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RELATIONSHIP OF INDONESIA & U.S AGGREGATE STOCK RETURNS PRE AND POST GLOBAL FINANCIAL CRISIS (GFC)

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Abstract
This article studies the correlation and volatilities between Indonesia's stock price (JKSE) and U.S's stock price (DJI, NASDAQ) aggregate return before and after The U.S. Subprime Mortgage Crisis in 2008. We use VAR Model to study the correlation and DIAGONAL GARCH-BEKK Model to see the volatilities between the two stock markets. We found that Indonesia's aggregate return is slightly more affected by its own past conditional volatilities after the crisis, contrary to the U.S aggregate return, which is somewhat less impacted by its own past conditional volatilities in the period after the crisis. This study will contribute to literature regarding the complex relationship between aggregate stock market returns of Indonesia and the U.S. before the global financial crisis and the period after the global financial crisis to see how each country's aggregate stock market return influenced each other.

1. Introduction

In early 2008, East Asian economies, including Indonesia, were tackling rising inflation caused by the surge in food and fuel prices after the collapse of the Lehman Brothers in the U.S. on September 15, 2008. They were all confronted by an acceleration in the financial turbulence that had started since mid-2007. The collapse of the Lehman Brothers sparked massive sell-offs on stock exchanges and foreign exchange markets, including in Indonesia (Thee, K., 2012). It is implied that many investors in Indonesia try to rebalance their portfolios affected by the economic turbulence happening in U.S. Chong and Yoke Chong (2011) stated that The bankruptcy of Lehman Brothers following the Subprime crisis turned out to have an enormous impact on the stock market volatility but not on the stock returns in general.

However, Indonesia, as a middle-income East Asian country like Malaysia, Thailand, and the Philippines, survived the financial turbulence well because they were better prepared for this shock after the Asian financial Crisis of 1997-1998. Over the past decade, Indonesia has strengthened its external balances, increased its foreign exchange reserves, reduced government debt to ensure fiscal sustainability, and improved banking supervision (World Bank, 2009a: 6).

In general, Indonesia has only suffered a relatively mild impact from the global financial crisis (GFC). Together with China and India, Indonesia was one of the only three Asian countries recording positive growth. Its economy grew by 4 percent in the year to June 2009, displaying a more resilient response than some of its neighbors (Resosudarmo & Yusuf, 2009: 287). Although there was a mild decline in economic growth compared to the preceding seven years, this decline was lower than the global average (Hill, 2009: 5) and that of Indonesia's neighbors, including Malaysia, Singapore and Thailand, which are much more export-oriented than Indonesia, since Indonesia's exports to GDP ratio is only 17 percent (Resosudarmo & Yusuf, 2009: 289). Based on that information, it could be concluded that the Global Financial Crisis has had a mild impact on Indonesia economically, but not on Indonesia's financial stock market. However, Indonesia's aggregate stock market has weakened from February 1, 2008, at a price level of 2731 and its lowest level at 1240 on November 3, 2008.

In December 2007, there was also a subsequent event regarding the stock market in Indonesia as it was announced that a merger would have happened between Jakarta Stock Exchange (BEJ) and Surabaya Stock Exchange (BES). The merger resulted in the newly formed Indonesia Stock Exchange (BEI). The merger aims to give investors, emiten, BEI and the government advantages. This merger is not a mechanism to fix the supply and demand of stocks but more on fixing the organization's governance to improve the transaction service on stocks trading. The urge to invest will increase along with the fixation on the service directly and indirectly and is predicted to increase the amount of stock trading (Hermanto et al. 2014).

Based on Hermanto et al. (2014), the merger of the capital market will affect the stock trading liquidity, resulting in negative growth. However, the stock trading liquidity in absolute will experience the most prominent growth after the merger compared to the pre-merger era. It is also found that the improvement of the financial ratio performance is better after the merger. However, it is to be noted that the effort on more optimal asset utilization is also an important thing to do. Other non-economical factors will help to more safe and optimal capital market such as the safety, convenience for investors and the financial supervisory regulation.

