Relationship between crude oil prices and global sukuk (islamic bond) index: evidence from Dow Jones Citygroup sukuk index

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Relationship between crude oil prices and global sukuk (islamic bond) index: evidence from Dow Jones Citygroup sukuk index

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Abstract: The global Islamic bond started gaining attention in capital markets just a few years ago. Since the launch of Dow Jones Citygroup Sukuk Index in 2006 , the number of issuance of global Islamic bonds has been sharply increasing. Saudi Arabia, UAE and Qatar had become major issuers of global bonds which are highly demanded by the investors .The rationale behind this might be because of religious commitment to get involved in riba (interest)-free investment or might be due to some other contributing factors. Realizing that the majority of global sukuk issuer is from the oil exporting countries, it might be related to the price of crude oil. This study attempts to find out the possible impact of the oil price on the global sukuk index using standard time series techniques. The findings evidence a significant relationship between the crude oil price and the global sukuk index. The US interest rate also influenced the global sukuk index based on the fact that the sukuk is denominated in US dollar and the interest rate had an inverse relationship with the bond price. Thus, crude oil price and the US interest rate should be taken into consideration by the global sukuk issuer as well as the investors. From this study, the investors might take the increase in crude oil prices as a positive signal and be motivated to buy global sukuk especially from the oil producing countries as it would give them a good yield on global sukuk. From the perspective of bond issuers, the appreciation or depreciation of US dollar against other currencies was one of the factors which affected their decision to issue global sukuk or not. An US interest rate affected the exchange rate of US dollar, since an increase in US interest rate led to the appreciation of US dollar in the short term and therefore influenced the global sukuk prices as well.

Keywords: Global sukuk (Islamic bond), oil price, VECM, VDC

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Introduction

In the bond market, the growth and development of Islamic bonds have been very impressive as we have witnessed significant increases in its size, currently totalling 98 billion ringgit, including those issued by corporate bodies. The issuance of Islamic corporate bonds has also risen significantly, with some 88 billion ringgit or 43 percent of total outstanding corporate bonds. It is also evident that Islamic bonds have become increasingly a preferred choice among investors and issuers, with the number and size of Islamic bonds approved exceeding those of conventional private debt securities. But, what have actually caused the supply and demand of Islamic bonds and the performance of global sukuk? Is it merely something to do with the religious commitment to get involved in non-riba investment? Do the hike in the crude oil price in oil producing countries increase the demand of their Islamic bonds? Does the appreciation of US dollar make the country issue more global bonds and attract more investors to buy global Islamic bonds? Realizing that the majority of global sukuk issuer is from the oil exporting countries, it might be related to the price of crude oil. In addition, since the global sukuk is denominated in US dollar, one might wonder if the US long term interest rate has any roles in influencing the performance of global sukuk. Thus, this study attempts to find out the possible impact of the oil price and the US interest rate on the global sukuk index by using standard time series techniques.

Overview

Global Islamic bond is a bond which is denominated in US dollar. Dow Jones City Group Sukuk serves as a benchmark for the performance of global Islamic bonds. It was launched in April 2006, with the stated objective to measure performance of global sukuk complying with Shariah compliance. These are among the components of Dow Jones City group Sukuk Index.

Name	Coupon	Maturity	Par ($)	Quality	Country	Stated Coupon
Sarawak International	6.493	12/22/09	350	A-	Malaysia	Floating rate
Islamic development bank	5.513	6/22/10	500	AAA	Supranational	Floating rate
State of Qatar	5.736	10/09/10	560	AA-	Qatar	Floating rate
Abu Dhabi Islamic Bank	5.760	12/12/11	800	A	UAE	Floating rate
DIB Sukuk	5.690	03/22/12	750	A	UAE	Floating rate

Emirates Islamic Bank	5.660	06/12/12	350	A	UAE	Floating rate
Dubai International Financial Center	5.735	06/13/12	1250	A+	UAE	Floating rate
DP World Sukuk LTD	6.250	07/02/17	1500	A+	UAE	Fixed rate

Source: Citygroup Index LLC

The US 10 year-interest rate can affect the US exchange rate to certain extent, especially in the short term. When the interest rate rises, US dollar will strengthen or appreciate against other currencies. The single US exchange rate cannot be used as one the variables in this study because Dow Jones Citygroup Sukuk Index consists of global sukuk issued by different countries such as Malaysia, Qatar, UAE, Saudi Arabia and so on. Thus, the US interest rate is best to be used as an indicator of depreciation or appreciation of US dollar. Since global sukuk is issued in US dollar, the stability of the currency affects the demand and supply of sukuk as well as the price. When the interest rate rises and the US dollar appreciates, the firm will be motivated to issue more global sukuk . The price of bonds decreases.

