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Abstract

This paper investigates the Granger-causal relationship between Dow Jones Islamic Market (DJIM), Dow Jones Industrial Average (DJIA), exchange rate, money supply, and CPI. The US is taken as a case study. The standard time series techniques are used for the analysis. The findings tend to indicate that the variables are theoretically related as evidenced in their cointegrating relationship and that the exchange rate is the most powerful determinant of stock market prices. This suggests that DJIM is very sensitive to the US currency fluctuations. Money supply and CPI are the other determinants of DJIM movements but to a lesser extent than the exchange rate. The findings have implications for the policy makers in that any changes in the macroeconomic variables have impact on the most important institution in the country which is stock market.

Keywords: Islamic stock, conventional stock, macroeconomic variables, VECM, VDC

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Introduction

Stock market plays a vital role to transfer funds from capital providers to capital borrowers which is very important for every economy. In other words the stock market is very significant to speed up economic growth through increasing liquidity of financial assets and diversification of global risk easier for investors to make a wiser investment decision. (Agrawalla 2006¹). A well performing stock exchange is very helpful for economic activity through growth and saving, efficient allocation of investment and attracting FDI (foreign direct investment). The stock market gives confidence to savers by providing domestic households having investable funds, innovation in financial instruments, which diversify their risk and better sharing in investment projects (Agrawalla 2006). Understanding the factors that influence the behavior of stock markets have been debated for quite long time and have attracted the attention of economists, policy makers, and other interested parties and they still pay attention to the issue until recent time. This is due to the significance of the stock markets' behavior to the whole economy and economic development of countries. Studies on the impact of macroeconomic variables on stock market have been dealt with extensively in developed market and it is growing in tremendous way in the emerging and developing countries.

Motivations and Objective of this study (why?)

- a) US stock market is considered as the most active and largest stock market in the globe. As such, the practical relevance of this study lies in its implications for policymakers. By showing if and/or how Islamic stock prices are related to conventional stock prices and major macroeconomic variables such as money supply and inflation, this paper will help policymakers strategize more optimally.
- b) Through such empirical studies, the feeling to become decision maker for decision takers to the extent that you can change the direction of an institution, a state, or a nation is a great motivation that pushes us towards further attempts to study and learn more.

¹ Agrawalla, Raman K, 2005, "Stock Market and the Real Economy: A policy perspective for India from Time Series Econometric Analysis" presented at the 42nd Annual Conference of the Indian Econometric Society (TIES) held at the Guru Nanak Dev University, Amritsar on 5-7 January, 2006

c) Recent researchers provide empirical studies that show the macroeconomic variables give an impact towards stock market. Most of the studies indicate that industrial production, risk premiums, consumer price index, inflation, interest rate, money supply and so forth as being crucial in explaining stock returns. Nevertheless, the studies neither identify whether all significant variables as mentioned above, affecting the Islamic stock market or indicates the correlation between the macroeconomic variables and Islamic stock market in the long term.

d) Albert Einstein says: “If you can't explain it *simply*, you don't understand it well enough”.

We are applying Johansen’s Cointegration Model and the Vector Error Correction Model (VECM), Variance Decompositions (VDCs), Impulse Response Functions (IRFs), and Persistence Profiles to test the relationship between Islamic stock market and macroeconomic variables. So one motivation is to apply such techniques in an empirical study and touch the results of our own study! ²

e) Curiosity to know :

1. Is there any cointegration between Islamic and conventional stock indices?
2. Is there any cointegration among Islamic stock indices and the macroeconomic variables?
3. Which of the macroeconomic variables will affect the Islamic stock market more?
4. What should we do to develop Islamic stock market?

f) Before proceeding further, we would like to add some words that exhibit the motivation behind this study further. The soul of Islamic finance is risk sharing and the recommended way to do business in Islam is trade and tying financial transactions to the real economy. Once we study the reasons behind global financial crisis, we discover that one of the most crucial factors led to such catastrophic situations was leveraging or over leveraging and decoupling financial market from real economy. Stock is the best model that properly ties financial sector with real economy. Islamic or non-Islamic stock is a proxy of ownership of some underlying assets that really exist and fairly shares the risk and profit based on loss or profitability accordingly. As such, identifying the elements that lead to the development of such market worth a lot of works and efforts. Nowadays, Islamic financial institutions carry a beautiful name but the substance is debt creation and encouraging people to apply for debt to become slaves to such institutions! We must remember that it is the art of venture capitalism mixed with stock market that made

² I used to read articles but once I faced econometric parts, I was ignorant and I skipped those parts and I felt no confidence. Now my feeling is like a bicycle rider (if not a car driver!) who is not scared of driving anymore!

Silicon Valley as the world's hub in entrepreneurship and creativity. Thanks to the US strong infrastructures in capital market and specifically stock market, thousands of noble ideas in information technology and computer science came to reality. If such ideas waited for bank loans, majority of them would be disappeared from the beginning. As such, understanding stock markets and the things affecting them positively or negatively is very important and could be a reasonable motive for this short study.

Literature Review

A wide range of studies have been conducted in order to determine the nature of relationship between the macroeconomic indicators and the stock market in several developed countries. Mukherjee and Naka (1995)³ found that Japanese stock market is cointegrated with a group of six macroeconomic variables, which are exchange rate, inflation, money supply, real economic activity, long-term government bond rate, and call money rate. Another study is authored by Nasseh and Strauss (2000)⁴ in which the authors concluded the existence of a significant, long-run relationship between stock prices and domestic and international economic activities in six European countries and that stock prices are determined by macroeconomic activities. A third study by Lovatt and Parikh (2000)⁵, investigated the relationship between real stock returns and a number of financial and economic variables for the United Kingdom economy and showed that a plausible relationship exists between real stock returns and most of the financial and economic variables. Hondroyiannis and Papapetrou (2001)⁶, focused on the dynamic interactions of macroeconomic indicators, such as industrial production, interest rate, exchange rate, the performance of the foreign stock market, and oil prices with the stock market in

³Mukherjee, Tarun K., & Naka, Atsuyuki, (1995), **Dynamic relations between macroeconomic variables and the Japanese stock market: An application of a vector error correction model**, Journal of financial research, Vol. 18, issue 2, pp. 223-237, retrieved from <http://www.allbusiness.com/personal-finance/investing-stock-investments/514746-1.html>.

⁴Nasseh, Alireza, & Strauss Jack, (2000), **Stock prices and domestic and international macroeconomic activity: A cointegration approach**, The quarterly review of economics and finance, Vol. 40, issue 2, pp. 229-245.

