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Do macroeconomic variables affect stock–sukuk correlation in the regional markets? evidence from the GCC countries based on DOLS and FM-OLS

Aisha Aden Abdi¹ and Mansur Masih²

Abstract

It is so important for the investors, academicians and portfolio managers to know the co-movement and dynamic correlations between the Shariah compliant stock and sukuk, as well as the role they play in asset allocation and risk diversification and also, to identify the factors that affect the correlation between these assets. In the literature, the macroeconomic factors such as inflation and interest rate have great effects on the stock-sukuk correlation.

In this paper, we investigate the correlation between sukuk and sharia-compliant stocks in GCC countries, with concentration on the macroeconomic factors that affect stock-sukuk co-movement. MGARCH dynamic conditional correlation (DCC) is estimated under Student-t distribution to get the required correlation and then we applied cointegration panel techniques such as DOLS and FMOLS for the estimation analysis. We found that we can reject the null hypothesis of cointegration which says there is no effect of the macroeconomic variables on the stock and sukuk correlation. The industrial production and interest rate have effects on the stock and sukuk correlation, however we found that the CPI doesn't have any effect on the stock and sukuk correlation. The policy makers should consider the correlation and volatility of the Islamic assets, and they should take into account the factors that affect the stock and sukuk correlation in GCC.

Keywords: Macro-economic determinants of stock-sukuk correlation, GCC, DOLS, FM-OLS

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1. Introduction

Sharia stocks and sukuk are financial instruments complying with the sharia codes. For sharia stocks, Islamic sharia permits investment in stocks given that those firms do not engage in ‘Haram’ or prohibited activities including lending, gambling or production of alcohol, tobacco, weaponry or pornography. There is no general consensus among researchers on the dynamic co-movement between the stock and bond assets.(Aloui et al. 2015).The stock and sukuk are Islamic instruments for investment. However, the co-movement between these two assets are of interest to the policy makers, investors, Islamic financial institutions managements and academicians. It is thought that the correlation between the stock and bond exists between the conventional and shariah stock and sukuk in Islamic system, but the main question is what are the factors that impact the correlation of these assets?

There is no general consensus among researchers on the dynamic co-movement between the stock and bond assets.(Aloui et al. 2015). In the conventional market, there is a conflict about the effect of macroeconomic factors on the stock-bond correlation. Switzer and Vezina (2003) concluded that the bond-stock GARCH conditional covariance is not significantly influenced by macroeconomic announcement effects. While (Christiansen & Rinaldo 2005) found that the realized bond-stock correlation is significantly influenced by macroeconomic announcements and surprises. Since the conflict still exists in this field we are trying to answer if the relevant macroeconomic variables has any effect on the shariah compliant stock and sukuk in GCC countries, by using monthly data of S&P GCC shariah stock and Nasdaq Dubai GCC sukuk ideal rating starting from 2013 to 2016. We run the MGARH-DCC to see the correlation between the stock and sukuk to get their correlation between the two assets, then we collect data of macroeconomic variables of CPI, IPI and IIR which are mainly used in the literature, these data

are also monthly and starting from 2013 to 2016, and we use these variables as independent variables and the correlation between the stock and sukuk as dependent variable and to see the effect of these variables on the stock and sukuk correlation. We used the panel cointegration techniques DOLS and FM-OLS.

From this estimation, we found that IPI and IIR have effects on the stock and sukuk correlation while we rejected the null hypothesis that there is no effect of the macroeconomic variables on the stock and sukuk correlation. However, CPI has no effect on the stock and sukuk correlation, this may be because the data is after financial crises, may be the CPI has effect in the financial crises times.

Since we got the effect of the macroeconomic variables on the stock and sukuk correlation as some other studies found, we are extending the literature that some macroeconomic variables have effect while others have no effect such as, in our study the CPI has no effect, while CPI is a major variable which affects the stock sukuk correlation. So, we find that there is no major macroeconomic variable which has the same effect always on the stock and sukuk correlation since the variables are subjected to different situations. And hence the policy makers should consider the different situations in order to apply the appropriate policy measure to the stock and sukuk correlation.

