causality in variance between the two. Their data were divided into pre- and post-current financial crisis. The former period revealed bidirectional causality in mean between gold and stock whilst the latter period there exists only a unilateral causality in mean and variance from stock to gold. They also conclude that the findings imply that flight-to-quality has occurred during the recent financial turmoil.

Hoang (2010) studies the return of investment in gold assets quoted at the Paris stock exchange during 54 years, from 1950 to 2003. He attributed the closure of Paris Stock Exchange Gold market in 2004 due to the negative real return in the asset. He concluded that when the political, economic, and social environments are more secure, the new generation of investors turn their interest in risky assets with more potential returns than in gold.

Lawrence (2003) conducted studies on gold and macroeconomic variables using the VAR model and made four findings: 1) there is no statistically significant correlation between returns on gold and changes in macroeconomic variables such as GDP, inflation and interest rates; 2) Returns on financial assets such as the Dow Jones Industrial Average Index, Standard & Poor's 500 index and 10-year US government bonds are correlated with changes in macroeconomic variables; 3) Changes in macroeconomic variables have a much stronger impact on other commodities (such as aluminium, oil and zinc) than they do on gold; and, 4) Returns on gold are less correlated with returns on equity and bond indices than are returns on other commodities. He used gold price

and US macroeconomic and financial market quarterly data from January 1975 to December 2001. He concludes that his findings support the notion that gold may be an effective portfolio diversifier.

Baur and Lucey (2010) analysed the constant and time-varying relations between U.S., U.K., and German stock, bond, and gold returns to see if gold can serve as a hedge and safe haven. They found that gold is a hedge against stocks but not bonds on average and a safe haven in extreme stock market conditions for a limited time.

Iscan (2014) investigates whether there is a co-integration between the stock prices and commodity prices in Turkey. He was unable to find evidence that commodity prices affect the stock prices and implied that a boom or a recession in the global economy increases or decreases the commodity prices but this rise or decline does not affect the stock markets.

From the literature review provided, there seems to be some mixed of findings whether the relationship of gold and stock market exists. For this reason, we decided to conduct our own investigation on this matter.

4.0 Data and Methodology

This study employs the Vector Auto Regression (VAR) model for multivariate time series. The list of the variables used in this study is listed in Table 1 below.

Table 1

Variables	Code	Description	Source
Gold	GOLD	Gold price XAU	Thomson Reuters Eikon
Dow Jones Industrial Average	DJIA	US Equity Index	Thomson Reuters Eikon
FTSE 100	FTSE	UK Equity Index	Thomson Reuters Eikon
Nikkei 225	NIKK	Japan Equity Index	Thomson Reuters Eikon
Kuala Lumpur Composite Index	KLCI	Malaysia Equity Index	Thomson Reuters Eikon
Russia Trading System	IRTS	Russia Equity Index	Thomson Reuters Eikon

The data used in this study are monthly data starting from December 1995 till November 2015 totalling 240 observations. Since the Russia Index (IRTS) only started in n1995, any earlier data observations were not possible. We were also unable to include China in our study due to insufficient data points. The popular Shanghai index, CSI 300, was established only later in 2005.

5.0 Empirical Results and Discussion

We conducted unit root test on each of the variables to see whether they are stationary or non-stationary at the level form and at differenced form. ADF test result shown in Table 2 and 3

revealed that all our variables are non-stationary in level form and stationary in differenced form i.e. I(1).

Table 2

	VARIABLE	ADF	VALUE	T-STAT.	C.V.	RESULT
LOG FORM ADF	LGOLD	ADF(1)=AIC	377.6835	- 1.7632	- 3.4302	Non-Stationary
		ADF(1)=SBC	370.7720	- 1.7632	- 3.4302	Non-Stationary
	LKLCI	ADF(1)=SBC	298.9489	- 3.4365	- 3.4302	Stationary
		ADF(4)=AIC	307.2316	- 3.2005	- 3.4302	Non-Stationary
	LDJIA	ADF(1)=AIC	399.6374	- 2.6508	- 3.4302	Non-Stationary
		ADF(1)=SBC	392.7268	- 2.6508	- 3.4302	Non-Stationary
	LFTSE	ADF(1)=SBC	406.5722	- 2.3905	- 3.4302	Non-Stationary
		ADF(4)=AIC	413.6685	- 2.6993	- 3.4302	Non-Stationary
	LNIKK	ADF(1)=AIC	335.1438	- 1.5347	- 3.4302	Non-Stationary
		ADF(1)=SBC	328.2332	- 1.5347	- 3.4302	Non-Stationary
	LIRTS	ADF(1)=AIC	129.4905	- 1.8711	- 3.4302	Non-Stationary
		ADF(1)=SBC	122.5798	- 1.8711	- 3.4302	Non-Stationary