⁵Lovatt, David, & Parikh Ashok, (2000), **Stock returns and economic activity: The UK case**, The European journal of finance, Vol. 6, issue 3, pp. 280-297.

⁶Hondroyiannis, George, & PapaetrouEvangelia, (2001), **Macroeconomic influences on the stock market**, Journal of economics and finance, Vol. 25, issue 1, pp. 33-49.

Greece. The empirical evidence suggested that stock returns do not lead changes in real economic activities while the macroeconomic activity and foreign stock market changes explain only partially stock market movements. As for Singapore, Maysami and Koh (2000)⁷ examined such relationship and they found that inflation, money supply, changes in short and long-term interest rate and variations in exchange rate formed a cointegrating relation with changes in Singapore's stock market. Another study by Islam (2003)⁸, examined the short-run dynamic adjustment and the long-run equilibrium relationships between the Kuala Lumpur stock exchange composite index, and four macroeconomic variables, namely interest rate, inflation rate, exchange rate, and industrial production. The results support the existence of short-run dynamic adjustment and the long-run equilibrium relationships between the macroeconomic variables and the Kuala Lumpur stock market. Maghyereh (2002)⁹ investigated the long run relationship between the Jordanian stock prices and selected macroeconomic variables by using Johansen's methodology in cointegration analysis. The study finds that macroeconomic variables are reflected in the stock prices of the Jordanian capital market. Hussainey & Ngoc (2009)¹⁰, investigated the impact of macroeconomic indicators on Vietnamese stock prices and they concluded that there is a statistically significant association between domestic production sector, money market and stock prices in Vietnam. And finally, Tunali (2010)¹¹ which analyzed the relationship between macroeconomic variables and stock returns in the Turkish stock market index, showed that there is a long run relationship between basic macroeconomic indicators of Turkish economy and stock returns on different levels.

Studying further will not tell us the relationship between Islamic stock indices and conventional stock indices. Furthermore, there are not many works empirically showing the relationship between Islamic stock indices and macroeconomic variables. As such, this study attempts to elaborate on these issues empirically.

⁷Maysami, Ramin Cooper, & Koh, Tiong Sim, (2000), **A vector error correction model of the Singapore stock market**, International review of economics & finance, Vol. 9, issue 1, pp. 79-96.

⁸Islam, Mazher M., (2003), **The Kuala Lumpur stock market and economic factors: A general to specific error correction modeling test**, Journal of academy of business and economics, retrieved from <http://www.allbusiness.com/personal-finance/investing-stock-investments/752251-1.html>.

⁹Maghyereh, Aktham Issa, (2002), **Causal relations among stock prices and macro-economic variables in the small open economy of Jordan**, retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=317539.

¹⁰Hussainey, Khaled & Ngoc, Le Khanh, (2009), **Impact of macro-economic indicators on Vietnamese stock prices**, Journal of risk finance, Vol. 4.

¹¹Tunali, Halil, (2010), **The analysis of relationships between macro-economic factors and stock returns: Evidence from Turkey using VAR model**, International research journal of finance and economics, issue 57, pp. 169-182.

Theory Development

The focus of this study is to understand the relationship between Islamic stock market, conventional stock market, and macroeconomic variables. As such, Dow Jones Islamic Market index ¹²or DJIM, Dow Jones Industrial Average or DJIA, and macroeconomic variables like exchange rate of the USD against UK sterling pound¹³, money²¹⁴, CPI or consumer price index have been selected accordingly. Including DJIA adds two advantages to this study. First of all, Dow is among the most closely watched U.S. benchmark indices tracking targeted stock market activity. Secondly, it is a proper variable as a control variable since compared to DJIM, DJIA is too much bigger and it properly receives and transmits market shocks. And lastly, we will be able to examine the interaction between an world's most important Islamic and non Islamic stock index and macroeconomic variables.

Variable	Explanation
Djim	Dow Jones Industrial Average
Djia	Dow Jones Islamic Market Index
Xch	Exchange Rate; US \$ TO UK £
M2	Money Supply (M2)
CPI	Consumer Price Index

The source of our data is Datastream and it is monthly basis data

DJIM

The Dow Jones Islamic Market Index (DJIM), launched in 1999 in Bahrain, was the first index created for investors seeking investments in compliance with Muslim Sharia law .The DJIM has an independent Shari'ah (islamic Law) Supervisory Board. The DJIM screens have been adopted by the Auditing & Accounting Organization of Islamic Financial Institutions (“AAOIFI”)-Standard 21.The DJIM measure the performance of a global universe of investable equities that have been screened for Shari'ah compliance consistent with Dow Jones Indexes' methodology. The selection universe for the DJIM family of indexes is the same as the universe for the Dow Jones World Index, a broad-market

¹² Why DJIM? DJIM is the first index created for investors seeking investments in compliance with Muslim Sharia law

¹³ Why SSD-UK pound? Among internationally recognized currencies like Japanese Yen, Chinese Yuan, European Euro, Canadian Dollar, why UK Sterling Pound? Because compared to other currencies globally it has more credibility and stability. UK monetary policy is different from all of the European Zone. (We can see UK never accepted to become a member for Euro currency and it kept Sterling as its currency. The whole Euro zone encountered a few financial crises; like recently Greece debt issue, but UK and Sterling Pound is safe).

¹⁴ Why M2 and not M1? Because M1 is so narrow consisting of currency and demand deposit, while M2 includes NCD and REPOs as well. As such, M2 provides more real results.

index that seeks to provide approximately 95% market coverage of 44 countries. The first level of DJIM screening removes companies involved in such products alcohol, pork-related products, conventional financial services (e.g. banks and insurance companies), entertainment (e.g. hotels, casinos, gambling etc.), tobacco, and weapons and defense. A second level of DJIM screening based on financial ratios is intended to remove companies based on debt and interest income levels in their balance sheets.¹⁵

DJIA

The Dow Jones Industrial Average also called the Industrial Average, the Dow Jones, the Dow Jones Industrial, the Dow 30, or simply the Dow, is a stock market index, and one of several indices created by Wall Street Journal editor and Dow Jones & Company co-founder Charles Dow. It was founded on May 26, 1896, and is now owned by Dow Jones Indexes, which has its majority owned by the CME Group. Along with the NASDAQ Composite, the S&P 500 Index, and the Russell 2000 Index, the Dow is among the most closely watched U.S. benchmark indices tracking targeted stock market activity. Equivalent indices, such as the FT 30, have largely become redundant in favour of more representative and neutral indices, such as the S&P 100. Although Dow compiled the index to gauge the performance of the industrial sector within the American economy, the index's performance continues to be influenced by not only corporate and economic reports, but also by domestic and foreign political events such as war and terrorism, as well as by natural disasters that could potentially lead to economic harm.¹⁶