The next section of our study will be the objectives and the questions of our study, section four is the contribution of this study, section five is the theoretical underpinning, section six is the literature review, section seven is the data, section eight is the methodology, section nine is the result interpretation, section ten is the conclusion, section eleven is the limitation and last section is the reference.

2. The objective and questions of the study

The objective of this paper is to investigate the effect of macroeconomic factors on the stock-sukuk correlation. We are answering the question in this paper as to what is the impact of macroeconomic factors on the stock-sukuk correlation?

3. Contribution

From our humble study, we extend the literature in that there is no major macroeconomic variable which would have always the same effect on the stock and sukuk correlation since the variables are subjected to different situations. And hence the policy makers should consider the different situations while applying appropriate policy measures to the stock and sukuk correlation.

4. Theoretical underpinning

Sharia stocks, Islamic sharia permit investment in stocks given that those firms do not engage in ‘Haram’ or prohibited activities including lending, gambling or production of alcohol, tobacco, weaponry or pornography.(Aloui et al. 2015)

4.1. Overview of stock and sukuk

The foundation principles for sukuk certificates have developed in conformity with Islamic legal principles based on the Quran’s commandments *sukuk* certificates have developed in commandments and elaborated in *Shari’ah* through 14 centuries of development. The word *sukuk* is plural for a certificate (*sakk*) of ownership of a given class of assets that a borrower gives to a lender as proof of ownership. Therefore, *sukuk* securities are debt instruments that require the creation of assets in a separate entity, these assets being owned proportionally by

the lenders, the fund providers. Full asset-backed lending is a fundamental principle of *sukuk* contracting.(Safari et al. 2014)

A sukuk contract may thus be defined simply as a funding (debt) arrangement agreed to between a party providing the funds (investor) and the counterparty (a government or a firm or an individual) borrowing the funds for the purposes of using the funds to engage only in permissible economic production/services. (Ariff et al. 2012)

4.2.Difference between sukuk and bond

The sukuk certificates are properly described as Islamic bonds, the financial press has dubbed sukuk as Islamic bonds, an empirical study about same size, issuers, terms and similar rating for conventional bond and sukuk proved that the bond and sukuk are not behaving in the same manner.

The first key difference is that the yield to investors from a sukuk issue is based on profit shares, and is certainly not fixed and pre-determined, which is a requirement under Shari'ah law. The second difference is that part of the assets of the issuer is transferred to, or at least allow for legal claims from the date of issue, by a special purpose company, which is owned jointly by the investors. These critical differences, one would have thought, ought to have made the conventional bond, based on pre-agreed interest and issued without collaterals as notes, behave differently from that of a sukuk.(Ariff et al. 2013)

5. Literature review

In the conventional market, it is one of the most important issues for the financial researchers, risk analysts, and portfolio managers to understand properly the correlation between the stock and bond market, many analysts have addressed the importance of cross-linkage between the conventional stock-bond markets in designing optimal portfolios. However, the question is still open and there

is no general consensus among researchers on the dynamic co-movement between the stock and bond assets.(Aloui et al. 2015). We are discussing here the effect of macroeconomic variables on co-movement of stock and sukuk. In the conventional market, there is conflict about the effect of macroeconomic factors on the stock-bond correlation. By using a bivariate GARCH model(Switzer & Vezina 2003) concluded that the bond-stock GARCH conditional covariance is not significantly influenced by macroeconomic announcement effects. In contrast, (Christiansen & Rinaldo 2005) found that the realized bond-stock correlation is significantly influenced by macroeconomic announcements and surprises.

(Piljak 2013) got in his study that there is an important role of the macroeconomic factors specially inflation in explaining stock-bond correlation. He emphasized inflation as a key driver of the stock–bond correlation. High inflation periods lead to changes in common discount rates that dominate the cash-flow expectations and lead to a positive correlation between the two asset classes.

In a different way, some of the studies looked at the effect of the time that macroeconomic news announced on the stock-bond correlation, they got a positive correlation of stock and bond returns in expansions and lower, perhaps even negative, correlations during recessions.(Yang et al. 2009).

Although the sukuk is based on Shariah principles some studies confirmed that there is not significant different between sukuk and bond, they built this claim on that sukuk are generally structured according to western rules of securitization and do not represent a financial innovation. (Aloui et al. 2015). In contrary (Godlewski et al. 2013) found that the stock market is neutral to announcements of conventional bond issues, but it reacts negatively to announcements of sukuk issues.

