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Dynamic Linkages between Newly Developed Islamic Equity Style Indices: Is Growth Style More Influential Than Value Style?

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Abstract: This study investigates the dynamic linkages between the newly developed Islamic equity style indices from stocks listed in FTSE EMAS Shariah Index from May 2006 to May 2017. Based on the Vector Autoregressive model (VAR), the results indicate: Firstly, there are short-run dynamics between Islamic equity style indices. Notably, growth style indices are more influential than value style; Secondly, the Large Growth index is the most influential, followed by Medium and Small Growth; Thirdly, Large Growth index precedes Large Value index. These results reaffirm that growth style is more receptive than value style with respect to new information due to institutional investors who prefer growth stocks from blue-chip companies, GLCs and GLICs. This study also proposes the effect of retail investors to explain information flow from small-cap to medium, and medium to large-cap. Robustness check with Toda-Yamamoto procedure yields similar result with VAR model except for one short-run relationship from Large Growth to Large Value. Our results redefine the importance of growth style and support new product differentiation in the quest to develop the Islamic fund management industry.

Keywords: Islamic finance, equity style index, information transmission, growth style, fund management.
JEL classification: G11, G12, G18, G23

1. Introduction

The Fama and French three-factor model (1992) stands to be one of the most important theoretical development in the area of asset pricing. Despite the arguments and criticisms against the three-factor model, academics and practitioners successfully utilise the Fama and French factors, which classify stocks based on value and growth characteristics as well as market capitalisation, in order to develop stock market indices which are better known as equity style indices.

The equity style index has been lauded for its usefulness as a benchmark for the purpose of portfolio construction and used as a means to determine the performance of fund managers. Some practitioners advocate that equity style index has been a valuable tool for analysts to forecast the future economic performance of a country.

Renowned index providers or research houses such as Morgan Stanley Composite Index (MSCI), Russell in the U.S., Nomura and Daiwa in Japan, have developed style indices based on conventional stocks. However, there is yet for them to develop commercially

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available equity style indices for Islamic stocks, especially for emerging markets like Malaysia.

The ability of equity style index to transmit information has been found by Liew and Vassalou (1999), Tan and Lau (2013) and Lau and Lee (2015). It is found that conventional equity style indices have the predictive properties which precede macroeconomic indicators. These results are proven to be useful in the setting of both developed and developing markets.

In an attempt to bridge the gap between the conventional and Islamic Finance in the area of equity style index, Islamic equity style index has been developed initially from 2006 to 2011 as discussed in Shaharuddin *et al.* (2017a, 2017b). This new data set has been further extended to May 2017.

This study is unique as most finance literature only looks into the application of indices in the factor model. There is no attempt to look into the time series properties of the indices and their interaction. This paper contributes to the literature by unravelling the time series properties as well as the interaction between equity style indices of an emerging economy.

As the concept of the Islamic equity style index is relatively new, there is a scarcity of literature when it comes to equity style indices and their ability in information transmission. In order to bridge this gap in the literature, this paper sets out to investigate the dynamic linkages between the six newly developed Islamic equity indices.

This study will look into the short-run and long-run information flow between the six newly developed Islamic equity style indices from stocks listed in FTSE EMAS Shariah Index. In addition, this study intends to verify which equity style index is more efficient in terms of information transmission as well as the relationship between Growth and Value style. Using Granger causality in a VAR framework, a few hypotheses will be tested. Lastly, a robustness check is conducted using Toda-Yamamoto Wald Procedure.

The remainder of this paper will be presented as follows. Section 2 discusses the relevant literature and theoretical framework. Section 3 outlines the data and methodology. Section 4 results and the last section concludes the paper.

2. Literature Review

The efficacy of using stock market indices in order to predict future economic performance of a can be found in as early the 1940's through the seminal work by Burns and Mitchell (1945) in studying macroeconomic variables and its use in measuring cyclical and noncyclical behaviour in an economy which lead towards the development of coincident economic indicators (CEI) and leading economic indicators. However, it was not until the 1980's where Stock and Watson (1989) formalized a mathematical framework for the CEI and LEI in order to develop indices which would help to predict the economy.

The development of leading economic indicators in the form of indices by Stock and Watson (1989) and findings by Fama and French (1992) and their three-factor model would later result in researchers studying the information transmission capabilities of the Fama and French factors. The results from the Fama and French (1992) study gave impetus to investors and analysts to not only rely on new equity style indices for purposes of making asset allocation decisions and performance benchmarking but also to experiment with the potential of applying the equity style indices for purposes of forecasting economic performance. The predictive qualities of the equity style indices were initially tested by Liew and Vassalou (1999). The results of this study provided evidence that the Fama and French factors contain economic information that precedes macroeconomic variables such as gross domestic product (GDP).

Various other studies have been performed in order to test the information transmission capabilities of the Fama and French factors. For instance, in testing the Fama and French factors using the ICAPM model, Petkova (2006) found that by applying the VAR model, the high-minus-low (HML) and small-minus-big (SMB) factors are significantly correlated to innovations in state variables to predict excess market returns and its variance. The study further establishes the empirical robustness of the Fama and French factors.

Further studies using the Fama and French factors to explain or forecast an economy include Bai and Ng (2006). In this study, it was found that the Fama and French factors, as well as several business cycle indicators, acts as latent factors which influence an economic time series. It was also found that the Fama and French factors better approximate the factors in a portfolio and individual stock returns.

The study of cointegration analysis between Fama and French variables are scarce. However, Valtonen (2008) in his study of the cointegration between Fama and French factors using an error correction model found that there are long-term trends between the Fama and French variables with the market portfolio. The results of the study also indicated that contrary to theory, the small-cap growth premium diminished when tested during the period 1980 to 2004.

The Granger-causality and variance decomposition tests were applied to test the Fama and French factors with market returns by Shijin *et al.* (2007). The findings from the study provided evidence to suggest that there is a causal relationship between market risk factors and non-market based measures (i.e. non-market based measures relate to the Fama and French factors).

As a compliment to the cointegration techniques applied by previous researchers, the wavelet analysis was used to test the explanatory power of the Fama and French factors during different time scales (Trimech *et al.*, 2009). The results of the study showed that the relationship between risk factors such as market, size and value factors depend upon the time-horizon and is useful for researchers and investors in developing investment portfolios.