Exchange rate

There is wide debate among researchers, policy makers and economists as to whether stock prices influence exchange rates or vice versa and empirically the literature were inconclusive and unable to find unique findings. This is quite true due different institutional and environmental forces that each country adapted to. In classical economic theory side, it is argued that the deprecation of a certain currency will lead to increasing the demand for the country export and consequently leading to increase in cash flow and profit of companies and by turn it will drive the stock prices to higher level

¹⁵ Wikipedia

¹⁶ Wikipedia

(Kutty, 2010; Maysami et al, 2004; Phylasktis and Ravazzolo 2005). Conversely, according to tradition approach the appreciation in the currency is considered a bad news for local firms as it will drives the competitive advantages of export to lower rate and therefore, leading to decline in firm's profitability and hence stock prices decline. Thus, according to this view a negative relationship would exist between stock prices and exchange rate. Other like (Maysami et al, 2004) suggest an alternative way and explanation and they argue that appreciation in the currency would attract the investment and thus push up the stock market prices to rise up. As such conflicting results, in line with finding from Phylaktis and Ravazzolo (2005) this paper hypothesize that there is positive relationship between stock market and exchange rate.

Money Supply

An increase in money supply growth would indicate excess liquidity available for buying securities, resulting in higher security prices. The modern quantity theory of money developed by Brunner (1961), assumed investors reaches an equilibrium position in which they hold a number of assets including money in their portfolio. A monetary disturbance, such as an increase in rate of money supply, causes disequilibrium in portfolios of assets. As a result, asset holders adjust the portion of their portfolio (Quoted in Alkhudairy, 2008). This adjustment alters the demand for other assets that compete with money balances, including stocks. Due to the increase in the money supply, there would be an excess demand from investors for stock and hence the prices of stocks will rise up and vice versa. Even though the literature and empirical evidence did not reach the agreement on the affect on money supply on stock prices, the paper hypothesize that increase in money supply will lead to increase in stock prices as argued in the discussion above.

CPI

Another variable of interest is CPI. There are two opinions which explain the relationship between CPI and stock price. The first opinion said that there is positive relationship between CPI and stock price. Increasing CPI leads to higher inflation rate that will have positive effect to the stock price. The follower of this opinion assumes that the inflation occurred is caused demand pull inflation. The inflation condition in the company, producer, can impact increasing more consumer cost. Therefore,

the profit margin increases, so it will be positive perspective to stock price in stock market, so on. The same opinions are said by Donald E. Vaugh: "...a growing assets base should support sales and earnings per share. Lastly, during an inflationary economics, sales prices per unit of output are likewise usually rising, thus providing higher dollar per share and hopefully larger reported earnings per share figure..." (Vaugh, 1984: 195). The second opinion explains that increasing CPI or inflation rate will result in decreasing stock price. Arising this opinion assumes that happened inflation is cost push inflation. The inflation existence results raw material cost and labor wages, so at this condition, the producer do not dare to increase its product price. This matter causes decreasing profit margin, so expected return and dividend follow it downhill. This condition causes downhill share price. Meanwhile, Kolb express in its book, investment, that high inflation rate whether anticipated or unanticipated seems to occur with low stock price (Kolb, 1988: 268). The increasing of accelerating inflation will cause disinclination all investor to invest its fund in the stock form, investor tend to choose investment in the other form like investment in real estate or gold (Winger, 1992: 475).

Methodology

This study employed a time series techniques, in particular cointegration, error correction modeling and variance decomposition, in order to find empirical evidence of the nature of relations amongst DJIM, DJIA, Exchange Rate, Money 2, and CPI as it has elucidated in previous sections. This method is likened because the starting point is to exploit the information that one can get from a variable that is available through the variable itself (Asteriou and Hall, 2007). Unlike its predecessor -linear regression, the strength of time series techniques are as follows: (1) these techniques allow the researcher to test long-run theoretical relationships amongst the variables (i.e. cointegration), and (2) these techniques also allow the researcher to test the causality relationship (via Granger-causality test) amongst the variable. By adopting such techniques allows the researchers to take the consideration for the problems faced in the regression. The main problem of regression centers on the idea that economic variables are non stationary and hence the results of t-test and f-test could be invalid. The researchers tried to solve such problems by differencing the variables, however, such approach has another implication on the data as it will remove the long run relationship or the theoretical part.

Overall, time series analysis allows the researcher to capture and examine the dynamics of the data. Before testing the cointegration, unit-root test is conducted in the first step. According to Brooks

(2008), formal tests for identifying non-stationarity are needed because of several reasons; (1) the stationarity or non-stationarity of a series can strongly influence its behavior and properties, (2) the use of non-stationarity data can lead to spurious regressions, and lastly (3) non-stationary variables will result in invalid assumptions for asymptotic analysis, i.e. “t-ratios” will not follow a t-distribution, and F-statistic will not follow an F-distribution. It is known that a variable is said to be integrated of order d , $I(d)$, if it requires differencing d times to achieve stationarity. Our main focus is to have $I(1)$, that is the variables are stationary in the first-differenced form. As such, the researcher exercised ADF (Augmented Dickey-Fuller) unit root test, before succeeding to lags determination in the step 2.

After determining the order of lags, Johansen approach is employed in the cointegration test (step 3). Johansen approach is used instead of Engel-Granger approach because it allows the researcher having more than one cointegrating vector in a multivariate variables model. Henceforth, long run structural modeling (LRSM) is exercised to estimate theoretically meaningful long-run (cointegrating) relations by normalizing the variable of interest as well as tests the underlying economic theory. At this stage, the researcher knows that the variables are cointegrated in the long run.

Next steps are aimed to have deeper understanding on the role of the variables whether they are explanatory or dependent variables. Error Correction Model (ECM) test, Variance Decompositions (VDCs) test are taken in order to understand which are leading and which are following. Nonetheless, the order of the leader are given in the VDCs. Furthermore, graphical visualization of the relationship is shown in Impulse Response Functions (IRFs) graphs. And it is concluded with Persistence Profiles (PP) graphs which along with IRFs graphs visualize the dynamic response path of the long-run relation. The distinguish line between the two is that PP trace out the effects of a system-wide shock. In other words, would external shock affect the model, how long the variables need to return back to their equilibrium.