Table 3

	VARIABLE	ADF	VALUE	T-STAT.	C.V.	RESULT
1ST DIFF. FORM ADF	LGOLD	ADF(1)=AIC	375.5529	- 12.0344	- 2.8740	Stationary
		ADF(1)=SBC	370.3763	- 12.0344	- 2.8740	Stationary
	LKLCI	ADF(1)=SBC	295.0431	- 8.7206	- 2.8740	Stationary
		ADF(3)=AIC	301.8321	- 8.4120	- 2.8740	Stationary
	LDJIA	ADF(1)=AIC	395.2958	- 11.2774	- 2.8740	Stationary
		ADF(1)=SBC	390.1193	- 11.2774	- 2.8740	Stationary
	LFTSE	ADF(1)=SBC	404.0921	- 10.9365	- 2.8740	Stationary
		ADF(3)=AIC	409.5713	- 6.5250	- 2.8740	Stationary
	LNIKK	ADF(1)=AIC	332.0184	- 9.5840	- 2.8740	Stationary
		ADF(1)=SBC	326.8419	- 9.5840	- 2.8740	Stationary
	LIRTS	ADF(1)=SBC	124.1701	- 10.3673	- 2.8740	Stationary
		ADF(2)=AIC	129.4853	- 8.0160	- 2.8740	Stationary

The PP test conducted on the variables (Table 4) confirmed the ADF test above. KPSS test, however, gave us contradictory findings but we decided to ignore it and be satisfied with the ADF and PP test results.

Table 4

	VARIABLE	T-STAT.	C.V.	RESULT
LOG FORM PP	LGOLD	- 2.0611	- 3.4298	Non-Stationary
	LKLCI	- 2.2635	- 3.4298	Non-Stationary
	LDJIA	- 2.8850	- 3.4298	Non-Stationary
	LFTSE	- 2.7263	- 3.4298	Non-Stationary
	LNIKK	- 1.5068	- 3.4298	Non-Stationary
	LIRTS	- 1.7854	- 3.4298	Non-Stationary

	VARIABLE	T-STAT.	C.V.	RESULT
1ST DIFF. FORM PP	LGOLD	- 17.7301	- 2.8738	Stationary
	LKLCI	- 12.6676	- 2.8738	Stationary
	LDJIA	- 15.0754	- 2.8738	Stationary
	LFTSE	- 15.4659	- 2.8738	Stationary
	LNIKK	- 13.9791	- 2.8738	Stationary
	LIRTS	- 12.1061	- 2.8738	Stationary

Next, we performed hypothesis testing and lag order in our VAR model. This test is to find out how many lags possible for the combination of variables that we have chosen. Our test revealed the following (Table 5).

Table 5

Order	LL	AIC	SBC	LR	test	Adjusted LR Test
6	2351.6	2129.6	1746.6	------	------	
5	2326.1	2140.1	1819.2	CHSQ(36)=	50.9943[.050]	42.8965[.199]
4	2308.5	2158.5	1899.6	CHSQ(72)=	86.3429[.119]	72.6318[.457]
3	2274.5	2160.5	1963.8	CHSQ(108)=	154.3071[.002]	129.8034[.075]
2	2255.7	2177.7	2043.1	CHSQ(144)=	191.8368[.005]	161.3735[.153]
1	2237.7	2195.7	2123.2	CHSQ(180)=	227.8665[.009]	191.6817[.262]
0	2199.1	2193.1	2182.7	CHSQ(216)=	305.1462[.000]	256.6895[.030]

Both Akaike information criterion (AIC) and Schwarz Bayesian criterion (SBC) point to VAR lag order of 1. And at the same time, adjusted LR test revealed that at p-value more than 5% causing us to accept the H_A that the lag order is 1. We then test for autocorrelation for each of the variables and found that two out of six variables in our study has serial correlation problem (Table 6).

Table 6

	GOLD	KLCI	DJIA	FTSE	NIKK	IRTS
CHSQ(12)	21.0408[.050]	51.0804[.000]	10.5168[.571]	15.2874[.226]	10.2977[.590]	14.6109[.263]
Serial Correlation	Yes	Yes	No	No	No	No

We take note of this limitation and keep in mind that we will run the co-integration test with lag 1 and also test for the next available lag that would give us at least 1 co-integration result that would reduce the serial correlation in our 2 variables.

In testing the co-integration of the variables in our study, we applied first and foremost the Engle Granger Univariate OLS test. The result came out negative for co-integration (Table 7).

Table 7

ADF	VALUE	T-STAT.	C.V.	RESULT	REMARK
ADF(4)=AIC	211.4467	- 3.1749	- 4.7782	Non-stationary	No Cointegration
ADF(2)=SBC	205.4462	- 4.1867	- 4.7782	Non-stationary	No Cointegration

Nevertheless, we decided to proceed with Johansen-Juselius test based on the Maximum Likelihood for Trace statistic and Maximum Eigenvalue statistic to check for co-integration and found that there is at least 1 co-integration exist between the variables with VAR lag order of 1 (Table 8).