Based on the information on the U.S government's website, Indonesia is currently U.S.'s 28th largest goods trading partner, with $27.9 billion in total (two-way) goods trade during 2019. The Goods exports totaled $7.7 billion; goods imports totaled $20.1 billion. The U.S. goods trade deficit with Indonesia was $12.4 billion in 2019. Indonesia, the largest economy in Southeast Asia, has enjoyed steady economic growth over the past decade, averaging between 5-6 percent, with moderate inflation, rising foreign direct investment, and relatively low-interest rates. Indonesia's annual budget deficit is capped at 3 percent of GDP, and the Government of Indonesia lowered its debt-to-GDP ratio from a peak of 100 percent shortly after the Asian financial crisis in 1999 to 30.1 percent in 2018. Indonesia's growing middle class, strong domestic demand, large and youthful population, and need for new infrastructure makes it a significant potential market for U.S. products and investment.

Based on the information provided above, it could be suggested that Indonesia's economy and capital market are linked to other countries' economies through international trade and capital flows, in this case, the United States. It is also safe to assume that Indonesia's stock market will have relations with the U.S economy and capital market. As Longin and Solnik (1995), Karolyi (1995), and Bae and Karolyi (1994) document, studying the linkage between stock markets can provide implications for trading strategies for investors, pricing and securities, and regulatory policies within their financial markets.

Several papers have study about the relationship between some countries' stock markets. The study by Chen (2017) found a significant global factor embodied in the fluctuations of stock market returns across markets in the world. There exists a strong phenomenon of international stock market co-movements. The study also finds that the regional factor is another crucial reason for the fluctuations in emerging markets, especially for the markets in South America and East Asia regions, but not in most developed markets.

Majid and Kassim (2009) explore the effects of the current financial crisis on the integration and co-movements of selected stock markets of the emerging economies, namely Indonesia and Malaysia. The study finds that

the U.S. 2007 crisis substantially impacts the stock markets' performance. As a result of the crisis, all the stock markets under review recorded average daily losses during the period compared to average daily gains in the period before the crisis. The correlation test shows an increased correlation between the markets during the crisis compared to before. The cointegration test results suggest that the markets have a long-run equilibrium relationship only during the crisis period, while the long-run equilibrium relationship was non-existent before the crisis.

Robiyanto (2018) states that the level of stock market integration in Indonesia with stock markets in Asia and the world has increased from pre-crisis until the crisis until the post-crisis of the subprime mortgage crisis. Therefore, regional stock markets are a better predictor of the Indonesian stock market's future movement than the U.S. stock market. However, the global financial crisis that is happening in the U.S could impact some countries in the Southeast Asia region. Therefore even though it does not directly affect Indonesia, the impact of the countries near Indonesia could influence Indonesia as well. Majid and Kassim (2009) explore the effects of the current financial crisis on the integration and co-movements of selected stock markets of the emerging economies, namely Indonesia and Malaysia. The study finds that the U.S. 2007 crisis substantially impacts the stock market performance based on rigorous empirical tests.

We use Indonesia's stock price (JKSE) and U.S's stock price (DJI, NASDAQ) daily data from 1992-2020. The data is collected from the yahoo finance website. We use VAR (Vector Autoregression) model to study the correlation and DIAGONAL GARCH-BEKK (Generalized Autoregressive Conditional Heteroskedasticity) model to see the volatilities between the two stock markets. We found that pre-crisis, If a shock is given to each of the aggregate returns of the two stock markets (JKSE-DJIA and JKSE-IXIC), each responded right away with its return compared to the cross return. However, it is found that U.S aggregate return from both indexes is slightly more sensitive towards shock given to Indonesia's return than Indonesia's return sensitivity towards shock given to U.S's return even though the value is not that significant. Post-crisis, If a shock is given to each of the aggregate returns of the two stock markets (JKSE-DJIA and JKSE-IXIC), each response right away with its own return compared to the cross return. However, aligned with the pre-crisis result, U.S aggregate return from both indexes is slightly more sensitive towards shock given to Indonesia's return than Indonesia's return sensitivity towards shock given to U.S's return even though the value is not significant.

