Al Mashalih: Journal of Islamic Law Vol. 5 No. 2, December 2024 *p-ISSN: 2621-055X*
DOI : 10.59270/mashalih.v5i02.30 *e-ISSN: 2620-9187*

THE CAUSAL RELATIONSHIP BETWEEN DEPOSIT INTEREST RATES, FOREIGN EXCHANGE RATES AND STOCK MARKET INDEX SHARIAH COMPLIANCE IN INDONESIA PRE AND POST CRISIS 2008

Helma Malini[1], Edwin Suwantono[2]
helma.malini@ekonomi.untan.ac.id
Universitas Tanjungpura (UNTAN), Indonesia

Abstrak

Tujuan utama dari penelitian ini adalah untuk mengetahui interaksi antara suku bunga deposito, nilai tukar mata uang asing dan indeks pasar saham Kepatuhan Syariah di Indonesia sebelum dan pasca krisis 2008. Periode data sebelum krisis adalah Oktober 2000 hingga November 2008. Periode data setelah krisis adalah Desember 2008 hingga Desember 2015. Metode analisis deskriptif dilakukan dengan menggunakan tabel analitik dan grafik. Metode analisis kuantitatif dilakukan dengan membuat model ekonometrik persamaan regresi dengan metode time series untuk menggambarkan ada atau tidaknya pengaruh variabel independen terhadap variabel dependan. Hasil penelitian menunjukkan bahwa pada masa pra krisis 2008, terdapat kausalitas searah dari Suku Bunga Deposito terhadap Nilai Tukar Mata Uang Asing, indeks pasar saham Kepatuhan Syariah terhadap Suku Bunga Deposito, Suku Bunga Deposito terhadap indeks pasar saham Kepatuhan Syariah, dan indeks pasar saham Kepatuhan Syariah terhadap Nilai Tukar Mata Uang Asing. Hasil pasca krisis 2008 menunjukkan bahwa ada kausalitas searah dari Nilai Tukar Mata Uang Asing terhadap Suku Bunga Deposito, Suku Bunga Deposito terhadap Suku Bunga Valuta Asing, dan indeks pasar saham kepatuhan Syariah terhadap Nilai Tukar Mata Uang Asing. Ditemukan bahwa arah kausalitas antara ketiga variabel cenderung menunjukkan perilaku tabrak lari dan berubah sesuai dengan pemilihan lag.

Kata Kunci: Suku Bunga Deposito, Nilai Tukar Mata Uang Asing, Indeks Pasar Saham, Kepatuhan Syariah, Kausalitas Granger dan Subprime Mortgage

Abstract

The main objectives of this study are to determine the interactions between deposit interest rates, foreign exchange rates and Shariah Compliance stock market index in Indonesia pre and post crisis 2008. The data period before the crisis is October 2000 until November 2008. The data period after the crisis is December 2008 until December 2015. Descriptive analysis method is performed by using analytical table and graphic. Quantitative analysis method is performed by making a regression equation econometric model with time series method to describe the presence or absence of the influence of the independent variable towards the dependant variable. The result showed that during the pre crisis 2008, unidirectional causality existed from Deposit Interest Rates towards Foreign Exchange Rates, Shariah Compliance stock market index towards Deposit Interest Rates, Deposit Interest Rates towards Shariah Compliance stock market index, and Shariah Compliance stock market index towards Foreign Exchange Rates. The result post crisis 2008 showed that unidirectional causality existed from Foreign Exchange Rates towards Deposit Interest Rates, Deposit Interest Rates towards Foreign Exchange Rates, and Shariah compliance stock market index towards Foreign Exchange Rates. It is found that the direction of causality between the three variables tends to demonstrate a hit-and-run behavior and changes according to the lag selection.

Keywords: Deposit Interest Rates, Foreign Exchange Rates, Stock Market Index, Shariah Compliance, Granger Causality and Subprime Mortgage

PENDAHULUAN

In 2008, there was a global financial crisis or known as the "Subprime Mortgage Crisis". It started in United States of America when there was a lot of default payment from the credit default swap instrument in the United States of America financial market. According to The Consumer Financial Protection Bureau of the United States, subprime mortgage is generally a loan that is meant to be offered to prospective borrowers with impaired credit records a subprime mortgage carries an interest rate higher than the rates of prime mortgages. Prime mortgage interest rates are the rates at which banks and other mortgage lenders may lend money to customers with the best credit histories. Prime mortgages can be either fixed or adjustable rate loans. More often, subprime mortgage loans are adjustable rate mortgages (ARMs). The higher interest rate is intended to compensate the lender for accepting the greater risk in lending to such borrowers. The interest rate on subprime and prime ARMs can rise significantly over time.

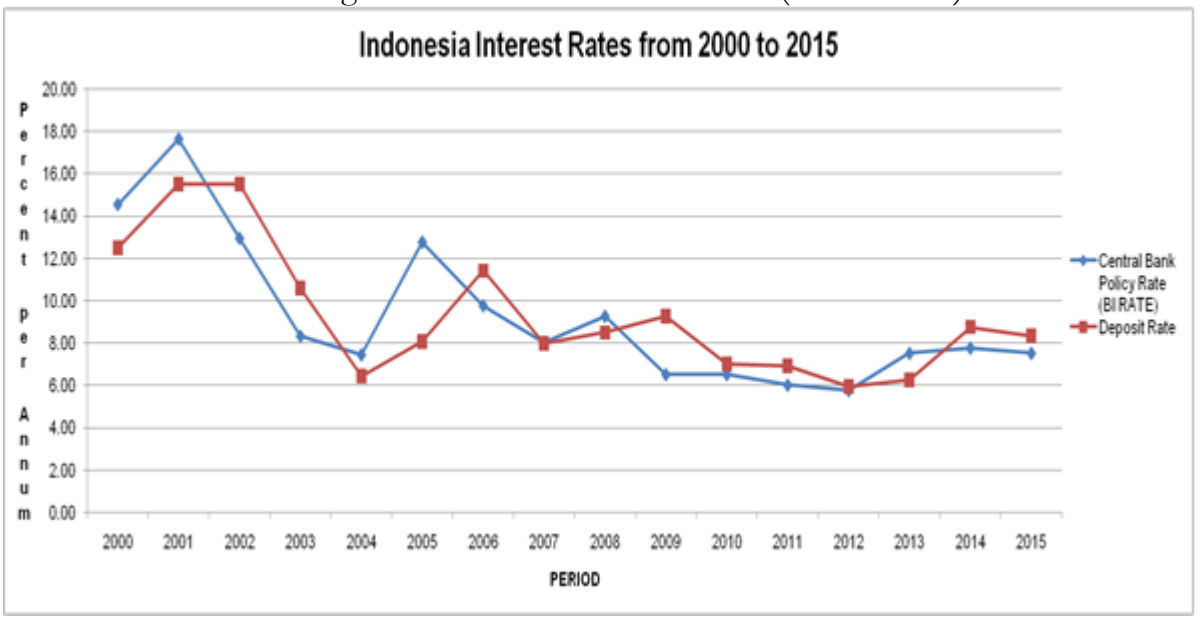
In the early 1990s, as investors became more familiar with the securitization of these assets, mortgage specialists and Wall Street bankers got in on the action. Securitization and subprime originations grew hand in hand. According to Amadeo (2016), the primary caused which trigger the financial crisis was deregulation in the financial industry that permitted banks to engage in hedge fund trading with derivatives. Banks then demanded more mortgages to support the profitable sale of these derivatives. They created interest-only loans that were affordable to subprime borrowers. The Fed raised the Fed funds rate just as the interest rates on these new mortgages reset. Housing prices started falling as supply outpaced demand. That trapped homeowners who couldn't sell their house. The values of the derivatives crumbled, and banks stopped lending to each other. That created the financial crisis that led to the Subprime Mortgage Crisis.