Table 8

JOHANSEN TEST at VAR Lag Order 1

Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix

Null	Alternative	Statistic	95% Critical Value	90% Critical Value	Result
r = 0	r = 1	49.9323	43.61	40.76	NA
r<= 1	r = 2	20.8959	37.86	35.04	1 cointegration

Cointegration LR Test Based on Trace of the Stochastic Matrix

Null	Alternative	Statistic	95% Critical Value	90% Critical Value	Result
r = 0	r>= 1	112.4624	115.85	110.60	No Cointegration

In addition, to avoid auto-correlation problem associated with VAR lag order of one, we also ran a simulation with other lag order. VAR lag order of 2 showed no co-integration but at lag order of 3 the results revealed that there is at least 1 co-integration (Table 9).

Table 9

JOHANSEN TEST at VAR Lag Order 3

Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix

Null	Alternative	Statistic	95% Critical Value	90% Critical Value	Result
r = 0	r = 1	61.3910	43.61	40.76	NA
r<= 1	r = 2	25.9936	37.86	35.04	1 cointegration

Cointegration LR Test Based on Trace of the Stochastic Matrix

Null	Alternative	Statistic	95% Critical Value	90% Critical Value	Result
r = 0	r>= 1	125.5710	115.85	110.60	NA
r<= 1	r = 2	64.180	87.170	82.880	1 cointegration

Testing for LRSM, the exact identification and the over identification tests gave us the following results in Table 10. In exact identification (Panel A), the negative coefficient for variable LKLCI, LFTSE and LIRTS are as per our expectation but we were surprised to find that statistically our variable DJIA and DNIKK had positive coefficients. Recall that, theoretically, the performance of stock indices are expected to be the inversed of gold movement. When times are good, liquidity is ample, and confidence level is high in the market, investors relax their risk expectation and are willing to invest in riskier assets such as equity market. On the other hand, when times are bad and liquidity is scarce, there will be flight-to-quality and one of the assets perceived to provide such safety is gold.

Table 10

VAR Lag Order of 1	EXACT IDENTIFICATION	OVER IDENTIFICATION				
VRBL	**PANEL A**	**PANEL B**	**PANEL C**	**PANEL D**	**PANEL E**	**PANEL F**
LGOLD	1.0000 (*NONE*)	1.0000 (*NONE*)	1.0000 (*NONE*)	1.0000 (*NONE*)	1.0000 (*NONE*)	1.0000 (*NONE*)
LKLCI	-1.1304 (0.18612)	0.0000 (*NONE*)	-1.8037 (0.34865)	-1.6186 (0.35785)	-0.98643 (0.24684)	-1.6727 (0.32446)
LDJIA	1.5127 (0.35056)	3.2383 (1.2647)	0.0000 (*NONE*)	0 .30779 (0.39356)	1.7917 (0.49248)	1.4551 (0.41528)
LFTSE	-1.2607 (0.32357)	-2.3277 (0.78487)	-0.17755 (0.38121)	0.0000 (*NONE*)	-0.98255 (0.48310)	-0.96536 (0.40701)
LNIKK	0.49869 (0.14734)	-0.036132 (0.68531)	0 .81811 (0.26536)	0.59885 (0 .26831)	0.0000 (*NONE*)	0.40948 (0.18466)
LIRTS	-0.037413 (0.047952)	-0.24822 (0.24030)	-0.020571 (0.094041)	-0.017121 (0.087120)	-0.076925 (0.069702)	0.0000 (*NONE*)
Trend	-0.0052590 (0.0016585)	-0.012614 (0.0035405)	0.0019077 (0.0023113)	-0.0003925 (0.0029412)	-0.0067473 (0.0021704)	-0.0021076 (0.0025594)
CHSQ(1)	**NONE**	**28.6934[.000]**	**7.6514[.006]**	**7.3324[.007]**	**10.5201[.001]**	**0.041108[.839]**

s.e. in parentheses

From panel A, the estimated long run co-integration between the selected variables is reflected by below relationship.

GOLD - 1.1304KLCI + 1.5127DJIA - 1.2607FTSE + 0.49869NIKK - 0.037413IRTS - 0.0052590

Panel B, C, D, E and F showed the results of different combination of restrictions imposed on our variables required in the over identification test. Among the 4 panels, we accept Panel E since the p-value exceeds critical value of 5% and we are not able to reject the H_0 that the Restriction imposed is correct. It reiterated the findings in Panel A.

Table 11

	LKLCI	LDJIA	LFTSE	LNIKK	LIRTS
T-test	6.0735	4.3151	3.8962	3.3846	0.7802
Remark	Significant	Significant	Significant	Significant	Insignificant

We computed t-test manually by dividing the coefficient with the standard error for each of the variables except for GOLD. It seems that all our variables are significant in this co-integration except for IRTS (Table 11).

Subsequently, we ran the same LRSM test using VAR lag order of 3. We wanted to know if the coefficients for our variables change with the order of lag. Results are shown in Table 12 below.