It is also found that the pre-crisis return of U.S variability is wildly influenced by its own return. On the other hand, the return of Indonesia's variability is getting a little influenced by shock in U.S return. The return of Indonesia's variability is also wildly influenced by its own return. On the other hand, the return of the U.S's variability is getting minuscule by shock in Indonesia's return. Post-crisis, the return of Indonesia's variability is wildly influenced by its own return.

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For Indonesia's return, there is a slight increase in the effect before the crisis compared to after the crisis; it indicates that after the crisis, the JKSE aggregate return is slightly more affected by its own past shock effect. On the other hand, there is a subtle decrease in the effect on the U.S after the crisis compared to the pre-crisis of both indexes (DJIA & IXIC), which indicates that after the Crisis, DJIA and IXIC aggregate return is less affected by its past shock effect. Indonesia's aggregate return experienced a slight decrease after the crisis compared to pre-crisis on the dependency of past conditional volatilities. Both U.S aggregate stock return indexes experience a modest increase in the dependency of past conditional volatilities. It indicates that Indonesia's

aggregate return is slightly less affected by its own past conditional volatilities after the crisis, contrary to the U.S aggregate return, which is slightly more affected by its own past conditional volatilities in the period after the crisis.

This study will contribute to literature regarding the complex relationship between aggregate stock market returns of Indonesia and the United States in the period before the global financial crisis and the period after the global financial crisis to see how each country's aggregate stock market return influenced each other. The rest of this article is organized as follows. Section II will discuss the Literature review and preliminary analysis; section III will discuss the result and methodology; section IV will include conclusions and limitations.

2. LITERATURE REVIEW AND PRELIMINARY ANALYSIS

Numerous studies provide results about integration and the relationship between the stock market and the financial crisis that occurred on a regional and global scale. The stock markets of Indonesia, Malaysia, Philippines, Singapore, and Thailand in the period after the Asian financial Crisis (July 1, 1998, through December 31, 2002) are cointegrated whether analyzed using daily data or weekly data and analyzed in local currencies, the U.S. dollar, or the Japanese Yen. (Click & Plummer, 2003) This is in line with a study that states that The ASEAN stock markets are going toward more integration among themselves, especially following the post-1997 financial crisis. (M. S. Abd. Majid et al., 2011).

Meanwhile, Suppakittiwong & Aimpresittichai (2015) stated that The integration among the U.S. and the emerging stock markets of Thailand, Indonesia, Malaysia, and the Philippines with structural break exists analysis pair. Moreover, emerging security markets in Southeast Asia, as represented by Thailand, Indonesia, Malaysia, and the Philippines, possess an integration relation with the U.S. equity market performances regardless of neither time nor economic circumstances.

Ameer (2006) concluded that, before the Asian Crisis, these 6 Southeast Asian stock markets (India, Indonesia, Malaysia, Pakistan, South Korea, and Thailand) had shown more global integration than regional integration. In the post-crisis period, the regional factors have been more important than global factors for some Asian markets compared to other countries. Supporting results are also obtained from a study by Robiyanto (2018), which states that after the subprime mortgage crisis in 2008, the Indonesian stock market was more integrated with several stock markets in Asia, especially in the stock markets in the ASEAN region. Huyghebaert and Wang (2011) stated that The Asian financial crisis had strengthened the linkages among stock markets in East Asia, except for those in Mainland China.

Another study from Chen (2018) states that the regional factor is another crucial reason for the fluctuations in emerging markets, especially for the markets in South America and East Asia regions, but not in most developed markets. In line with that, Robiyanto (2018) also states that the level of stock market integration in Indonesia with stock markets in Asia and the world is increasing, from pre-crisis until the crisis, until post-crisis of the subprime mortgage crisis. So the statement that regional stock markets are a better predictor of the Indonesian stock market's future movement than the U.S. stock market. (Purnomo & Rider, 2012) can be justified in line with some of the study results.

Several studies on the interdependence between stock markets in emerging countries, in particular, have also been carried out. Several results have been obtained, including a study by Wong et al. (2004), which states that there has been increasing interdependence between most developed and emerging markets since the 1987 Stock Market Crash. This interdependence intention after the 1997 Asian Financial Crisis. As has also been stated in a previous study by In et al. (2001) that the markets became more interdependent during the Asian crisis period but, at the same time, more integrated in the sense that they each reacted not only to local news but also to news originating in the other markets, especially when the news was adverse.

