
Munich Personal RePEc Archive

The dilemma of the sharia conscious investor: a time series analysis

Hamour, Mohamed and Masih, Mansur

INCEIF, Malaysia, Business School, Universiti Kuala Lumpur, Kuala Lumpur, Malaysia

30 March 2017

Online at https://mpra.ub.uni-muenchen.de/106129/
MPRA Paper No. 106129, posted 16 Feb 2021 03:42 UTC

The dilemma of the sharia conscious investor: a time series analysis

Mohamed Hamour[1] and Mansur Masih[2]

Abstract:

The universe of sharia compliant equities is rather small and diversification benefits are limited for the sharia conscious investor. This paper attempts to investigate diversification potential among S&P mainstream sharia compliant indices in all six GCC Countries by employing time series techniques of co-integration, vector error correction model, variance decomposition, impulse response functions, and persistence profile of co-integration. It further investigates if there is a diversification benefit between the S&P mainstream sharia indices (MSI) and sectoral sharia real estate in the region by use of Engle Granger and Johansen techniques. If Islamic and Sharia indices are integrating; this leaves the sharia conscious investor with the dilemma of where to invest his wealth to gain diversification benefits. Theoretically if a number of stock markets are found to be co-integrated, then the diversifications gains are lost, since all markets move together in the long run and become one market. To the best of our knowledge this is the first study to investigate diversification potential among MSI within the GCC region, and between MSI and sectorial sharia real estate indices. Evidence from the study indicates that the MSI in the GCC area are bound together by one co-integrating relationship with Bahrain Sharia being the leading index. The same result was found between the MSI and the sectoral sharia real estate indices, leaving the sharia conscious investor in the GCC region no option but to search for regional diversification or other sectoral indices for diversification benefit. Outcome of the study would be valuable for sharia conscious investors in particular and portfolio managers in general in setting their portfolio diversification strategies.

Keywords: Sharia, Conscious investor, Diversification, Co-integration, Main stream sharia index, Real estate sharia index

---

[1] INCEIF, Lorong Universiti A, 59100 Kuala Lumpur, Malaysia.

2 **Corresponding author**, Senior Professor, UniKL Business School, 50300, Kuala Lumpur, Malaysia.

Email: mansurmasih@unikl.edu.my

Introduction: The Issue Motivating the Paper

Most Muslim countries are rich in natural resources and with the right investments and development plans; their economies could be transformed to better the lives of their citizens. Five of the top ten producing oil producing countries in the world are Muslim, Saudi Arabia, UAE, Iran, Kuwait and Iraq. The long and sustained high oil prices of a barrel near and above 100 US dollars generated a great amount of wealth to oil producing countries; especially in the GCC region. This generated excess funds for investment and development and it is partly reflected in a real estate boom and a lavish consumption lifestyle. I believe it is the duty of the sharia conscious investor to invest his money wisely and help his fellow Muslims in the process, by investing in sharia Indices in Muslim countries. This will reinforce the spirit of Muslim brotherhood and co-operation "help one another in *Al-Birr and At-Taqwa* (virtue, righteousness and piety)" (*Al-Ma'idah* 5:2).

Sharia conscious investors seek diversification across a wider range of asset classes, no different to other investors besides being conscious of staying compliant with Sharia rules. By reason of sharia values and restrictions, a sharia compliant portfolio does not engage in a variety of investment practices and techniques normally employed by private investment partnerships or hedge funds. It does not invest in certain sectors like interest based financial services, conventional insurance tobacco, alcohol, gaming and gambling. Furthermore, the quantum of debt, interest income and receivables are restricted to stipulated allowable thresholds. Consequently, the pool of investable stocks by a sharia conscious investor gets smaller. Adherence to sharia guidelines restricts investment opportunities sets for Sharia conscious investors, creating a smaller investment universe. Stocks and real estate are among the two most popular asset classes in the spectrum of Sharia investments and that is why; there are of interest to this study.

Theoretically if a number of stock markets are found to be co-integrated, then the diversifications gains are lost, since all markets move together in the long run and become one market. Integrated markets tend to move together and have long run stable relationship Cheng (2000), any probable realization from diversification of a portfolio is inversely correlated to the degree of stock market integration. A small correlation between returns on stock market indices lets investors minimize portfolio risk by international diversification. Understanding stock market integration is crucial for investors who are interested in diversifying their portfolios across different stock markets. There is a substantial body of research that looked into the subject of conventional stock market

integration in the GCC region; Espinoza investigated the extent of regional financial integration in the member countries of the Gulf Cooperation Council and he concluded it is non-negligible, Espinoza (2010). Multilateral co-integration of the GCC markets was established minimally among these markets as a group Kassim, (2010)., Gulf financial markets are co-integrated with one co-integrating vector Hassan, (2003), evidence of linkages between the GCC countries are found. Mukesh & Chaudhry (2012), there is substantial evidence of interdependence and feedback effects among GCC stock markets. This could partly be explained by Political efforts in the GCC countries to integrate all financial markets creating one large market, eradicating in the process any diversification benefits between the stock markets in the different member states in the GCC union. The question is does this also affect the Islamic indices or are they different?

In an Effort to further integrate GCC countries their Ministers in their 100th regular meeting of GCC Financial and Economic Cooperation Committee (Sep, 2015), has approved the recommendation regarding equality of GCC citizens in member countries which is an extra forward step towards the grand plan of economic and financial integration of GCC economies.

in contrast to the before mentioned fact; about plentiful of research on conventional stock market integration, research on the integration of the Islamic stock indices is very limited in scope and very thin. To our best knowledge there is no study that investigated the co-movement of among MS's I in the GCC region and between MSI and sharia real estate indices in the GCC area. This study intends to address this gap by use of time series techniques of co-integration, vector error correction model, variance decomposition, impulse response functions, and persistence profile.