Step 1: Unit Root Test

Most of the time series data are non-stationary, meaning that the mean and variance are not constant over time. When the data are non stationary, it will lead to wrong conclusion in classical regression and hence spurious results will be produced. Therefore, in cointegration analysis we have to test the variable whether it is non stationary or not in order to proceed with the next step of testing cointegration. The variable should be $I(1)$ or non stationary in its level form and stationary in

its difference form. To test for stationarity¹⁷, the widely used Augmented Dickey Fuller (ADF) test is implemented to all the variables under consideration. The following tables summarize the results of the ADF test.

Step 1:Unit Root Testing			
Variables in Level Form			
Variable	Test Statistic	Critical Value	Implication
Ldjim	-2.502	-3.4331	Variable is non-stationary
Ldjia	-2.9608	-3.4331	Variable is non-stationary
LXch	-1.8104	-3.4331	Variable is non-stationary
LM2	-2.401	-3.4331	Variable is non-stationary
LCPI	-2.3438	-3.4331	Variable is non-stationary

Step 1:Unit Root Testing			
Variables in Differenced Form			
Variable	Test Statistic	Critical Value	Implication
DDjim	-9.9067	-2.876	Variable is stationary
Ddjia	-5.73	-2.876	Variable is stationary
DXch	-9.6388	-2.876	Variable is stationary
DM2	-5.4346	-2.876	Variable is stationary
DCPI	-6.8224	-2.876	Variable is stationary

Interpretation

Based on the highest level of AIC & SBC, the corresponding test statistic of each variable is compared against its respective 95% critical value of ADF statistic. It is found that for all the variables in level form, the ADF tests cannot reject the null hypothesis of non-stationary. Meanwhile, for all the differenced variables, the ADF tests reject the null hypothesis thus finding the differenced variables as stationary. Hence, it is concluded that all the variables fulfill the unit root test of I(1).

Step 2: Order of the VAR

Before proceeding with test of cointegration, we need to first determine the order of the vector auto regression (VAR), that is, the number of lags to be used. As per the table below, results show that AIC recommends order of 1 whereas SBC favours six lags.

¹⁷ Stationary: the variable where the mean, variance, and covariance with its lags are constant. The autocorrelation coefficients die down very quickly after only 2 or 3 significant lags. Shocks are transitory & Non-stationary: the variable where the mean, variance, and covariance with its lags are not constant. The autocorrelation coefficients tend to be unity. Shocks are permanent.

Step 2: Order of the VAR		
Choice Criteria		
	AIC	SBC
Optimal Order	1	6

Given this apparent conflict between recommendation of AIC and SBC, we address this in the following manner. First we checked for serial correlation for each variable and obtained the following results.

Variables	Chi Square Result (P-Value)	Implication (at 10%)
DDjim	0.279	No Serial Correlation
Ddjia	0.856	No Serial Correlation
DXch	0.578	No Serial Correlation
DM2	0.724	No Serial Correlation
DCPI	0.009	Serial Correlation Exists

Interpretation

As evident from the above results, there is autocorrelation in 1 out of the 5 variables. Thus, if we adopted a lower order, we may encounter the effects of serial correlation. Given that my data passed the ADF test, the problem of serial correlation is taken care of since ADF test tends to correct the problem of serial correlation in the data. Furthermore, AIC tends to choose the best order of lags. As such, to capture the best optimal order I will proceed with AIC's recommended; i.e. 1 lags, given that the serial correlation problem is taken care of by ADF.

Step 3: Test of cointegration

Cointegration implies that the relationship among the variables is not spurious i.e. there is a theoretical relationship among the variables and that they are in equilibrium in the long run. Employing the Cointegration LR Test Based on Maximal Eigen value, the results imply that there exists one cointegrating relationship at 5% & 10 % significance level between the variables.

Step 3: Test of Cointegration					
Criteria		Number of Co-integrating vectors			
Maximal Eigenvalue		1			
Trace		1			
AIC		3			
SBC		6			
HQC		1			

Null	Alternative	Statistic	95% Critical Value	critical Value	Conclusion
r=0	r=0	38.3	37.86	35	Reject Null , Accept Alternative
r<=1	r=2	22.36	31.79	29.13	Accept Null, Reject Alternative

Interpretation

The economic interpretation, in our view, is that the 6 variables are theoretically related, in that they tend to move together, in the long term. In other words, the 6 variable are cointegrated, that is, their relationship with one another is not merely spurious or by chance. This conclusion has an important implication for policy makers. By taking action on one economic variable, the policy makers will be aware of the impact on other economic variables on the stock market. In other words, their actions will not be in a silo i.e. it will have an impact on the investors' perceptions thus affecting the stock market and other economic factors. Also, the policy makers could model the effect of their decisions on the effect of one economic variable to another before making the actual implementation decision.

Step 4: Long Run Structure Modeling (LRSM)

With the confirmation of one cointegrating relationship amongst the variables, verifying the theoretical foundation as earlier discussed of the linkages between the variables of one strong cointegrating relationship. LRSM is important step in the analysis in the sense that we can compare the theoretical expectation with the generated statistics. In other words, LRSM allows estimating long run model based on theory by imposing identifying and over identifying on the parameters (Masih and Winduss, 2006¹⁸). Since the main purpose of the article is to know the influence of economic variables on Dow Jones stock index, we impose restriction on the DJIA. This means that we have to normalize the

¹⁸ Masih, M. and Winduss, T. (2006). Who Leads the Australian Interest Rates in the Short and Long Run? An Application of Long Run Structural Modelling. *Review of Pacific Basin Financial Markets and Policies*, 9 (1), 1–24.

dependent variable and hence we can see the significance of the variables as determined by its T-ratio statistics. The summary of results of exact identification is depicted in table.

Step 4:LRSM; Exact Identification				
Variable	Coefficient	Standard Deviation	T-Ratio	Implication
Ldjim				
Ldjia	-2.9952	2.0987	-1.4271692	Variable is insignificant
LXch	4.3158	4.3531	0.991431394	Variable is insignificant
LM2	4.6835	5.2751	0.887850467	Variable is insignificant
LCPI	3.887	47.8527	0.081228436	Variable is insignificant

Interpretation

Logically since we passed cointegration test in step 3, we can keep all the variables but to make sure whether the insignificant variables are really insignificant or not, then we do LRSM over identification test. Null says the variables are insignificant but based on 90% confidence level we found that except M2, all are significant as shown in the following table.