The waves of default payment which happened at the same time with the falling price of properties in United States caused a major liquidity problem for all the parties including investors, financial institutions, etc. One of the big financial institutions which is Lehman Brothers suffered greatly and need to announce their bankruptcy on 15 September 2008. Past and recent empirical literature has analyzed number of macroeconomic indicators which influence the stock markets. Most of the literatures focused on the stock market as a whole while ignoring the effect of these variables on different sectors of the economy (Ahmed, Rehman, & Raoof, 2010) , while this is significant, but as an investor, someone must understand that different sectors of the economy have different reaction towards changes in macroeconomic variables. Therefore, we choose to use the Indonesia Shariah compliance stock market index to represent the stock market index of Indonesia because it consist of stocks that have passes Shariah screening and one of the screening is the elimination of interest rate where all banking industries are not included. However, the choosing of the variable will be contradictive since Shariah is prohibiting interest rate while what we really wanted to

see whether Shariah compliance stock market index has really can taken off with the conventional trading system that still closely related with interest rate and other variables.

Studies conducted have different result concerning the relationship between interest rate and exchange rate. They can be negatively and positively correlated. There is mixed empirical evidence on the relationship between interest and exchange rates, even for developed countries (Eichenbaum & Evans, 1995). Another studies shown that, on average, a dramatic increases in interest rate have been associated with currency appreciations (Goldfajn & Gupta, 1999). At the other hand, there is no strong evidence that an increase in exchange rate variability is associated with an increase in interest rate volatility (Chow & Kim, 2004). For instance, whether higher interest rates are an essential part of the defense strategy for the currency in times of financial crisis is controversial. (Chow & Kim, 2004) This uncertainty is well borne out in the context of the Asian financial crisis. Many economists, including those from the IMF, recommended sharp increases in the interest rate to stem large depreciation of the currency. Another argued that the high interest rate policy destabilizes exchange rates by raising corporate bankruptcies and accelerating capital outflows (Furman & Stiglitz, 1998).

Figure 1.1 Indonesia Interest Rate (2000 – 2015)



Source: Inside Mortgage Finance (COMMISSION, 2011)

Several significant factors that could affect the stock market such as financial crisis, exchange rate, deposit interest rate, inflation, deflation, economic and political shocks, economic policy, economic outlook, etc. Because of the subprime mortgage in United States, the exchange rate, deposit interest rate, and stock market index of Indonesia has shown fluctuations. These movements were also still spotted during the economic recovery after the crisis. These movements were not only caused by the macroeconomics concerns but the foreign exchange market speculations also took part in it. Interest rate and foreign exchange rate are two important economic factors affecting the common stocks (Hyde, 2007). The evidence of fluctuations in the three variables has been a motivation to discuss deeper into the relationship between these three variables. The

economic crisis is shown within the high fluctuation at stock market, exchange rate and deposit interest rate. The question is whether the movement in one of the three variables has an impact to each of the other variables. Therefore, we are to find out the relationship between the deposit interest rate, exchange rate and the stock market index Shariah compliances stock market index.

Shariah compliance stock market index are an important part of the Islamic financial system, for the last ten years the growth of Islamic capital market showed major influence not only to the capital market industry but also for the economic growth of one country. A distinguished feature of Shariah compliance stock market index compare to conventional counterpart is the process that should be passed by each company in form of Shari'ah screening process, commonly stated as Shari'ah law. The fundamental differences between Shariah and conventional capital is that in Shariah that follow the Islamic rules where in Islam trading should support and establish a free market where prices are determined by the forces of demand and supply where both of the activities should free from any interference element by the regulator such price control and fixation. The attempt to influence prices by creating artificial shortage of supply (ihtikar) or to bid up prices by creating artificial demand are considered unethical according to the Islamic code of ethics. Granger (2000), the relationship between two variables could be a causal relationship.

Fluctuations at the exchange rate could affect a firm's value and impact the stock price. This is known as traditional approach. At the other hand, stock market fluctuations will cause capital movements in particular country which resulted in exchange rate fluctuations. This is known as portfolio approach. Interest rate variable is also a variable which could affect the fluctuations of stock price and exchange rate. Deposit interest rate becomes an indicator for investors to invest their capital. An investor normally invests their wealth in an asset depending on the return and risk of an asset. Deposit interest rate becomes an important aspect for the economic growth and improvement especially the flow of capital in a country.