There is some empirical research that shows sharia indices integrating globally, Kabir, Dewandaru & Masih, (2013). If Islamic and Sharia indices are integrating; this leaves the sharia conscious investor with the dilemma of where to invest his wealth to gain diversification benefits and at the same time invest in indices in Muslim countries to achieve *Maslahah* to the Muslim country and to the Ummah in general. There is a different research carried by Majid & Kassim (2010) that claims sharia indices are not co-integrating globally "Investors who are interested in diversifying their portfolio can gain benefits by diversifying in the Islamic stock market across economic grouping such as that in the developed and developing countries, however, limited benefits are available if investors only diversify their investments within the same economic grouping". For the sharia conscious investor to exploit this and diversify his investments he needs to invest in MSI in the developed countries e.g. The Islamic stock market in the UK or the US.

This will be less than ideal for the sharia conscious investor since his priority will be to invest in MSI in a Muslim country to support their economy and help its growth.

The focus of this study is twofold the first is to investigate if the sharia conscious investor is able to diversify his portfolio of investments by investing in a number of the GCC counties, in other words are the MSI in Bahrain, Kuwait, Oman, Qatar, Saudi and UAE all co-integrating and moving together in the long run creating a single market and nullifying the benefit of diversification. Statistically, the markets are integrated if the markets share a long run equilibrium relation between two variables Bachman, Choi, Jeon, & Kopecky (1996); Yusof & Majid (2006). To explore this; time series techniques will be deployed on a sample of time series daily data for six S&P main stream sharia indices, one each from all six GCC countries, Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and UAE. All data employed for this paper is obtained from Thomson Reuters data stream. Second fold is if the mainstream indices are found to be co-integrated, then we will investigate if the sharia conscious investor can diversify by investing in a mainstream index and in a sharia sectoral index. In other words, we will try to answer this question; does Sharia real estate indices and MSI in GCC markets move together in the long run, and whether there is any scope for diversification? To test this question Engle Granger and Johansen techniques of co-integration were applied to a sample of six indices from three GCC countries Kuwait, UAE, and Saudi. The three countries were chosen because they have the largest real estate markets among the GCC countries, from each country one S&P sharia real estate index and S&P sharia mainstream index were chosen to form the sample of the study. Forming a sample of three sharia real estate indices and three sharia mainstream indices.

This study finds one significant co-integrating relationship among the selected MSI at the 90% confidence level, with Bahrain S&P MSI being the most exogenous (i.e. Independent) index and UAE S&P MSI being the most endogenous (i.e. most dependent). This is comparable to Onour (2009) findings, Bahrain stock market is evidenced segmented from the group of GCC markets. Segmentation of Bahrain stock market is probably due to the distinct nature of Bahrain economy which is the smallest among GCC countries and the least oil-dependent economy in GCC region. UAE's S&P sharia index being the weakest in the group goes against expectation, because of UAE position as a financial centre for conventional finance. This could be attributed that the sharia conscious investor doesn't see it as a suitable place for halal investing because of its open and liberal nature of the society. Qatar MSI also goes against expectation being the second weakest, this could be attributed to it being the youngest among the other GCC in establishing a stock exchange. This study also showed that a linear combination of the selected Islamic equity

indices moves back to equilibrium condition after a certain period following any economic shock.

We have tested the second sample consisting three GCC countries, UAE, Saudi Arabia and Kuwait for co-integration by use of Engle Granger and Johansen methods. The sample is made up of S&P MSI's and S&P real estate sharia index from each of the before mentioned GCC countries. Engle Granger test returned one co-integrating relation and Johansen test returned three co-integrating relations[1]. The Johansen result could be explained by the real estate index following the country's MSI, this will require further investigation. The sharia conscious investor cannot benefit from investing in any of these MSI's and the real estate sharia indices because they are found to be co-integrated and there is no diversification advantage to be gained. The only other available options for the sharia conscious investor is look to invest in another region e.g. Malaysia or to investigate other sectoral sharia compliant indices to invest in. The remainder of the paper is organized as follows. Section II is a summary of the literature review of the study. Section III depicts sources of data and methodology used section IV presents data, results of empirical analysis and main findings. Lastly, section V brings concluding remarks

Literature review:

Research of stock markets integration has received considerable interests from various stakeholders. There are many reasons that institute the importance of stock markets integration. First, it provides further prospects in risk sharing among integrated markets at a cost of taking away the diversification benefit of international investment Siskawati (2011) Alsuhaibani (2004) found evidence of co-integration for some pairs of the GCC stock markets during the five-year period. Multilateral co-integration of the five markets was established minimally among these markets as a group. His findings also suggest that the GCC stock markets, except the Bahrain Stock Exchange, are not co-integrated with the developed markets. Islamic stock markets in similar geographical areas during the financial crisis of 2008 increased their integration, suggesting that investors can gain by diversifying their portfolios in markets of different geographical areas Kassim (2010). Studies by Ibrahim (2009) showed strong evidence of bivariate and multivariate co-integration between five GCC stock market returns in the long run. Naeem (2008) evidenced a similar relationship between GCC (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates) markets. Equities data using cross-listed stocks confirms that stock markets are fairly integrated in the GCC region Espinoza (2010). The positive and

[1] Result outputs of these tests are in the appendix

statistically significant correlation between markets indicates that these markets in GCC might be integrated Sadouni (2013)

In short, the literatures discussed above focus on the integration between conventional stock market indices within GCC region, which reflect the lack of research in sharia indices integration. More studies are needed in the area of sharia indices integration, this can potentially beneficial towards the sharia conscious investors especially the ones in GCC.

Methodology Used:

For the purpose of this paper Time Series Multivariate technique has been carried out to analyse co-integration, exogenous ranking, shock effects and diversification potential among the chosen variables. Prior to this technique, OLS regression-based analysis was conducted in order to assess this type of study. However, OLS regression analysis suffers from various limitations which make the model specification unreliable, thus further leading to unrealistic results. Therefore, utilizing Time Series technique, particularly co-integration, error correction modelling and variance decomposition, the study has been improved. Even though the variables selected have strong theoretical foundations (based on the literature), theories alone are not enough to derive conclusions or to forecast. Thus, attempt was made toward empirical data. Therefore, all eight steps of the Time Series technique were used in order to derive the proper results, and to have strong foundations for analysing the data and testing the relationship among the variables.