The evidence from the review of literature seems to indicate that a majority of the studies in relation to the information transmission properties of the Fama and French factors were performed in the context of conventional stock markets. However, there have been fewer studies performed when it comes to Islamic stocks or even the stock markets in emerging economies.

Amongst the studies relating to leading indicators and its predictive properties in emerging economies is the study by Burkaert and Coudert (2002). In this study, it was found that leading indicators including capital controls and banking sector indicators can be used in order to indicate a looming financial crisis. Spierdijk and Umar (2014) however suggested that the element of time and the timing of investments are important factors to consider when it comes to making international diversification investment decisions in stocks in emerging economies.

However, the test of Fama and French factors and its usefulness as a leading economic indicator in an emerging economy such as Malaysia was studied by Tan and Lau (2013) as well as Lau and Lee (2015). In both instances, it was found that the equity style indices are better at transmitting economic information as compared to the stock market index. By reviewing the state of the current literature on the information transmission capabilities of the Fama and French factors, the evidence seems to suggest that the equity style indices have information content that can be used to predict future economic performance.

2.1 Theoretical Framework

As mentioned in above, Islamic growth style and value style indices are used as the equity style indices in this study. Since equity style index has economic content, it is hypothesised that:

Hypothesis 1: There will be information flow from growth style to value style indices.
Hypothesis 2: There will be information flow from large growth to large value style indices.
Hypothesis 3: There will be information flow from small growth to small value style indices.
Hypothesis 4: There will be information flow from medium-cap to large-cap indices.
Hypothesis 5: There will be information flow from small-cap to medium-cap indices.

As discussed in above, equity style index is a refinement from the stock market index. Hence, there is information flow from growth stocks to value stocks. Hypothesis 1 is a strong hypothesis. It is further expected the Large Growth stocks will contain more information as compared to Large Value stocks (Hypothesis 2). A similar argument can also be put forth that Small Growth stocks will precede Small Value stocks (Hypothesis 3). This is especially true in the context of Malaysian where Shariah-compliant stocks are also linked to Government Linked Companies (GLCs) and Government-Linked Investment Companies (GLICs) where their stocks have higher PE. In short, Growth stocks tend to be the favourite of local or foreign institutional investors where they have the capacity to buy and sell the stocks when there is the arrival of new information. In other words, there exists "institutional investors" effect for explaining the information flow from growth style to value.

On the other hand, the information from medium-cap stocks to large-cap stocks is faster (Hypothesis 4). This is due to the fact they are priced cheaper than large-cap stocks. Investors find it is much easier to buy medium-cap stocks rather large-cap stocks. Hence, whenever there is an arrival of new information, their movement will precede large-cap stocks. A similar argument can also be used to support Hypothesis 5 where small-cap stocks tend to move faster than medium-cap stocks. In other words, medium-cap and small-cap stocks could be the favourite of retail investors. In other words, there exists “retail investors” effect for small and medium-cap stocks.

3. Data and Methodology

3.1 Data

New style indices are constructed from daily stock data collected from May 2006 to May 2017 to coincide with the listing of Shariah-compliant stocks from the Securities Commission of Malaysia. Index construction is based on the methodology as described in Shaharuddin *et al.* (2017b). It is an extension of the data set from 2006 to 2011 used in earlier papers by Shaharuddin *et al.* (2017a, 2017b).

There are six newly created Islamic equity style indices from Growth and Value as shown in Table 1. The universe of Islamic stocks chosen is determined by the listing of Shariah Compliant Securities from the Securities Commission of Malaysia.[20] The newly created Islamic equity style indices can be observed from Figure 1 to 3. For each pair of large, medium and small indices from the growth and value style, they exhibit some kind of lead and lag relationship.

[20] Shariah Compliant Securities are stocks listed on the Kuala Lumpur Stock Exchange (KLSE) which are approved by the Shariah Advisory Council (SAC) of the Securities Commission of Malaysia (SC) (refer to Securities Commission of Malaysia website). These stocks are classified as Shariah Compliant based on the SAC's methodology in screening companies to be included in their list of Islamic Shariah Compliant securities. The list of Shariah Compliant securities is produced twice a year.

Table 1: List of variables

Variable	Description	Unit of measurement	Source
LG	Large growth Islamic equity style indices	Base Value (100)	Author's construction
LV	Large value Islamic equity style indices	Base Value (100)	Author's construction
MG	Medium growth Islamic equity style indices	Base Value (100)	Author's construction
MV	Medium value Islamic equity style indices	Base Value (100)	Author's construction
SG	Small growth Islamic equity style indices	Base Value (100)	Author's construction
SV	Small value Islamic equity style indices	Base Value (100)	Author's construction