The Subprime mortgage crisis in 2008 followed by the instability of political and social economic condition making the capital market industry needed more stable platform of portfolio (see Trihadmini, 2011). The stability could be found in portfolio of investment that does not react or giving shocking volatility towards event or circumstances that happened in macro or micro variables. The financial crisis that hit the world in 1997 and 2008 has proven a setback for asset gatherers of all kinds in all marketplaces, but it is possible Shariah compliant stock market index funds may derive a long-term benefit (Price Water House Coopers, 2009). It is very interesting to interpret the causal relationship between deposit interest rate, foreign exchange rate and stock market index Shariah compliance stock market index in Indonesia. Furthermore, only few studies had been conducted in Indonesia which focused solely on the relationship between these three variables and there are no recent studies which provided with the present issue. There could be none causal relationship, unidirectional causal relationship or bidirectional causal relationship between each of these three variables. This research aim is to fill this gap by investigating the causal relationship between deposit interest rate, foreign exchange rate and Shariah compliance stock market index in Indonesia pre and post crisis 2008 using the period from October 2000 until December 2015.

TINJAUAN LITERATUR

According to Mishkin & Serletis, foreign exchange rate can be quoted in two ways because foreign exchange rate is the relative price of two national currencies, either as the amount of domestic currency that can be purchased with a unit of foreign currency or as the amount of foreign currency that can be purchased with a unit of domestic currency (Mishkin & Serletis, 2011). In other words, the exchange rate explains the purchasing power of the domestic currency over another country's currency. When there is a rise in the value of the domestic currency relative to currencies of the other countries then the domestic currency is said to have an appreciation, the domestic currency is able to buy more other currencies. In the contrary, when the domestic currency experienced a decline in value relative to other countries currency, then the domestic currency is said to be depreciated, the domestic currency is now only able to buy less other currencies.

Exchange rate regimes in the international financial system are of two basic types: fixed and floating. In a fixed exchange rate regime, the value of a currency is pegged relative to the value of one other currency (called the anchor currency), so that the exchange rate is fixed in terms of the anchor country. In a floating exchange rate regime, the value of a currency is allowed to fluctuate against all other currencies. When countries intervene in foreign exchange markets in an attempt to influence their exchange rates by buying and selling foreign assets, the regime is referred to as a managed float regime (or a dirty float) (Mishkin & Serletis, 2011). There are advantages to both floating and fixed exchange rates. Floating exchange rates leave monetary policymakers free to pursue objectives other than exchange-rate stability. Fixed exchange rates reduce some of the uncertainty in international business transactions. When deciding on an exchange-rate regime, policymakers are constrained by the fact that it is impossible for a nation to have free capital flows, a fixed exchange rate, and independent monetary policy (Mankiw, 2009).

According to Sargent and Wallace (Sargent & Wallace, 1981) a high interest rate policy may lead to a reduction in demand for money and increase in price level because an increase in interest rate implies an increase in government debt which, in turn, would be financed by seinorage, a similar finding was stated by Furman and Stiglitz (Furman & Stiglitz, 1998) that an increase in interest rate may adversely affect the future export performance which would reduce the future flow of foreign exchange reserves and thereby, leads to depreciation of currency. They also argued that the high interest rate policy destabilizes exchange rates and affect raising corporate bankruptcies and accelerating capital outflows. Goldfajn and Gupta (Goldfajn & Gupta, 1999) found that the high interest rates helped to stabilize exchange rates using monthly data for 80 countries for 1980-1998. They also found that on average, a dramatic increase in interest rate has been associated with currency appreciations. Cho and West (Cho & West, 2001) reported similar findings for Korea, Philippines, and Thailand. According to Pradyumna Dash (Dash, 2001), the declines in the value of exchange rate prompted monetary authorities to raise domestic interest rate. The Granger cause test indicates bidirectional causality between interest rate and exchange rate in India from April 1993 to March 2003 and June 1995 to March 2003. Pradyumna insisted that there is a strong case for an increase in interest rate to stabilize the value of rupee during the downward pressure in India because the cost of doing so, in terms of output loss, financial system fragility,

decline in investment, etc., may not outweigh the benefits of a more nominal appreciated exchange rate.

In their study, Chow and Kim (Chow & Kim, 2004) define the exchange rate as the local currency price of the US dollar, so an increase signals a depreciation of the local currency. The call rate is used to represent interest rate. They employ weekly data obtained from DataStream for the period from January 1993 to July 2002 for Indonesia, Korea, Philippines and Thailand. The method they implemented is the bivariate VAR-GARCH model. They established that all the Asian crisis countries appeared to adjust their exchange rate more sensitively in the post-crisis period to changes in the neighboring exchange rate except for Indonesia, interest rate fluctuations were much less pronounced post-crisis and the variability declined below pre-crisis levels. Hence, the exchange rates of the crisis countries appear to be more flexible while the volatility in their interest rates (except for Indonesia's) completely evaporated after the crisis. The relationship between the interest rate and the exchange rate can at times be ambiguous (Chow & Kim, 2004). For instance, whether higher interest rates are an essential part of the defense strategy for the currency in times of financial crisis is controversial. This uncertainty was well borne out in the context of the Asian financial crisis.

According to Kayhan, Bayat, and Ugur (Kayhan, Bayat, & Ugur, 2013) in their study focusing on the dynamic relationships between the real exchange rate and the real interest rate in the BRIC-T (Brazil, Russia, India, China and Turkey) countries, interest rate only affects exchange rate in the long run in China based on the frequency domain causality test results. They employ monthly data from the beginning of the flexible exchange rate regime to July 2011. Another study was done in Turkey by İnci Gümüş (Gümüş, 2003), the focus of this paper was during the 1994 crisis in Turkey. Gümüş tried to explain whether high interest rates had the effect of appreciating the nominal exchange rates. The data used in this research is weekly data and by applying a vector-error correction model. The result shows that raising interest rates had the significant long-run effect of depreciating the nominal exchange rates in contrast with the conventional wisdom.

A study done by Alam, Sabihuddin Butt and Iqbal (Alam, Butt, & Iqbal, 2001) focused on 10 Asian countries. The data they used are obtained from International Financial Statistics of the International Monetary Fund, World Development Indicator CD-ROM and Country Years Book. Their study implements the Johansen's co integration which indicated evidence of co integration between real exchange rate and real short run interest rate differential in the case of nine out of ten Asian countries; the long run interest rate differential resulted in five out of ten Asian countries. Another method which is LM panel shows the evidence of statistically significant long-run relationship for one currency pairing. They conclude that the result of panel co-integration test supports the results for individual countries long-run relationship between real exchange rate and real interest rate differentials.