Data:

Standard & Poor's launched the S&P/IFCI GCC Indices. The Indices include six Sharia compliant country indices one for each GCC country, the study uses daily data form these sharia indices covering the period of 2010–2015 for the first sample of MSI's. For the second sample data the period covered is from 2009-20015, from each of these counties Saudi Arabia, UAE and Kuwait an S&P sectoral sharia real estate and a MSI was included in the sample. Data for all the variables was sourced from Thomson Reuters Data Stream. For conformity data was obtained from one source and one provider of stock indices information to help with the robustness of the results. The time period for the first sample was shortened by one year because there was no variation in the year 2008-2009 of Qatar's S&P MSI. Other determinant factor for choosing of the period of the study was the availability of data. Daily data was chosen as opposed to weekly or monthly because it is more suitable in capturing daily changes in stock markets movement.

Variables Abbreviations					
Bahrain Sharia index	Kuwait Sharia index	Oman Sharia index	Qatar Sharia index	Saudi Arabia Sharia index	UAE Sharia index
BAS	KUS	OAS	QAS	SUS	UAES

The following eight steps of Time Series Multivariate technique are used in this research: Unit Root test (ADF and PP), VAR, Co-integration test (Engle-Granger and JJ), LRSM (Exact identification and Over identification), VECM, VDC (Generalized, Orthogonalized), IRF, and PP. In addition, Engle Granger and Johansen tests will be applied to the second sample of data.

Step I: Unit Root Test

Figures 1&2 below shows that the natural log has made the variables constant in the variance; while figures 3&4 show that the first difference form has made the variables constant in the mean. The first difference of the natural log form of each variable is taken, with prefix 'D' showing the differenced form, e.g.

$$DBAS = LBAS_t - LBAS_{t-1}$$

A non-stationary series have an infinite variance (it grows over time), shocks are permanent (on the series) and its autocorrelations tend to be unity. On the other hand, stationary series have a mean (to which it tends to return), a finite variance, shocks are transitory, autocorrelation coefficients die out as the number of lags grows. If the series is 'stationary', the demand-side short run macroeconomic stabilisation policies are likely to be effective but if the series is 'non-stationary', the supply-side policies are more likely to be effective.