METHODOLOGY

Eight steps of Time Series techniques are adopted in this study. After first examining the unit root tests and the order of the vector auto regression (VAR), the Johansen cointegration tests will be applied. The test of cointegration is designed to examine the long run theoretical or equilibrium relationship among the variables. The co integrating estimated vectors then will be subjected to exactly identifying and over identifying restrictions based on theoretical and a priori information of the economy. However, the evidence of cointegration cannot tell us the direction of Granger causality among the variables for example, which variable is leading and which variable is lagging. That can be done by the test of the vector error correction model (VECM) that can indicate the direction of Granger causality both in the short run and long run. The VECM however cannot tell us which variable is the most leading and which variable is the most lagging. The variance decomposition (VDC) technique is designed to indicate the relative endogeneity/exogeneity of a variable by decomposing the variance of the forecast error of a variable into proportions attributable to shocks in each variable in the system including its own. The variable which is explained mostly by its own past is the most exogenous. If needed, the variance decompositions can also be represented similarly by the impulse response functions (IRFs). They are designed to map out the dynamic response path of a variable due to

a one period standard deviation shock to another variable. The IRFs is a graphical way of exposing the relative exogeneity or endogeneity of a variable. Finally, the persistence profile will be applied. Persistence profiles are designed to estimate the speed with which the variables get back to equilibrium when there is a system wide shock to the long run equilibrium.

DATA

These are the variables used in Microfit.

Variables in Log Form	Description	Variables in Differenced Form	Description
LDJSUKUK	LOG (DJSUKUK)	DLDJSUKUK	LDJSUKUK-LDJSUKUK(-1)
LCRUDE	LOG(CRUDE)	DLCRUDE	LCRUDE-LCRUDE(-1)
LUSRATE	LOG(USRATE)	DLUSRATE	LUSRATE-LUSRATE(-1)

The data used in my study are daily with 283 observations starting from 20 November 2009. The daily Dow Jones Citygroup Sukuk Index which is the indicator of global sukuk performance is obtained from Islamic Finance Information Services (IFIS).The crude oil prices data and the US 10 year interest rate are obtained from Thomson Reuters DataStream.

Empirical Results

Unit Root Test: Time series data are often assumed to be non-stationary and thus it is necessary to perform a pre-test to ensure there is a stationary cointegrating relationship among variables to avoid the problem of spurious regression. Based on the error correction mechanism as indicated by Johansen (1990), it is necessary for the variables to be of the same order of integration.

The dynamics between global sukuk returns (LDJSUKUK), crude oil prices (LCRUDE) and US long term interest rate (LUSRATE) is tested in this paper. All the variables are transformed into logarithms to achieve stationarity in variance. The unit roots of all the variables are tested and it has been found that all of them can be taken as I (1) on the basis of augmented Dickey-Fuller (ADF) tests. I(1) implies that the variables are non stationary in the log form and need to be differenced once in order to make them stationary.

ADF tests with null hypothesis of existence of unit root, which implies the variable, is non-stationary. Alternate hypothesis says that the variable has no unit root, implying the variable is stationary. The results for the level form variables are represented in Table 2.

	t statistic	95% critical value	Null Hypothesis	Result
Dow Jones Citygroup Sukuk Index	1.4970	3.4160	Accepted	Non -Stationary
Crude oil price	1.5299	3.4160	Accepted	Non -Stationary
US Interest rate	3.0940	3.4160	Accepted	Non -Stationary

Table 2: Level log form ADF Output

In the level log form all the variables represent a lower t statistic, thus accepting the null hypothesis, that there is unit root. And all variables are non stationary.

A unit root test is further applied on the variables in their log differenced form. The results are presented in Table 3.

	t statistic	95% critical value	Null Hypothesis	Result
Dow Jones Citygroup Sukuk Index	24.9886	2.8644	Accepted	Stationary
Crude oil price	24.2962	2.8644	Accepted	Stationary
US Interest rate	27.3385	2.8644	Accepted	Stationary

Table 3: Differenced log form ADF Output

For the differenced form of the log variables, as represented in Table 3, the t statistics are higher than 95% critical value and thus the null hypothesis is rejected and the alternate hypothesis of no unit root is accepted.