Step4:LRSM; Over Identification		
Variable	Chi-Sq P-Value	Implication
Ldjim		
Ldjia	3.0458[.081]	Variable is significant
LXch	7.7189[.005]	Variable is significant
LM2	.020174[.887]	Variable is insignificant
LCPI	6.0760[.000]	Variable is significant

Our intuition says we can keep M2 as money supply positively or negatively plays an important role in stock markets as it is elaborated in theory development before. Therefore the following line demonstrates the theoretical relationship among our variables:

$$Djim - 2.9952Djia + 4.3158Xch - 4.68M2 - 3.887CPI$$

Step 5: Vector Error Correction Model (VECM)

VECM shows further information on the relationship between variables. As we know cointegration, cannot tell the direction of Granger causality as to which variable is endogenous and which is

exogenous. Thus, for revealing which variable is dependent and which is independent VECM is used for that purpose. Looking to the table and particularly to the significant of ECM or otherwise the error correction coefficient ¹⁹we can draw up conclusion on which variable is endogenous and which is exogenous and therefore, the policy makers and related parties can know which variable should pay attention to when they make their decision as it may need certain actions to be taken in order to have an influence on one variable to get the required results or impact on other. The following table exhibits the result of our test to find out which variable is exogenous and which one is endogenous.

Step 5: VECM		
Variable	ECM(-1)T-Ratio	Implication
Ldjim	6.0769[.000]	Variable is Endogenous
Ldjia	4.9117[.000]	Variable is Endogenous
LXch	.89039[.374]	Variable is Exogenous
LM2	1.97872[.0722]	Variable is Exogenous
LCPI	1.7565[.081]	Variable is Exogenous

Interpretation

The table above suggests that DJIM and DJIA are endogenous (dependent) variables, as they have p-values which are less than 5%. When the p-values are less than 5%, the results are statistically significant, and the commensurate variable becomes endogenous. Similarly, when the result is insignificant, the commensurate variable is exogenous (leader). Here, following this line of reasoning, exchange rate, money supply and CPI are exogenous variables (leader variables).

Step 6: Variance Decompositions (VDCs)

The results of the previous step do not tell the relatively endogeneity and endogeneity of the variables. Therefore, the VDCs designed to draw conclusion on such matter. There are two types of VDCs tests, the first is the orthogonalized forecast error variance decomposition and the second one is generalized

¹⁹ If the error correction term statistic is insignificant, then the commensurate dependent variable is “exogenous”. Conversely, if the error correction term is significant, then the commensurate dependent variable is “endogenous”. The coefficient of the error correction term is also important, as it indicates the speed which short term adjustment can take place so as to achieve long-term equilibrium. In this respect, the coefficient’s statistical size signifies the proportion by which the disequilibrium of the commensurate variable in each short time period is being corrected.

forecast error variance decomposition. The results for two period of time horizon; 24month and 60 months ²⁰are as follow.

Step 6: VDC					
Orthogonalized : 24 Months					
	LDjim	Ldjia	LXch	LM2	LCPI
Ldjim	17%				
Ldjia		6%			
LXch			98%		
LM2				77%	
LCPI					62%

Step 6: VDC					
Orthogonalized : 60 Months					
	LDjim	Ldjia	LXch	LM2	LCPI
Ldjim	4%				
Ldjia		1%			
LXch			97%		
LM2				63%	
LCPI					51%

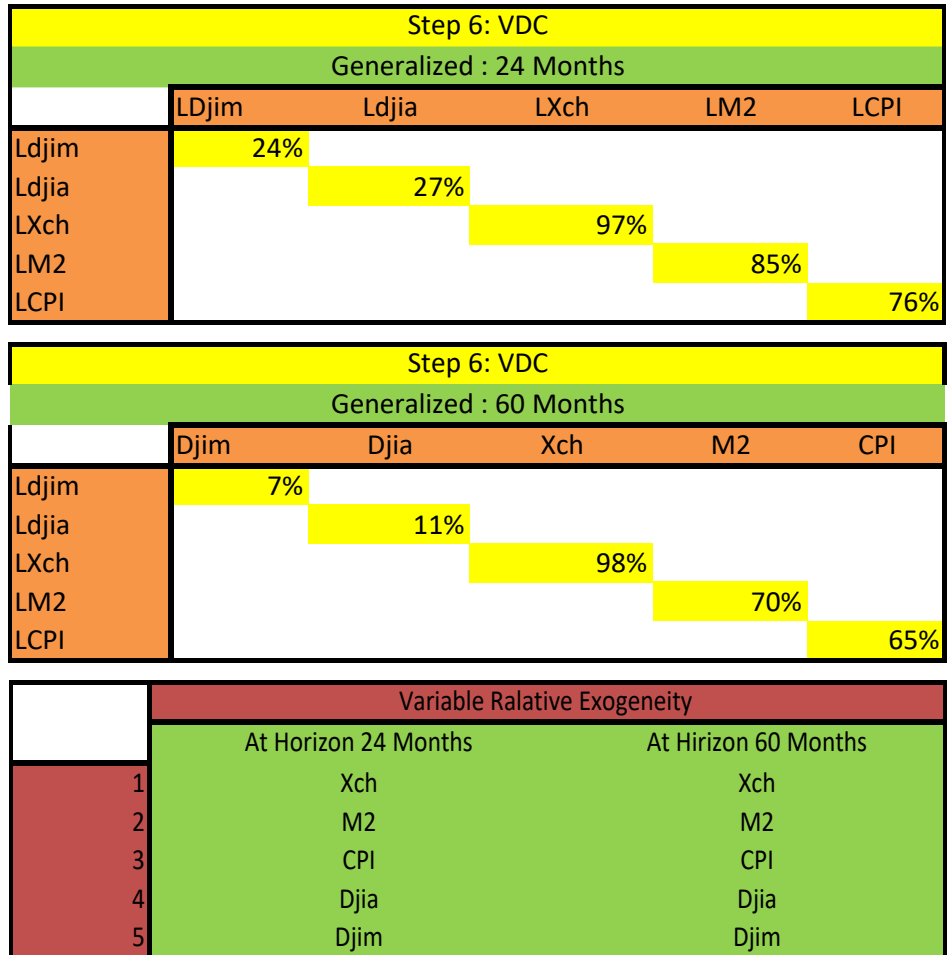
Variable Relative Exogeneity		
	At Horizon 24 Months	At Hirizon 60 Months
1	Xch	M2
2	M2	Xch
3	CPI	CPI
4	Djim	Djim
5	Djia	Djia

Interpretation

Looking at the above tables we find out that DJIM is more exogenous compared to DJIA that is not logic. The reason for such irrational ranking is the tow main problems laid down in Orthogonalized method. The first problem is that when we shock on variables, Orthogonalized VDCs method is biased to that variable and gives the highest rank among 5 variables. The second problem is that in Orthogonalized method when we shock one variable, the rests are switched off and it makes the results non-realistic as we can see in the above ranking tables. As such, we have to find out which variable is more exogenous with a more realistic method that is Generalized VDCs. The above two mentioned

²⁰ 24 months for short term and 60 months for long term

problems do not exist in Generalized VDCs. The results for our generalized VDCs are shown in the following graphs.



