Macroeconomic determinants of islamic and conventional stocks: Malaysian evidence based on ARDL and NARDL approaches

Shahwahid, Muhammad and Masih, Mansur

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

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Macroeconomic determinants of islamic and conventional stocks: Malaysian evidence based on ARDL and NARDL approaches

Muhammad Shahwahid[1] and Mansur Masih[2]

Abstract The paper focuses on the determinants of Islamic and conventional stocks. Based on the findings of the study, it is evidenced that there is a long term theoretical relationship between the macroeconomic factors (interest rate, inflation, crude oil price) and the stocks' performance both Islamic (Shariah) stocks and conventional stocks. The results tend to suggest that any changes in the macroeconomic factors do have an impact on both Shariah and conventional stocks. Based on NARDL analysis, Shariah stocks and conventional stocks have both short-run and long-run symmetrical relationship. Both Shariah and conventional stocks have similar characteristics and the shocks to any of the macroeconomic factors have similar impact on both Shariah and conventional stocks in the context of Malaysia.

Based on our Granger Causality analysis, it is evidenced that interest rate is the only exogenous variable while others are endogenous variables. This means that the interest rate is the leader among the variables while other variables are the followers. It indicates that the interest rate is the best tool to shock the other variables. VDC analysis shows that the causality chain starts from interest rate as the most exogenous followed by crude oil price, inflation rate, and lastly Shariah and conventional stocks.

Keywords: shariah stocks, conventional stocks, macroeconomic factors, ARDL, NARDL, Malaysia

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[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

Stock markets are subject to volatility and it is due to this volatility that it generates relatively higher returns compared to other investment instruments. This volatility in the stock market is due to its exposure to both systematic and non-systematic risks. While non-systematic risks can be mitigated by diversification of portfolio, the systematic risk is not easily handled. The systematic risk refers to the changes in market and macroeconomic factors some of which can be mitigated through hedging activities such as buying interest rate and exchange rate derivative instruments, but it incurs additional costs which in turn reduces the profitability of their investment. Therefore, it is important for investors to understand the relationship between these macroeconomic factors and how it impacts the stock's performance. The study is done to investigate how macroeconomic factors influenced the performance of stock markets. Secondly, the study also tries to investigate the Shariah compliance stocks' (Shariah stocks) performance and non-Shariah compliance stocks' (conventional stocks) performance in relation to the impact of changes to macroeconomic factors.

There have been many previous researches done that have produced mixed results on whether Shariah stocks are more shock resistance compared to conventional stocks. Past literature claims that Islamic equity funds and Islamic indices outperformed their conventional counterparts during crisis due to the conservative nature of Shariah compliant investments (Alam &Rajjaque, 2010; Ho, Abd Rahman, Yusuf, & Zamzamin, 2014; Jawadi, Jawadi, & Louhichi, 2014). While Hayat & Kraeussl (2011), who used a sample that includes almost all Islamic funds rather than a sub-sample from a specific region, find that Islamic equity funds – in relation to conventional funds – underperformed more during the GFC. Therefore, this research might also give a clearer idea on this comparison in Malaysian context.

This research is done two stages. The first stage is by finding relationship between the chosen variables (performance of conventional stocks, performance of Shariah stocks, inflation rate, interest rate and crude oil price) through the application of linear cointegration test and Non-linear Autoregressive Distributed Lag (NARDL) cointegration test introduced by Shin et.al. (2014). The objective is to find the short-run and long-run asymmetries through positive and negative partial sum decompositions of the changes in both Shariah and conventional stocks performance as well as the movement of these two variables in response to changes among the other macroeconomic variables. This information can help both the investors as well as policy makers on how to capture or improve the performance of Shariah and conventional stocks. On the second stage, the focus is in finding the Granger causality among the variables. The objective of this study is to identify which variable are the leaders and which are the followers as well as forecasting the impact of shocks between the variables.

To achieve the objective of the study, the paper applies the time series monthly data for all the five variables (Shariah stocks performance, conventional stocks performance, inflation rate, interest rate and crude oil price) from the period of March 2005 to April 2019. The focus is on the performance of Malaysian Shariah stocks represented by the FBM Hijrah Index and Malaysian conventional stocks represented by FBM KLCI Index. While the controlled macroeconomic factors are the Malaysian interest rate represented by Malaysian's Overnight Policy Rate (OPR) set by the nation central bank, inflation rate measured by Malaysian's Consumer Price Index and the world crude oil price.

The study found that there is a both linear and non-linear relationship among the variables. While based on NARDL analysis, the non-linear relationship of shariah stocks and conventional stocks are symmetrical in nature. The Granger Causality analysis determines that interest rate is the only exogenous variable in the study while the causality chain of exogenous followed by crude oil price, inflation rate and both Shariah stocks and conventional stocks. Based on the Impulse response function and Persistence Profile, an individual shock to variables or a system-wide shock to the model will take more than 13 months to get the model equilibrium again.

The paper is structured in a way that it starts with **Section 2**, a brief discussion on previous literatures covering both the theoretical background of this study as well as empirical studies related to the area of study. **Section 3** outlines the research methodology used in this study. **Section 4**, discuss on the empirical findings of the study. Lastly, **Section 5** consist of some conclusion drawn from the study and the policy implications of the findings.

Literature Review

Theoretical Framework

The performance of stock market both Shariah and conventional stocks represent the level of liquidity of the equity side of the capital market of a nation. A good performance of a nation stock market shows the level of confident of investors whether local or foreign on the economic prospect of the nation. A continuous positive performance of the stock market gives positive impacts to both the investors as well as the businesses listed in the market. A good performance of stock market contributes to good return to investors and more fund for business expansion for listed companies. However, a negative performance of a stock market shows a low level of confident of investors on the economic growth prospect of the nation because of investors pulling the investment from the stock market. This will impact the liquidity in the capital market as well as the flow of funds required to expand businesses. No expansion of businesses or worse negative growth of business will lead lower profit margin to business and in turn result in lower return to investors. The FTSE Bursa Malaysia Kuala Lumpur Composite Index (KLCI) have been at its lowest point since mid of 2015. This might be impacted by other external factors like the political change in ruling government in the nation as well as extended trade war between United State and China. In this study KLCI is used as a proxy to represent the performance of conventional stocks index as it is represented by top 30 biggest market capitalization in Malaysia stock market.