6. Data

This study contains two different types of data, the first type of data is financial data while we are looking for the correlation between stock and sukuk by using Mgarch DCC. The second part of data is macroeconomic data, we use the correlation between sukuk and stock as dependent variable and use macroeconomic variables as independent variable to see how stock-sukuk correlation effected by macroeconomic variables.

6.1. Stock and sukuk data:

The empirical analysis is performed using monthly data for stock and sukuk price from 2013 to 2016 on five GCC countries except Bahrain, we collected the data from the BLOOMBERG. For the sharia stocks, we refer to the S&P GCC sharia index as the sharia-compliant benchmark, for the sukuk we used Nasdaq Dubai GCC sukuk ideal rating.

6.2. Macroeconomic data

Macroeconomic data are from the DataStream database. Monthly inflation rate is the first difference of natural log of the Consumer Price Index (CPI). Monthly industrial production growth rate is the first difference of the natural log of the Industrial Production Index (IPI). Monthly interbank interest rate. The macroeconomic data is monthly data starting from 2013 to 2016 and it is collected from the Thompson Reuters DataStream, we take that sample period because we couldn't get further data for the stock and sukuk. This data contains four GCC countries while couldn't some important data for the Bahrain and Oman.

7. Methodology

We used in our study two different methods, we use MGARCH-DCC to get the correlation between the stock and sukuk correlation, then we applied DOLS and FM-OLS to estimate equations that allowed us to predict the effect of the macroeconomic variables on the GCC stock and sukuk correlation.

7.1. Multivariate GARCH-Dynamic Conditional Correlation

Multivariate GARCH models are designed to study volatilities and correlations co-movements between markets, in order to provide better decision tools in portfolio selection, asset pricing and risk management techniques. We are interested in MGARCH to get the correlation between the stock and sukuk that we used as dependent variable to estimate the regression and to see the effect of macroeconomic variables on the sukuk-stock correlation.

This model allows for capturing the dynamic market interrelationships through the dynamic conditional correlations (DCC) as well as the asymmetric effects and the long memory property in the conditional volatility processes through fractional integration (i.e., persistence and predictability) (Naifar 2016)

7.2. DOLS and FM-OLS

As the normal OLS can't handle endogeneity and correlation problem in time series data, we applied DOLS and FM-OLS panel technique which take care of the small number and small time series. According to the number of our observations and time series we used in this study we choose Dynamic OLS and Fully-Modified OLS.

Levin, Lin and Chu (LLC) unit root tests is proposed by (Levin et al. 2002), in this test the degree of persistence in individual regression error, the intercept and trend coefficient are allowed to vary freely across individuals. The Im, Pesaran unit root test is proposed by (Im et al. 2003) based on unit root tests for dynamic heterogeneous panels based on the mean of individual unit root statistics.

Kau test is a residual-based tests for cointegration regression in panel data proposed by (Kao 1999). This test built on Dickey—Fuller (DF) tests and an augmented Dickey—Fuller (ADF) test to test the null of no cointegration. Pedroni test is a residual-based tests for the null of no cointegration for dynamic panels in which both the short-run dynamics and the long-run slope coefficients are permitted to be heterogeneous across individual members of the panel. (Pedroni, P. (2004).

The cointegration tests aim to identify the presence of a long-run equilibrium relationship among the variables by extending to panel data the application of the cointegration test from Engle and Granger (1987) which tests the stationarity of the residuals from a spurious regression of $I(1)$ variables whereby $I(0)$ residuals indicate cointegration while $I(1)$ residuals indicate no cointegration.(Othman & Masih 2015)

Discussion of Results

Table 2: Estimates of λ_1 and λ_2 and Delta

	Parameters	Normal Distiribution		T Distribution	
		Estimate	T ratio	Estimate	T ratio
LAMPDA 1	S&P shariah GCC stock	.846469	12.71	0.7622766	11139.49
LAMPDA 1	Nasdaq Dubai GCC Sukuk	846469	11139.49	0.7622766	11139.49
LAMPDA 2	S&P shariah GCC stock	0.000916	0.19	0.000376	16.83
LAMPDA 2	Nasdaq Dubai GCC Sukuk	.0009156	0.19	0.000376	16.83
Max. log likelyhood			118.5942	116.6993	
degree of freedom					

The table above contains Lampda 1 and Lampda 2 of GCC shariah stock market and GCC sukuk, as we see there is no different between lampda of stock and lampda of sukuk, this is due to STATA which provide the values of lampdas as one value for the whole assets, maybe there is way to get the individual Lampda for each asset from STATA but I don't know.