Interpretation

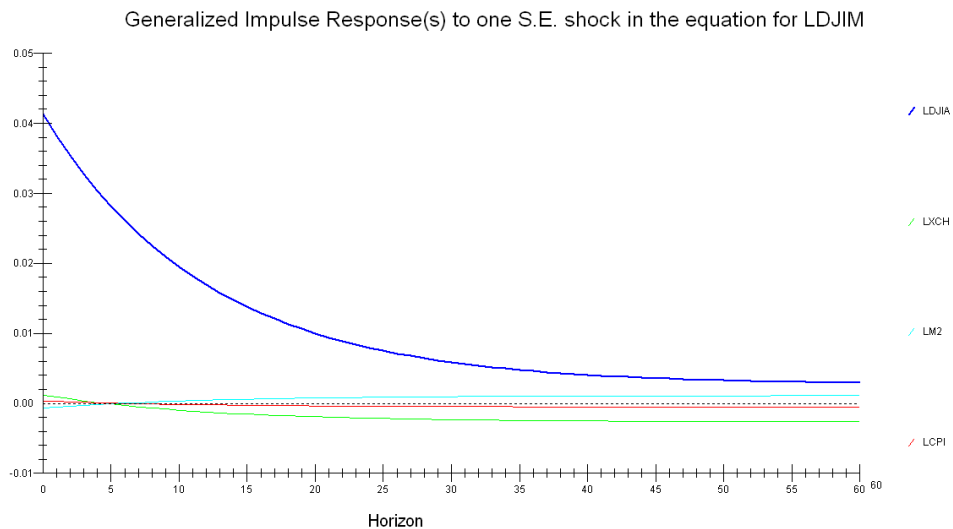
The shock in the exchange rate variable is contributing to the variance of itself by 97% & 98% in the 24th & 60th period respectively. Overall, the variable which is contributing most to its own variance in the most distant period is the most influential leader variable. In our study, this is exchange rate, which is contributing 97% up to 98% to its own variance in the 24th & 60th period. So, exchange rate is the most leader variable in our study. Money and CPI stand as next most exogenous variables affecting DJIM. Why exchange rate is such influential in our study? If we look at many other studies, they conclude that money or inflation are the most influential factors affecting stock exchange indices. The reason for our case could be because US is the biggest financial market and capital market internationally. The flow of capital from and towards US market is huge. It means daily, monthly,

annually billions and trillions of USD being inflow and outflow. China, Japan, UK, Euro Zone, Canada, Australia all invest in the US stock market since the US market is the safest market for investment. As such, exchange rate must be favorable to investors so that they feel comfortable to invest or withdraw their investment. US exchange rate regime is a floating regime being adjusted to market forces of demand and supply instantly. For capital being invested in DJIA or DJIM, exchange rate could play the most important role.

Interestingly, the result in this step is in consistency with previous step; i.e. VECM and it verifies that not only exchange rate, M2, and CPI are exogenous in the sample period, but they still will remain as exogenous or leader variables explaining the movements in DJIM or DJIA in the future as well.

Step 7: Impulse Response Function (IRF) ²¹

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



Interpretation

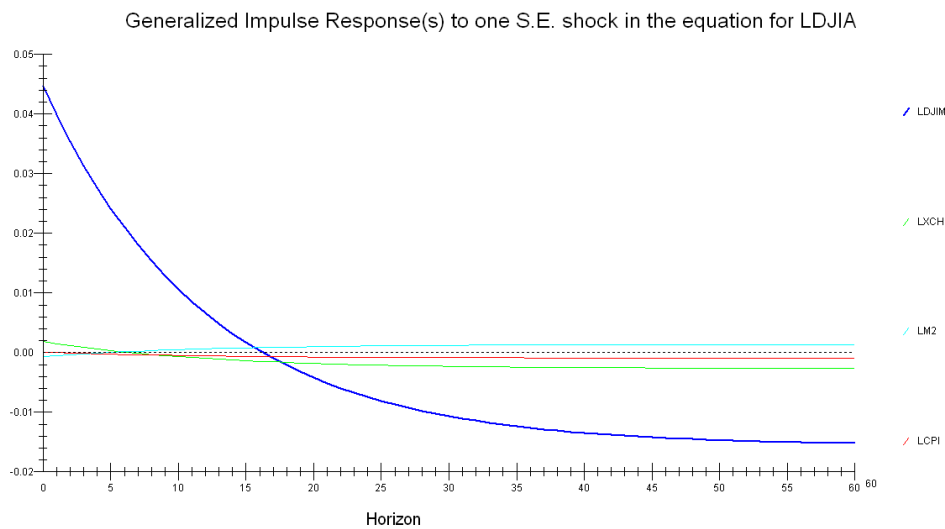
Having the least level of exogeneity; 7% (shown in VDCs step) in the next 60 months , DJIM logically can impact on DJIA with exogeneity of 11% and DJIA’s reaction to DJIM’s shock is light and steady.

²¹ to avoid lengthening the paper, I only elaborate on 60 months

On the other hand, DJIM will influence exchange rate, M2, and CPI (with exogeneity of 98%, 70%, and 65%) very less and they almost move around 0 once DJIM is shocked. This proves the fact that DJIM cannot affect the macroeconomic factors considerably.

Furthermore, DJIA reacts adversely in the form of downward sloping. It is in consistence with the results shown in LRSM exact identification. (minus coefficient) .

Interestingly, DJIM and DJIA in all of the IRF Graphs exhibited in this part react synchronistic either positively or negatively that amplify our result in step 3 that all variables are theoretically cointegrated.