Hooi-Hooi Lean, Marwan Halim, and Wing-Keung Wong (Lean, Halim, & Wong, 2003) research has implication that during the crisis there was a mutual movement in long term but at opposite direction. It also indicates that the past information of exchange rate could be used significantly to predict the stock price, and the past information of stock price could be used to predict the exchange rate. This could be seen when the stock index was keep decreasing and at the same time the exchange rate

was keep on increasing and otherwise. Another possible explanation is because of the chaos within the market, investors sell their stocks and currency at the same time continuously which cause the stock market index to keep on decreasing while the exchange rate keep on increasing.

METODOLOGI PENELITIAN

In this research the overall time range from the data is from October 2000 until December 2015. The fluctuation between these three macro variables in Indonesia increased during the crisis period. Then there is a possibility of change in the relationship between these variables. In other words, if we separately regress the parameter at both times then the value will be different. The differences could be found at the line intersection, slope or both. Then this is referred as structural change. To find how is the relationship between the deposit interest rates variable, foreign exchange rates variable and Shariah compliance stock market index variable we need to regressed them at two different periods, before crisis and after crisis.

Granger Causality Statistical Analysis

1. Unit Root Test

The Stationary Test of the data will be analyzed using the unit root test. Stationary Test is important to be done because if the analyzed time series data is not stationary, then the regression relevant to the time series data normally has a high R and low DR relatively. In other words, we are facing the problem of spurious regression. The procedure of the test is carried out as follows:

For example, the time series model has the following form:

1. (without intercept)
2. (with intercept)
3. (with intercept and trend)

Explanation: □ = first difference from the variables.

t = trend variable

□ = □ -1, if □ = 1, unit root exist, not stationary.

By using the table corresponding to one of the above time series model, the hypothesis to be tested are:

Ho : 0, unit root existed, the model is not stationary.

H1 : , unit root not existed, the model is stationary.

The null hypothesis stated that the absence of the stationary characteristic in the model will be rejected, if the value of the t-statistics obtained relevant to the regression coefficient model is smaller than the t-table value at certain significant level.

2. Co Integration Test (Engle-Granger Test)

Co integration theory has been developed by Engle and Granger. This test is important to avoid the spurious regression problem. If a variable is not stationary, then the variable can still be regressed with co integrated record. Therefore, the co integration test involves residual elements of a regression model so that the variables within a model are stated to have long-term relationships. For example in the following regression model:

Through Dickey-Fuller test, it will be found that the ER and SM which is a random walk variables; is not stationary. With this, the above model known as co integration regression models is estimated with regular regression method then tested with the residual element that is stationary.

The hypothesis for co integration test is:
H0 : □ 0, the variables are not co integrated
H1 : □ < 0, the variables are co integrated
ER and SM each co integrated when the residual elements from the co integration regression model is stationary.

3. Autocorrelation Test (Breusch-Godfrey Test)

The test used to test the presence or absence of autocorrelation in this study is Breusch-Godfrey (BG) test or often called Lagrange Multiplier (LM) test. This test is one of the autocorrelation tests that can be done in a regression when there is a lag in the dependant variable as independent variable and recommended for a bigger number of conservations. Besides, the LM test also can be performed on autocorrelation degree over zero. For example AR (1), AR (2) and so on.

For example, from the equation, assuming that the residual follows the autocorrelation degree 2 or AR (2):

Means the residuals of the equation is regressed against all other independent variables as well as the lag value from the residual as additional regressor in the model:

The null hypothesis at the LM test above is Ho = or there is no autocorrelation in 2 degree. The determinant of rejection or acceptance of Null Hypothesis is following the Chi Square table with as the degree of freedom. If the value of obtained is greater than the chi square value then null hypothesis is rejected, in other words there is a problem of autocorrelation.

4. Granger Causality Test

Granger causality test is used to determine the relationship between two variables that theoretically have a relationship. The basic principle of testing Granger in this research is to help explain the relationship between SM (Stock Market Index), ER (Exchange Rate), DR (Deposit Interest Rate).

If three variables SM, ER and DR are known in a research, then it will be determined whether:

Between SM and ER
(1) SM is determined by ER,
(2) ER is determined by SM,
(3) there is a two-way relationship between SM and ER, or
(4) both variables are mutually independent.
Between SM and DR
(1) SM is determined by DR,
(2) DR is determined by SM,

DOI : 10.59270/mashalih.v5i02.30 e-ISSN: 2620-9187

(3) there is a two-way relationship between SM and DR, or
(4) both variables are mutually independent.
Between ER and DR
(1) ER is determined by DR,
(2) DR is determined by ER,
(3) There is a two-way relationship between ER and DR, or
(4) Both variables are mutually independent.

In the application of Granger method, two regression model were formed on two sets of time series data, specifically:

Granger Causality Test between SM and ER
Whether ER affect SM:
SM = +
Whether SM affect ER:

- Granger Causality Test between SM and DR

Whether DR affect SM:
SM = +
Whether SM affect DR:

- Granger Causality Test between ER and DR

Whether DR affect ER:

Whether ER affect DR:

Where:
SM : Stock Market Index for Indonesia
ER : Exchange Rate for Indonesia
DR : Deposit Interest Rate for Indonesia
SM : Stock Market Index for Indonesia at previous period
ER : Exchange Rate Value for Indonesia at previous period
DR : Deposit Interest Rate for Indonesia at previous period
u and v : error terms ; m = n = r = s and mutually not correlated

In the causality test between the two variables there are two kinds of methods, namely:

1. See the regression coefficient overall linear regression model and test the t obtained. For example the equation and are divided over condition:

a) One way causality from SM to ER happen if
and
b) No relationship between ER to SM happen if
and
c) One way causality from ER to SM happen if
and
d) Two way causality between ER and SM happen if
and

Measures of the test:

Granger equation model is regressed to obtain the value of tstat from the independent variable. The tstat obtained then will be compared with the value of ttable.

Ho = Independent variable doesn't affect the dependant variable

H1 = Independent variable affect the dependant variable

Ho is rejected if tstat > ttable..

2. Applying two models of regression that is unrestricted regression and restricted regression.

Do the regression on each model to obtain 2 values of Residual Sum of Square (RSS) which are RSSR and RSSUR. In the Granger causality test using the restriction we need to refer to the definition of Granger causality. According to Granger, if there are two variables which are Xt and Yt then the Xt variable is said to affect Yt if the value of Yt could be better predicted if all the information at the previous period (t-i) in the universe is used to predict Yt, rather than removing the X value from the universe.