The above table results present the maximum likelihood estimates of and (Volatility Parameters) for the GCC shariah stock and Sukuk, observe that volatility parameters are highly significant except the lampda 2 under normal distribution, the parameters are close to unity This implies that shock to the volatility is mean-reverting not following the I-GARCH. Although the maximum log likelihood is lower in T distribution (116.6993) comparing to ML in normal distribution (118.5942), but the estimates are all significant under T distribution so we consider the T distribution is appropriate. Because it is more efficient in capturing the fat-tailed nature of distribution of asset returns.

Figure 1:

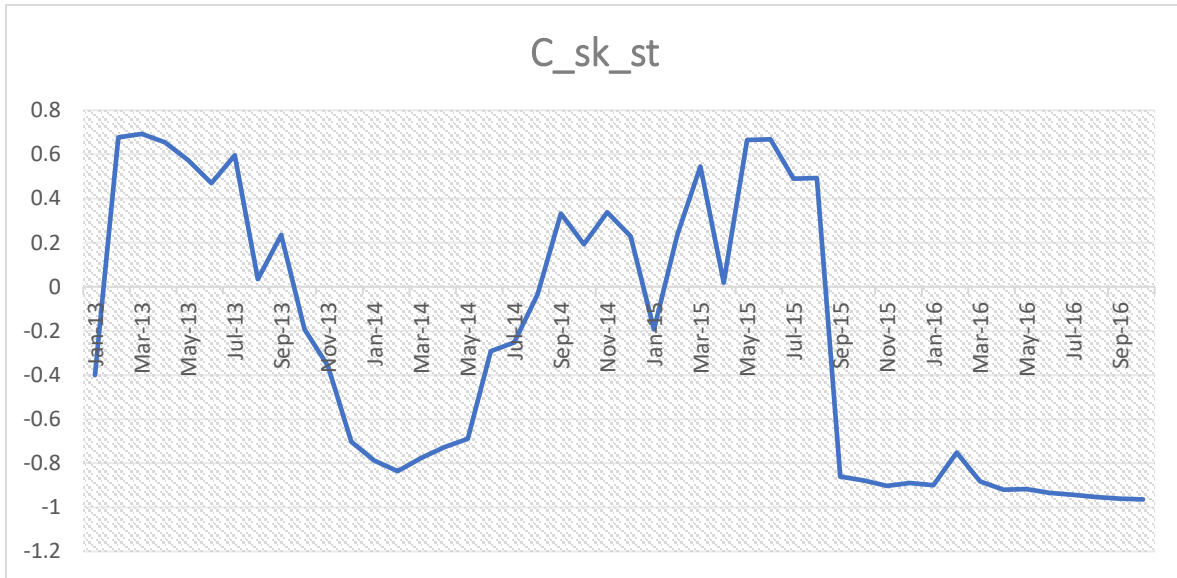
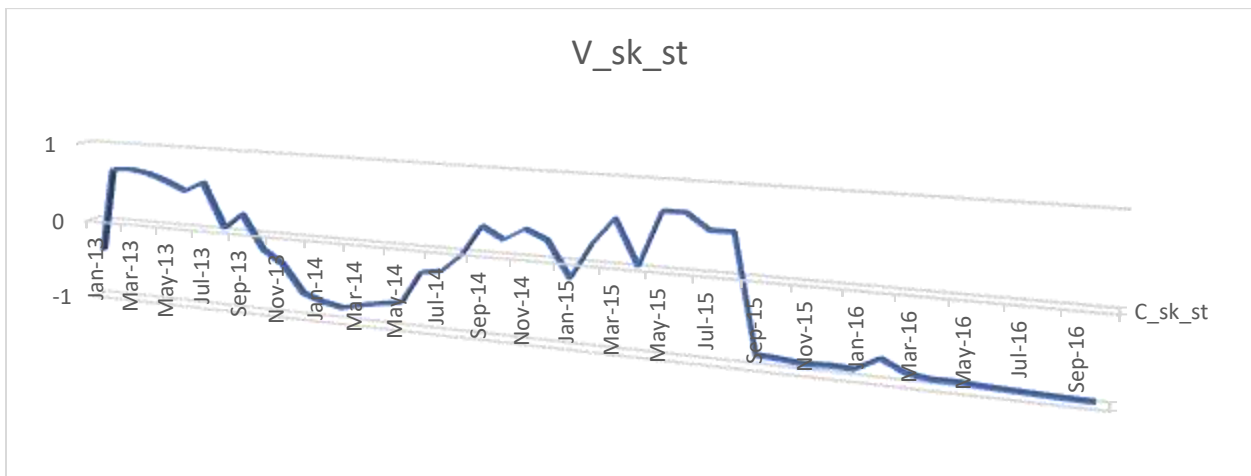