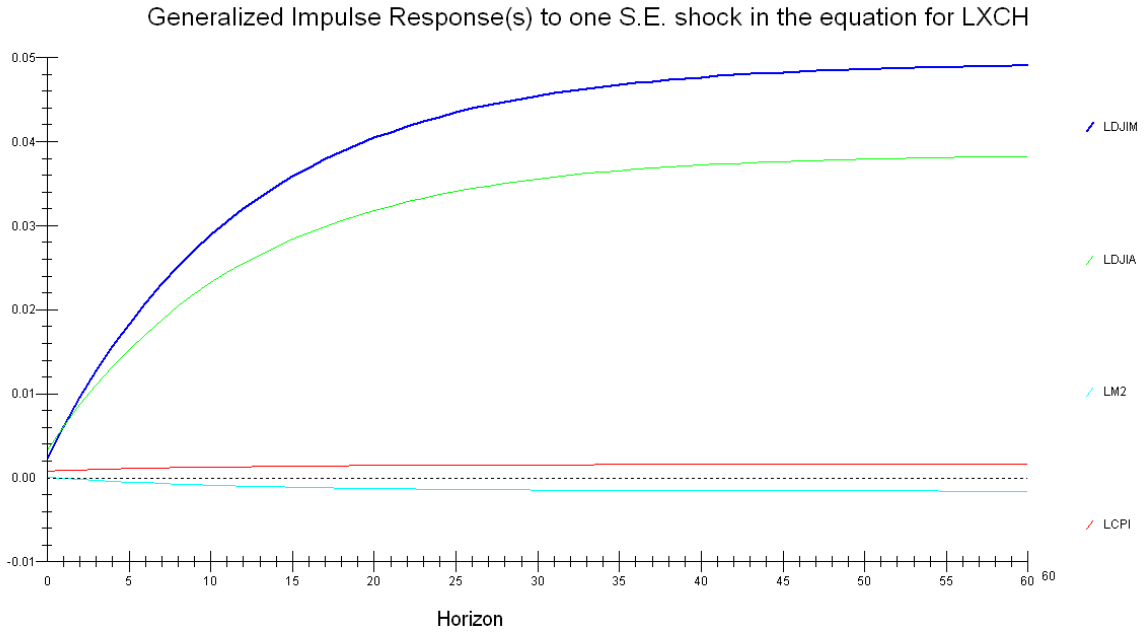


Interpretation

Having the level of exogeneity of 11% (shown in VDCs step) in the next 60 months, DJIA logically can impact on DJIM with exogeneity of 7% that is lower compared to DJIA. On the other hand, DJIA will influence exchange rate, M2, and CPI very less and they almost move around 0 once DJIM is shocked.

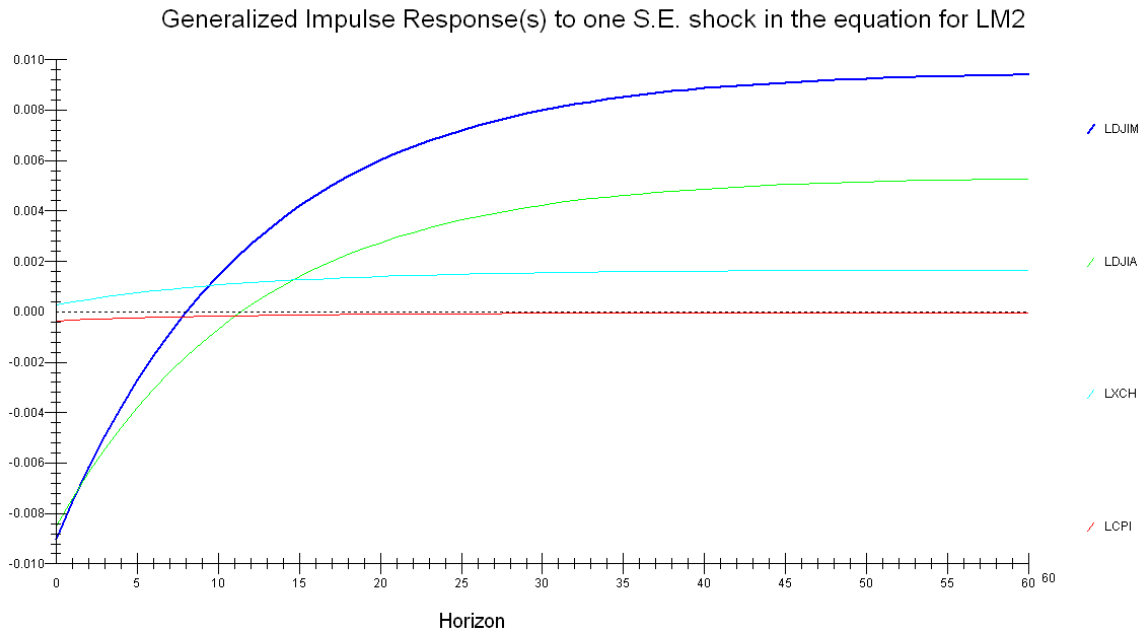
DJIM will react sharper compared to DJIA's reaction to DJIM's shock in the previous graph. It is due to the fact that DJIA is more exogenous compared to DJIM.

Furthermore, DJIM reacts adversely in the form of downward sloping. It is in consistence with the results shown in LRSM exact identification. (negative coefficient)