Figure 1- Level Form Sample 1

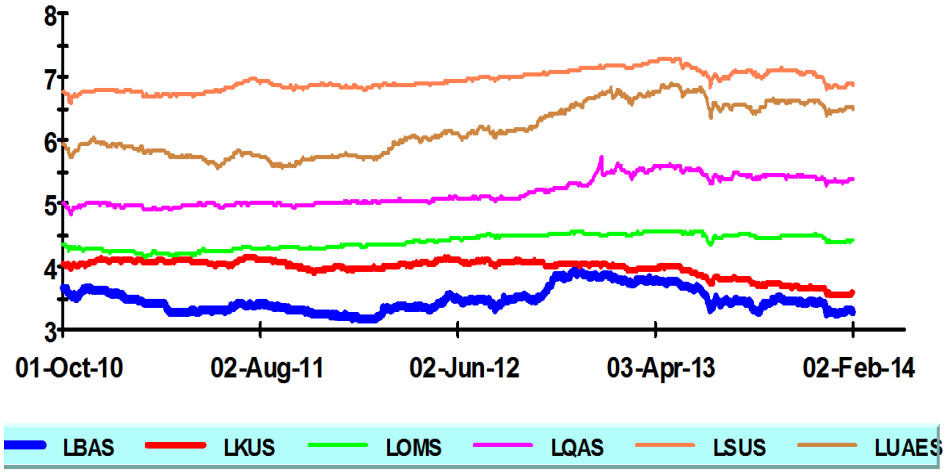


Figure 2 – Level Form Sample 2

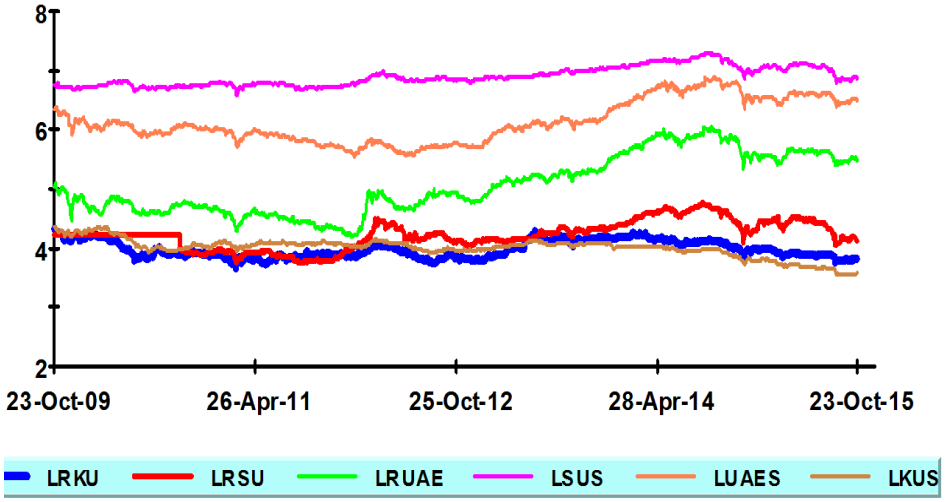


Figure 3- Differenced Form Sample 1

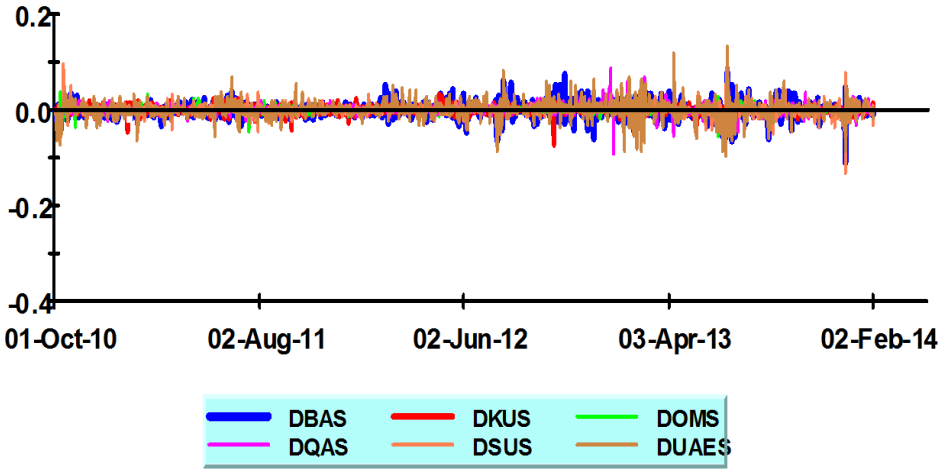
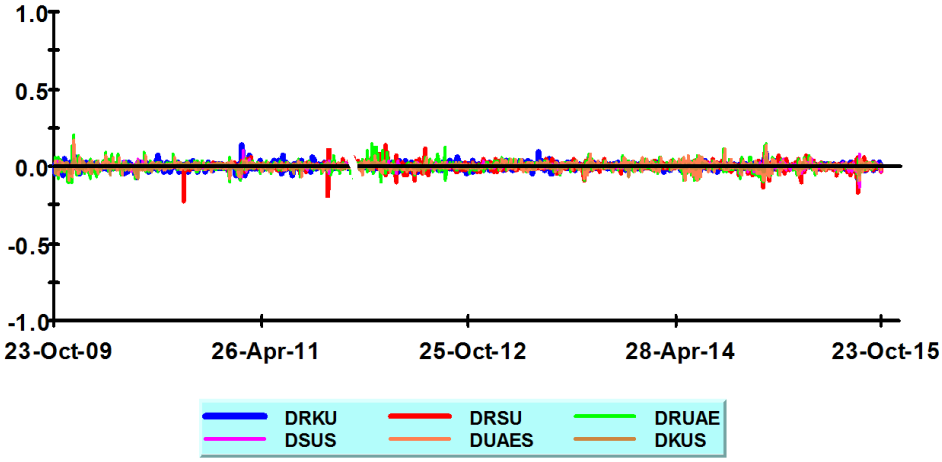


Figure 4 - Differenced Form Sample 2



Looking at the graph we can only assume about the stationarity of the variables but we cannot conclude. Therefore, ADF and PP tests need to be run for the confirmation. Using Akaike Information Criteria (AIC) and Schwarz Bayesian Criteria (SBC), results of the ADF and PP will be analysed to see whether to proceed to the step 2. ADF Regression order will be selected based on the highest computed values of AIC and SBC, while PP is tested based on the t-statistics.

Augmented Dickey-Fuller (ADF) test is used for each variable in the first sample. The second sample variables are found to be non-stationary in the log level form and stationary in the differenced form by use of the ADF and PP test[2]. In table 1 below presented are the outcomes

[2] Only the tables of the focus sample will be presented in the study, sample 2 test results will be included in the appendix

of ADF test, in level, table 2 below are the outcomes of ADF in differenced form. AIC and SBC tests show that all variables are I (1)[3] in their first difference form.

Table 1

Unit root tests – ADF Log form								
		T-Statistic	**CV**	**LL**	**AIC**	**SBC**	**HQC**	**Result**
LQAS	ADF(1)	0.7566	-1.922	3477.5	3475.5	3470.4	3473.6	Non Stationary
	ADF(5)	0.8528	-1.922	3488	3482	3466.7	3476.2	Non Stationary
LBAS	ADF(1)	-0.781	-1.922	3493.5	3491.5	3486.4	3489.6	Non Stationary
	ADF(5)	-0.64	-1.922	3504.3	3498.3	3483	3492.5	Non Stationary
LOMS	ADF(2)	0.2477	-1.877	4337.3	4334.3	4326.6	4331.4	Non Stationary
	ADF(5)	0.2373	-1.922	4345.5	4339.5	4324.2	4333.7	Non Stationary
LSUS	ADF(1)	0.2563	-1.922	3692.4	3690.4	3685.3	3688.5	Non Stationary
	ADF(1)	0.2563	-1.922	3692.4	3690.4	3685.3	3688.5	Non Stationary
LUAES	ADF(1)	0.9029	-1.922	3120.8	3118.8	3113.7	3116.9	Non Stationary
	ADF(1)	0.9029	-1.922	3120.8	3118.8	3113.7	3116.9	Non Stationary
LKUS	ADF(1)	-1.565	-1.922	4119.5	4117.5	4112.4	4115.6	Non Stationary
	ADF(2)	-1.464	-1.877	4122.4	4119.4	4111.8	4116.6	Non Stationary

Table 3 presents the outcomes of PP test, in both level and differenced form. The PP test shows that all variables are I (1) or stationary in their differenced form. ADF and PP results show enough consistency for us to consider all variables to be non-Stationary in their level form and Stationary in their first difference form, indicating that the results of the forecasting are not suspicious, while maintaining the trend component. Based on this we can move to the Step ii.

Table 2

Unit Root Test - ADF Differenced Form								
		T-Statistic	**CV**	**LL**	**AIC**	**SBC**	**HQC**	**Result**
DQAS	ADF(1)	-22.78	-1.922	3474.9	3472.9	3467.8	3471	Stationary
	ADF(4)	-17.58	-1.897	3484.3	3479.3	3466.6	3474.5	Stationary
DBAS	ADF(1)	-23.18	-1.922	3498.2	3496.2	3491.1	3494.3	Stationary
	ADF(4)	-12.73	-1.897	3507.6	3502.6	3489.9	3497.8	Stationary
DOMS	ADF(1)	-21.64	-1.922	4333.2	4331.2	4326.1	4329.3	Stationary
	ADF(4)	-13.98	-1.897	4341.4	4336.4	4323.7	4331.6	Stationary
DSUS	ADF(1)	-23.36	-1.922	3689.3	3687.3	3682.2	3685.4	Stationary
	ADF(1)	-23.36	-1.922	3689.3	3687.3	3682.2	3685.4	Stationary
DUAES	ADF(1)	-23.64	-1.922	3118.3	3116.3	3111.2	3114.4	Stationary
	ADF(1)	-23.64	-1.922	3118.3	3116.3	3111.2	3114.4	Stationary
DKUS	ADF(1)	-23.16	-1.922	4117.5	4115.5	4110.4	4113.6	Stationary
	ADF(1)	-23.16	-1.922	4117.5	4115.5	4110.4	4113.6	Stationary

[3] I(0) represents non-stationarity; I(1) represents stationarity after taking the difference of the first log of the variables