Figure 1 representing the dynamic conditional correlation between the stock and sukuk in GCC, it seems that the correlation is high in the beginning time as well as in 2015, while it is decreased suddenly in September 2015 and till now the correlation between the two assets are low

Figure 2:



The above graphs showing the dynamic conditional volatility of GCC shariah stock and sukuk, the volatility seems high in 2014 and 2015 in GCC market while the volatility is low from November 2015 and it stays low till the end of the period we run it in our study, Maybe the high correlation and the high volatility is caused by the price volatile at those period.

Panel cointegration result

To explore the effect of macroeconomic variables on the stock-sukuk correlation we used FMOLS and DOLS cointegrating equation estimations as an appropriate technique. To estimate the cointegrating equation, DOLS and FMOLS object to estimate the following model assuming normalization against CRR STSK:

$$CRR_STST_{i,t} = \alpha + \beta_1 CPI_{i,t} + \beta_2 IPI_{i,t} + \beta_3 IIR_{i,t} + \varepsilon$$

where i refers to the cross-section, t refers to the time, α refers to the constant term, CPI refers to inflation rate, IPI refers to industrial production which is proxy to the business cycle, IIR refers to interbank interest rate which represents the monetary policy for the countries, and ε refers to the error or residual term.

Using the panel cointegration, the paper tests the null hypothesis of each macroeconomic variable, do not affect the correlation between the stock and sukuk. For example, we can reject the null of no cointegration if the correlation coefficient of CPI is statistically significant, thus rejecting the null hypothesis indicates the presence of a long-run relationship between CPI and CRR_STSK. Otherwise the acceptance of null hypothesis appears when there is no significant.

Table 1: Description of variables

variable	description
CRR_STSK	correlation of sukuk and stock driven from the Mgarch

CPI	cpi used as a proxy of inflationary environment
IRR	it is the inter bank interest rate representing the monetary policy
IPI	this is industrial production and representing the business cycle pattern

Table 2: Descriptive statistics

	CPI	CRR	IPI	IRR
Mean	0.002094	-0.271113	0.833838	122.0859
Median	0.00184	-0.379306	0.716715	129.5
Maximum	0.019141	0.693025	2.5	149.1
Minimum	-0.00865	-0.96361	0.38	82.7
Std. Dev.	0.003286	0.629892	0.391768	18.0818
Skewness	1.42551	0.291905	1.595553	-0.624895
Kurtosis	10.69661	1.406137	5.717028	2.142769
Jarque-Bera	516.4736	22.08946	134.668	17.60897
Probability	0	0.000016	0	0.00015
Sum	0.385309	-49.88471	153.4261	22463.8
Sum Sq. Dev.	0.001976	72.60778	28.0873	59832.14
Observations	184	184	184	184

The above table is representing the descriptive statistics of all variables, we took natural log different for the consumer price index (CPI) and industrial production index (IPI) to get the inflation rate and business cycle pattern respectively. We take interbank interest rate as other studies done, the above variables together are the explanatory variables in our equation and lastly, we derived our dependent variable from the GCC stock-sukuk correlation using Multivariate Garch Dynamic Correlation Coefficient.

variables	Levin, Lin and Chu t		Im, Pesaran and Shin W-stat	
	level	first different	level	first different
CRR	-3.05	-15.796	-1.4906	-7.7165
CPI	-14.98	-15.796	-7.3272	-9.2571
IPI	-1.012	-7.913	-0.7298	-4.8273
IIR	-3.515	1.02	-1.6487	-9.7721

Table 3: Unit root tests for all variables

Note: Both constant and trend terms are included in the tests of level variables while only the constant term is included in the tests of first difference variables. The table displays results based on 5 lags. The test is T test.