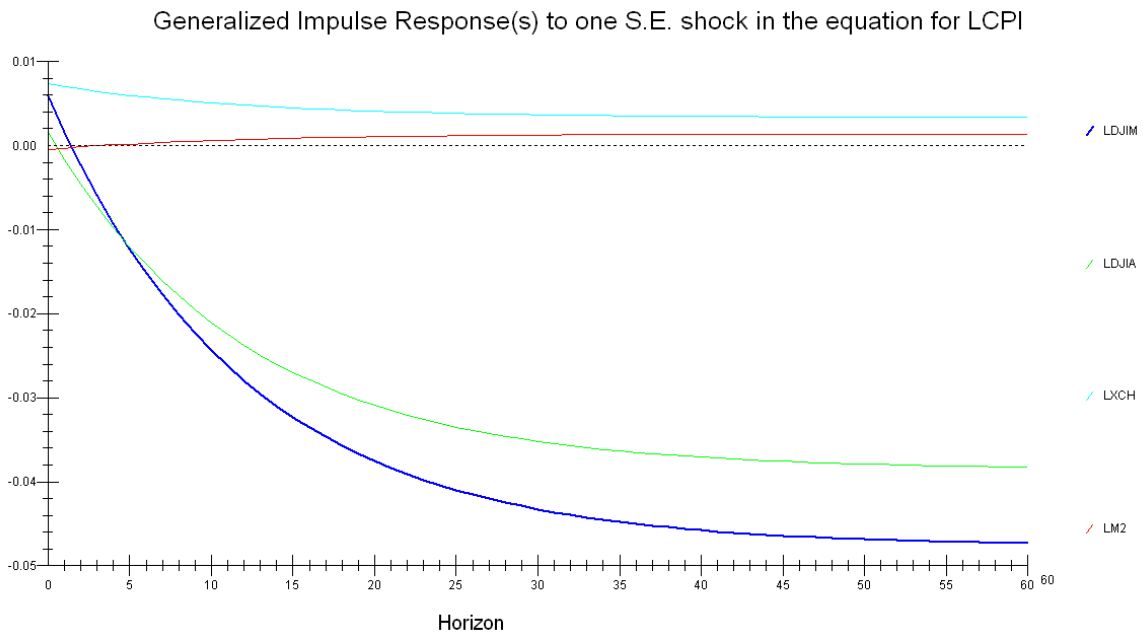
Interpretation

Having exogeneity of 98%, any shock to exchange rate will let DJIA and DJIM (with 11% & 7% exogeneity) jump sharply. Furthermore, DJIM’s reaction is positively (it is in line with LRSM exact identification result that our exchange rate has positive coefficient affecting DJIM positively).



Interpretation

With exogeneity of 70% , M2 will impact on DJIM (with 7% exogeneity) strongly (DJIM's reaction is sharper than DJIA's reaction once M2 is shocked). In line with our results in LRSM (exact identification), M2 affects DJIM positively. Meaning if M2 increases, DJIM will increase as well.

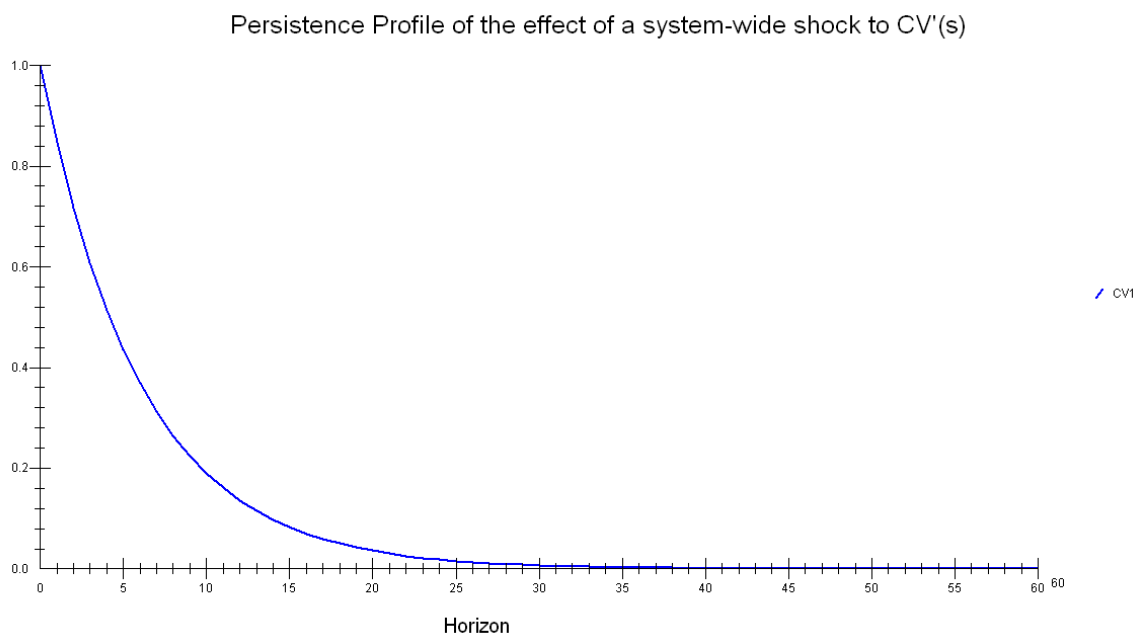


Interpretation

Having exogeneity of 65%, and having negative coefficient (in our equation from LRSM exact identification), CPI influences DJIM (with only 7% exogeneity) strongly (more than DJIA) and downward sloping or negatively.

Step 8: Persistence Profile of the effect of a system-wide shock

A Persistence Profile graphically displays the time horizon required for the cointegrating relationship to return to a state of equilibrium when a system-wide shock occurs. Using this technique on our current variables, we obtain the following result:



Interpretation

Once the whole system being shocked by an external factor, it takes about 30 months that the whole variables come back to equilibrium condition.

Conclusion and Policy Implication

In conclusion, we revisit the two research questions raised at the beginning of present paper. Based on the above time series techniques that we employed to test the cointegration and Granger-causality amongst variables, we suggest the following:

- i. There is a cointegration between DJIM and DJIA. The evidence is step 3 and step 7. In step 3 we found out that all variables are cointegrated among which are DJIM and

DJIA. Furthermore in step 7 the reaction of DJIM and DJIA to shocks is in harmony and synchronic.

- ii. There is co-integration between the macroeconomic variables and DJIM (as a proxy for Islamic stock market).
- iii. For Islamic stock market specifically DJIM, we found that all of the macroeconomic variables will influence DJIM index either positively or negatively.
- iv. Inflation needs to be adequately controlled by the government of the day in order to prevent negative effects on the Islamic stock index price. If inflation is allowed to run rampant, the Islamic stock index price would most likely be depressed.
- v. Based on the statistical analysis, we indicate that exchange rate is the most exogenous variables that give positive impact to the level of price within the sample period. However, this result is verified when we conducted the VDCs and IRFs. Our reasoning to justify why exchange rate plays such crucial role in DJIM index fluctuations is that US stock market is influenced heavily by foreign investments. Such trillion USD market faces trillions of USD inflow and outflow. As such, exchange rate logically could be an important macroeconomic variable facilitation the flow of international investments. The message is that once a country opens its economy, in order to get benefit from such situation and to improve Islamic stock market, exchange regime must be appropriately settled so that capital inflow becomes more profitable and fluent for investors and the target market.
- vi. In theory there are many views saying money impacts stocks negatively, positively, or neutrally, or positive in short run and in long run negative and etc. The study discovered that money has positive impact on DJIM. Logically once money supply increases, the interest rate drops and cost of borrowing decreases. As such, more money would be available for investment. As stock market considered to be a preferred option for many investors, the demand for stocks increases and therefore stock indexes moves positively. Definitely the story is not like this simple since excessive money supply would lead to inflation. We mentioned that increasing in inflation has inverse impact on stock prices. Anyway, our conclusion is that money in the US economy impacts DJIM positively and in order to improve DJIM index or Islamic stock market, availability of money is very important.

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