Table 3

	Philip Peron test (PP)					
	LQAS	**LBAS**	**LOMS**	**LSUS**	**LUAES**	**LKUS**
T-Statistic	-2.243	-1.769	-1.904	-1.333	-1.979	-1.026
CV	-3.4529	-3.453	-3.453	-3.453	-3.453	-3.453
Result	Non-Stationary	Non-Stationary	Non-Stationary	Non-Stationary	Non-Stationary	Non-Stationary
	DQAS	**DBAS**	**DOMS**	**DSUS**	**DUAES**	**DKUS**
T-Statistic	-33.4458	-34.8	-34.58	-33.53	-34.73	-35.72
CV	-2.8551	-2.855	-2.855	-2.855	-2.855	-2.855
Result	Stationary	Stationary	Stationary	Stationary	Stationary	Stationary

Step II: VAR Order Selection

Table 4 results show that Akaike information criterion (AIC) recommends order of lag 3 while schwarz Bayesian criterion (SBC) shows the order of lag 0.[4] Choosing an order of VAR represents a trade-off between AIC value and SBC value. However, the lower order of VAR would help to avoid over-parameterization, when there is a short time series and no Serial correlation, while a higher order VAR will address Serial correlation, when there is a longer time series. The trade-off results in a problem if there is a short-time series and Serial correlation. The SBC suggests a VAR of order 0 and the AIC of order 3. So in fear of over- parameterization I have chosen 2 as an order of the VAR[5] as chosen by Johansen and Juselius (1992) when confronted by AIC and SBC select order of 3 and respectively.

Table 4

Order	AIC	SBC	p-Value	C.V.
3	22924.1	22633	[.000]	5%
2	22923.4	22724	[.000]	5%
0	22913.8	22899	[.000]	5%

Step III: Co-integration Test

After the stationary testing findings show that all variables are I (1) having optimal VAR order of 2. These two tests were prerequisite for the next step, step iii-co-integration. In this step, Engle-Granger test (E-G) and Johansen test (J) are used to see whether there is a long-term

[4] The lag order values were usually computed based on the highest values for both AIC and SBC
[5] Microfit Tutorials &lessons pages 295,293

relationship among the variables. From the Table 5 below, we can see the summary of the results from the Engle-Granger test.[6]

Table 5

Test statistic -4.5895,-4.9020	Highest AIC & SBC Values	Critical Value -1.96

From the results in Table 6, the Eigenvalue test statistics is lower than the 95% critical value indicating we don't have co-integration at that level of confidence. The Eigen value test statistics at the 90% level is higher than the critical value indicating the presence of at least one co-integration. Based on this we reject H_0 for r=0. Using the 90% bound, we can conclude that based on the Johansen test, the number of co-integration vectors is equal to 1. Results from the Trace Table show the same result.

Table 6

Co-integration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix					
Null	**Alternative**	**Statistic**	**95% Critical Value**	**90% Critical Value**	**Result**
r = 0	r = 1	43.229	43.610	40.760	1 co-integration
r<= 1	r = 2	30.877	37.860	35.040	At 90%
Co-integration LR Test Based on Trace of the Stochastic Matrix					
Null	**Alternative**	**Statistic**	**95% Critical Value**	**90% Critical Value**	**Result**
r = 0	r>= 1	114.534	115.850	110.6	1 co-integration
r<= 1	r>= 2	71.306	87.170	82.88	At 90%

Step IV: LRSM Test

The variable of interest in this study is LSUS; therefore we normalize it by putting exact identification restriction of unity on its coefficient. This normalization process is shown in the Panel A, Table 8. Exact-identification test is calculated and based on the t-ratios (t.ratio= $\frac{coefficient}{standard\ error}$), and the result of the test shows that variables – BAS & KUS are insignificant, while OMS, QAS & UAES are significant.

[6] If the Test Statistics corresponding to the highest value of AIC and SBC – higher than the Critical value (95% critical value for the Dickey-Fuller statistic in this case), the Null Hypothesis can be rejected and we can consider the variables to be correlated.

Table 8– LRSM Results

Exact and Over Identification Restrictions			
	PANEL A	PANEL B	PANEL C
LBAS	-0.1638	0	0
	-0.15643	(*NONE*)	(*NONE*)
LKUS	-0.08993	-0.04755	0
	-0.20293	-0.22059	(*NONE*)
LOMS	-1.0622	-1.2951	-1.3654
	-0.38747	-0.37116	-0.18523
LQAS	-1.0134	-1.035	-1.0333
	-0.17023	-0.18299	-0.18748
LSUS	1	1	1
	(*NONE*)	(*NONE*)	(*NONE*)
LUAES	0.44264	0.34112	0.3402
	-0.13988	-0.10028	-0.10275
Trend	7.72E-05	2.45E-04	2.81E-04
	-2.13E-04	-1.74E-04	-5.93E-05
CHSQ(1)	NONE	1.0092[.315]	1.0533[.591]

For over identification the insignificant variables were equalled to zero BAS in panel B and KUS in Panel C. In both cases the CHSQ value is greater than 5%, indicating the restrictions is accurate.

Table 9 – LRSM Results: t-ratio and Implication

Variable	coefficient	Standard Error	T-ratio	Implication
SUS	-	-	-	-
BAS	-0.1638	-0.15643	1.047114	Insignificant
KUS	-0.08993	-0.20293	0.443158	Insignificant
OMS	-1.0622	-0.38747	2.741374	Significant
QAS	-1.0134	-0.17023	5.953122	Significant
UAES	0.44264	-0.13988	-3.16443	Significant

Step V: VECM Test

Until now, theoretical long run relationship was established between the variables –BAS, KUS, OAS, QAS, SUS and UAES. However, co-integration cannot tell is the direction of Granger-causation as to which variable is leading and which variable is lagging (i.e. which variable is exogenous and which variable is endogenous). Therefore Vector Error Correction

Model (VECM) will be conducted to decide on the granger-causation. This is another important part where Time Series Multivariate Forecasting differs from Regression technique.

Prior to this step, we tested the Theory of the mode, and now we can move to the final steps of the study which test the Causality. VECM is the first part of testing the Causality, based on which we can determine the extent to which the change in one variable is caused by another variable in previous period. The results for the testing are presented in Table 10.