Impact of the U.S. The subprime mortgage crisis in 2007 has been widely studied, as in the study by S. Abd. Majid & Kassim (2009), which resulted in the conclusion of The U.S. 2007 crisis, had a substantial impact on the performance of the stock markets. As a result of the crisis, all the stock markets under review recorded average daily losses compared to average daily gains in the period before the crisis. The markets only have a long-run equilibrium relationship during the crisis

period, while the long-run equilibrium relationship was non-existent before the crisis. Furthermore, The stock markets tend to show greater integration or increased co-movements during the crisis period, resulting in a lesser benefit of diversification that investors can gain.

Furthermore, the impact of the crisis is explained in a study conducted by Lee and Chou (2020), which concluded that the correlations between the Asian and U.S. stock markets are nonstationary, indicating that permanent changes occurred in the correlations as a result of certain major global events. As well as the subprime mortgage crisis-induced structural changes in the correlations. As such, when a major macroeconomic or financial event occurs in the U.S. stock market, it permanently affects the correlations. The correlations did not revert to their pre-event levels even when the economy rebounded afterward.

Chong and Yoke Chong (2011) stated that the bankruptcy of Lehman Brothers after the Subprime crisis had a more significant impact on stock market volatility but not on the stock returns in general. However, the impact is transitory and decays in time at a prolonged rate. Another conclusion obtained is a comparison between the pre-crisis stock index volatility lower than the volatility of JCI after the subprime mortgage crisis. (Purbawati & Dana, 2016)

Concerning the contagion of the U.S. effect on the stock market in Indonesia and several other emerging markets, several studies have been conducted, such as those conducted by Morales and Andreosso-O'Callaghan (2012), concluding that The U.S. stock markets are not generating contagious effects. Into the Asian stock markets. In line with that, the study's conclusion stated that China had increased its influence on the Indonesian stock market after the global financial crisis. In contrast, the U.S has become less influential than before the crisis. (Kenani et al., 2013), in line with the previous study. The conclusion from Luchtenerg and Vu (2015) also states that the contagion following the 2008 global financial crisis is not confined to emerging markets.

Samarakoon (2011) argues that essential bi-directional yet asymmetric interdependence and contagion exist in emerging markets, with substantial regional variations. Interdependence is driven more by U.S. shocks, while contagion is driven more by emerging market shocks.

Several studies about the merger of JSX and SSX stated that the merger of the Surabaya Stock Exchange and the Jakarta Stock Exchange into the Indonesia Stock Exchange (IDX) shows no significant effect of the merger on stock behavior in IDX, especially in the term of liquidity. (Kholisoh, 2017) This contradicts the results of a study that states that The merger of the capital market will affect the stock trading liquidity, resulting in negative growth. However, the stock trading liquidity in absolute will experience the most significant growth after the merger compared to the pre-merger era. (Hermanto et al., 2014)

The merger between JSX and SSX also causes large market capitalization companies and the non-financial sector to achieve greater market efficiency than their counterparts. (Yang & Pangastuti, 2016) The improvement of the financial ratio performance is better after the merger. However, it is to be noted that the effort on more optimal asset utilization is also an important thing to do. Other non-economic factors will help to more safe and optimal capital market such as the safety, convenience for investors and financial supervisory regulation. (Hermanto et al., 2014).

3. RESULT & METHODOLOGY

3.1 Research Question

Based on the explanation before, there will be three research questions that will need to be answered. The research questions are :

1. What is the relationship between Indonesia and U.S aggregate stock market?
2. Between both countries, which one has a more significant influence in affecting the aggregate stock market of each other?
3. How does each country's aggregate stock market respond to a given shock?

3.2 Data

The data used in this research are Indonesia's daily stock returns (JKSE) and United States's daily stock returns using Dow Jones Indexes (DJIA) and NASDAQ (IXIC) from 1992-2020. The data is collected from yahoo finance for stock price daily data, and then we calculated the returns based on the daily stock price data

for each Indonesia's stock price and U.S stock price.