Unrestricted regression model

Restricted regression model

According to that definition then to assume SM is affecting ER, the variance of the unrestricted regression model should be smaller than the variance of the restricted regression model. This matters in the F test to determine whether the value of the restricted regression model is stated in a significant value.

Calculating the F test:

$$\frac{(RSS - RSS)/m}{RSS / n-k}$$

Where:

m = number of lag used in the model

n = number of observation

k = number of parameters in the unrestricted regression.

The F test subsequently will determine whether the overall value of which are the parameters related to SP significantly is not equal to zero.

Test results:

Ho: , then SM doesn't affect ER

H1: , then SM affect ER.

Ho is accepted if Fstat< Ftable. Means that SM is not affecting ER and vice versa the same test procedure could be done to test the other null hypothesis which is ER is not affecting SM. This also implies to the other equation in this research.

HASIL DAN PEMBAHASAN

Table 1

	DR	ER	SSM
Mean	9.166776	9888.672	442.4860
Median	7.990000	9376.000	449.6600

Maximum	17.39000	14657.00	961.9300
Minimum	5.610000	8279.000	71.11000
Std. Dev.	3.112887	1359.589	272.6916
Skewness	1.094239	1.465220	0.124458
Kurtosis	3.139094	4.378919	1.611889
Observations	183	183	183

Descriptive Statistics of Deposit Interest Rates, Foreign Exchange Rates and Stock Market Index (LQ45)

	DR	ER	SSM
Mean	9.166776	9888.672	442.4860
Median	7.990000	9376.000	449.6600
Maximum	17.39000	14657.00	961.9300
Minimum	5.610000	8279.000	71.11000
Std. Dev.	3.112887	1359.589	272.6916
Skewness	1.094239	1.465220	0.124458
Kurtosis	3.139094	4.378919	1.611889
Observations	183	183	183

Source: Eview 8.1

Table 1 of the descriptive statistics showed that Deposit Interest Rates has 183 data, the data accumulated from International Monetary Fund's International Financial Statistics period of October 2000 until December 2015. The skewness is 1.094239 which is positively skewed distribution. The kurtosis is 3.139094 which is Positive kurtosis which indicates a relatively peaked distribution leptokurtic. Foreign Exchange Rates has 183 data, which is acquired from International Monetary Fund's International Financial Statistics period of October 2000 until December 2015. From these 183 data, the Minimum data is 8279 at May 2003. The Maximum data is 14657 at September 2015. The Mean or Average data is 9888.672. The Median data is 9376. The standard deviation is 1359.589. The skewness is 1.465220 which is positively skewed distribution. The kurtosis is 4.378919 which is Positive kurtosis which indicates a relatively peaked distribution leptokurtic. Variable Stock Market Index of Shariah compliance has 183 data, which is acquired from historical prices from Investing.com period of October 2000 until December 2015. From these 183 data, the Minimum data is 71.11000 at April 2001. The Maximum data is 961.9300 at March 2015. The Mean or Average data is 442.4860. The Median data is 449.6600.

Correlation Matrix
Table 2
Covariance Analysis: Ordinary

Date: 11/29/18 Time: 12:37

Sample: 2000M10 2015M12

Included observations: 183

Correlation Probability	DR	ER	SM
DR	1		

ER	0.027	1	
	0.7143	-----	
SM	-0.630	0.450	1
	0	0	-----

Correlation Matrix of Deposit Interest Rates, Foreign Exchange Rates and Stock Market Index (LQ45)

Covariance Analysis: Ordinary
Date: 11/29/18 Time: 12:37
Sample: 2000M10 2015M12
Included observations: 183
Correlation
Probability DR ER SM
DR 1

ER 0.027 1
0.7143 -----
SM -0.630 0.450 1
0 0 -----
Source : Eviews 8.1

From the table above, Deposit Interest Rates and Foreign Exchange Rates correlation is 0.027 which is positively very weak correlation with 71.43% of probability. This result is consistent with the first hypothesis that deposit interest rates do have positive effect on foreign exchange rates appreciation. It is supported by the founding in Cho & West in Philippines & Thailand, and also by Strike Mbulawa in Zimbabwe. The increase in interest rate will attract investors which will increase the value of exchange rate due to higher demand for domestic currency, ccontrary to the findings by Pradyumna Dash which is negative weak correlation in India. This is because in India the declines in the value of the exchange rate have prompted monetary authorities to raise domestic interest rates. Exchange rate and interest rate are having bi-directional granger causality and interest rate was found to be endogenous in stabilizing the exchange rate by using both weak and block exogenity tests.

Deposit Interest Rates and Stock Market Index result is -0.630 which is negatively moderate correlation with 0% probability. This is in accordance to the second

hypothesis that deposit interest rates do have negative effect on stock market index (LQ45) appreciation. It is supported by the result of Alam & Uddin in their research about interest rate and stock market index in 15 developed and developing countries that interest rate has significant negative relationship with share price. During the event of interest rate depreciation, stock market will appreciate, and vice versa.

The reason could be interpreted as the depreciation of interest rate will push investors to invest in stock market rather than obligations which will increase the demand for stocks and will increase the price. Foreign Exchange Rates and Stock Market Shariah compliance stock market index result is 0.450 which is positively moderate correlation with 0% probability. This is in accordance to the fourth hypothesis that foreign exchange rates do have positive effect on Shariah compliance stock market index appreciation. It is supported by the conclusion of Saadet Kasman in Turkey which found the causality from exchange rate to the industry sector index and also by Strike Mbulawa result that stock market performance and exchange rate correlation is 0.99 which is positively very strong correlation or almost perfectly correlated in Zimbabwe. In terms of exchange rate and stock market index fluctuations, when exchange rate depreciate stock market index will depreciate due to higher cost of production which will increase commodity prices in several industries. Contrary to the founding of Bala Ramasany which interpret the correlation between exchange rate and stock market index as robust and vigorous. They found that the causality can vary according to the period of study.