The LLC and IPS unit root tests in Table 3 present contradictory results. On one hand, the

LLC test identifies CRR, CPI, IPI as I (1), on other hand the IM Peseran identify all variables as I(1), in this paper we prefer IM-pesaran test result over LL test because of the heterogeneity allowed in IPS. According to the IPS test results Fully-Modified OLS seems applicable as well as all variables integrated to I (1).

Table 4: Cointegration test

Kao residual cointegration test

Test	T statistic	prob
ADF	-4.15645	0

Pedroni Residual Cointegration Test

			Weighted	
	Statistic	Prob.	Statistic	Prob.
Panel v-Statistic	0.778169	0.2182	0.408669	0.3414
Panel rho-Statistic	-8.186112	0	-8.098614	0
Panel PP-Statistic	-10.70161	0	-10.57733	0
Panel ADF-Statistic	-10.58788	0	-10.46652	0

Note: The Kao test involves the individual intercept while the Pedroni tests involve the individual intercept and individual trend. The table displays results based on 5 lags.

The Kao and Pedroni cointegration tests present consistency results for three variables in

Table 4. The significant of pedroni test in Table 4 for all variables except the V test, and the Kao test indicates there is cointegration, here we are rejecting the null hypothesis of no effect of macroeconomic variable son the stock sukuk correlation, and the existence of cointegration in the equation indicate the long run relationship between the variables. So, in the policy implication we suggest tocontrol the macroeconomic variables to control the correlation of stock and sukuk.

As well as we have statistically insignificant V test in pedroni test in Table 4, it is not able to us to apply FM-OLS while it requires all variables to be integrated under one order like I(1), so DOLS is an appropriate method to estimate our equation.

Table 5: Cointegrating relation estimates by DOLS

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	-74.50659	69.29515	-1.075206	0.2842
IPI	-1.312863	0.382097	-3.435944	0.0008
IRR	0.007734	0.002804	2.757932	0.0066
R-squared	0.086139	Mean dependent var		-0.274746
Adjusted R-squared	-0.174964	S.D. dependent var		0.626799
S.E. of regression	0.679424	Sum squared resid		61.39507
Long-run variance	0.66991			

Fully-modified OLS

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	-23.80784	19.00519	-1.252702	0.212
IPI	-1.212656	0.301147	-4.026787	0.0001
IRR	0.00658	0.001816	3.623595	0.0004
R-squared	-0.067079	Mean dependent var		-0.268245
Adjusted R-squared	-0.079137	S.D. dependent var		0.636592
S.E. of regression	0.661302	Sum squared resid		77.4056
Long-run variance	0.665809			

In table 5 we run the both DOLS and FM-OLS, although we got a contradiction between LL test and Pedroni test which leads to not apply the FM-OLS because of the variables not integrated in in one order eg: I (1). However, we applied FM-OLS along with DOLS according to the past results in table 3 which indicating the integration of all variable under one order in IM-Peseran test. The cointegrating equation estimations using DOLS and FMOLS present same result, the both estimations exhibit low adjusted R-squared values of 17% and 7% respectively.

DOLS and FMOLS estimations present the statistical significance and direction of the correlation coefficients for IPI and IIR, this result indicates the long run relationship between the correlation of sukuk and stock and IPI and IIR, while 1% increase in in IPI affects negatively the stock-sukuk correlation by 1.2 and 1.3 in DOLS and FM-OLS respectively.

Contrary to the empirical literature, the CPI hasn't any statistical significance in that it has no effect on the stock sukuk correlation.

8. Conclusions and policy implications

In this paper, we investigate the correlation between sukuk and sharia-compliant stocks in GCC countries, with concentration on the macroeconomic factors that affect stock-sukuk co-movement. MGARCH dynamic conditional correlation (DCC) is estimated under Student-t distribution to get the required correlation and then we applied cointegration panel techniques such as DOLS and FMOLS for the estimation analysis.