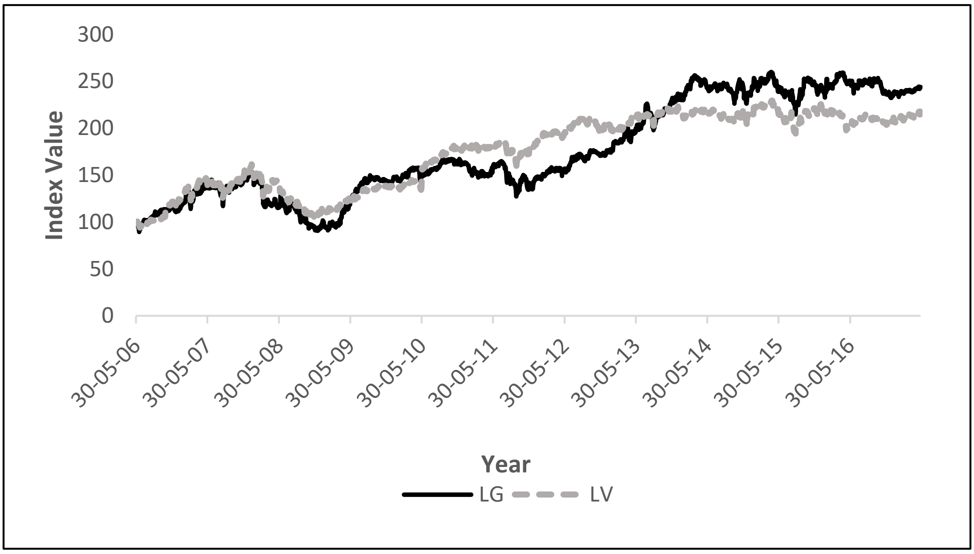

Figure 1: Large Growth (LG) and Large Value (LV) Islamic Equity style indices

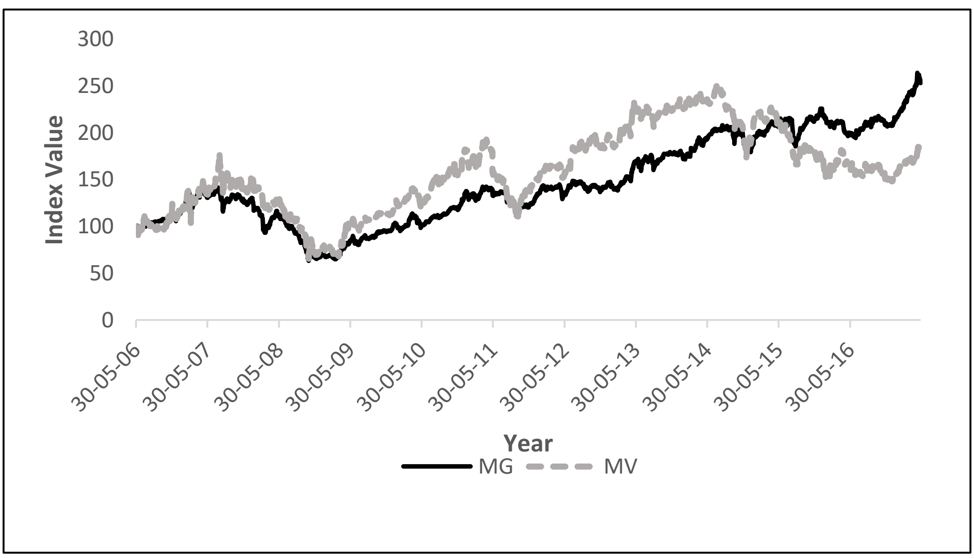

Figure 2: Medium Growth (MG) and Medium Value (MV) Islamic Equity style indices

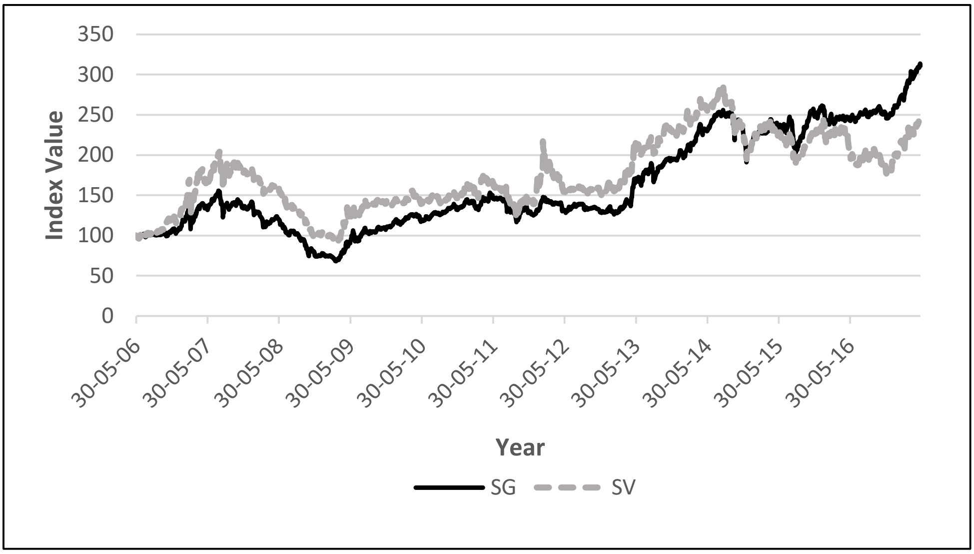

Figure 3: Small Growth (SG) and Small Value (SV) Islamic Equity style indices

Table 2 shows the descriptive statistics of all indices. It is observed that SG index is the most volatile as opposed to LG index which yields the lowest standard deviation. Therefore, LG index is the safest index to invest in as it contains mostly large-cap growth stocks.

Table 2: Descriptive statistics

Variables	Mean	Median	Maximum	Minimum	Std. Dev.	Observation
LG	175.4129	183.3249	229.6206	94.17168	39.13831	2867
LV	176.4769	158.8246	260.1812	89.39072	52.08928	2867
MG	146.7914	137.3417	263.7816	63.32066	46.23187	2867
MV	158.3623	157.7355	250.8772	65.57917	43.65921	2867
SG	162.1375	137.5232	313.6080	68.18218	59.21096	2867
SV	175.4706	166.2796	283.9265	92.35218	44.22160	2867

Notes: LG denotes Large Growth, LV denotes Large Value, MG denotes Medium Growth, MV denotes Medium Value, SG denotes Small Growth, SV denotes Small Value.

3.2 Unit Root Test

A unit root test is used to examine whether a time series is stationary or non-stationary using the autoregressive model. It is essential that the economic time series is stationary in a VAR framework. A differencing method is commonly used in order to eliminate non-stationary trend for time series data which has a non-stationary sequence. In order to establish sequence stationarity, standard unit root tests will be performed. The tests which shall be employed include the Augmented Dickey-Fuller (ADF) test and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test in order to improve the credibility of the empirical findings. These tests are further explained below.

3.2.1 Augmented-Dickey Fuller (ADF) Test

The Augmented-Dickey Fuller (ADF) test is an extension of the Dickey-Fuller test of which is used to test the unit root a series by adding lagged terms of dependent variables to ensure that error terms are not correlated. Furthermore, by adding the lagged difference term of variable y_t, the ADF test enables higher-order serial correlation to be avoided. The ADF test equation can be explained below:-

$$\Delta y_t = \psi y_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta y_{t-i} + u_t \quad (1)$$

where μ is a constant and β denotes the coefficient on a time trend, whilst p is the lag order of the autoregressive function and Ɛ is the error term. The test for stationarity can be further explained based on the hypothesis below:

$$H_0 : \psi = 0$$

$$H_1 : \psi < 0$$

The test statistic refers to

$$DF = \frac{\hat{\gamma}}{\mathrm{SE}(\hat{\gamma})} \sim \tau \text{ distribution} \quad (2)$$

and Ho is rejected if the computed DF>Mackinnon critical value and the series y_t is integrated into the order of 0. In choosing the appropriate lag length for the unit root test, the value that minimizes the information criteria such as Akaike Information Criteria (AIC) as below:

$$AIC = n\sum \tilde{\varepsilon}_t^{\ 2} + 2m \quad (3)$$

and Schwarz's Bayesian Information Criteria (BIC) (as below)

$$BIC = n\sum \tilde{\varepsilon}_t^{\ 2} + m \ln n \quad (4)$$

where ε_t is the residual of the unit root test regression and m is the parameter in the test regression including a constant is used.