The test was carried out to examine the error correction term e_{t-1}, for each variable checking the significance.[7] The study shows that two variables are endogenous QAS & OMS while the rest are all exogenous. The coefficient e_{t-1} tells us how much time it takes to return to long-term equilibrium if a particular variable is shocked. The coefficient represents the proportion of imbalance that is corrected in each period. For example for QAS, the coefficient is 0.04656 , meaning that if the shock happens to this variable, it will take about 0.04656 unit time for it to return to equilibrium.

Table 10

ecm1(-1)	Coefficient	Standard Error	T-Ratio [Prob.]	C.V.	Result
dLQAS	-0.04656	0.010107	-4.6065[.000]	5%	Endogenous
dLBAS	-0.00723	0.010079	-.71725[.473]	5%	Exogenous
dLOMS	-0.01992	0.00505	-3.9437[.000]	5%	Endogenous
dLSUS	0.004765	0.008578	.55545[.579]	5%	Exogenous
dLUAES	-0.00386	0.013671	-.28228[.778]	5%	Exogenous
dLKUS	-0.00854	0.005985	-1.4271[.154]	5%	Exogenous

Step VI: VDC Test

Previously we couldn't comment on anything based on relative exogenity and endogeneity of the variables. This means that we couldn't say which variable is the strongest leader and which variable is the weakest follower. However, using VDC test we will be able to arrive at such conclusion. VDC test was done for both Generalized and Orthogonalized approaches.

[7] The Null Hypothesis for VECM is that the variable is endogenous

Orhogonalized tests are presented in the Table 11 while Generalized tests are in the Table 12.

Table 11– VDC Test Results – Orthogonal

ORTHOGONOLIZED APPROACH										
		LBAS	LKUS	LOMS	LQAS	LSUS	LUAES	Total	Self Dep	Ranking
	LBAS	98.19%	0.02%	0.01%	0.45%	1.26%	0.07%	100%	98.19%	1
	LKUS	11%	83%	0%	1%	5%	0%	100%	83%	2
100 days	LOMS	11%	6%	54%	11%	16%	2%	100%	54%	4
	LQAS	7%	6%	2%	53%	29%	3%	100%	53%	5
	LSUS	11%	12%	7%	7%	62%	1%	100%	62%	3
	LUAES	17%	5%	4%	7%	12%	54%	100%	54%	4
ORTHOGONOLIZED APPROACH										
		LBAS	LKUS	LOMS	LQAS	LSUS	LUAES		Self Dep	Ranking
	LBAS	98%	0%	0%	0%	1%	0%	100%	98%	1
	LKUS	11%	83%	0%	1%	5%	0%	100%	83%	2
150 days	LOMS	11%	6%	52%	12%	17%	2%	100%	52%	5
	LQAS	7%	6%	2%	49%	32%	4%	100%	49%	6
	LSUS	11%	12%	8%	7%	62%	1%	100%	62%	3
	LUAES	17%	5%	4%	7%	12%	54%	100%	54%	4

Table 12– VDC Test Result – Generalized

GENERALIZED APPROACH										
		LBAS	LKUS	LOMS	LQAS	LSUS	LUAES	Total	Self Dep	Ranking
	LBAS	63.1%	6.2%	5.5%	1.62%	10.53%	13.08%	100.0%	63.10%	1
	LKUS	6.0%	56.2%	4.7%	1.51%	21.55%	10.05%	100.0%	56.20%	2
100 Days	LOMS	6.0%	7.0%	51.5%	0.47%	21.58%	13.36%	100.0%	51.50%	4
	LQAS	2.7%	5.5%	0.9%	35.97%	32.06%	22.96%	100.0%	35.97%	6
	LSUS	5.8%	9.8%	9.7%	10.64%	53.11%	10.94%	100.0%	53.11%	3
	LUAES	9.2%	6.1%	7.3%	11.75%	16.49%	49.16%	100.0%	49.16%	5
GENERALIZED APPROACH										
		LBAS	LKUS	LOMS	LQAS	LSUS	LUAES	Total	Self Dep	Ranking
	LBAS	63%	6.17%	5.44%	1.51%	10.70%	13.18%	100%	63%	1
	LKUS	6%	56.1%	4.55%	1.32%	21.93%	10.18%	100%	56.11%	2
150 Days	LOMS	6%	7.05%	50.63%	0.32%	22.35%	13.69%	100%	50.63%	4
	LQAS	3%	5.51%	0.69%	33.67%	33.72%	23.79%	100%	33.67%	6
	LSUS	6%	9.81%	9.77%	10.89%	52.79%	10.86%	100%	52.79%	3
	LUAES	9%	6.12%	7.50%	12.21%	16.21%	48.77%	100%	48.77%	5

In the tables presented above, both Orthogonalized and Generalized, all the variables are turned into proportions, attributable to shocks from all the variables. The percentage form in each column shows changes in the variables due to shocks from other variables. The highlighted sections inside the tables show those variables with highest exogenity, which represents the dependency of each variable on its own past. It shows that higher the percentage in the section,

the more exogenous is the variable. That is handled by the Generalized test, which doesn't depend on the ordering of the variables.

From the results in Generalized and the Orthogonalise approach, BAS appears to be the most exogenous variable among all, since it has the highest percentage of it variation explained by itself. This could be partly be explained by Bahrain being the second oldest stock exchange in the region behind Kuwait, it also allow foreigners ownership of stocks and securities, and it is the least oil dependent of all six GCC countries. A consistent ranking in both tables put BAS & KUS and 1&2 giving more credence to the result of VDC test. In the generalised ranking UAES is the weakest, which is rather peculiar considering how big the United Arab Emirates as financial centre. It could be it could not attract sharia conscious investors because of the image of the country being a very open and liberal society.

Step VII: IRF Test

In this part we carry out Impulse Response Function (IRF), It gives us graphical interpretation of the information contained in the previous step, VDC, representing the same variables. Both VDC and IRF are obtained from the MA representation of the original VAR model. IRFs essentially map out the dynamic response path of a variable owing to a one-period standard deviation shock to another variable. The IRFs are normalized such that zero represents the steady-state value of the response variable.