Table 12

VAR Lag Order of 3	EXACT IDENTIFICATION	OVER IDENTIFICATION				
VRBL	**PANEL A**	**PANEL B**	**PANEL C**	**PANEL D**	**PANEL E**	**PANEL F**
LGOLD	1.0000 (*NONE*)	1.0000 (*NONE*)	1.0000 (*NONE*)	1.0000 (*NONE*)	1.0000 (*NONE*)	1.0000 (*NONE*)
LKLCI	-1.4848 (0.26261)	0.0000 (*NONE*)	-2.4313 (0.56773)	-2.1361 (0.53677)	-1.5868 (0.47913)	-1.6067 (0.28820)
LDJIA	1.3731 (0.36094)	NA	0.0000 (*NONE*)	0.38150 (0.42930)	1.5372 (0.57946)	1.3359 (0.39366)
LFTSE	-1.1394 (0.34412)	NA	-0.14206 (0.45176)	0.0000 (*NONE*)	-0.69414 (0.58460)	-1.0827 (0.37315)
LNIKK	0.51609 (0.16095)	NA	0.79959 (0.30784)	0.55612 0.29233	0.0000 (*NONE*)	0.54992 (0.17435)
LIRTS	-0.061151 (0.055287)	NA	-0.054046 (0.11242)	-0.043192 (0.10031)	-0.082950 (0.093430)	0.0000 (*NONE*)
Trend	-0.0023598 (0.0021483)	NA	0.0064562 (0.00378610)	0.0031856 (0.0041319)	-0.0023459 (0.0036143)	-0.0023308 (0.0023492)
CHSQ(1)	**NONE**	**NA**	**5.8218[.016]**	**5.2520[.022]**	**8.1761[.004]**	**1.1233[.289]**

s.e. in parentheses

From the table 12 above, we observed that with a higher VAR order of lag 3, the coefficient signs for LKLCI, LDJIA, LFTSE, LNIKK and LIRTS are still intact. The restriction imposed in Panel F yields the same result as in VAR with lag order 1. With p-value exceeding 5%, we cannot reject that H_o as restriction is correct. Another thing to note is that we were aware that there is a possible structural break in our data. This is because throughout the past 15 year horizon, our variables suffer from market anomalies such as the Asian Financial Crisis in 1997 and Financial Market crisis in 2008. The correct approach is to divide the dataset into two and run the regression on each of the datasets but unfortunately we were constraint by the availability of data. Nevertheless, we had introduced a dummy variable (D2008) to our dataset and run the same tests of VAR lag order, co-integration Engle Granger and Johansen tests and they exhibit the similar results we found without the dummy. The LRSM exact identification tests are revealed in Table 13.

Table 13

VAR Lag Order of 1	EXACT IDENTIFICATION
VRBL	**PANEL A**
LGOLD	1.0000 (*NONE*)
LKLCI	-1.1939 (0.24045)
LDJIA	1.3513 (0.51698)
LFTSE	-1.1947 (0.37046)
LNIKK	0.52591 (0.16712)
LIRTS	-0.047331 (0.054629)
D2008	-0.0071442 (0.18684)
Trend	-0.0043690 (0.0025979)
CHSQ(1)	**NONE**

s.e. in parentheses

VAR Lag Order of 3	EXACT IDENTIFICATION
VRBL	**PANEL A**
LGOLD	1.0000 (*NONE*)
LKLCI	-1.5287 (0.34962)
LDJIA	1.4929 (0.49956)
LFTSE	-1.2151 (0.40643)
LNIKK	0.49759 (0.19080)
LIRTS	-0.11523 (0.079624)
D2008	0.32401 (0.26705)
Trend	-0.0017803 (0.0032016)
CHSQ(1)	**NONE**

s.e. in parentheses

The t-test for the dummy variable showed that it is not significant and that we could proceed with VAR causality tests. By now, we know that 4 of our variables are co-integrated to a significant degree. It will be very interesting to see which ones are exogenous and which ones are endogenous. In the following Vector Error Correction Model (VECM) test, we conduct simulation on the error term. This test revealed two parts – a) the speed of adjustment for each of the variables to adjust back to equilibrium if it is singly shocked and also; 2) the endogeneity and exogeneity of the variables. Our results revealed the below tables for VAR lag order of 1 and 3.

Table 14

VECM at VAR Lag Order 1						***DIAGNOSTICS***			
ecm1(-1)	**Coefficient**	**Standard Error**	**T-Ratio [Prob.]**	**C.V.**	**Result**	**CH(12) SC**	**CH(1) FF**	**CH(2) N**	**CH(1) H**
dLGOLD	-0.039427	0.018309	-2.1535[.032]	5%	Endogenous	16.3072[0.178]	0.31364[0.575]	5.1141[0.078]	0.54095[0.462]
dLKLCI	0.062223	0.025582	2.4323[.016]	5%	Endogenous	44.9316[0.000]*	0.050862[0.822]	251.3067[0.000]*	49.9302[0.000]*
dLDJIA	-0.014993	0.016821	-0.89133[.374]	5%	**Exogenous**	9.6253[0.649]	0.20349[0.652]	37.2910[0.000]*	0.067647[0.795]
dLFTSE	-0.0070762	0.015821	-0.44728[.655]	5%	**Exogenous**	8.1411[0.774]	0.053375[0.817]	23.6924[0.000]*	1.0396[0.308]
dLNIKK	-0.018777	0.022250	-0.84393[.400]	5%	**Exogenous**	9.5585[0.655]	1.6489[0.199]	30.2071[0.000]*	3.8959[0.048]
dLIRTS	-0.228770	0.053243	-4.2968[.000]	5%	Endogenous	17.7872[0.122]	2.3218[0.128]	115.8723[0.000]*	46.6593[0.000]*