We choose the period of 1992 to 2020 for the data because the stock price daily data for JKSE is only available since 1990, and DJIA has been available since 1992. On the other hand, we also choose that observation range so that the range between the pre-crisis and post-crisis is balanced and not heavy on one side. Based on that, there will be 3987 observation data in the pre-crisis era and 3038 observation data post-crisis era.

After the data has been collected and transformed, we use Vector Auto Regression (VAR) and Diagonal Generalized Autoregressive Conditional Heteroskedasticity (GARCH) BEKK to study the dynamic relationship between the return of the aggregate stock market to its past shock/volatilities. The impulse response analyses capture how rapidly the Indonesia and U.S stock returns respond to shock or innovation. The Forecast Error Decomposition Variance Test is used to figure out how big the change in variance happened because of shocks and how significant each variable's contribution is in explaining the variability of other variables.

Figure 1 compares Indonesia (JKSE index) returns with the US Stock returns (DJIA & IXIC) returns. In contrast, figure 2 shows the monthly volatility (measured by S.D.s) in the same period observed. It is shown that the JKSE average return moves more volatile than both the DJIA and IXI returns. There is a high volatility level of average return in JKSE during the several moments of crisis like 1998 and especially the Global Financial Crisis in 2008. It may reflect the capital flight rush from the emerging country to the U.S. when the crisis happened. Each index's monthly volatility showed that it runs seemingly to no indication of moving contrary from time to time.

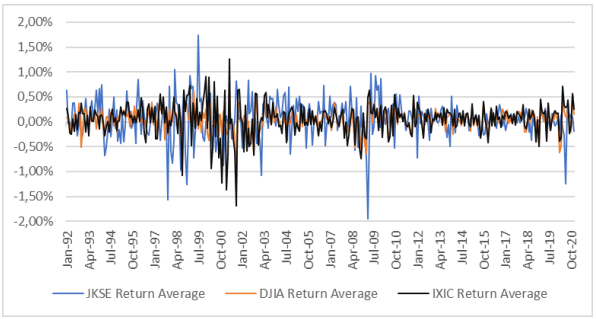

Figure 1. Indonesia and U.S. indices average monthly return (%)

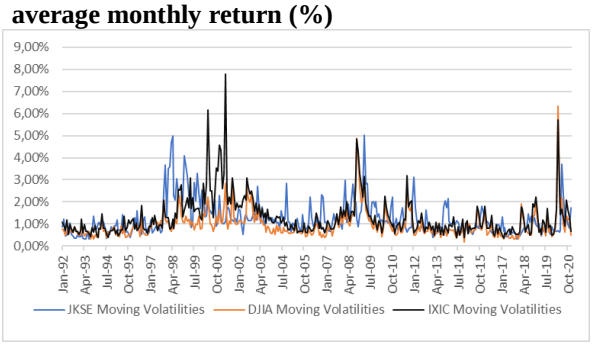

Figure 2. Indonesia and U.S. indices monthly volatility (%)

3.3 Methodology

First, we will separate the observation data for Indonesia and U.S aggregate stock returns into pre and post-crisis. As for the U.S daily data, we use the Dow Jones Index (DJI) and NASDAQ index to see whether there is any significant difference when we use different indexes to their relationship to Indonesia's aggregate stock return (JKSE). The data are going to be processed using e-views analytical tools.

Next, we processed the data twice; first, we ran the VAR analysis on DJI and JKSE and then proceeded to run the analysis on NASDAQ and JKSE. However, because we divide the data into the period before and after the crisis, we need to run the data 4 times: DJI-JKSE pre-crisis, DJI-JKSE post-crisis, NASDAQ-JKSE pre-crisis, and NASDAQ-JKSE post-crisis.

After that, we also run the impulse response function test to figure out how significant the response of independent variables to some innovation, shocks, or quake that could be coming from its own past values (lag) or from other observed variables not only in a short time but can also gain some long-term information by analyzing some future horizons. Analysis of the impulse response function can also provide information on the effects' duration or how long the effect will last. The Forecast Error Decomposition

Variance Test is used to figure out how big the change in variance happened because of shocks and how significant each variable's contribution is in explaining the variability of other variables. Then, we run the diagonal GARCH-BEKK method to analyze the relationship between Indonesia and U.S aggregate stock market return on its past shock and volatilities. We are using the diagonal BEKK method instead of full BEKK because the instrument or tools' limitation as e-views only support up to diagonal BEKK but not full BEKK. Therefore, we cannot analyze the cross-relationship between the two aggregate stock market returns.