Granger Causality Statistical Analysis

Table 3

VARIABLES	ADF test			
	Intercept		Trend & Intercept	
level				
DR	-2.719.891	***	-2.820.552	
ER	-2.504.709		-2.282.343	
SM	-1.258.906		-3.236.371	
first difference				
DR	-2.614.255	***	-2.665.729	
ER	-7.354.450	*	-7.441.597	*
SM	-7.181.233	*	-7.211.279	*

Unit Root Test Result for Period before Crisis

Source : Ms.Excel Processed Data

Explanation : *, ** and *** explains null hypothesis is rejected at 1%, 5% and 10% level

Table 4

VARIABLES	ADF test			
	Intercept		Trend & Intercept	
level				
DR	-3.174.655	**	-3.551.442	**
ER	0.390874		-1.878.248	
SM	-2.566.768		-2.298.495	
first difference				
DR	-2.985.106	**	-3.426.647	***
ER	-8.363.430	*	-9.078.863	*
SM	-9.192.460	*	-9.512.375	*

Unit Root Test Result for Period after Crisis

Source : Ms. Excel Processed Data

Explanation : *, ** and *** explains null hypothesis is rejected at 1%, 5% and 10% level

Based on the unit root test result using the critical value standard and hypothesis result, it can be concluded that the unit root test result for the period before crisis in table 4.3 and period after crisis in table 4 is accepting the null hypothesis at I(0) or level for most variables which means the data is not stationary at I(0) or level.

Table 3 and table 4.4 shown the stationary test result by using Augmented Dickey Fuller test at level or I(0) and first difference I(1). At I(0) almost all variables accepted the null hypothesis that there is an unit root, or the data is not stationary. At the other hand, at I(1) or first difference all the data are stationary. Regression at I(0) couldn't be run before the co integration test. This is to avoid the spurious regression problem. If the residual from the linear regression of the three variables is stationary or the three variables are co integrated then regression at I(0) could be done. Otherwise, the regression could be done at I(1).

Table 5
Null Hypothesis: RESIDUALBEFORE has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.518939	0.5199
Test critical values:	1% level	-3.499910	
	5% level	-2.891871	
	10% level	-2.583017	

*MacKinnon (1996) one-sided p-values.

Co-integration Test Result for Period before Crisis
Null Hypothesis: RESIDUALBEFORE has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

t-Statistic Prob.*

Augmented Dickey-Fuller test statistic		-1.518939	0.5199
Test critical values:	1% level	-3.499910	
5% level		-2.891871	
10% level		-2.583017	

*MacKinnon (1996) one-sided p-values.
Source : Eviews 8.1
Explanation : *, ** and *** explains null hypothesis is rejected at 1%, 5% and 10% level.

Table 6
Null Hypothesis: RESIDUALAFTER has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.062159	0.2604
Test critical values:	1% level	-3.510259	
	5% level	-2.896346	
	10% level	-2.585396	

*MacKinnon (1996) one-sided p-values.

Co-integration Test Result for Period after Crisis
Null Hypothesis: RESIDUALAFTER has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

t-Statistic Prob.*

Augmented Dickey-Fuller test statistic		-2.062159	0.2604
Test critical values:	1% level	-3.510259	
5% level		-2.896346	
10% level		-2.585396	

*MacKinnon (1996) one-sided p-values.
Source : Eviews 8.1

Explanation : *, ** and *** explains null hypothesis is rejected at 1%, 5% and 10% level.

From two tables above, it can be seen that before and after the period of crisis, the null hypothesis is accepted or there were unit root. In other words, there was no long term relationship between the variables in that period. The absence of co integration between these variables at I(0) makes the research should be done at I(1) because all the variables are stationary at I(1).

Table 7

GRANGER CAUSALITY REGRESSION	Breusch-Godfrey Serial Correlation LM Test:			
DER→DDR	F-statistic	3.425.247	Prob. F(1,94)	0.0000
	Obs*R-squared	7.611.229	Prob. Chi-Square	0.0000
DDR→DER	F-statistic	3.475.242	Prob. F(1,94)	0.0654
	Obs*R-squared	3.458.298	Prob. Chi-Square	0.0629
DSM→DDR	F-statistic	2.429.645	Prob. F(1,94)	0.0000
	Obs*R-squared	6.994.077	Prob. Chi-Square	0.0000
DDR→DSM	F-statistic	5.136.106	Prob. F(1,94)	0.0257
	Obs*R-squared	5.025.437	Prob. Chi-Square	0.0250
DSM→DER	F-statistic	2.163.900	Prob. F(1,94)	0.1446
	Obs*R-squared	2.182.714	Prob. Chi-Square	0.1396
DER→DSM	F-statistic	5.447.848	Prob. F(1,94)	0.0217
	Obs*R-squared	5.313.752	Prob. Chi-Square	0.0212

Granger Causality Model Autocorrelation Test at Lag 1 Period Before Crisis

Source: Processed data.
DER : First Difference Foreign Exchange Rates
DDR : First Difference Deposit Interest Rates
DSM : First Difference Stock Market Index (LQ45)
The arrow (→) shows the direction of granger causality. DER→DDR means that variable DDR are dependant variables in the granger causality regression.
The letter D before the variable means that the data is in first difference form.

Table 8

GRANGER CAUSALITY REGRESSION	Breusch-Godfrey Serial Correlation LM Test:			
DER→DDR	F-statistic	8.811.364	Prob. F(1,81)	0.0039
	Obs*R-squared	8.241.213	Prob. Chi-Square	0.0041
DDR→DER	F-statistic	0.016884	Prob. F(1,81)	0.8969
	Obs*R-squared	0.017506	Prob. Chi-Square	0.8947
DSM→DDR	F-statistic	1.552.261	Prob. F(1,81)	0.0002
	Obs*R-squared	1.350.874	Prob. Chi-Square	0.0002
DDR→DSM	F-statistic	0.022304	Prob. F(1,81)	0.8817
	Obs*R-squared	0.023124	Prob. Chi-Square	0.8791
DSM→DER	F-statistic	0.006405	Prob. F(1,81)	0.9364
	Obs*R-squared	0.006642	Prob. Chi-Square	0.9350
DER→DSM	F-statistic	1.120.631	Prob. F(1,81)	0.2929
	Obs*R-squared	1.146.277	Prob. Chi-Square	0.2843

Granger Causality Model Autocorrelation Test at Lag 1 Period after Crisis

Source: Processed data.
DER : First Difference Foreign Exchange Rates
DDR : First Difference Deposit Interest Rates
DSM : First Difference Stock Market Index (LQ45)
The arrow (→) shows the direction of granger causality. DER→DDR means that variable DDR are dependant variables in the granger causality regression.
The letter D before the variable means that the data is in first difference form.