3.2.2 Kwiatkowski-Phillips-Schmidt-Shin (KPSS) Test

However, the power of ADF tests is low if the root is close to a non-stationary boundary. In order to confirm the result of the unit root test, stationarity tests have also been carried out. In this instance, KPSS test by Kwiatowski *et al.* (1992) is used.

To further explain the KPSS test, it could be argued that KPSS is another unit root test with time trend, *t*, where:

$$y_t = \mu + \beta t + \varphi \sum_{i=1}^{t} \varepsilon_{t-1} + u_t \quad (5)$$

where μ is constant, u_t is a stationary process and the past error ε_{t-1} ~ i.i.d (0,1). Under the null hypothesis, the series y_t is assumed to be stationary. On the contrary, under the alternative hypothesis, yt is non-stationary. So that by default under the null the series will appear stationary.

$\mathrm{H}_0 : y_t \sim \mathrm{I}(0)$

$\mathrm{H}_1 : y_t \sim \mathrm{I}(1)$

3.3 Vector Autoregression (VAR)

Vector autoregression model VAR(p) is an extension of the univariate autoregression model to model multivariate time series model. In the case where the k variables are not co-integrated, a VAR model with lag$p$ is defined as

$$y_t = c + A_1 y_{t-1} + A_2 y_{t-2} + \cdots + A_p y_{t-p} + \varepsilon_t \qquad (6)$$

where y_t defined as ($y_{1,t}$, $y_{2,t}$,$y_{k,t}$) of$k \times 1$ vector, each c is a $k \times 1$ vector of constant (intercept), each A_i is a $k \times k$coefficient matrix and ε_i is $k \times 1$ error terms vector.

The lag length for the VAR(p) model may be determined by using model selection. A standard practice Akaike Information Criterion (AIC)

$$\text{AIC} = n \sum \widehat{u_t}^2 + 2(k+1) \qquad (7)$$

where u_t denoted as residuals are applied in selecting a lag length.

3.4 Granger's Causality Test

Next, causality tests are used to assess the information content of leading indicators. Granger's (1969) test used within a bivariate context, states that if a variable x Granger causes the variable y, the mean square error (MSE) of a forecast y based on the past values of both variables is lower than that of a forecast that uses only past values of y. Equation (8) shows the autoregression where the Granger causality test is carried out. However, differencing is only restricted to variables with unit roots.

$$\Delta y_t = \alpha + \sum_{i=1}^{p} \beta_i \, \Delta y_{t-i} + \sum_{i=1}^{p} \gamma_i \Delta x_{t-i} + \varepsilon_t \qquad (8)$$

and testing the joint hypothesis

$$H_0 : \gamma_1 = \gamma_2 = \ldots.. = \gamma_p = 0$$

H_1: At least one of the γ_i is not equal to zero

If the asymptotic chi-square test rejects the H_0, then Granger causality from the leading indicator x to the coincident indicator y is established. A significant test statistic indicates that the leading indicator x has predictive value for forecasting movements in the chosen coincident indicator y, over the information contained in the past of y. In Granger's causality test, the direction of causal effect between equity style indices and stock indices, equity style indices and economic indicators, stock indices and economic indicators are tested using restricted F test statistic as shown equation (9). Using optimal lag length, the parameter of the model is tested with a null hypothesis that there is no Granger causality between two series. As proposed by Engle and Granger (1987):

$$\text{F=} \frac{(RSS_R - RSS_U)/p}{RSS_U \, /(n-2p-1)} \qquad (9)$$

where RSS_R is the residual sum of squares of a restricted model while the RSS_u is the residual sum of the square of an unrestricted model; n represents sample size and p is the number of restricted parameters.

3.5 Toda-Yamamoto Level Vector Autoregression

Sims *et al.* (1990) show that inference based on level VAR is valid since the Wald test used in Granger causality has a limiting chi-square distribution if the time series are cointegrated. However, this approach has a limitation because of its dependence on pre-test for cointegration and its inapplicability to mixed orders of integration processes. A recent method proposed by Toda and Yamamoto (1995) is complementary to the Sims *et al.* (1990) technique because it allows for causal inference based on augmented level VAR with integrated and cointegrated processes. This method is useful because it bypasses the need for potentially biased pre-test for unit roots and cointegration common to other formulations.

The Toda and Yamamoto (1995) procedure use a modified Wald (MWALD) test to test restrictions on the parameters of the VAR(k) model. This test has an asymptotic chi-squared distribution with k degrees of freedom in the limit when a VAR [k + d(max)] is estimated (where d(max) is the maximal order of integration for the series in the system). Two steps are involved in implementing the procedure. The first step includes determination of the lag length (k) and the maximum order of integration (d) of the variables in the system.

Measures such as the Akaike Information Criterion (AIC) and Hannan-Quinn (HQ) Information Criterion can be used to determine the appropriate lag structure of the VAR. Given the VAR (k) selected, and that the order of integration d(max) is determined a level VAR can then be estimated with a total of p= [k + d(max)] lags. The second step is to apply standard Wald tests to the first k VAR coefficient matrix (but not all lagged coefficients) to conduct inference on Granger causality.

4. Results and Discussion

Table 3 presents the unit root and stationary test results for the six different indices which have been created. Before the unit root test is conducted, all series are transformed into natural logarithm for the purpose of avoiding the possibility of non-stationarity in the variance. The ADF test and KPSS test are conducted on the logarithmic series of the respective variable of large growth index (LnLG), large value index (LnLV), medium growth index (LnMG), medium value index (LnMV), small growth index (LnSG), and small value index (LnSV).

As shown in table 3, both ADF test and KPSS test has shown that all the series become stationary after taking the first difference. As such, this indicates that LnLG, LnLV, LnMG, LnMV, LnSG, LnSV are integrated of the order one. Since all the series are integrated of the order one, it is interesting to examine the long run relationship among the six indices. Therefore, a cointegration test has been conducted.