Figure 1 Performance of FBM KLCI for the past 5 years

The interest rate is one of the monetary policies tools the central bank use to manage the economic growth of a nation. To improve economic growth, the central bank will decrease interest rate and in doing so increase the money supply to the economy by making borrowing cheaper. Similarly, to maintain the nation's economic growth, the central bank will increase interest rate as a result increase the cost of borrowing and reduce the supply of money to the economy. In Malaysia, the central bank uses the Overnight Policy Rate (OPR) to control the nation's interest rate. Just recently on 7th May 2019, the central bank of Malaysia has just reduced its OPR from 3.25% to 3%. They said it is done to maintain the level of growth of the nation economy due to the uncertainty of world economy caused by the trade war between United State and China. The role of interest rate can give a big impact to the confident of the investor as a result might improve the performance of the stock market.

Inflation refers to the purchasing power of people in the nation. In this research it is represented by Malaysian's Consumer Price Index (CPI). An increase in inflation can be due to (1) Increase in demand of a particular good and services might be associated with an increase of disposable income of its people or (2) A reduction of Purchasing Power Parity (PPP) due to a decline of exchange rate value of the nation currency as a result an increase in price of most exported goods. In theory, an increase in level of inflation also give a positive impact to the performance of stock market. If the increase in inflation level is due to increase in demand of good and services, will result in increase of revenue as well as profit in businesses. This will result in more investors interested to invest in the stock markets. While of the inflation is caused by a reduction in PPP, then the foreign investor might see this as an opportunity to invest when the local currency is relatively low in exchange rate value. Thus, showing the impact of changes in inflation toward stock market performance.

Crude oil is one of the most basic and importance commodities for businesses as are exposed to the volatility of its price. Almost every business needs some degree of transportation in their business operation. Thus, most businesses listed in the stock market are somewhat exposed to the changes in crude oil prices either positively or negatively. Some business gains when oil price goes up like the oil and gas production sectors while others like transportation, plantation and consumer are negatively affected by the increase in oil price. This changes in oil price might increase the cost of business operation as a result reduce company profitability and vice versa. The level of profitability of these company will impact the demand of these stocks as a result impact the performance of the stocks.

While the changes in these macroeconomic factors impact both the Shariah and conventional stocks, only how significant the impacts to them are not known between these two stock segments. The performance of stock market between Shariah and conventional stocks might be similar however, due to some different traits due to Shariah screening requirement in Shariah stocks might create different impacts between the two by the changes in macroeconomic factors. FBM Hijrah index is used as a proxy for capturing the performance of the shariah stocks as comparable to the KLCI, Hijrah index is an index of top 30 most market capitalization Shariah compliance companies listed in the Bursa Malaysia.

Existing Empirical Frameworks

There have been previous studies shows the relationship between the three selected macroeconomic factors and the performance of the stock market. Primarily the research done by Rjoub, Tursoy and Gunsel in 2009 states that “there is a significant pricing relationship between the stock return and the tested macroeconomic variables; namely, unanticipated inflation, term structure of interest rate, risk premium and money supply have a significant effect in explaining the stock market returns in various portfolios" (Rjoub, Türsoy, & Günsel, 2009). This finding is based on their research in Istanbul Stock Exchange. However, they also mentioned that the result shows a weak explanatory power which might means that there are other macroeconomic factors affecting stock returns which is not considered. Gjerde and Sættem found out that stock returns responded immediately negatively to the change in interest rate and it is also significant in leading inflation and influences stock returns immediately (Gjerde & Sættem, 1999). This finding is also supported by Rahman, Sidek and Tafri whom studied the Malaysian stock market and found out that monetary policies variables (proxied by money supply, exchange rate, reserves and interest rate) have a significant long-run effects on Malaysia's stock market. (Rahman, Sidek, & Tafri, 2009) .

A study by Nelson shows that the rate of return on common stocks is negatively correlated with the rate of inflation over short period of time. He argued that the result is perfectly consistent with the theories of asset pricing that the results should not be used to advise investors to shun stocks when they forecast a high rate of inflation. (Nelson, 1976). His finding is also supported by Filis whom found out that the Greek stock market receives negative and significant influence from Consumer Price Index (CPI) which is used as a proxy for inflation in the research.(Filis, 2010). Which is also echoed by Jamaludin, Ismail and Manaf who also found out that CPI pose greater effect on both indices compared to exchange rate and money supply. They also prove the negative interconnection between inflation rate and stock market returns. They argued that the finding is explained by the surplus of money due to the inflation rate increase the supply of stock in stock exchange while the demand side remained unchanged. (Jamaludin, Ismail, & Manaf, 2017).

Based on a research done in Norway, the oil price does affect the stock returns which is a contrast to the result from other European markets (Gjerde & Sættem, 1999). While a research done in Greek shows that oil prices and the Greek stock market exercise a significant positive effect on the Greek CPI, in the long-run while the short-run parameters suggest that oil prices act as one of the leading indicators on the Greek stock market. To be more specific, the oil price shocks cause a negative effect on the Greek stock market(Filis, 2010). Jones and Kaul found out that the change in oil prices have a detrimental effect on the output and real stock returns in United State, Canada, Japan, and United Kingdom during the post war period. They argue that the main reason of this event is due to the impact on current and expected future real cash flows. (Jones & Kaul, 1996).

Not many articles have been published on the different impacts of changes in macroeconomic factors toward Shariah and conventional stocks. However, a paper from Jamaludin, Ismail and Manaf have suggested that both conventional and Islamic indices are affected by the macroeconomic variables with similar pattern. However, the macroeconomic variables pose a greater effect on Islamic stock indices as compared to the conventional stock indices due to less risky behavior(Jamaludin, Ismail, & Manaf, 2017). These previous research have created a gap to study whether there is a difference in impact to the Shariah stocks as well as conventional stocks when there are changes in macroeconomic factors.