Granger Causality Test (Ftest)

Table 9

LAG	NULL HYPOTHESIS	F-STAT	Probability	CONCLUSION
3	DER dnc DDR	1,09354	0.3563	ACCEPTED
	DDR dnc DER	3,83246	0.0125**	Rejected at 5%
	DSM dnc DDR	0.74294	0.5293	ACCEPTED
	DDR dnc DSM	2,81123	0.0441**	Rejected at 5%
	DSM dnc DER	2,57367	0.0591***	Rejected at 10%
	DER dnc DSM	0.98826	0.4022	ACCEPTED
6	DER dnc DDR	0.82578	0.5534	ACCEPTED
	DDR dnc DER	3,07107	0.0095*	Rejected at 1%
	DSM dnc DDR	0.75020	0.6111	ACCEPTED
	DDR dnc DSM	1,43200	0.2131	ACCEPTED
	DSM dnc DER	1,77566	0,1150	ACCEPTED
	DER dnc DSM	0.60901	0.7224	ACCEPTED
9	DER dnc DDR	1,27946	0,2639	ACCEPTED
	DDR dnc DER	2,22204	0,0306**	Rejected at 5%
	DSM dnc DDR	0,90625	0,5249	ACCEPTED
	DDR dnc DSM	1,35439	0,226	ACCEPTED
	DSM dnc DER	2,59186	0,0123**	Rejected at 5%
	DER dnc DSM	0,7216	0,6875	ACCEPTED
12	DER dnc DDR	1,1522	0,3377	ACCEPTED
	DDR dnc DER	1,20339	0,3021	ACCEPTED
	DSM dnc DDR	1,64516	0,1032***	Rejected at 10%
	DDR dnc DSM	0,88173	0,5695	ACCEPTED
	DSM dnc DER	2,55528	0,0085*	Rejected at 1%
	DER dnc DSM	1,10198	0,3755	ACCEPTED

Granger Causality Result between DDR, DER and DSM before Crisis

*,** and *** shows Ho is rejected at level 1%,5% and 10% ; dnc (does not cause)

Table 9 shown the granger causality result between DDR, DER and DSM before crisis. The null hypothesis of Foreign Exchange Rates implies that Deposit Interest Rates are accepted using all lags. At the contrary, the null hypothesis of Deposit Interest Rates does implies that Foreign Exchange Rates are rejected at 5% using lag 3, 1% using lag 6 and 5% using lag 9. The null hypothesis of Shariah compliance stock market index

does imply that Deposit Interest Rates is rejected at 10% using lag 12. The null hypothesis of Deposit Interest Rates implies that Stock Market Index is rejected at 5% using lag 3. The null hypothesis of Stock Market Index imply that Foreign Exchange Rates is accepted using lag 6 and rejected at 10% using lag 3, 5% using lag 9 and 1% using lag 12. The null hypothesis of Foreign Exchange Rates does not cause Stock Market Index are accepted using all lags.

Table 10

LAG	NULL HYPOTHESIS	F-STAT	Probability	CONCLUSION
3	DER dnc DDR	0,60067	0,6166	ACCEPTED
	DDR dnc DER	5,46633	0,0019*	Rejected at 1%
	DSM dnc DDR	1,10274	0,3535	ACCEPTED
	DDR dnc DSM	0,40952	0,7466	ACCEPTED
	DSM dnc DER	0,45672	0,7133	ACCEPTED
	DER dnc DSM	0,14738	0,9311	ACCEPTED
6	DER dnc DDR	0,81376	0,5631	ACCEPTED
	DDR dnc DER	1,33842	0,2531	ACCEPTED
	DSM dnc DDR	0,61062	0,7209	ACCEPTED
	DDR dnc DSM	0,13999	0,9904	ACCEPTED
	DSM dnc DER	2,35530	0,0404**	Rejected at 5%
	DER dnc DSM	0,67801	0,6678	ACCEPTED
9	DER dnc DDR	4,49667	0,0002*	Rejected at 1%
	DDR dnc DER	1,22398	0,2993	ACCEPTED
	DSM dnc DDR	1,18926	0,32	ACCEPTED
	DDR dnc DSM	0,62511	0,7707	ACCEPTED
	DSM dnc DER	2,2231	0,0337**	Rejected at 5%
	DER dnc DSM	0,34569	0,9552	ACCEPTED
12	DER dnc DDR	4,25799	0,0002*	Rejected at 1%
	DDR dnc DER	1,01893	0,4476	ACCEPTED
	DSM dnc DDR	0,96704	0,4925	ACCEPTED
	DDR dnc DSM	1,06739	0,4079	ACCEPTED
	DSM dnc DER	2,12498	0,0332**	Rejected at 5%
	DER dnc DSM	0,49622	0,9065	ACCEPTED

Granger Causality Result between DDR, DER and DSM after Crisis

Source: Ms.Excel Processed Data.
DER : First Difference Foreign Exchange Rates
DDR : First Difference Deposit Interest Rates
DSM : First Difference Stock Market Index (LQ45)
*,** and *** shows Ho is rejected at level 1%,5% and 10% ; dnc (does not cause)

Table 14 showed the granger causality result between DDR, DER and DSM after crisis. The null hypothesis of Foreign Exchange Rates does not imply Deposit Interest Rates are rejected at 1% using lag 9 and lag 12. The null hypothesis of Deposit Interest Rates does not imply Foreign Exchange Rates is rejected at 1% using lag 3. The null

hypothesis of Shariah compliance stock market index does not cause Deposit Interest Rates are accepted using all lags. The null hypothesis of Deposit Interest Rates does not imply Stock market index are accepted using all lags. The null hypothesis of Shariah compliance stock market index does not imply Foreign Exchange Rates is accepted using lag 3 and rejected at 5% using lag 6, lag 9 and lag 12. The null hypothesis of Foreign Exchange Rates does not imply Stock Market Index is accepted at all lags.