Table 3: Unit root and stationary test results

Series	ADF Test		KPSS test	
	Level	First difference	Level	First difference
LnLG	-2.02(0)	-50.93(0)***	5.79(42)**	0.19(8)
LnLV	-1.33(0)	-51.79(0)***	6.01(42)**	0.07(12)
LnMG	-0.19(1)	-50.19(0)***	5.36(42)**	0.13(12)
LnMV	-1.75(2)	-35.12(1)***	3.96(42)**	0.08(10)
LnSG	-0.18(2)	-33.51(1)***	5.49(42)**	0.13(11)
LnSV	-1.76(0)	-51.19(0)***	4.29(42)**	0.07(9)

Notes: The asterisks *** and ** denote statistical significance at 1% and 5% level respectively. Figures in parentheses are the optimal lag length chosen. Ln denotes all series have been transformed into the natural logarithm. LG denotes Large Growth, LV denotes Large Value, MG denotes Medium Growth, MV denotes Medium Value, SG denotes Small Growth, SV denotes Small Value.

4.1 Testing for Long-Run Relationship

In testing for cointegration, this paper uses the Johansen Juselius (1991) procedure. This procedure is a multivariate cointegration analysis, in which it allows one to test for the number of cointegrating vectors that might exist. Before the test for cointegration, a vector autoregressive model (VAR) in level form is conducted to determine the appropriate lag length. Lag length criteria are checked, Akaike information criterion suggests the model is at its optimal lag length three.

The cointegration test is conducted because the unit root test results show all of them are I(1). In addition, one may hypothesise that the six Islamic equity indices represent the whole universe of stock investment. Intuitively, when one trader sells growth stock, he might buy value stock. Hence, when there is a sale, there will be a purchase. On that premise, one may think market forces will ensure these series to move together.

However, in real life, a trader who sells a stock may substitute with an investment in bond or other financial instruments. In other words, traders are free not to substitute a growth stock with value stock. Hence, this creates an imperfect market within the equity style universe. Due to such imperfect substitution, the market forces do not work all the time. Hence, there is no long-run relationship despite the fact that one may think they exist in the first place.

Table 4 presents the result for Johansen cointegration test. The first test involves a null hypothesis of no cointegrating vectors and the result is statistically insignificant, in which trace statistics and Max-Eigen statistics are lower than the 5% critical value. Hence, it can be concluded that there is no long-run relationship among the six indices.

Table 4: Johansen cointegration test

Hypothesized number of CE	Trace test		Maximum Eigenvalue tests	
	Trace statistics	5 % Critical value	Max-Eigen statistics	5 % Critical value
None	94.1079	95.7536	34.4544	40.0776
At most 1	59.6535	69.8188	22.0332	33.8768
At most 2	37.6202	47.8563	18.7754	27.5843
At most 3	18.8448	29.7970	11.4832	21.1316
At most 4	7.3615	15.4947	6.8246	14.2646
At most 5	0.5369	3.8414	0.5369	3.8414

To ensure robustness in our results, Johansen-Juselius (1990) Cointegration Test has been carried out for each pair of the series, namely LG and LV, MG and MV, SG and SV to test for the long-run relationship among them. All the possible lag length selected by information criteria has been tested under Johansen-Juselius Test. Appendix 1 shows that none of the results is significant, regardless of the lag length used. Thus, it can be concluded that no long-run relationship exists between each pair of the series.

By modelling those series in a pairwise manner is unable to give any significant explanation of the role of each index. However, if all the indices are treated as a system and test for the information transmission, we can determine which index is faster than other in acquiring information. The lead and lag relationship between the indices will be helpful for the investors to form their trading strategy using the equity styles.

4.2 Short-Run Dynamics

Since no long-run relationship can be observed in the series, we proceed to form a vector autoregressive model and conduct Granger's Causality test for the model. Lag length criteria are checked and the model is at its optimal lag length of three. To ensure the validity of VAR(3), the portmanteau test for autocorrelations has been conducted and the null hypothesis is not rejected at 1 percent level. Hence, VAR(3) is free from autocorrelation problem. Table 5 shows the Granger's Causality test result based on VAR.

Table 5: Granger causality test results based on VAR of six indices

Dependent Variables	Independent Variables					
	ΔLnLG	ΔLnLV	ΔLnMG	ΔLnMV	ΔLnSG	ΔLnSV
ΔLnLG		2.3449 (0.5040)	17.7709 (0.0005)**	2.0818 (0.5556)	3.8679 (0.2761)	2.8623 (0.4133)
ΔLnLV	6.2532 (0.0999)*		9.5008 (0.0233)**	5.3292 (0.1492)	0.1371 (0.9870)	5.0165 (0.1706)
ΔLnMG	10.0714 (0.0180)**	1.7024 (0.6364)		7.8789 (0.0486)**	16.0174 (0.0011)**	6.5079 (0.0894)*
ΔLnMV	3.5626 (0.3127)	0.2527 (0.9687)	4.4332 (0.2183)		7.2861 (0.0633)*	6.0099 (0.1111)
ΔLnSG	15.8927 (0.0012)**	0.3283 (0.9546)	12.0785 (0.0071)**	6.2379 (0.1006)		3.4307 (0.3299)
ΔLnSV	11.2829 (0.0103)**	0.8973 (0.8261)	2.4167 (0.4905)	6.0087 (0.1112)	8.8371 (0.0315)**	

Notes: ** and * denote statistical significance at 5% and 10% level respectively. All estimates are asymptotic Granger Chi-squared statistics. Values in parentheses are p-values. Ln denotes all series have been transformed into the natural logarithm. LG denotes Large Growth, LV denotes Large Value, MG denotes Medium Growth, MV denotes Medium Value, SG denotes Small Growth, SV denotes Small Value.

Notably from table 5, the VAR results indicate that growth style indices are more efficacy than value style as 10 out of 12 cases of causality originate from growth style indices; Secondly, among the growth style indices, Large Growth index is the most influential, followed by Medium and Small Growth. Hence, hypothesis 1 is well supported.

Third, large growth stocks seem to be more receptive than large value stock to new information arrival (hypothesis 2 is supported). Similarly, small growth stocks are more receptive than small value stocks (hypothesis 3 is supported).