Order of the VAR: The next empirical result is the determination of the Order of VAR model. The differenced log form of variables is taken into consideration, due to their stationary characteristic. The unrestricted VAR post estimation menu with an arbitrarily high order of 6

for estimation, gives a varying result for Alkaline Information Criterion and Schwarz Bayesian Criterion. The results are presented in Table 4.

```
 Test Statistics and Choice Criteria for Selecting the Order of the VAR Model
*****************************************************************************
 Based on 283 observations from  930 to 1212. Order of VAR = 6
 List of variables included in the unrestricted VAR:
 DLDJSUKUK       DLCRUDE         DLUSRATE
 List of deterministic and/or exogenous variables:
 C
*****************************************************************************
 Order    LL        AIC      SBC             LR test         Adjusted LR test
   6     2758.8    2701.8    2597.9             ------               ------
   5     2757.3    2709.3    2621.8  CHSQ(  9)=   3.0306[.963]    2.8271[.971]
   4     2752.4    2713.4    2642.3  CHSQ( 18)=  12.9208[.796]   12.0533[.844]
   3     2748.1    2718.1    2663.4  CHSQ( 27)=  21.4962[.763]   20.0530[.829]
   2     2742.4    2721.4    2683.2  CHSQ( 36)=  32.7308[.625]   30.5334[.726]
   1     2733.3    2721.3    2699.4  CHSQ( 45)=  50.9837[.250]   47.5608[.369]
   0     2700.0    2697.0    2691.5  CHSQ( 54)= 117.6699[.000]  109.7698[.000]
*****************************************************************************
 AIC=Akaike Information Criterion     SBC=Schwarz Bayesian Criterion
```

Table 4: Test Statistics and Choice Criteria for Selecting the Order of the VAR Model

With the Order of VAR test the AIC shows a high order of VAR of 2 whereas SBC shows a high order of 1. However, I preferred the order of VAR of 2 suggested by AIC test because the number of observation is about 283 observations, which is large.

Cointegration Result: The standard Johansen co integration test has been applied to find any co integrating vector. I could find one co integration vector at the 95-percent significance level on the basis of maximal eigen value and trace statistics. An evidence of co integration implies that each variable contains information for the prediction of other variables. Cointegration also implies that the relationship among the variables is not spurious i.e. there is a theoretical relationship among the variables and that they are in equilibrium in the long run. There is a relationship between crude oil prices a, US interest rate and the return of global Islamic bond from November 2009 to December 2010.

Null Hypothesis	Alternate Hypothesis	Statistic	95% Critical Value	90% Critical Value	Conclusion
r= 0	r=1	91.2301	25.4200	23.1000	Reject Null Hypothesis Accept Alternate
r<=1	r=2	12.9501	19.2200	17.1800	Accept Null Hypothesis Reject Alternate
r<=2	r=3	1.5546	12.3900	10.5500	Accept Null Hypothesis Reject Alternate

Table 5: Cointegration Test Results based on Test of Maximal Eigenvalue

Null Hypothesis	Alternate Hypothesis	Statistic	95% Critical Value	90% Critical Value	Conclusion
r= 0	r>=1	105.7348	42.3400	39.3400	Reject Null Hypothesis Accept Alternate
r<=1	r>=2	14.5047	25.7700	23.0800	Accept Null Hypothesis Reject Alternate
r<=2	r=3	1.5546	12.3900	10.5500	Accept Null Hypothesis Reject Alternate

Table 6: Cointegration Test Results based on Trace Test

Long Run Structural Modelling: In order to make the coefficients of the co integrating vector consistent with the theoretical and priori information of the economy, the long run structural modelling procedure has been applied. Since the number of co integrating relationship is one, I imposed an exact identifying restriction of "unity" on the coefficient of LDJSUKUK ,which in this study I wanted it to be a dependent variable . In vector one, it shows that all variables are significant. The significance of the variables is known through the T ratio test which is derived from dividing the coefficient with the standard error. (refer Table 6). The variables are significant when the values of T ratios are more than 2.

```
       ML estimates subject to exactly identifying restriction(s)
     Estimates of Restricted Cointegrating Relations (SE's in Brackets)
                        Converged after 2 iterations
  Cointegration with unrestricted intercepts and restricted trendsin the VAR
*******************************************************************************
 283 observations from  930 to 1212. Order of VAR = 2, chosen r =1.
 List of variables included in the cointegrating vector:
 LDJSUKUK        LCRUDE          LUSRATE         Trend
*******************************************************************************
 List of imposed restriction(s) on cointegrating vectors:
 A1=1
*******************************************************************************
                  Vector  1
 LDJSUKUK            1.0000
                    (   *NONE*)

 LCRUDE              -.049057
                    (  .013018)

 LUSRATE              .057591
                    (  .010009)

 Trend               -.3313E-3
                    ( .1527E-4)
```

```
*****************************************************************************
 LL subject to exactly identifying restrictions=   2778.9
*****************************************************************************
```