Granger Causality Test Result: Economical Analysis

Table 11

PERIOD	LAG	DER → DDR	DDR → DER	DSM → DDR	DDR → DSM	DSM → DER	DER → DSM
BEFORE CRISIS	3	NO	YES	NO	YES	YES	NO
	6	NO	YES	NO	NO	NO	NO
	9	NO	YES	NO	NO	YES	NO
	12	NO	NO	YES	NO	YES	NO
AFTER CRISIS	3	NO	YES	NO	NO	NO	NO
	6	NO	NO	NO	NO	YES	NO
	9	YES	NO	NO	NO	YES	NO
	12	YES	NO	NO	NO	YES	NO

Granger Causality Existence Between DDR, DER and DSM

Source: Ms.Excel Processed Data.
DER : First Difference Foreign Exchange Rates
DDR : First Difference Deposit Interest Rates
DSM : First Difference Stock Market Index (LQ45)
"YES" means there is a granger causality relationship, "NO" means there is no granger causality relationship.

Granger causality relationship existed at every lag between specific independant variables. Before the crisis, using lag 3 granger causality relationship exist from Deposit Interest Rates towards Foreign Exchange Rates, Deposit Interest Rates towards Shariah compliance stock market index and Shariah compliance stock market index towards Foreign Exchange Rates. Using lag 6, granger causality relationship exist from Deposit Interest Rates towards Foreign Exchange Rates. Using lag 9, granger causality relationship exist from Deposit Interest Rates towards Foreign Exchange Rates and from Shariah compliance stock market index towards Foreign Exchange Rates. Using lag 12, granger causality relationship exist from Shariah compliance stock market index towards Deposit Interest Rates and from Shariah compliance stock market index towards Foreign Exchange Rates. After the crisis, using lag 3 granger causality relationship exists from Deposit Interest Rates towards Foreign Exchange Rates. Using lag 6, granger causality relationship exist from Shariah stock market index towards Foreign Exchange Rates. Using lag 9 and 12, granger causality relationship exist from Foreign Exchange Rates towards Deposit Interest Rates and from Shariah compliance stock market index towards Foreign Exchange Rates.

KESIMPULAN

Government should be more predictive about how the market reacts towards a new regulation implemented by the government. After the crisis, Bank Indonesia changed their operational target to the overnight interbank interest rate which resulted at unidirectional causal relationship at smaller lag from Deposit Interest Rates towards Foreign Exchange Rates. This means that there are less risks in short term deposits rather than long term deposits. Government could compare the current situation with the previous issues to make preemptive decision.

The firms that included in the Shariah compliance market index should be more predictive about the movement in the foreign exchange rates because most of the causal relationships showed that there is unidirectional relationship from Shariah compliance market index towards Foreign Exchange Rates in Indonesia. Investors could have more recommendations about the market possibilities before making their investment decisions. Causal relationship will help to predict the future information based on the current data. The movement of the causal relationship between the variables and the lag will help the investors to determine where and when and how long their investment should be invested to gain the maximum profit at the current situation.

DAFTAR PUSTAKA

Ahmed, M., Rehman, R., & Raoof, A. (2010). Do interest rate, exchange rate effect stock returns? A Pakistani perspective. International Research Journal of Finance and Economics(50), 146-150.

Alam, S., Butt, M. S., & Iqbal, A. (2001). The Long-run Relationship between Real Exchange Rate and Real Interest Rate in Asian Countries: An Application of Panel Cointegration. The Pakistan Development Review, 577-602.

Amadeo, K. (2016, July 26). Retrieved from The Balance: https://www.thebalance.com/what-caused-2008-global-financial-crisis-3306176

Cho, D., & West, K. (2001). Interest Rates and Exchange Rates in the Korean, Philippine, and Thai Exchange Rate Crisis. NBEP, Conference on Management of Currency Crisis. Monterey, California.

Chow, H. K., & Kim, Y. (2004). The Empirical Relationship Between Exchange Rates and Interest Rates in Post-Crisis Asia. School of Economics and Social Sciences, Singapore Management University.

Commission, T. F. (2011). The Financial Crisis Inquiry Report. Subprime Lending, 70.

Commission, T. F. (2011). The Financial Crisis Inquiry Report, Final Report Of The National Commission On The Causes Of The Financial And Economic Crisis In The United States. Washington D.C: Official Government Edition.

Dash, P. (2001). The Relationship between Interest Rate and Exchange Rate in India. Indian Economic Journal.

Eichenbaum, M., & Evans, C. L. (1995). Some Empirical Evidence on the Effects of

Shocks to Monetary Policy on Exchange Rates. The Quarterly Journal of Economics, Vol. 110, No. 4, 975-1009.

Furman, J., & Stiglitz, J. (1998). Economic Crisis: Evidence and Insights from East Asia. Brookings Papers on Economic Activity, 1-135.

Goldfajn, I., & Gupta, P. (1999). Does Monetary Policy Stabilize the Exchange Rate Following a Currency Crisis? Working Paper of the International Monetary Fund.

Granger, C., Huang, B. N., & Yang, C. (2000). A Bivariate Causality between Stock Prices and Exchange Rates: Evidence from Recent Asian Flu. The Quarterly Review of Economics and Finance 40, 337-354.

Gümüş, İ. (2003). Effects of the Interest Rate Defense on Exchange Rates During the 1994 Crisis in Turkey. Research Department Working Paper No.14 The Central Bank Of The Republic Of Turkey.

Hyde, S. (2007). The response of Industry stock returns to market, exchange rate and interest rate risks. Managerial Finance, 693-709.

Kayhan, S., Bayat, T., & Ugur, A. (2013). Interest Rates and Exchange Rate Relationship in BRIC-T Countries. Ege Academic Review, 227-236.

Lean, H.-H., Halim, M., & Wong, W.-K. (2003). Bivariate Causality Between Exchange Rate and Stock Price On Major Asian Countries. Department Of Economics National University Of Singapore.

Mankiw, N. G. (2009). Macroeconomics Seventh Edition. New York: Worth Publishers.

Mishkin, F. (2011). The Economics of Money Banking and Financial Market. Fourth Canadian Edition. Toronto: Pearson Canada.

Price Water House Coopers, (2009). Shariah-compliant funds: a whole new world of investment.

Trihadmini, N. (2011). Contagion dan spillover effect Pasar Keuangan Global Sebagai Early Warning System. Jurnal Ekonomi dan Pembangunan Indonesia, Vol. 11 No. 2.