Research Methodology

This section will discuss about the sample data and the methodological framework selected in the study. The variables considered in this study consist of two focus variable the Performance of FBM KLCI (KLCI) representing the 30 largest market capitalization conventional stocks in Malaysia, FBM Hijrah Index (HJRH) representing 30 largest market capitalization Shariah stocks in Malaysia and three other macroeconomic variables consisting of Malaysian Central Bank's Overnight Policy Rate (OPR) representing interest rate, Consumer Price Index (CPI) representing inflation rate, Crude Oil (CO). For the study, the data is collected based on monthly basis from March 2005 to April 2019 (over 14 years) consisting of 170 observations of each variable taken from Bloomberg database. The data were all denominated in Malaysian Ringgit (RM) to provide consistency in comparison and computation.

Most empirical analysis is done through Microfit 5.0 while STATA software is used to do the NARDL cointegration test. The analysis is done based on an 8 step time-series analysis consisting of a series of tests on cointegration and Granger Causality test.

Step 1 is the Unit Root Test to examine the stationarity of the variables. This step is important because for Engle Granger and Johansen cointegration test, the assumption is that the variables are stationary. To test the stationarity of variables, the log form I(0) and first differenced form I(1) of the variable is tested in the Augmented Dicky-Fuller test (ADF) and Phillips-Perron test (PP). The ADF test was introduced in 1981 to handle the serial correlation presence in the residuals of the Dickey-Fuller (DF) test which might result in biased empirical results. The idea behind ADF test is to include enough number of lagged dependent variables to rid average errors as well as to correct for residual autocorrelation problem (Dickey and Fuller, 1981). While PP tests (Phillips and Perron, 1988) is done by correcting both the autocorrelation and heteroscedasticity problems using Newey-west adjusted variance method.

Step 2: VAR order test to determine the number of lags to use in the study by considering both the Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC) result. The number of lags is chosen based on the highest number of lags which is statistically significant. This chosen number of lags will be used throughout the study.

Step 3: Cointegration test. The cointegration test is done to study the movement between variables whether they move together (cointegrated) in the long run. In this cointegration test, four tests were conducted which were (1) Engle Granger test (1987), (2) Johansen test (1991), (3) Autoregressive Distributed Lag (ARDL) cointegration test introduced by Pesaran and Shin (1999) and extended by Pesaran (2001), (4) Non-linear ARDL (NARDL) cointegration test introduced by Shin et al (2014). In (1) Engle Granger test, the cointegration is examine by studying the error term. However, it is limited to identifying the present of cointegration instead of number of cointegration. (2) Johansen's test is an improvement from the Engle Granger test whereby in case of more than two variables, the test can identify possible cointegrated vectors in the model or more than one cointegrations. (3) ARDL test introduced by Pesaran and Shin (1999) and later extended by Pesaran et. al. (2001) is an improvement of the Johansen's test, whereby the test is able to test cointegration with the variables in stationary I(0) and non-stationary form I(1). (4) NARDL test is also an improvement from the ARDL test developed by Shin et. al. (2014) to capture the short-run and long-run relationship between variables when the linkages are non-linear and asymmetric.

Step 4: Long Run Structural Modelling (LRSM) test which is done to identify the theoretical cointegration relationship between variables. It is divided into two parts, (1) exact-identifying and (2) over-identifying. In exact-identification, the dependent variable is normalized and the relationship between other variables are observed. While under the over-identifying test is done to test the long-run coefficient of a variable against the theoretically expected values. The variable without significant impact to the focus variable is made equal to zero and observed whether the elimination of these variables have a significant impact to the study. When cointegration is proven, the study continues with finding the Granger Causality test to examine the causality chain between all the variables.

Starting with Step 5 Vector Error Correction Model (VECM) the first step in the Granger Causality. VECM indicates the direction of Granger causality, indicating which variable is the leader (exogenous) and which variable is endogenous (follower). It also can be called the test of endogeneity. VECM also implies that the change in dependent variable is the function of the level of disequilibrium in the cointegrating relationship between other variables. The variable is exogenous if the corresponding dependent variable is insignificant, while the variable is endogenous if the corresponding dependent variable is significant which refers to the error correction coefficient.

Step 6 Variance Decomposition (VDC) is the next step to test the strength or relative degree of exogeneity and endogeneity of the variables. VDC identifies which variable is the most exogenous and which is the most endogenous as well as able to provide a ranking of exogeneity among the variables. VDC is divided into two, generalized VDC and orthogonalized VDC. In orthogonalized VDC, it assumes that when a variable is shocked, all the other variables in the system are switched off. While in generalized VDC relax the assumption in orthogonalized VDC. Generalized VDC is stronger than orthogonalized VDC. The Generalized VDC examine the proportion of the variance of variable explained by its own past. The variable explained most by its shocks is the most exogenous.

Step 7 Impulse Response Function (IRF) like VDC as both provides similar information. However, IRF produce the information of a variable specific shock impact to other variables in graphic form.

Step 8 Persistent Profile (PP) is a systemwide shock on the long-run relationship between the variables to estimate the time required for the model to get back to equilibrium if the entire cointegrating equation is shocked.

Results and Discussions

Step 1 Unit Root Test

The unit root test to examine the stationarity of the variables. The unit root test can be done by ADF or PP. In this study, ADF is done first followed by PP test if the stationary of the variable is not satisfied. The objective in this test is to get the I(0) non-stationary and I(1) stationary. In this test, the Null Hypothesis (H_0) assume the variable is not stationary. If the T-statistic < Critical Value (C.V.), means we fail to reject the null. Thus, the variable is not stationary. While if T-statistic > Critical Value (C.V.), this means we reject the null therefore, the variable is stationary. Since in ADF we failed to get all I(0) variables non-stationary, we continue to PP cointegration test based on Table 1. The result in Table 2 shows that all the variables in I(0) is non-stationary while all variables in I(1) is stationary. This result means we can proceed to Step 2.