Fourthly, it is observed that medium-cap stock is more likely to predict the movement of the large-cap stock. As such, there is unidirectional causality from MG to LV. Besides, bidirectional causality MG and LG. Hypothesis 4 that *there will be information flow from Medium-cap to Large-cap indices* is supported. One explanation is that investors shift their preference toward the medium cap which is cheaper but more volatile than large-cap stocks.

Finally, it is observed that small-cap stock is capable to predict the movement in the medium-cap stock. There is unidirectional causality from SV to MG, SG to SV and SG to MV. Besides, bidirectional causality is observed between SG and MG. Hence, hypothesis 5 that *there will be information flow from Small-cap to Medium-cap indices* is supported. Small cap stock tends to be more volatile in the crisis than non-crisis periods. As such, due to uncertainty toward the global economy, Malaysia investors remain conservative and seek for safer investment haven.

To ensure robustness of our VAR results, a level VAR model is estimated using the procedure developed by Toda and Yamamoto (1995). Table 6 outlines the result. Although the optimal lag length for VAR model was three, a (k+1=4) order VAR was estimated with restrictions placed on lagged terms up to the kth lag. Since all the variables are in levels, no short-run causality flows exist. Rather, the results provide information about the long-run causal relationships among the six indices. Interestingly, Toda-Yamamoto model shows consistent results with the VAR model as mentioned in above except the unidirectional causality from LG to LV.

These results underscore that large Islamic equity style index has information content that precedes medium and small Islamic equity style index. As such, LG is able to transmit information to medium and small Islamic equity style index. Interesting, MG is the only one that capable to transmit information to LG. Furthermore, findings also indicate that small Islamic equity style index is able to predict the economic performance of medium equity style index.

Table 6: Granger causality test results based on Toda-Yamamoto Augmented VAR model of six indices

Dependent Variables	Independent Variables					
	LnLG	LnLV	LnMG	LnMV	LnSG	LnSV
LnLG		2.3954 (0.4945)	19.0052 (0.0003)**	2.0662 (0.5588)	3.8085 (0.2829)	3.2581 (0.3535)
LnLV	5.9515 (0.1140)		10.7744 (0.0130)**	5.1685 (0.1599)	0.1273 (0.9884)	5.6478 (0.1301)
LnMG	9.8769 (0.0196)**	1.7502 (0.6258)		7.6157 (0.0547)*	15.8308 (0.0012)**	6.9886 (0.0723)*
LnMV	3.4065 (0.3331)	0.2541 (0.9684)	5.6735 (0.1286)		6.5064 (0.0894)*	6.0715 (0.1082)
LnSG	15.8651 (0.0012)**	0.4717 (0.9251)	14.7222 (0.0021)**	6.1117 (0.1063)		3.5284 (0.3171)
LnSV	11.3369 (0.0100)**	0.9297 (0.8183)	3.0157 (0.3892)	5.7806 (0.1228)	8.1908 (0.0422)**	

Notes: ** and * denote statistical significance at 5% and 10% level respectively. The [k + d(max)]th order level VAR was estimated with d(max) = 1, since the order of integration is 1. Lag length selection of k = 5 was based on AIC and SIC information criteria. All estimates are asymptotic Wald statistics. Values in parentheses are p-values. Ln denotes all series have been transformed into the natural logarithm. LG denotes Large Growth, LV denotes Large Value, MG denotes Medium Growth, MV denotes Medium Value, SG denotes Small Growth, SV denotes Small Value.

The results from Table 5 and 6 are summarized in Figure 4 and 5. It can be observed that both models yield similar results except the short-run relationship from LG to LV. The latter only appears in the short-run.

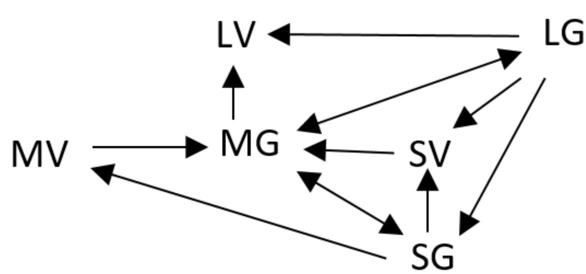

Figure 4: Short-run causal relationship based on VAR model

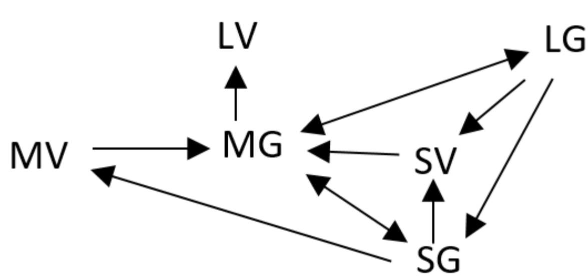

Figure 5: Long-run causal relationship based on Toda-Yamamoto Level VAR model

5. Further Analysis

From the VAR, we generate impulse response and variance decomposition. Generalised impulses have been used to generate the impulse response function. As shown in figure 6, if there is one standard deviation shock in LG, LV will increase and go back to equilibrium in roughly 3 days. A similar response can be observed in SV, LG, and MG. As such, they react positively to one standard deviation shock in SG, MG, and SG, respectively.

Table 7 illustrates how much of the forecast error variance of each of the domestic variables can be explained by exogenous shocks to the other variables. Notably, the dominant role for explaining the variation of LV is LG changes. This strongly supports hypothesis 2. Moreover, SG changes are the second dominant role in explaining the variation in SV (hypothesis 3 is well supported).