Note: Standard error in parenthesis (). P-Values in brackets [], Serial Correlation (SC), Functional Form (FF), Normality (N), Heteroskedasticity (H)
** 5% levels*

Table 15

VECM at VAR Lag Order 3						***DIAGNOSTICS***			
ecm1(-1)	**Coefficient**	**Standard Error**	**T-Ratio [Prob.]**	**C.V.**	**Result**	**CH(12) SC**	**CH(1) FF**	**CH(2) N**	**CH(1) H**
dLGOLD	0.0034964	0.014466	.24171[.809]	5%	**Exogenous**	18.2038[0.110]	.22957[0.632]	7.5972[.022]	.70211[0.402]
dLKLCI	0.079609	0.019712	4.0386[.000]	5%	Endogenous	32.2763[0.001]*	9.9652[0.002]*	119.36320[.000]*	4.6407[0.031]*
dLDJIA	-0.012473	0.013403	-.93068[.353]	5%	**Exogenous**	7.0696[0.853]	2.4440[0.118]	33.8338[0.000]*	0.14672[.702]
dLFTSE	-0.011052	0.012728	-.86836[.386]	5%	**Exogenous**	6.1287[0.909]	1.3966[0.237]	18.8163[0.000]*	0.10233[0.749]
dLNIKK	0.0058008	0.017798	.32592[.745]	5%	**Exogenous**	10.2605[0.593]	13.6643[0.000]*	14.5159[0.001]*	20.0835[0.000]*
dLIRTS	-0.1539	0.041295	-3.7269[.000]	5%	Endogenous	12.6835[0.392]	2.6579[0.103]	81.2358[0.000]*	10.9401[0.001]*

Note: Standard error in parenthesis (). P-Values in brackets [], Serial Correlation (SC), Functional Form (FF), Normality (N), Heteroskedasticity (H)
** 5% levels*

Comparing between VECM table 14 and 15 above, we are inclined to favour the former with VAR lag order of 1. This is because we strongly feel that the gold movement is induced by fear in the market and hence its endogeneity trait. Looking at the variables t-ratios, we confirm that three variables in our studies – DJIA, FTSE, NIKK – exhibit exogenous trait whilst the rest – GOLD, KLCI, IRTS – exhibit endogenous trait. More interesting is that in table 14, all the variables are seen to adjust itself in the short run to achieve long run equilibrium except for KLCI. FTSE demonstrates the fastest speed of adjustment to equilibrium when presented with variable specific shock whilst, IRTS demonstrates the slowest speed of adjustment to equilibrium amongst the variables. The diagnostics for KLCI shows that the variable proves significant in all four diagnostic tests. When regressed, dependent variable KLCI seems to have problem with serial correlation, functional form, normality and heteroskedasticity involving its error term. If these problems are not rectified, the model will not be well specified.

Now that we have successfully identified the endogenous variables from the exogenous variables, we pose question about the ranking among the two groups. This ranking will be very helpful in the sense that it will assist us in estimating the outcome if the equilibrium relationship among the

six variables are disturbed. For this purpose, we proceed with a technique called Variance Decomposition (VDC). Essentially this technique helps us to discover the amount of information each variable contributes to the other variables in the auto-regression. It determines how much of the forecast error variance of each of the variables can be explained by exogenous shocks to the other variables. Since our data is monthly data, we instruct Microfit to project the movement of our variables for the next 60 months. Table 16 and 17 consist the results for both Generalized VDC and Orthogonalized VDC.

Table 16

	HORIZON	LGOLD	LKLCI	LDJIA	LFTSE	LNIKK	LIRTS	TOTAL	SELF-DEP	RANKING
LGOLD	12	87.32%	10.72%	0.09%	0.34%	0.17%	1.36%	100.00%	87.32%	1
LKLCI	12	5.25%	48.36%	15.93%	8.05%	9.40%	13.00%	100.00%	48.36%	3
LDJIA	12	0.15%	10.86%	39.51%	26.80%	11.49%	11.19%	100.00%	39.51%	6
LFTSE	12	0.01%	6.84%	27.06%	42.64%	11.82%	11.63%	100.00%	42.64%	5
LNIKK	12	0.05%	7.09%	16.09%	16.20%	50.77%	9.81%	100.00%	50.77%	2
LIRTS	12	1.55%	26.39%	8.78%	12.94%	3.71%	46.62%	100.00%	46.62%	4