Augmented Dicky Fuller (ADF) Unit Root Test

Table 1 Augmented Dicky Fuller Unit Root Test

Series in Logarithms	Include an intercept and a linear trend				
	ADF	Value	T-Statistics	Critical Value	Outcome
LKLCI	ADF (1) = SBC	315.2869	-1.8547	-3.4476	Non-Stationary
	ADF (5) = AIC	322.7114	-2.8719	-3.3834	Non-Stationary
LOPR	ADF (2) = SBC	313.8131	-1.8941	-3.3838	Non-Stationary
	ADF (2) = AIC	321.5628	-1.8941	-3.3838	Non-Stationary
LCPI	ADF (1) = SBC	-5.2692	-6.0951	-3.4476	Stationary
	ADF (4) = AIC	8.4672	-3.8111	-3.4731	Stationary
LCRUDE	ADF (1) = SBC	165.9569	-3.6030	-3.4476	Stationary
	ADF (1) = AIC	172.1566	-3.6030	-3.4476	Stationary
LHJRH	ADF (1) = SBC	302.0796	-1.9850	-3.4476	Non-Stationary
	ADF (1) = AIC	309.6459	-2.5921	-3.4434	Non-Stationary
Series in first difference	**Include an intercept but not a trend**				
	ADF	Value	T-Statistics	Critical Value	Outcome
DKLCI	ADF (3) = SBC	314.1191	-7.2679	-2.8868	Stationary
	ADF (5) = AIC	318.7598	-7.2679	-2.8868	Stationary
DOPR	ADF (1) = SBC	313.1739	-6.4336	-2.8868	Stationary
	ADF (1) = AIC	317.8145	-6.4336	-2.8868	Stationary
DCPI	ADF (5) = SBC	-10.0742	-6.2442	-2.8681	Stationary
	ADF (3) = AIC	2.6503	-8.1631	-2.8295	Stationary
DCRUDE	ADF (1) = SBC	160.7224	-7.7313	-2.8868	Stationary
	ADF (4) = AIC	166.1094	-6.7530	-2.8500	Stationary
DHJRH	ADF (1) = SBC	301.1642	-6.9684	-2.8868	Stationary
	ADF (1) = AIC	305.8048	-6.9684	-2.8868	Stationary

Phillips-Perron (PP) Unit Root Test

Table 2 Philips-Perron Unit Root Test

Series in logarithms	Include an intercept and a linear trend			Series in first difference	Include an intercept but not a trend		
	T - Statistic	Critical Value	Outcome		T- Statistic	Critical Value	Outcome
LKLCI	-1.5443	-3.4870	Non-Stationary	DKLCI	-10.8817	-2.8509	Stationary
LOPR	-2.1941	-3.4870	Non-Stationary	DOPR	-9.6506	-2.8509	Stationary
LCPI	-2.4635	-3.4870	Non-Stationary	DCPI	-7.8026	-2.8509	Stationary
LCRUDE	-2.5787	-3.4870	Non-Stationary	DCRUDE	-9.9857	-2.8509	Stationary
LHJRH	-1.4923	-3.4870	Non-Stationary	DHJRH	-10.4634	-2.8509	Stationary

Step 2 VAR Order Selection

In Step 2, the objective is to find the best order (lags) for the Vector Autoregressive (VAR) for the study. The number of lags is chosen based on the highest value of Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC) with p-value > C.V. From Table 3, the best number of lags is 4 as it is the only number of lags satisfying p-value > 5%.

Table 3 VAR Order Selection

No of Order	Selection Criteria			
	SBC	AIC	p-value	C.V.
4	1109.0	1271.4	0.086	5%

Step 3 Cointegration Test

Having able to get all variable in i(1) in stationary form and the best order of VAR, We can proceed to cointegration tests. In this test, the null hypothesis (H_0) represent there is no cointegration between the variables, while the alternative hypothesis (H_1) represent there is cointegration between the variables in the long-run. In Step 3, four tests will be conducted. Firstly, Engle Granger, then followed by Johansen, then ARDL and lastly NARDL. All these tests have their own unique traits.

(1) Engle-Granger Cointegration Test

Engle- Granger can identify if there is any cointegration in the model. Based on Table 4, there is no cointegration between the variables. This is due to the fact that T-statistic < C.V. Therefore, we failed to reject the null hypothesis. This means there is no cointegration between the variables.

Table 4 Engle-Granger Cointegration Test

OLS regression of LKLCI on other variables	Unit root tests for residuals				
	ADF	Value	T-Statistics	Critical Value	Outcome
LKLCI	ADF (1) = SBC	477.0580	-1.8210	-4.5584	No Cointegration
	ADF (1) = AIC	480.1579	-1.8210	-4.5584	No Cointegration

Notes: The Engle-Granger test checks whether the variables are moving together (cointegrated) or not. The error term would be stationary, when its test statistic is greater than the critical value at 95% confidence interval and thus proving cointegrating relationship.

(2) Johansen Cointegration Test

Johansen is an improved cointegration test whereby if there are more than two varaibales, it is able to find more than one cointegration in a model. Based on Table 5, the Johansen test found two cointegration in the model. This is seen as there is two time when T-statistic > C.V. This means that we reject the null, thus alternative hypothesis is acceptance at r=1 and r=2 in both Maximal Eigen Value and Trace Statistics. This means there are at least two cointegration between the variables in the long run. However, Johansen test is very sensitive to the number of lags or constant term or trend. Therefore, if there is a change in number of lags, the result might also change.

Table 5 Johansen Cointegration Test

Test of the Stochastic Matrix	Cointegration with unrestricted intercepts and restricted trends in the VAR					
	Null	Alternative	Statistic	95% Critical Value	90% Critical Value	Outcome
Maximal Eigenvalue	r = 0	r = 1	45.7855	37.8600	35.0400	2 Cointegration
	r <= 1	r = 2	35.5230	31.7900	29.1300	
Trace Statistics	r = 0	r = 1	114.0280	87.1700	82.8800	2 Cointegrations
	r <= 1	r = 2	63.2425	63.0000	59.1600	

Notes: The statistic refers to Johansen's cointegration test based on unrestricted intercept and restricted trends in the VAR. From the above results, we choose one cointegrating vector according to eigenvalue tests statistics at 95% confidence interval. If the test is significant, we will reject the null hypothesis and accept the alternative which indicates an existence of cointegrating vectors.

(3) Autoregressive Distributed Lag

The study proceeds with Autoregressive Distributed Lag ARDL which is able to perform when the variables are stationary and non-stationary. ADRL assumes that the cointegration is linear and symmetric. The null hypothesis represents that there is no cointegration between the variables in the long run. The null hypothesis is not rejected when the F-statistic < C.V. While if F-statistic > C.V., the null hypothesis is rejected thus means that there is cointegration between the variable in the long run and the outcome remain inconclusive if the T-statistic is in between the lower critical bound and upper critical bound. From Table 6, it indicates that CPI and CRUDE is cointegrated in the long run and OPR and HJRH is not cointegrated in the long run while KLCI remain indecisive. The cointegration in the long run refers to the availability of information between one variable to predict the other variable in the future.