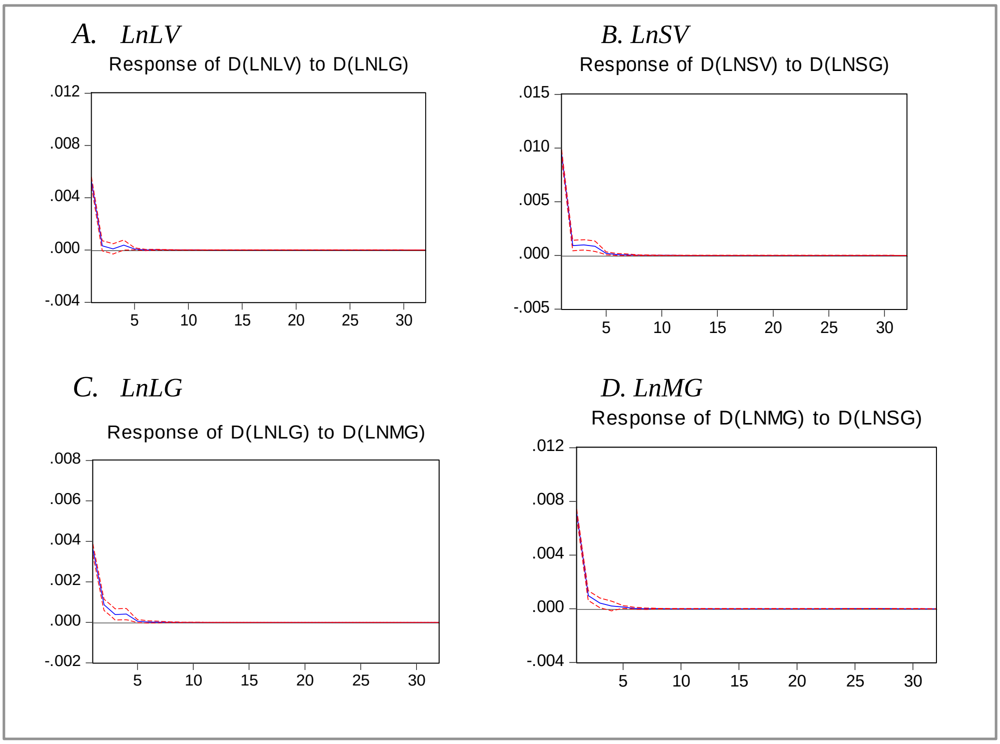

Figure 6: Impulse response

Next, aside from large-cap stock, MG play an important role in explaining the variation in LG as compared to MV, SG, and SV. Hence, hypothesis 4 is well supported as well. Besides, among the small cap, SG is the dominant role in explaining the variation in MG (hypothesis 4 is supported). Lastly, it can be observed that LG is the dominant role in explaining the variation in LV and SV. Moreover, the attribution of LG changes in explaining the variation in LV and SV are strengthened with more than one period-ahead forecast. Thus, hypothesis 1 is strongly supported.

Table 7: Variance decomposition

Period	VDC of *LnLG*					
	LnLG	*LnLV*	*LnMG*	*LnMV*	*LnSG*	*LnSV*
4	97.6410	0.4824	1.2745	0.2036	0.2578	0.1401
8	97.6328	0.4835	1.2744	0.2048	0.2624	0.1419
12	97.6327	0.4835	1.2744	0.2048	0.2624	0.1419
20	97.6327	0.4835	1.2744	0.2048	0.2624	0.1419
24	97.6325	0.4835	1.2744	0.2048	0.2624	0.1419
32	97.6327	0.4835	1.2744	0.2048	0.2624	0.1419
Period	VDC of LnLV					
	LnLG	*LnLV*	*LnMG*	*LnMV*	*LnSG*	*LnSV*
4	25.3746	73.4151	0.7574	0.2229	0.0294	0.2005
8	25.3762	73.4094	0.7575	0.2235	0.0322	0.2005
12	25.3766	73.4094	0.7575	0.2235	0.0322	0.2005
20	25.3766	73.4094	0.7575	0.2235	0.0322	0.2005
24	25.3766	73.4095	0.7575	0.2235	0.0322	0.2005
32	25.3770	73.4094	0.7575	0.2235	0.0322	0.2005
Period	VDC of LnMG					
	LnLG	*LnLV*	*LnMG*	*LnMV*	*LnSG*	*LnSV*
4	23.9983	7.9699	66.8814	0.3802	0.5294	0.2406
8	23.9999	7.9734	66.8687	0.3816	0.5327	0.2434
12	23.9999	7.9734	66.8687	0.3816	0.5327	0.2434
20	23.9999	7.9734	66.868	0.3816	0.5327	0.2434
24	23.9999	7.9734	66.868	0.3816	0.5327	0.2434
32	23.9999	7.9734	66.8687	0.3816	0.5327	0.2434
Period	VDC of LnSV					
	LnLG	*LnLV*	*LnMG*	*LnMV*	*LnSG*	*LnSV*
4	17.2820	5.0951	14.0007	4.6538	14.8705	44.0975
8	17.2860	5.0999	14.0105	4.6537	14.8668	44.0829
12	17.2860	5.0999	14.0105	4.6537	14.8667	44.0829
20	17.2860	5.0999	14.0105	4.6537	14.8667	44.0829
24	17.2860	5.0999	14.0105	4.6537	14.8667	44.0829
32	17.2880	5.0999	14.0105	4.6537	14.8667	44.0829

6. Conclusion

This paper empirically investigates the relationship between the newly developed Islamic equity style indices based on the FTSE EMAS Shariah index in Malaysia. The six Islamic equity style indices are found to be non-stationary in level form but become stationary after first differencing and there is no long-run relationship between the indices.

By applying the Vector Autoregressive model in order to test the short-run dynamics between the six Islamic equity style indices, the evidence indicates that the LG index has information that precedes medium and small Islamic equity style indices. The other Islamic equity style indices, most notably the MG is able to predict the movement of LG and LV. Besides, SG is capable to predict the movement of MG and MV. Hence, all the five hypotheses are accepted. These results are useful to investors as well as researchers studying the forecasting abilities of equity style indices specifically from the point of view of Islamic stocks in emerging economies.

The study, in fact, corroborates with previous results from Liew and Vassalou (1999), Tan and Lau (2013) as well as Lau and Lee (2015) on the information transmission capabilities of the equity style indices. Furthermore, the results would suggest that the newly developed Islamic equity style indices are useful to investors for purposes of predicting the performance of Islamic equity style stocks. In particular, the results of

Granger causality tests implies that the predictive qualities of the LG index would be useful for investors and fund managers for purposes of making investment decisions. Furthermore, our results are robust as VAR model shows consistent results with Toda-Yamamoto's procedure.

The growth of the Islamic capital market would undoubtedly result in analyst and investors seeking to understand the potential implication of investing in Islamic stocks either from local or foreign funds. Future work could be extended to include studies of the capability of information transmission of Islamic equity style indices and stock markets in different countries. Analyst and investors would then be able to gain more insights as to the idiosyncratic nature of Islamic equity style stocks and its potential for the purpose of diversification.