	HORIZON	LGOLD	LKLCI	LDJIA	LFTSE	LNIKK	LIRTS	TOTAL	SELF-DEP	RANKING
LGOLD	24	81.32%	15.78%	0.13%	0.51%	0.37%	1.89%	100.00%	81.32%	1
LKLCI	24	7.73%	43.12%	17.43%	7.91%	11.28%	12.53%	100.00%	43.12%	4
LDJIA	24	0.25%	11.81%	38.81%	26.77%	11.00%	11.36%	100.00%	38.81%	6
LFTSE	24	0.01%	7.25%	26.83%	42.61%	11.57%	11.73%	100.00%	42.61%	5
LNIKK	24	0.10%	8.01%	15.84%	16.35%	49.63%	10.07%	100.00%	49.63%	2
LIRTS	24	2.64%	30.93%	7.39%	12.41%	2.53%	44.09%	100.00%	44.09%	3

	HORIZON	LGOLD	LKLCI	LDJIA	LFTSE	LNIKK	LIRTS	TOTAL	SELF-DEP	RANKING
LGOLD	36	78.37%	18.27%	0.15%	0.59%	0.47%	2.14%	100.00%	78.37%	1
LKLCI	36	9.00%	40.56%	18.14%	7.82%	12.20%	12.28%	100.00%	40.56%	5
LDJIA	36	0.29%	12.24%	38.50%	26.75%	10.78%	11.44%	100.00%	38.50%	6
LFTSE	36	0.01%	7.43%	26.72%	42.59%	11.46%	11.78%	100.00%	42.59%	4
LNIKK	36	0.13%	8.43%	15.73%	16.42%	49.10%	10.19%	100.00%	49.10%	2
LIRTS	36	3.12%	32.74%	6.84%	12.18%	2.09%	43.02%	100.00%	43.02%	3

	HORIZON	LGOLD	LKLCI	LDJIA	LFTSE	LNIKK	LIRTS	TOTAL	SELF-DEP	RANKING
LGOLD	48	76.74%	19.64%	0.17%	0.64%	0.53%	2.28%	100.00%	76.74%	1
LKLCI	48	9.72%	39.12%	18.54%	7.77%	12.72%	12.14%	100.00%	39.12%	5
LDJIA	48	0.32%	12.47%	38.33%	26.74%	10.66%	11.48%	100.00%	38.33%	6
LFTSE	48	0.02%	7.53%	26.66%	42.58%	11.40%	11.80%	100.00%	42.58%	3
LNIKK	48	0.15%	8.66%	15.66%	16.45%	48.82%	10.25%	100.00%	48.82%	2
LIRTS	48	3.37%	33.65%	6.57%	12.06%	1.87%	42.47%	100.00%	42.47%	4

	HORIZON	LGOLD	LKLCI	LDJIA	LFTSE	LNIKK	LIRTS	TOTAL	SELF-DEP	RANKING
LGOLD	60	75.73%	20.49%	0.17%	0.67%	0.57%	2.37%	100.00%	75.73%	1
LKLCI	60	10.17%	38.21%	18.79%	7.74%	13.05%	12.05%	100.00%	38.21%	6
LDJIA	60	0.33%	12.61%	38.22%	26.74%	10.59%	11.50%	100.00%	38.22%	5
LFTSE	60	0.02%	7.59%	26.63%	42.58%	11.36%	11.82%	100.00%	42.58%	3
LNIKK	60	0.16%	8.80%	15.63%	16.48%	48.65%	10.29%	100.00%	48.65%	2
LIRTS	60	3.52%	34.19%	6.41%	11.99%	1.74%	42.15%	100.00%	42.15%	4

Table 17

	Horizon	LGOLD	LKLCI	LDJIA	LFTSE	LNIKK	LITRS	TOTAL	SELF-DEP	RANKING
LGOLD	12	91.5%	4.8%	1.9%	0.9%	0.9%	0.0%	100.0%	91.51%	1
LKLCI	12	9.8%	84.7%	2.8%	1.4%	1.3%	0.0%	100.0%	84.71%	2
LDJIA	12	0.4%	28.4%	70.9%	0.1%	0.1%	0.0%	100.0%	70.94%	3
LFTSE	12	0.0%	16.3%	47.2%	36.5%	0.0%	0.0%	100.0%	36.47%	6
LNIKK	12	0.1%	14.3%	19.0%	3.5%	63.1%	0.0%	100.0%	63.11%	4
LITRS	12	2.6%	47.6%	1.5%	7.7%	0.5%	40.1%	100.0%	40.14%	5

	Horizon	LGOLD	LKLCI	LDJIA	LFTSE	LNIKK	LITRS	TOTAL	SELF-DEP	RANKING
LGOLD	24	84.9%	8.6%	3.3%	1.6%	1.6%	0.0%	100.0%	84.88%	1
LKLCI	24	14.7%	75.0%	5.2%	2.6%	2.5%	0.0%	100.0%	74.99%	2
LDJIA	24	0.6%	31.3%	67.6%	0.2%	0.2%	0.0%	100.0%	67.60%	3
LFTSE	24	0.0%	17.3%	45.7%	36.9%	0.1%	0.0%	100.0%	36.94%	5
LNIKK	24	0.2%	16.5%	17.7%	4.0%	61.6%	0.0%	100.0%	61.62%	4
LITRS	24	4.1%	52.5%	0.8%	8.6%	1.0%	33.0%	100.0%	32.98%	6