Table 6 Test of Long-Run Relationship in Autoregressive Distributed Lag

Variable	F-Statistics	P-Value	95% Critical Lower Bound	95% Critical Upper Bound	Outcome
KLCI	3.9597	0.002	2.9635	4.1161	Inconclusive
OPR	1.4871	0.198	2.9635	4.1161	No Cointegration
CPI	5.7545	0.000	2.9635	4.1161	Cointegration
CRUDE	5.7545	0.000	2.9635	4.1161	Cointegration
HJRH	2.7083	0.023	2.9635	4.1161	No Cointegration

Notes: The critical values are based on F table of (Pesaran et al., 2001), unrestricted intercept and trend with five regressors. If it is lesser than the lower bound, we fail to reject the null of no long run relationship among the variables, otherwise – there is long run relationship. If the values fall within the bound, the result is inconclusive. Based on this basis, unit rot test needs to be carried out.

Table 7 shows the relationship between the dependent variable in this case KLCI to the listed regressors. Based on the coefficient, it is found that there is a negative relationship between KLCI performance and OPR as well as CRUDE. For every 1% change in OPR, there will be -0.45% change in KLCI while for every 1% change in Crude oil price, there is -0.04% change in KLCI. On a positive note, for every 1% change in CPI will leads to a 0.01% change in KLCI and for every 1% change in HJRH index, there is a 0.77% change in KLCI index.

Table 7 Test of long-run coefficient in ARDL when LKLCI is a dependent variable

Regressor	Coefficient	Standard Error	T-Ratio	P-Value
LOPR	-0.45142	0.21806	-2.0702	0.04
LCPI	0.018240	0.031621	0.57683	0.565
LCRUDE	-0.044557	0.083017	-0.53672	0.592
LHJRH	0.77013	0.054935	14.0190	0.000

(4) Non-Linear Autoregressive Distributed Lag

The improvement in Non-linear Autoregressive Distributed Lag (NARDL) is that it relaxes all assumptions in all the other three cointegration test. NARDL can find both symmetric and asymmetric relationship between variables. In this study, we try to find the relationship between shariah stocks represented by HJRH index and conventional stocks represented by KLCI index. In this test, the null hypothesis is there is no cointegration in the long run. Null hypothesis is rejected if the F-Statistics > C.V. of upper bound and vice versa. While if F-Statistics is in between the critical lower bound and critical higher bound, the relationship is inconclusive. Based on the result in table 8, shows that KLCI and HJRH is cointegrated. Showing there is a long-run relationship between the two variables.

Table 8 NARDL Cointegration Test

Variable	F-Statistics	Critical Lower Bound	Critical Lower Bound	Outcome
KLCI	22.95	3.79	4.85	Cointegrated

$$\Delta ir_t = \beta_0 + \beta_1 KLCI_{t-1} + \beta_2 HJRH^{+}_{t-1} + \beta_3 HJRH^{-}_{t-1} + \sum_{i=1}^{p} \varphi_i \Delta KLCI_{t-i} + \sum_{i=0}^{q} (\theta_i^{+} \Delta HJRH^{+}_{t-i} + \theta_i^{-} \Delta HJRH^{-}_{t-i}) + u_t$$

The equation above is the NARDL equation introduced by Shin et. al. (2014). that represent the relationship between Shariah stocks represented by FBM Hijrah index (HJRH) and conventional stocks represented by FBM KLCI index (KLCI). NARDL approach will decompose Shariah stocks into its positive $\Delta HJRH^{+}_{t-i}$ and negative $\Delta HJRH^{-}_{t-i}$ partial sums for increases and decreases. The null hypothesis in this test is that the Shariah stocks and conventional stocks is symmetry in the long run and the short run. If the p-value > 5%, we reject the null hypothesis, thus saying that these two variables is asymmetry in the short and long run.

Based on the result in table 9, shows that the relationship between shariah stocks and non-shariah stocks is symmetric at 5% significant level as the p-value is lower than 5%.

Table 9 NARDL symmetry/asymmetry relationship

Independent: KLCI	F-Statistics	P-Value	Selected Specification
Short-run	4.537	0.033	Symmetry
Long-run	4.614	0.035	Symmetry