Shocking the exogenous variable SUS the impact on other variables is visually noticeable for the Orthogonalized and the Generalised approaches. UAES and QAS showing the biggest response to the shock being the two weakest and the other variable which are ranked higher than SUS showed a much smaller response. Results are in line with the VDC results, showing that when UEAS– the most endogenous variable – is shocked, BAS – the most endogenous variable – doesn't deviates the most from the equilibrium, compared to other variables. This effect is similar in both the Orhogonalized and Generalised, but it is a pit more pronounced on the latter. In the Figure 6, presented are the results of shocking the weakest variable that is, UAES and it shows from the graphs the impact is minimal on the other variables.

Figure 5

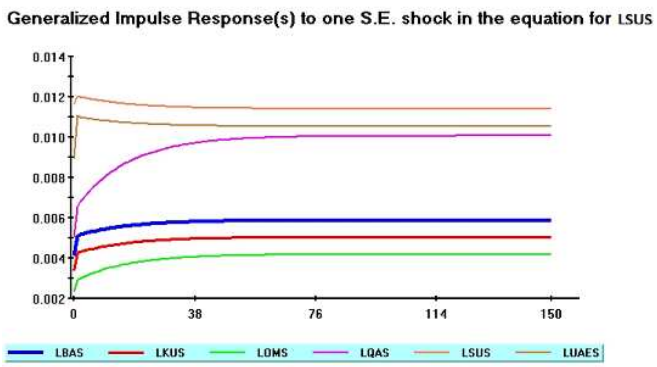


Figure 6

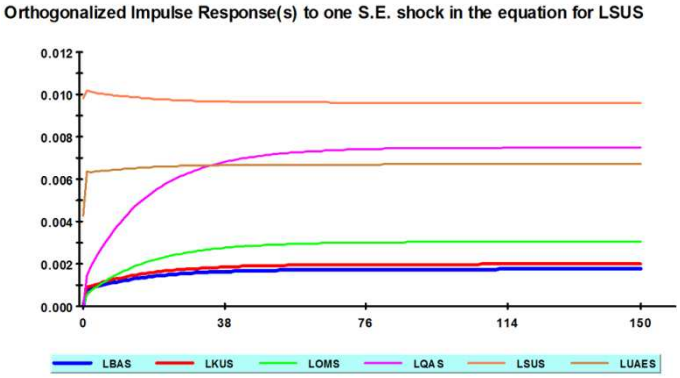
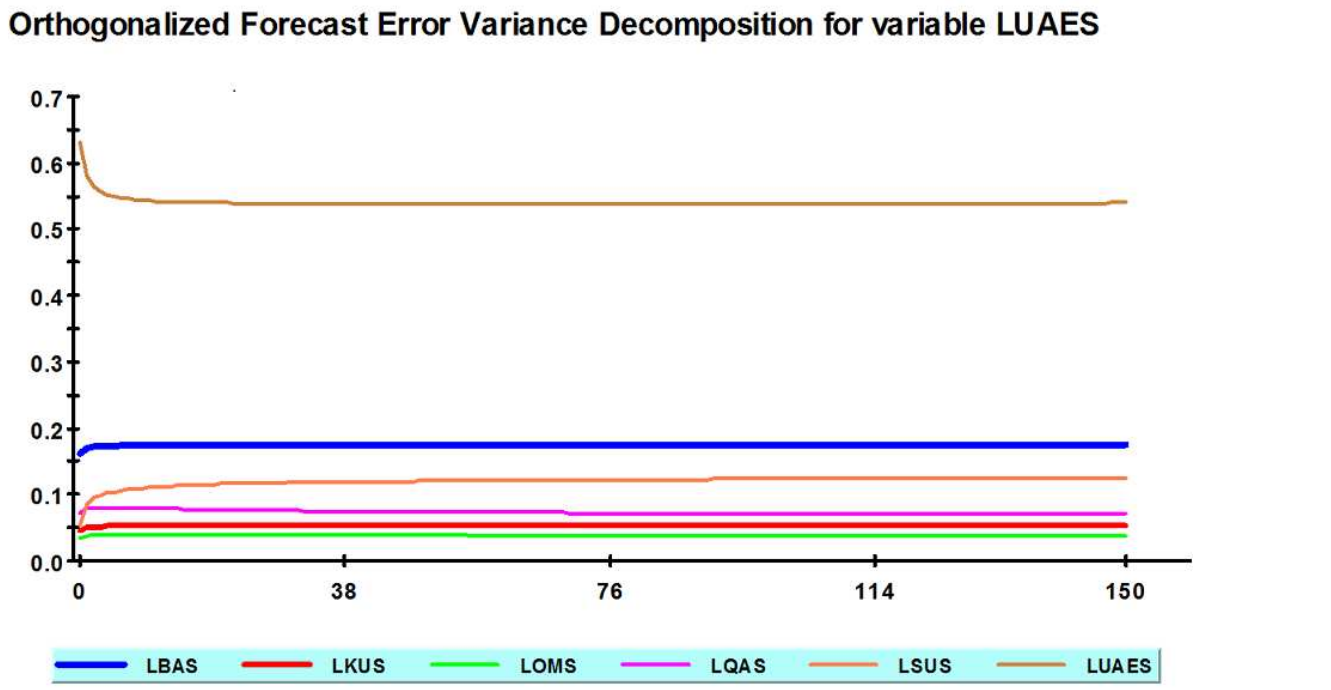