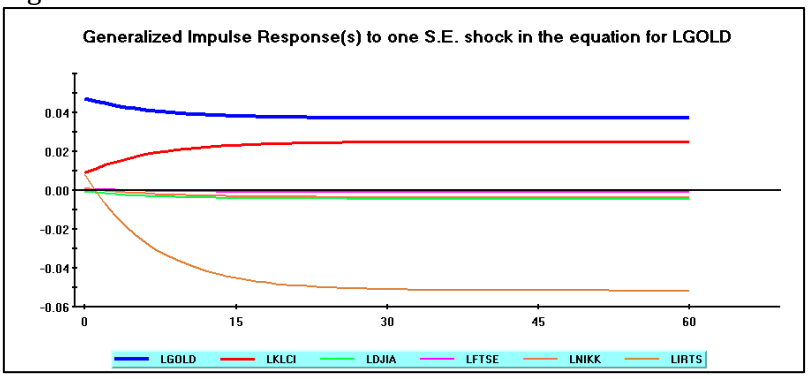
	Horizon	LGOLD	LKLCI	LDJIA	LFTSE	LNIKK	LITRS	TOTAL	SELF-DEP	RANKING
LGOLD	36	81.5%	10.5%	4.0%	2.0%	1.9%	0.0%	100.0%	81.52%	1
LKLCI	36	17.2%	69.9%	6.5%	3.3%	3.1%	0.0%	100.0%	69.88%	2
LDJIA	36	0.7%	32.6%	66.1%	0.3%	0.3%	0.0%	100.0%	66.07%	3
LFTSE	36	0.0%	17.8%	45.0%	37.1%	0.1%	0.0%	100.0%	37.15%	5
LNIKK	36	0.3%	17.5%	17.1%	4.3%	60.9%	0.0%	100.0%	60.91%	4
LITRS	36	4.7%	54.2%	0.6%	9.0%	1.2%	30.3%	100.0%	30.32%	6

	Horizon	LGOLD	LKLCI	LDJIA	LFTSE	LNIKK	LITRS	TOTAL	SELF-DEP	RANKING
LGOLD	48	79.7%	11.6%	4.4%	2.2%	2.1%	0.0%	100.0%	79.67%	1
LKLCI	48	18.6%	67.0%	7.3%	3.6%	3.5%	0.0%	100.0%	66.97%	2
LDJIA	48	0.8%	33.3%	65.2%	0.3%	0.3%	0.0%	100.0%	65.25%	3
LFTSE	48	0.0%	18.0%	44.6%	37.3%	0.1%	0.0%	100.0%	37.26%	5
LNIKK	48	0.3%	18.1%	16.7%	4.4%	60.5%	0.0%	100.0%	60.52%	4
LITRS	48	5.0%	54.9%	0.6%	9.2%	1.3%	29.0%	100.0%	29.03%	6

	Horizon	LGOLD	LKLCI	LDJIA	LFTSE	LNIKK	LITRS	TOTAL	SELF-DEP	RANKING
LGOLD	60	78.5%	12.2%	4.7%	2.3%	2.2%	0.0%	100.0%	78.52%	1
LKLCI	60	19.5%	65.1%	7.8%	3.9%	3.7%	0.0%	100.0%	65.13%	2
LDJIA	60	0.8%	33.8%	64.7%	0.3%	0.3%	0.0%	100.0%	64.74%	3
LFTSE	60	0.0%	18.2%	44.4%	37.3%	0.1%	0.0%	100.0%	37.33%	5
LNIKK	60	0.3%	18.4%	16.5%	4.5%	60.3%	0.0%	100.0%	60.28%	4
LITRS	60	5.2%	55.4%	0.6%	9.2%	1.4%	28.3%	100.0%	28.29%	6

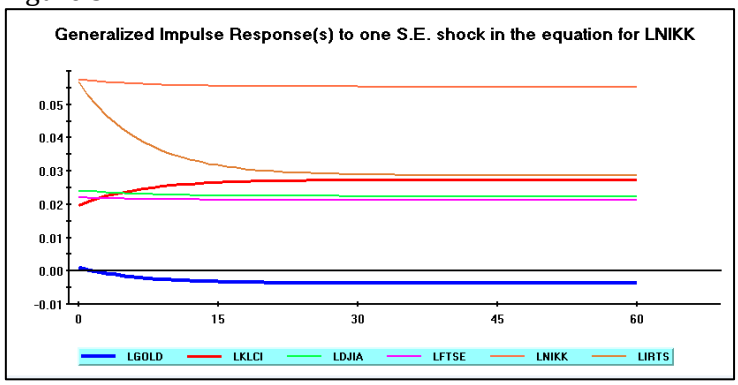
Both the Generalised and Orthogonalised VDC results gave us a contradicting result from the VECM test. Our variable GOLD which was identified as endogenous in VECM had transformed to an exogenous variable in the short and long term horizon. We cannot explain this sudden change but we suspect that this discrepancy could be due to the dataset used. They are new estimates generated by Microfit using the VDC model and so the data are out of sample data. The only explanation that makes sense to the ranking disclosed by the VDC exercise is that GOLD movement affects the KLCI and IRTS but not the major markets like DJIA, FTSE and NIKK.