	Crude oil price	US interest rate
T Ratio	3.7684	5.7539

Table 6: T ratio with Identifying restriction of A1 = 1

All variables are significant in the LRSM equation, which does not need a further test anymore. However, for the purpose of this paper, I had a further test of the significance of variables to find out if it can give similar result by imposing an over- identifying restriction on Crude Oil price as it is the least significant as represented in Table 6. The over identifying restriction applied is A2 = 0. With this restriction the other variable is still significant (refer Table 7) and must be kept in the equation.

	US interest rate
T Ratio	3.6906

Table 7: T ratio with Identifying restriction of A1 = 1 and A2 =0

With the over identifying relation the Null hypothesis is that A2=0 , the p value is less than 0.05 which means I can safely reject the null hypothesis, and thus accepting the alternate hypothesis. This means I can really keep the variable of crude oil price. Therefore I proceed with Vector 1 for the remainder analysis.

Vector Error Correction Model: Co integration however cannot tell us the direction of Granger causality between the variables as to which variable is leading and which variable is lagging, I applied the vector error correction modelling technique concerning the endogeneity/exogeneity of the variables.

The vector error correction model allows us to identify that which variables are exogenous and which are endogenous. The vector error correction model can be employed by the interpreting of the coefficient where if the error-correction coefficient in any equation is insignificant, that implies that the corresponding dependent variable of that equation is ‘exogenous. The null hypothesis states that all the variables are independent/exogenous and the alternate stating that the variable is dependent/endogenous.

By looking at T ratio and the probability of the error correction term, we can find that the variable of LDJSUKUK is the only endogenous variable, whereas the other variables, including LCRUDE and LUSRATE are exogenous. This indicates the global sukuk index respond to both crude oil prices and US interest rate. The error –correction term in the LDJSUKUK equation is significant. It implies that the deviation of the variables has a significant feedback effect on the LDJSUKUK variable that bears the burden of short run adjustment to bring about the long term equilibrium. The speed of short run adjustment to bring about the long term equilibrium is given by the coefficient of error-correction term which indicates that if the long term equilibrium between variables is disturbed by any shocks, it will take about 3 days to restore the equilibrium (refer Table 9)

	Null Hypothesis	Alternate Hypothesis	T-ratio	Probability	Conclusion	Result
LDJSUKUK	Variable is Exogenous	Variable is Endogenous	10.086	0.0000	Reject Null	Variable Is Endogenous
LCRUDE	Variable is Exogenous	Variable is Endogenous	0.22536	0.822	Accept Null	Variable is Exogenous
LUSRATE	Variable is Exogenous	Variable is Endogenous	1.4238	0.156	Accept Null	Variable is Exogenous