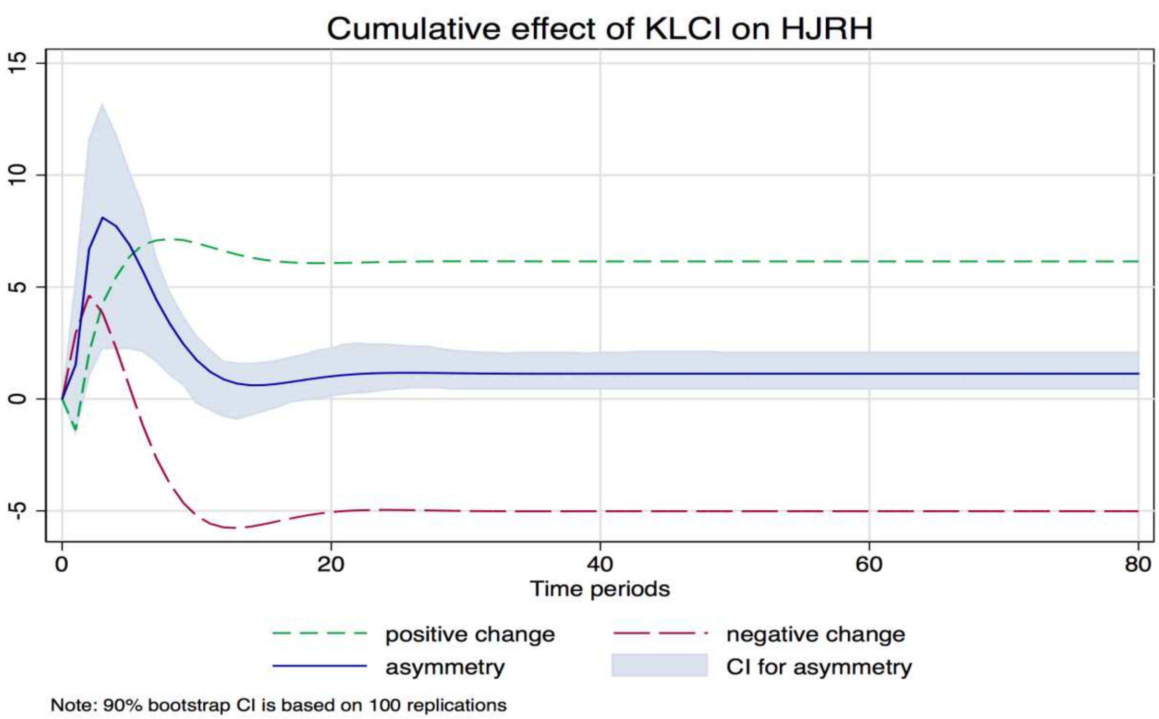


Figure 2 Cumulative effect of KLCI on HJRH based on NARDL

Figure 2 shows the relationship between KLCI on HJRH is shown to be always symmetry as the asymmetry line is always within the shaded area representing the confidence interval for symmetry relationship. This relationship indicates that any shocks on shariah stocks due to changes in conventional stocks is quickly adjusted to equilibrium both in short term and long term.

Step 4 Long Run Structural Modelling

Long-Run Structural Modelling (LRSM) is a test to identify the theoretical cointegration relationship between variables. It is done by first normalized the focus variable to see the significant of other variable to itself in the exact identifying restriction(s). While in over-identifying restrictions, the objective is to test the theoretical relationship of insignificant variables to other variables impacting the focus variables. Based on the result, we can decide whether to remove the insignificant variables. Based on Table 10, the only significant variables to the focus variables are KLCI and CRUDE. However, under over-identifying restrictions test , it shows that both OPR and CPI have a significant relationship toward KLCI and CRUDE. Therefore, if we drop the two insignificant variables (OPR and CPI) it might impact the cointegration of the model.

Table 10 The Long Run Structural Modelling theoretical relationship test

Variable	**ML estimates subject to exact-identifying restriction(s)**			
A1=1	Coefficient	Standard Error	T-Ratio	Outcome
LHJRH	1.0000	None	None	None
LKLCI	-1.3463	-0.159	8.4439	Significant
LOPR	-0.14138	-0.198	0.0714	None
LCPI	0.13453	-0.071	-1.897	None
LCRUDE	0.19217	-0.082	-2.344	Significant
Variable	**ML estimates subject to over identifying restriction(s)**			
A1=1, A3=0	Coefficient	Standard Error	T-Ratio	Outcome
LHJRH	1.0000	None	None	None
LOPR	0.0000	None	None	None
LCPI	0.0000	None	None	None
LKLCI	-1.3619	-0.147	9.2338	Significant
LCRUDE	0.22151	-0.077	-2.868	Significant
	LR Test of Restrictions	CHSQ(2) = 11.8636 [0.003]		

Notes: The result above shows the maximum likelihood estimates subject to exactly identifying and over identifying restrictions. In exact identification, we are normalizing the coefficients by imposing restriction 1 to our focus variable treated as dependent. Over identifying tests, the computed long run coefficient against it theoretically expected values. The significant results are given in the result column in the table. When p-value is greater than 5%, we fail to reject the null hypothesis which suggests that the restriction is correct.

Step 5 Vector Error Correction Model

Vector Error Correction Model (VECM) is done to indicate the direction of Granger Causality. This means it identifying which variable is a leader (exogenous) and which variable is a follower (endogenous). The variable is exogenous if the corresponding dependent variables is insignificant while variable is endogenous if the corresponding dependent variable is significant referring to the error correction coefficient. The size of error correction term coefficient indicates the length of time it takes to get back to equilibrium if one of the variables is shocked. The null hypothesis in this test is the variable is exogenous. If the p-value > 5%, the null hypothesis is not rejected. Based on Table 11, only one of the variables has a p-value > C.V. and it is OPR. Thus, null hypothesis is not rejected and OPR is identified as an exogenous variable. While KLCI, CPI, CRUDE and HJRH are endogenous variables. This shows that OPR is a leader among the variables while other variables are the followers. This result at the same time confirms the significant long-run cointegration relationship between the variables.

Intuitively, OPR or interest rate is exogenous as the change in interest rate is decided by the central bank of the country in their monetary policy. While this change in interest rate will impacts other macroeconomic factors like inflation and in turn give impacts to the stock markets both represented by KLCI and HJRH. However, CRUDE being endogenous can be quite strange as changes in Malaysia’s interest rate might not be good enough to impact the world oil price. Having said that, in the study the crude oil is priced in Malaysian Ringgit. This might provide some explanation on why change of interest rate might impact the oil price as the Malaysian exchange rate can be impacted by the change in monetary policy.

Table 11 VECM Statistical Test

Dependent Variable	ECM (-1) Coefficient	Standard Error	T-Ratio	P-Value	Critical Value	Outcome
dLKLCI	-0.10999	0.041266	-2.6653	0.009	5%	Endogenous
dLOPR	-0.070759	0.039418	-1.7951	0.075	5%	Exogenous
dLCPI	-1.0682	0.285083	-3.7470	0.000	5%	Endogenous
dLCRUDE	-0.28460	0.10217	2.7857	0.006	5%	Endogenous
dLHJRH	-0.15045	0.044790	-3.3590	0.001	5%	Endogenous

Notes: The significant of p-value or t-ratio at 95% confidence level indicates whether the deviation from equilibrium give significant relationship or not on the dependent variable (GDP). If the error term coefficient is found to be significant, the corresponding variable is the follower (endogenous), otherwise – if its insignificant the corresponding variable is the leader (exogenous).

Step 6 Variance Decomposition (VDC)

VDC is a test measure the strength or relative degree of exogeneity and endogeneity of the variables. VDC identifies which variable is the most exogenous and which is the most endogenous as well as able to provide a ranking of exogeneity among the variables. In this study, we only focus on the generalized VDC which is stronger than orthogonalized VDC as it relax the assumptions in orthogonalized VDC of switching off other variables when applying shocks to the intended variable. The strongest exogenous variable when shocked, will impact itself the most. From the result in Table 12, the most exogenous variable is represented by the only exogenous variable in the model OPR, then followed by CPI, then CRUDE and finally KLCI and HJRH. There seems to be a different ranking at horizon 20 and 30 this might be due to unusual changes occur during those period that might influence the ranking. However, at horizon 10 the result is supported by the result in VECM. Thus, the make more sense to follow ranking based on horizon 10.