Figure 2



The Impulse Response graph that depicts the relationship between our variables is shown in Figure 2 above. When gold is shocked by one standard deviation, the endogenous variables, KLCI and the IRTS, react instantly to the shock. On the other hand, our exogenous variables, DJIA, FTSE and NIKK, are not affected by the shock. We attribute this to the fact that DJIA, FTSE and NIKK are major markets which performances are affected by many other factors.

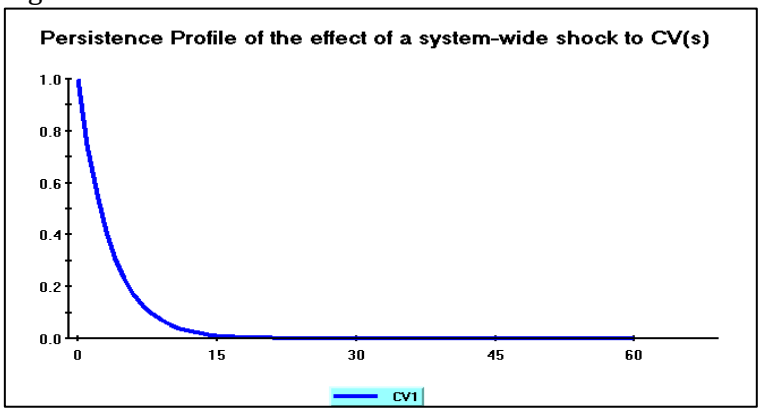
Figure 3



Interestingly in Table 3, if the variable NIKK is shocked, the other two main markets, DJIA and FTSE, also exhibit smaller but steady reaction and transmit the bigger balance of shock to the smaller markets, KLCI and IRTS, with endogenous traits. This is why KLCI and IRTS evince larger swings than the rest. However, the most fascinating finding from the graph above is that our variable GOLD seems to be not affected somewhat to the shock on exogenous variable NIKK. This feature imply that GOLD is a good hedging instrument and should be considered as one of the assets to keep.

We know that in the Impulse Response exercise, the reaction shown by the variables are due to the shock imposed on one variable within the group. But what if the shock is system-wide and not originated by any of our variables? How long will it take for all of our six variables to move back to equilibrium position?

Figure 4



The Persistent Profile test result, shown by the Figure 4 above, estimated that our variables need approximately 15 periods (months) to adjust back to their equilibrium position.

6.0 Concluding Remarks

Through our analysis using the Vector Auto Regression (VAR) model, we are able to answer our research questions. They are as below:

- There exists a long-term theoretical relationship between GOLD and our selected indices DJIA, FTSE, NIKK, KLCI and IRTS
- GOLD is an ENDOGENOUS variable
- Major markets – DJIA, FTSE, NIKK – exhibit EXOGENOUS trait, whilst smaller markets – KLCI, IRTS – exhibit ENDOGENOUS trait

The policy implication that we can derive from this study is very important to the policy makers in smaller markets with endogenous trait. When they are considering the proportion of reserve currencies, more weight should be given to gold. The rationale for this is that if a major market suffers shock in their system, their currency will weaken and hence affect the value of the smaller markets' reserve baskets. Gold is good for storing of value. If gold is broken to pieces, each pieces still has a proportionate value attributable to gold. Paper money on the other hand, if it is torn into two, the part without the serial number loses any value attached. The other part with the serial number only carries half of the original value of the paper money.

The same can be inferred to any paper money that supports a government. A government can fall because of debt burden and its currency automatically loses all value. The wealth accumulated in that affected paper money diminishes instantly. On the contrary, gold is much more stable in the sense that although its value fluctuates over time, it still carries value and that wealth is not entirely diminished. The best proven example to this can be found in the US Federal Reserve Total Reserve data. Over the past 15 years it has maintained the amount of gold kept in its reserve. Although its total reserves without gold has also been increasing, the value of gold is still seen growing bigger in proportion to total reserves. This policy implication from our study, in fact, answers our main research objective that YES, gold is a better currency in reserve baskets. And for this very reason also, there is a need to restore gold as the standard international payment system (Askari and Krichene, 2014). The usage of gold in the international Islamic gold standard serves as the natural foundation of money which safeguards against governments' debasement of money and inflationary deficits. It removes the major source of instability, which is interest-based credit and the major cycles of crisis it brings. Hence, only risks and uncertainty which are a part of nature, enterprise and investment remains.

In arriving to the above conclusion, we acknowledge that our findings are based on the VAR model and the fact that our knowledge is minimal. Various other time series models should be used to see if this finding can be emphasized further. Other than that, the choice of index could be different from our variables for example EMAS Index instead of KLCI, and S&P500 Index instead of DJIA Index.

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