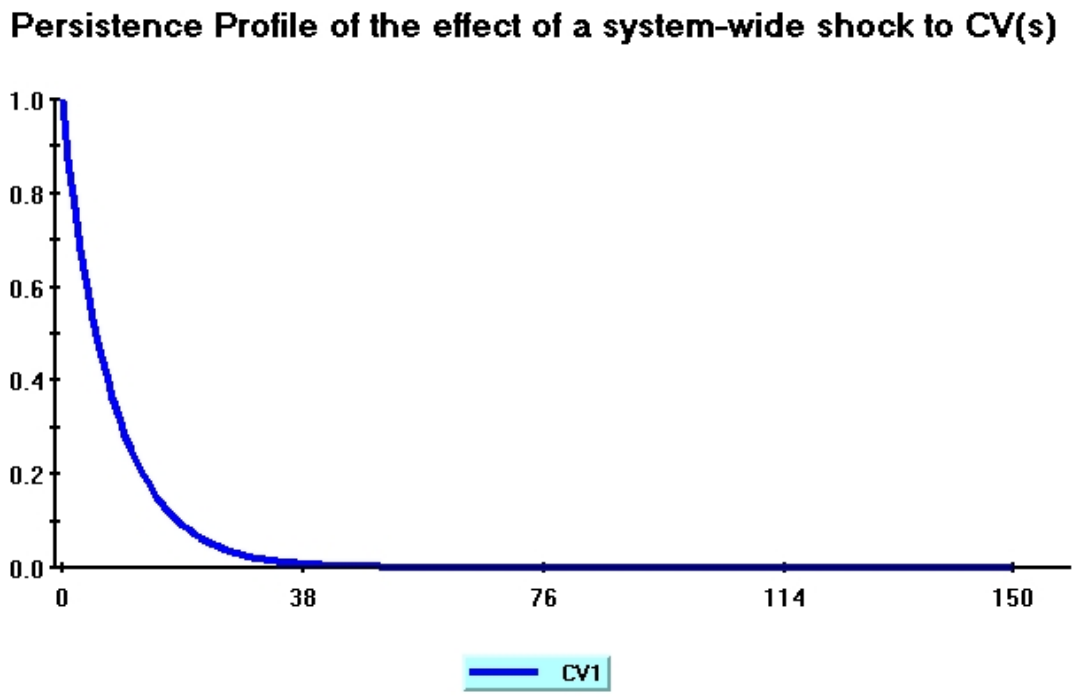
Figure 7



Step VIII: PP Test

The persistence profile is indicative of the time horizon required to get back to equilibrium when there is a system-wide shock. The main difference between IRF and PP is that the persistence profile trace out 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 relationship. Figure 5 shows that it will take the model approximately 45 days to return to equilibrium. This means that, when there is some external shock to the system, the variables will go away from the equilibrium, resulting in the temporary situation where there is no co-integration among them. However, after about 45 days, they will come back to the state of equilibrium and become co-integrated again.

Figure 6 – PP Test Results



Conclusion:

The Sharia conscious investor's dilemma is set to continue this paper set out to find diversification potential among the sharia compliant indices in the GCC region by means of time series techniques, applied to a main sample of six S&P MSI from Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and UAE. The study also investigated the diversification potential in investing in

a sectoral sharia compliant index, time series techniques were applied to a second sample of three S&P real estate sharia indices and three S&P MSI from UAE, Saudi and Kuwait. This study found one co-integrating relationship among the selected six indices (Main sample). In other words, the selected six indices are bound together by a theoretical relationship as a whole, with Bahrain being the most exogenous variable, i.e. most influential market among the MSI's under consideration and UAE being the weakest. Implication to the sharia conscious investor is; he can only invest in the long run in one GCC sharia index because the diversification benefits are nullified by the market being integrated and moves together in the long run. To try and solve this dilemma we looked into the sectoral sharia indices as solution, our selection was for real estate being very popular choice among sharia conscious investors. The study found three co-integrating vectors among our second sample by applying the Johansen method; indicating real estate sharia indices flow the MSI's in the GCC region. So there is no diversification benefit for the sharia conscious investor in investing in a MSI and a sharia real estate index because they will move in tandem in the long run. The findings of this study could have several implications for the sharia conscious investors and policy makers in general and portfolio managers in particular of sharia equity markets. Portfolio managers thinking of investing in MSI's should incorporate Bahrain S&P sharia index in their portfolios as it is the least co-integrated market. GCC policy makers should take the results of the study into account while formulating policies in the concerned Islamic equity markets in order to move towards resilient, robust and competitive Islamic capital markets in the region. While this study looked at only MSI's and MSI's and its relation the sectoral sharia real estate indices, future research should try to look at a more comprehensive picture of integration pattern by trying to map out the diversification benefits map of all the sharia compliant indices in all sectors in all Muslim countries giving the sharia conscious investor a chance to prioritise his investment activities in sharia compliant indices in Muslim countries first. This could be achieved by conducting more research in the area of sectoral sharia indices, which is a very much under researched area, so until then the dilemma continues.

References

Alsuhaibani, S. (2004). *Financial Integration of Stock Markets in the Gulf Cooperation Council Countries*, Ph.D. thesis, Colorado State University, USA.

Bachman, D., Choi, J. J., Jeon, B. N., & Kopecky, K. J. (1996). Common factors in international stock prices: Evidence from a co-integration study. *International Review of Financial Analysis*, *5*(1), 39-53.

Chaudhry, M., & Boldin, R. J. (2012). GCC equity market indices integration. *Applied Financial Economics*, *22*(6), 471-478.

Engle, R. F., & Granger, C. W. (1987). Cointegration and error-correction representation, estimation, and testing. *Econometrica,* 55(2), 251–276.

Espinoza, R. A., Williams, M. O., & Prasad, A. (2010). *Regional financial integration in the GCC*, IMF Working Paper number 10/90.

Ibrahim, O. (2009), "Financial integration of GCC capital markets: evidence of non-linear co-integration," *Afro-Asian Journal of Finance and Accounting*, 1(3), 251-265.

Kabir, S., Dewandaru, G., & Masih, M. (2013). Are Islamic Stock Markets Integrated Globally? Evidence From Time Series Techniques. *Australian Journal of Basic and Applied Sciences*, 7(7), 702-720.

Kassim, S. H. (2010). *Global financial crisis and integration of Islamic stock markets in developed and developing countries*. Institute of Developing Economies, Japan External Trade Organization, Working paper number 461, December.

Majid, M. S. A., & Kassim, S. H. (2010). Potential diversification benefits across global Islamic equity markets. *Journal of Economic Cooperation and Development*, 31(4), 103-126.

Siskawati, E. (2011). Islamic Capital Market Interconnection: Evidence from Jakarta Islamic Index to The Regional Islamic Market and Global Islamic Market. *International Journal on Social Science, Economics and Art*, 1(2), 153-156.