Table 8: Probability Values for error in rejecting the Null Hypothesis

The null hypothesis states that all the variables are exogenous and the alternate stating that the variable is endogenous. P value gives the percentage of committing error when rejecting the null. If the Probability is higher than 0.05 it means that we would be making a greater error in rejecting the Null hypothesis, and thus we accept the Null Hypothesis. When the T ratio is more than 2, it implies that the variable is dependent. The resultant probability and T ratios for the variables are summarized in the Table 8.

```
 ECM for variable LDJSUKUK estimated by OLS based on cointegrating VAR(2)
*******************************************************************************
 Dependent variable is dLDJSUKUK
 283 observations used for estimation from  930 to 1212
*******************************************************************************
 Regressor              Coefficient       Standard Error         T-Ratio[Prob]
```

```
 Intercept                  1.4788            .14661           10.0870[.000]
 dLDJSUKUK1                 .28968           .039740            7.2895[.000]
 dLCRUDE1                -.0096171           .010629           -.90480[.366]
 dLUSRATE1                 .020872           .011245            1.8561[.064]
 ecm1(-1)                  -.32090           .031816          -10.0860[.000]
*******************************************************************************
 List of additional temporary variables created:
 dLDJSUKUK = LDJSUKUK-LDJSUKUK(-1)
 dLDJSUKUK1 = LDJSUKUK(-1)-LDJSUKUK(-2)
 dLCRUDE1 = LCRUDE(-1)-LCRUDE(-2)
 dLUSRATE1 = LUSRATE(-1)-LUSRATE(-2)
 ecm1 =    1.0000*LDJSUKUK  -.049057*LCRUDE +  .057591*LUSRATE -.3313E-3*Trend
*******************************************************************************
 R-Squared                     .40014   R-Bar-Squared                    .39151
 S.E. of Regression          .0029586   F-stat.    F(  4, 278)   46.3607[.000]
 Mean of Dependent Variable  .1554E-3   S.D. of Dependent Variable    .0037927
 Residual Sum of Squares     .0024333   Equation Log-likelihood         1248.9
 Akaike Info. Criterion        1243.9   Schwarz Bayesian Criterion      1234.8
 DW-statistic                  1.9386   System Log-likelihood           2778.9
*******************************************************************************
```

Table 9: ECM for variable LDJSUKUK estimated by OLS based on cointegrating VAR(2)

Variance Decomposition: The VECM, however, cannot tell us the relative degree of endogeneity or exogeneity among the variables. Therefore, I had to apply the generalized variance decomposition technique to discern the relative degree of endogeneity or exogeneity of the variables. The relative exogeneity or endogeneity of a variable can be determined by the proportion of the variance explained by its own past, the variable that is explained mostly by its own shocks and not by others is deemed to be the most independent or exogenous. In table 9,at the end of forecast horizon number 50, it can be observed that only 37 percent of the forecast error variance of LDJSUKUK (global sukuk returns) is explained by its own shocks, makes it very dependent variable. In the case of LCRUDE (crude oil prices), the proportion is 99 percent which is very high and makes it the most leading variable. USRATE (US interest rate) has 97 percent of the forecast error variance which is explained by its own shock.

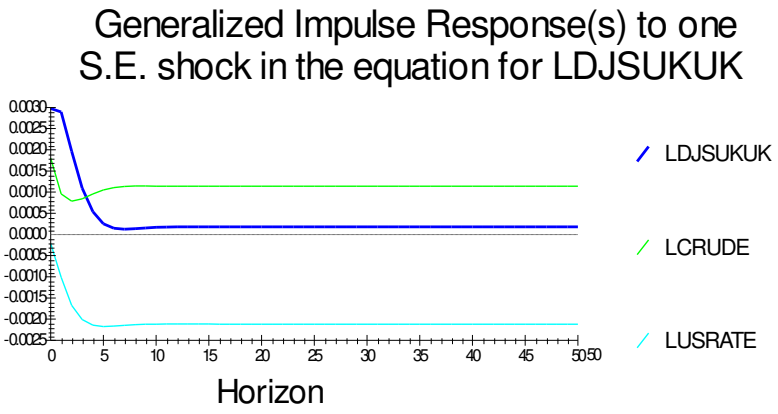
	LDJSUKUK	**LCRUDE**	**LUSRATE**
LDJSUKUK	0.37367	0 .26004	0.23161
LCRUDE	0.0041979	0.99008	0 .11474
LUSRATE	0.019073	0.10038	0.97686

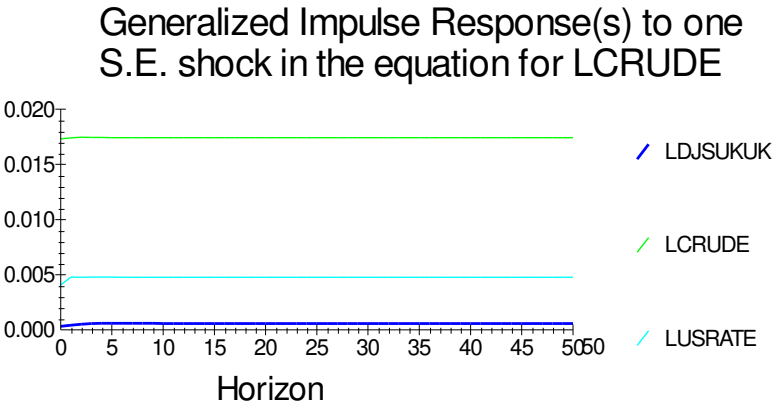
Table 10: Generalized Forecast Error Variance Decomposition (Shocked Variable in Left Column)