Table 12 Generalized Variance Decomposition

Variable	Horizon	LKLCI	LOPR	LCPI	LCRUDE	LHJRH	RANKING
LKLCI	10	48%	1%	5%	2%	44%	4
LOPR	10	8%	79%	7%	3%	4%	1
LCPI	10	11%	1%	66%	5%	17%	2
LCRUDE	10	15%	7%	15%	49%	14%	3
LHJRH	10	41%	1%	7%	3%	48%	4
LKLCI	20	48%	1%	6%	2%	44%	3
LOPR	20	17%	58%	14%	1%	10%	2
LCPI	20	8%	2%	63%	12%	14%	1
LCRUDE	20	20%	7%	19%	36%	18%	5
LHJRH	20	42%	1%	8%	3%	46%	4
LKLCI	30	48%	1%	6%	2%	44%	3
LOPR	30	17%	58%	14%	1%	10%	2
LCPI	30	8%	2%	63%	12%	14%	1
LCRUDE	30	20%	7%	19%	36%	18%	5
LHJRH	30	42%	1%	8%	3%	46%	4

The percentage shows the degree of a shock to a variable impacts itself. The variable with the most impact to itself is the most exogenous. The table also present the variables based on 3 different horizon which are 10, 20, and 30 months.

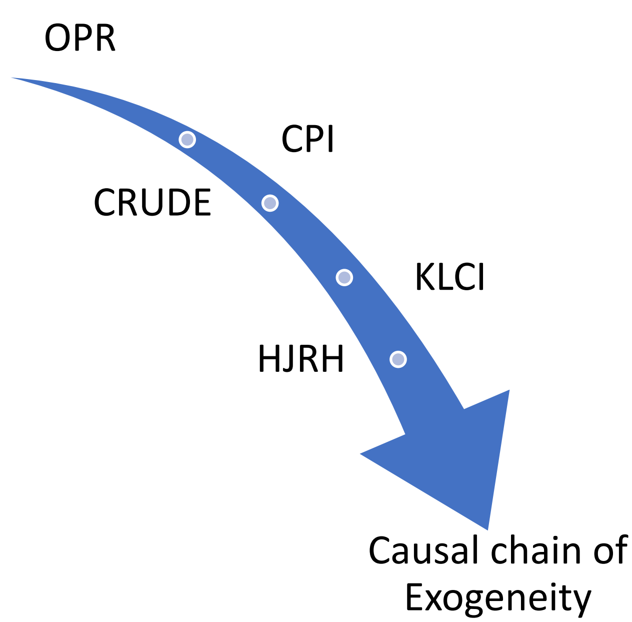


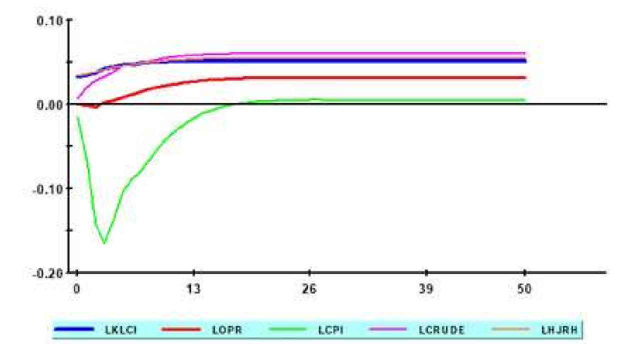
Figure 3 The causal chain from the most exogenous (left) to the most endogenous (right)

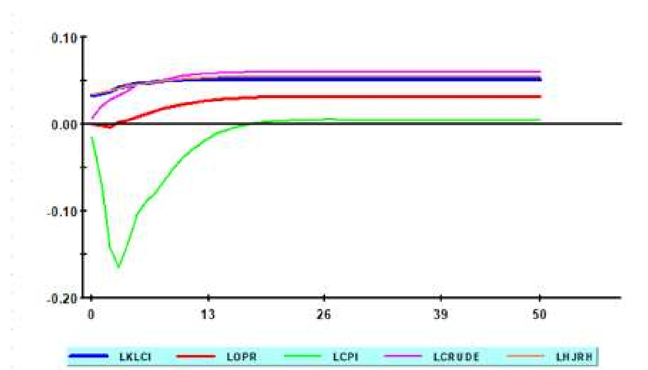
Figure 3 is the summary of the causal chain from the result in VDC. From this diagram, we conclude that the shock to the OPR which is the most exogenous variable in the model will give the most impact to other variable.

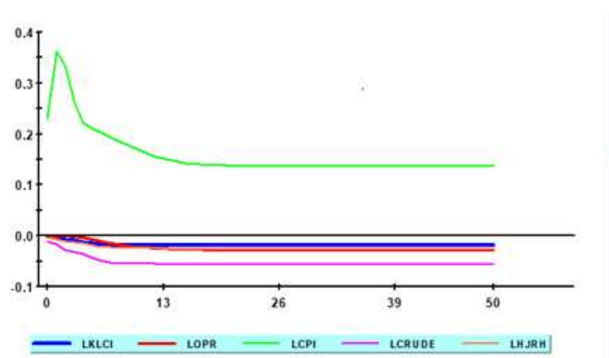
Intuitively, the finding can be justified as discussed in VECM where OPR is most exogenous due to the change in OPR or interest rate in government monetary policy might impacts CPI, and CRUDE and finally impact the stock performance represented by KLCI and HJRH.