The panel cointegration results reject the null hypothesis that there is no effect of macroeconomic variable on the stock and sukuk correlation in the GCC in IIR and IPI, while IPI indicating there is negative relationship between sukuk and shariah stock in GCC, this means if the IPI increases by 1%, the stock and sukuk correlation decrease by 1.2. On the other hand the interbank interest rate has a positive effect on the stock sukuk correlation , while if IIR increases by 1%, the stock sukuk correlation will increase by 0.00658.

It was interesting to see that the CPI has no effect on the stock sukuk correlation in this study contrary to the other studies which assert the CPI is the major macroeconomic variable which has impact on the stock and sukuk correlation. The insignificance of CPI may be due to the fact that there are no crisis time in our sample period.

Our finding provides a useful implication for the policy makers in GCC. The portfolio fund managers must consider the correlation and volatility of the Islamic asset, and the most important thing in this study is that the policy makers should take into account the factors that affect the stock and sukuk correlation in the GCC.

9. Limitations

- I. We couldn't get the stock and sukuk monthly data further than 2013, so we couldn't analyze the financial crises effect.
- II. To analyze the MGARCH DCC of stock and sukuk, we use STATA which couldn't provide some important information for the analysis.
- III. There are two countries we couldn't get the required data for them, then we had to drop them from the study.

10. References

- Aloui, C., Hammoudeh, S. & Hamida, H. ben, 2015. Global factors driving structural changes in the co-movement between sharia stocks and sukuk in the Gulf Cooperation Council countries. *North American Journal of Economics and Finance*, 31, 311–329.
- Ariff, M., Safari, M. & Mohamad, S., 2012. Sukuk securities , their definitions , classification and pricing issues Mohamed Ariff , Meysam Safari and. *The Islamic debt market for sukuk securities: The theory and practice of profit sharing investment*, 11–41.
- Ariff, M., Safari, M. & Mohamed, S., 2013. SOCIAL SCIENCES & HUMANITIES Sukuk Securities and Conventional Bonds : Evidence of Significant Differences. *Pertanika Journal of Social Sciences & Humanities*, 21(2), 621–638.

- Christiansen, C. & Rinaldo, A., 2006. Realized Bond-Stock Correlation : Macroeconomic Announcement Effects, Swiss National Bank Working paper, Number 2006 - 2, Zurich.
- Godlewski, C.J., Turk-Ariss, R. & Weill, L., 2013. Sukuk vs. conventional bonds: A stock market perspective. *Journal of Comparative Economics*, 41(3), 745–761.
- Im, K.S., Pesaran, M.H. & Shin, Y., 2003. Testing for unit roots in heterogeneous panels. *Journal of Econometrics*, 115(1), 53–74.
- Kao, C., 1999. Spurious regression and residual-based tests for cointegration in panel data. *Journal of Econometrics*, 90(1), 1–44.
- Levin, A., Lin, C.F. & Chu, C.S.J., 2002. Unit root tests in panel data: Asymptotic and finite-sample properties. *Journal of Econometrics*, 108(1), 1–24.
- Naifar, N., 2016. Do global risk factors and macroeconomic conditions affect global Islamic index dynamics? A quantile regression approach. *Quarterly Review of Economics and Finance*, 61, 29–39.
- Othman, A.N. & Masih, M., 2015. Do profit and loss sharing (PLS) deposits also affect PLS financing? Evidence from Malaysia based on DOLS, FMOLS and system GMM techniques, MPRA Paper 65224, University Library of Munich, Germany.
- Piljak, V., 2013. Bond markets co-movement dynamics and macroeconomic factors: Evidence from emerging and frontier markets. *Emerging Markets Review*, 17, 29–43.
- Switzer, L.N. & Vezina, A., 2003. *Sources of Time-Varying Risk and Risk Premia in U.S. Stock and Bond Markets*, Mimeo, John Molson School of Business, Concordia University, Montreal, Canada.

Yang, J., Zhou, Y. & Wang, Z., 2009. The stock-bond correlation and macroeconomic conditions: One and a half centuries of evidence. *Journal of Banking and Finance*, 33(4), 670–680.