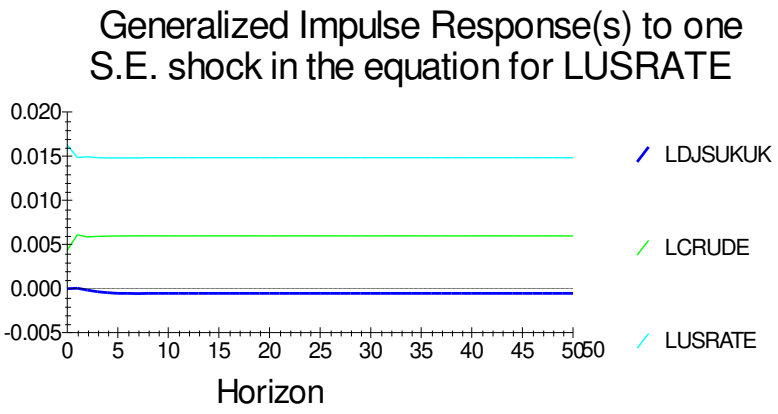
The out of sample variance forecast results given by the generalized variance decompositions are consistent with the earlier within sample results given by the error correction model: the crude oil price and the US interest rate lead the Dow Jones Citygroup Sukuk Index.

Impulse Response Functions: The information that has been tabulated in VDC can be equivalently represented by Impulse Response Functions. IRFs essentially map out the dynamic response path of a variable owing to a one-period standard deviation shock to another variable.

By looking at the figures below, it can be observed that crude oil price and US rate are not so sensitive to a one standard deviation shock to other variables.

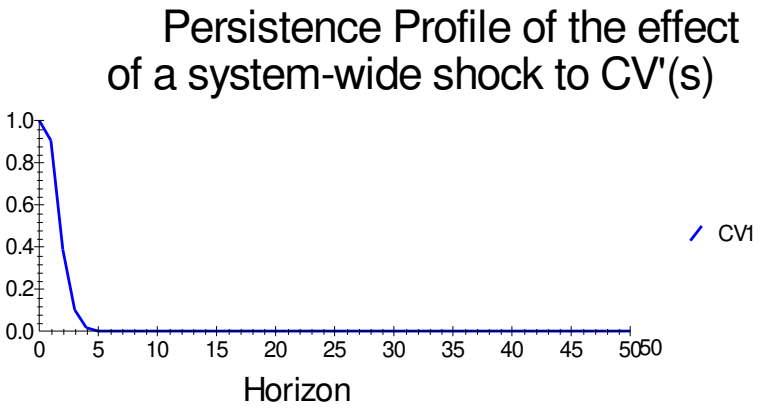






Persistence Profiles: Both IRFs and the persistence profiles map out the dynamic response path of the long run relations, The main difference between them is that the persistence profiles trace about the effects of a system wide shock on the long run relations but the IRFs trace out the effects of a variable specific shock on the long run relations. The persistence profile is indicative of the time horizon required to get back to equilibrium when there is a system wide shock.

The application of the persistence profile analysis in this study indicates that if the whole integrating cointegrating relationship is shocked, it will take about five periods for the equilibrium to be restored.



Concluding Remarks

The main reason of the existence of a cointegrating vector between the variables from November 2009 to December 2010,might be because during this period, the world's leading exporter of oil, United Arabia Emirates has issued a large amount of global sukuk and becomes one of the major components in the Dow Jones Citygroup Sukuk Index. Therefore, we may start to see there is a significant relationship between the crude oil price and the global sukuk index. The US interest rate also has influenced the global sukuk index based on the fact that the sukuk is denominated in US dollar and the interest rate has an inverse relationship with the bond price. Thus, crude oil price and the US interest rate should be taken into consideration by the global sukuk issuer as well as the investors. From this study, the investors might have taken the increase in crude oil prices as a positive signal and be motivated to buy global sukuk especially from the oil producer countries as it will give them a good yield on global sukuk.

From the perspective of bond issuers, the appreciation or depreciation of US dollar against other currencies is one of the factors which affect their decision to issue global sukuk or not. An US interest rate affects the exchange rate of US dollar, the increase in US interest rate will lead to the appreciation of US dollar in the short term and therefore influences the global sukuk prices as well.

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