3.4 Econometrical Result

3.4.1 **Summary statistic**

Table 1. reports the summary statistics for the JKSE (Indonesia) and 2 U.S. stock indices (DJIA & IXIC) returns for the entire sample. The JKSE mean return (0,5%) is higher than the Dow Jones (DJIA) 0,4% but lower than the Nasdaq (IXIC) 0,6%. The Indonesia stock returns have positive skewness, while the U.S. indices both have negative skewness. The kurtosis of the three indices is higher than 3, meaning it has sharper peaks and longer tails.

Table 1. Summary Statistic

3.4.2 **Model specification**

We consider a VAR model, assuming the error terms are heteroscedastic and un-auto correlated. We define the general VAR equations as follows :

$$r_t = \alpha + \beta \sum_{k=1}^{t} r_{t-k} + \varepsilon_t$$

Where:

$r_t = [r_{indo,t}, r_{u.s,t}]'$ is a two-dimensional vector of the two monthly returns at time t, k is the lag length, α is a 2x1 vector of constants representing long-term drift coefficients, and β is a two x2 matrix of parameters associated with the lagged returns. The diagonal elements in matrix β, which are denoted by βindo and βUS, measure the effect of past returns on current returns, while the off-diagonal elements, βindo--> U.S. and βindo <-- U.S., capture the cross effects. The 2x1 vector of error terms, εt, reflects the innovations. The Jarque–Bera test rejects the null hypotheses of normality. Hence, we assume each error term is t distributed with the degree of freedom υ and mean zero.

The error terms are modeled by a GARCH model, following Engle (1982) and Bollerslev (1986). In order to measure both countries' aggregate return's relationship to their own past shock and volatilities, Diagonal GARCH-BEKK is employed. The variance-covariance matrix of returns, Ht, depends on past values of squared innovations, εtk ε0tk, and the past values in the matrix itself, Htk. We define the equations as follows :

$$H_t = CC' + \sum_{k=1}^{n} A_k \varepsilon_{t-k} \varepsilon'_{t-k} A'_k + \sum_{k=1}^{n} G_k H_{t-k} G'_k$$

Here, C is a lower triangular matrix of constants. Each of A's is a 2x2 matrix, where the diagonal elements of A measure the own past shock effect. Each of G's is a 2x2 matrix, while the diagonal elements of G indicate the dependency of past own conditional volatility. To be specific, the matrices equation is going to be :

$$\begin{aligned} H_t &= \begin{bmatrix} C_{indo} & 0 \\ C_{Indous} & C_{us} \end{bmatrix} + \begin{bmatrix} C_{indo} & 0 \\ C_{Indous} & C_{us} \end{bmatrix}' \\ &+ \begin{bmatrix} \alpha_{indo} & 0 \\ 0 & \alpha_{us} \end{bmatrix} \begin{bmatrix} \varepsilon^2_{indo,t-1} & \varepsilon_{indo,t-1}\varepsilon_{us,t-1} \\ \varepsilon_{us,t-1}\varepsilon_{indo,t-1} & \varepsilon^2_{us,t-1} \end{bmatrix} \begin{bmatrix} \alpha_{indo} & 0 \\ 0 & \alpha_{us} \end{bmatrix}' \\ &+ \begin{bmatrix} \beta_{indo} & 0 \\ 0 & \beta_{us} \end{bmatrix} H_{t-1} \begin{bmatrix} \beta_{indo} & 0 \\ 0 & \beta_{us} \end{bmatrix}', \end{aligned}$$

3.4.3 Result

Summary	JKSE	DJIA	IXIC
Mean	0,05%	0,04%	0,06%
Median	0,07%	0,06%	0,12%
Maximum	14,03%	11,37%	25,00%
Minimum	-11,95%	-12,93%	-12,32%
Std. Dev	1,45%	1,15%	1,54%
Skewness	4,87%	-12,58%	41,76%
Kurtosis	12,53503	15,81326	19,4952
Jarque Bera	26611,09	48068,46	79836,27
p-Value	<0,001	<0,001	<0,001

Stationarity is mandatory in this process analysis. Hence we conduct the stationarity test using the Augmented Dickey-Fuller (ADF) Test for all observed variables. Based on table 2 below, the ADF test shows that all t-values reject the unit root hypothesis at the 1% and 5% levels. This means that the return of JKSE, DJIA and IXIC are all stationary at level.