References

Bai, J., & Ng, S. (2006). Evaluating latent and observed factors in macroeconomics and finance. *Journal of Econometrics, 131*(1-2), 507-537.

Burkart, O., & Coudert, V. (2002). Leading indicators of currency crises for emerging countries. *Emerging Markets Review, 3*(2), 107-133.

Burns, A. F., & Mitchell, W. C. (1945). *Measuring business cycles.* New York, NY: National Bureau of Economic Research.

Engle, R. F., & Granger, C. W. J. (1987). Co-integration and error correction: Representation, estimation and testing. *Econometrica, 55*(2), 251-276.

Fama, E. F., & French, K. R. (1992). The cross-section of expected stock returns. *Journal of Finance, 47*(2), 427-465.

Financial Engines. (2017, September 2). *Market Capitalization: Large Cap, Mid Cap & Small Caps Stocks.* Retrieved on November 2, 2017, from https://financialengines.com/education-center/small-large-mid-caps-market-capitalization/

Granger, C. W. J. (1969). Investigating causal relations by econometric models and cross-spectral methods. *Econometrica, 37*(3), 424-438.

Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration with applications to the demand for money. *Oxford Bulletin of Economics and Statistics, 52*(2), 169-210.

Kwiatkowski, D., Philips, P. C. B., Schmidt, P., & Shin, Y. (1992). Testing the null hypothesis of stationarity against the alternative of a unit root. *Journal of Econometrics, 54*(1-3), 159-178.

Lau, W. Y., & Lee, C. (2015). Testing the efficacy of information transmission: Is equity style index better than stock market index? *E+ M Ekonomie a Management, 18*(3), 4-17.

Liew, J., & Vassalou, M. (1999). Can book-to-market, size and momentum be risk factors that predict economic growth? *Journal of Financial Economics, 57*(2), 221-245.

Petkova, R. (2006). Do the Fama-French factors proxy for innovations in predictive variables? *Journal of Finance, 61*(2), 581-612.

Shaharuddin, S. S., Lau, W. Y., & Ahmad, R. (2017a). Constructing Fama-French factors from style indices: Evidence from the Islamic equity market. *Emerging Markets Finance and Trade, 53*(7), 1563-1572.

Shaharuddin, S. S., Lau, W. Y., & Ahmad, R. (2017b). New Islamic equity style indices: Constructing and testing the efficacy of information transmission. *Cogent Economics and Finance, 5*(1), 1-19.

Shijin, S., Kumar, G. A., & Bhattarcharyya, S. (2007). The relationship between size, value and market risk. *Investment Management and Financial Innovations, 4*(2), 125-147.

Sims, C. A. (1980). Macroeconomics and reality. *Econometrica, 48*(1), 1-48.

Sims, C. A., Stock, J. H., & Watson, M. W. (1990). Inference in linear time series models with some unit roots. *Econometrica, 58*(1), 113-144.

Spierdijk, L., & Umar, Z. (2014). Stocks for the long run? Evidence from emerging Markets. *Journal of International Money and Finance,* 47, 217-238.

Stock, J. H., & Watson, M. W. (1989). New indexes coincident and leading economic indicators. In O. J. Blanchard & S. Fischer (Eds.), *NBER Macroeconomics Annual 1989* (Vol. 4, pp. 351-409). Cambridge, MA: MIT Press.

Tan L. Y., & Lau, W. Y. (2013). Does equity style index play a role in transmitting economic information? Evidence from selected Asia-Pacific countries. In N. M. Nor, A. Mohamed., & A. Hassan (Eds.), *Readings on applied economics issues* (pp. 118-132). Kuala Lumpur, Malaysia: McGraw-Hill.

The Edge (2016, November 29). Trends: Asian investors becoming more conservative. Retrieved on November 2, 2017, from http://www.theedgemarkets.com/article/trends-asian-investors-becoming-more-conservative

Toda, H. Y., & Yamamoto, T. (1995). Statistical inference in vector autoregression with possibly integrated processes. *Journal of Econometrics, 66*(1-2), 225-250.

Trimech, A., Kortas, H., Benammou, S., & Bennammou, S. (2009). Multiscale Fama-French model: Application to the French market. *Journal of Risk Finance, 10*(2), 179-192

Valtonen, J. (2008). *Cointegration between Fama-French factors*. Paper presented at the Aboa Centre for Economics, Åbo Akademi University, Finland. Retrieved on December 12, 2016, from http://ace-economics.fi/kuvat/Valtonen%20-%20Cointegration%20%20eng.pdf

Appendix 1

Johansen Juselius Test

Pair of indices and selected lag length	Hypothesized no of CE(s)	Trace Test		Maximum Eigenvalue Test	
		Trace Statistics	0.05 Critical Value	Max-Eigen Statistics	0.05 Critical Value
LG and LV					
1	None	8.3279	15.4947	5.6229	14.2646
	At most 1	2.7050	3.8414	2.7050	3.8414
2	None	8.0540	15.4947	5.5152	14.2646
	At most 1	2.5387	3.8414	2.5387	3.8414
3	None	7.7303	15.4947	5.3689	14.2646
	At most 1	2.3613	3.8414	2.3613	3.8414
MG and MV					
1	None	5.0567	15.4947	5.0531	14.2646
	At most 1	0.0035	3.8414	0.0035	3.8414
3	None	5.9649	15.4947	5.9649	14.2646
	At most 1	8.4206	3.8414	8.4200	3.8414
5	None	6.6971	15.4947	6.6970	14.2646
	At most 1	0.0001	3.8414	0.0001	3.8414
SG and SV					
2	None	11.1174	15.4947	11.0767	14.2646
	At most 1	0.0406	3.8414	0.0406	3.8414
3	None	11.6854	15.4947	11.6574	14.2646
	At most 1	0.0279	3.8414	0.0279	3.8414
6	None	12.5770	15.4947	12.4997	14.2646
	At most 1	0.0773	3.8414	0.0773	3.8414

Notes: The asterisks *** and ** denote statistical significance at 1% and 5% level respectively. Figures in parentheses are the optimal lag length chosen. Ln denotes all series have been transformed into the natural logarithm. LG denotes Large Growth, LV denotes Large Value, MG denotes Medium Growth, MV denotes Medium Value, SG denotes Small Growth, SV denotes Small Value.