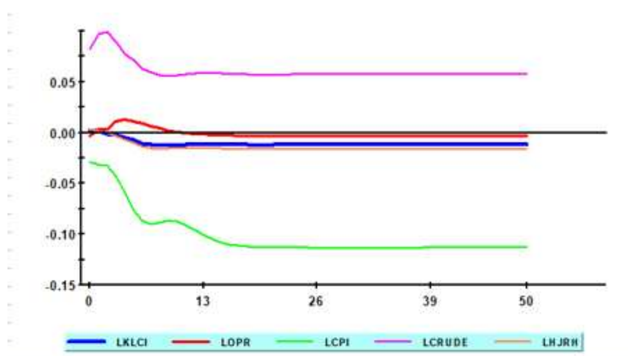
Step 7 Impulse Response Functions

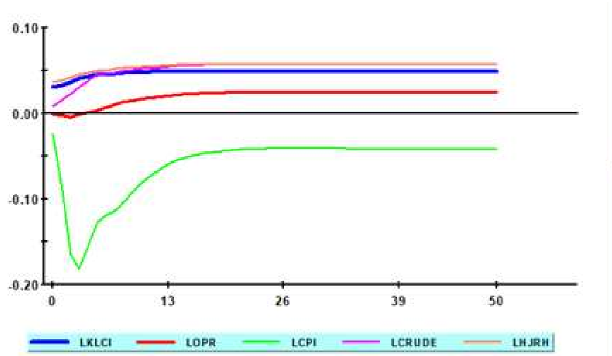
Impulse Response Functions (IRF) produces the same information as VDC but it is presented in a graphic form. Both method use a variable specific shock to capture the impact on other variables in the system. Basically IRF determines the impact of a shock on a specific variable to all other variables.











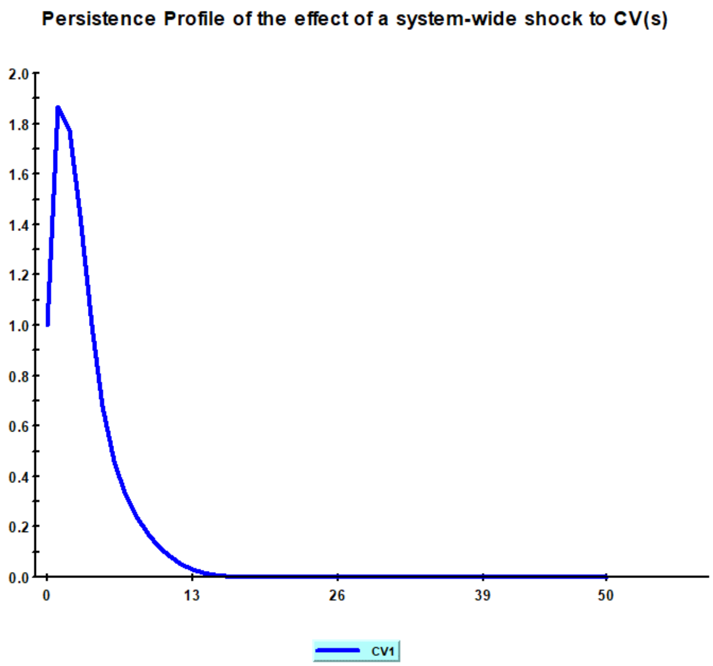
Note: The graph represent the Generalized IRF for all variables beginning with applying shock to KLCI, OPR, CPI,CRUDE and lastly HJRH

Figure 4 Generalized Impulse Response to stock to each variable

Figure 4 shows confirms that all these variables are cointegrated as it is seen to be moving together. However, CPI tends to be most volatile irrespective of which variable is being shocked. While other variables tend to move along together in scenario. The figure shows the relationship between the stock performance (both Shariah and conventional stocks) and interest rate is positive. While the stock performance and both inflation and crude oil price show an inverse relationship. Overall, regardless the shocks, the variables tend to move in equilibrium after the 13th months. Based on the finding, it is good to note that any action taken by the government to control these variables will have a big impact to the inflation level of the nation for more than a year.

Step 8 Persistence Profile

Persistence Profile (PP) uses a system-wide shock on the long-run relationships between the variables to estimate the time taken for the model to get back to equilibrium if the entire co-integrated model being shock.



Note: CV1 refers to the movement of the cointegrated model.

Figure 5 Persistence Profile of the effect of a system-wide shock

Based on the finding in Figure 5, it shows that it will took more than 13 months for the model to get back to equilibrium after a system-wide shock.

Conclusion

The study is set up with two objectives. (1) To examine how the macroeconomic factors influence the performance of stock markets. (2) To examine the relationship between the Shariah compliance stocks (Shariah stocks) performance and non-Shariah compliance stocks (conventional stocks) performance in relation to the impact of changes to macroeconomic factors. Based on the finding of the study, it is identified that the there is a longrun theoretical relationship between the macroeconomic factors (interest rate, inflation, crude oil price) and the stocks performance both Shariah stocks and conventional stocks. The results tend to indicate that any changes in the macroeconomic factors do have an impact on both Shariah and conventional stocks. Based on NARDL analysis, Shariah stocks and conventional stocks have both short-run and long-run symmetrical relationship. Both Shariah and conventional stocks have similar traits and the shocks to any of the macroeconomic factors have similar impact on both Shariah and conventional stocks in the context of Malaysia.

Based on our Granger Causality analysis, it is identified that interest rate is the only exogenous variable while others are endogenous variables. This means that interest rate is the leader among the variable while other variables are the followers. Whereby interest rate is the best tool to shock the other variables. VDC analysis shows that causality chain from interest rate as the most exogenous followed by crude oil price, inflation rate, and lastly Shariah and conventional stocks.

From our IRF and PP analysis show that the impact of the shocks to individual variables and system-wide shock takes about 13 months for it to get back to equilibrium. It also shows that interest rate, crude oil prices, Shariah stocks and conventional stock all move together even when shocks are applied and both Shariah and conventional stocks performance tends to have a positive relationship with interest rate but have negative relationship with inflation and crude oil price. However, the IRF analysis shows that any shocks to the variable does impact inflation deeply. Something the policy makers need to be aware. On the investor perspective, the study shows that both Shariah and conventional stocks perform almost similar to each other even when shocks are applied to other microeconomic factors. They also should take note on the positive relationship between interest rate and stocks performance as well as the negative relationship between inflation as [highlighted by Nelson (1976)] and crude oil price towards stock performance.

Lastly, we sincerely hope that our humble attempt to provide a light in the discussion on the relationship between Shariah and conventional stocks and the impacts of macroeconomic factors on the performance of both segments of the stock market is informative. Although we do realize the shortcomings of leaving out many other macroeconomic factors that might also influence the performance of the stock market, any shortcomings and unintended errors in this study are reflection of the authors alone.

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