Table 2. Stationarity Test

Variables	ADF (*Schwarz Information Criterion*) *Trend and Intercept*		
	Automatic, Maximum lag	*t-stat*	*p-value*
JKSE Return	34	-92,31267 (0)	0,0001
DJIA Return	34	-63,23441 (0)	0,0001
IXIC Return	34	-72,11339 (0)	0,0001

Source: Eviews, processed data.

We began the observation by dividing it into two significant timelines, before and after the Global Financial Crisis. The first timeline is from January 2, 1992, to September 12 2008, right before the Lehman Brothers declares bankruptcy, which we assume is the starting point of the Global Financial Crisis moment. The second timeline starts from September 15, 2008, right up to December 31, 2020, reflecting the moment after the Global Financial Crisis hit U.S. Economy and widely affected many countries worldwide.

After conducting the stationarity test for the entire data set, we run a correlation test to ensure whether the dataset of the first timeline (Before the crisis) is correlated or not. In table 3, we found that the correlation between JKSE and DJIA is negative but very low. The next is found that the JKSE and IXIC negatively correlated but at a meager value, at a point where we can neglect the correlation level. Meanwhile, the correlation is changing to the positive side even though still at a low-level value in the after-crisis data set. This low-level correlation brings the conclusion that we proceed to apply the VAR at the level model.

Table 3. JKSE-DJIA Correlation Test

Coefficient Correlation (JKSE-DJIA)		
	JKSE Return	DJIA Return
JKSE Return	1	-0,022294
DJIA Return	-0,022294	1

Table 4. JKSE-IXIC Correlation Test

Coefficient Correlation		
	JKSE Return	IXIC Return
JKSE Return	1	-0,011502
IXIC Return	-0,011502	1

Source: Eviews, processed data.

Braun and Mitnik (1993) claim that the incorrect lag that has been chosen will bring problems and inconsistencies in the process of Impulse Response Function and the variance decomposition. Based on the Eviews Simulation, the test between JKSE and DJIA data before crisis using the all-information criterion such as Akaike Information Criterion (AIC), Final Prediction Error (FPE), Likelihood Ratio (L.R.), Schwarz Information Criterion (S.C.), and the Hannan-Quinn Information Criterion (H.Q.), the four criteria except L.R. selected Lag 1. In contrast, the three criteria except L.R. and S.C. chose Lag 2 for the dataset of JKSE and IXIC. For the second timeline, all information criteria for both data sets selected the Lag 7; all exclude the S.C. and H.Q. criterion for both datasets.

After we figured out the optimum lag for all data sets and observation periods, we conducted a VAR Stability test model for both datasets. It is profoundly found that both data sets before the crisis have no root lies outside the modulus or the unit circle. This concluded that both data sets satisfy the VAR model.

Based on the Granger Causality Test, as shown in Figure 5, both DJIA and JKSE do not granger-cause each other. This result indicates that no significant relationship exists between the two aggregate stock market returns before the crisis. We also find that there is no Granger Causality from JKSE to IXIC and vice versa, meaning there is no directional relationship between these variables and the move independently.

Table 5. Granger Causality JKSE-DJIA & JKSE-IXIC Before-After Crisis

Pairwise Granger Causality - Before Crisis				Pairwise Granger Causality - After Crisis			
Lags: 1				Lags: 7			
Null Hypothesis:	Obs	F-Statistic	Prob.	Null Hypothesis:	Obs	F-Statistic	Prob.
JKSE_RETURN does not Granger Cause DJIA_RETURN	3985	.71082	0.3992	JKSE_RETURN does not Granger Cause DJIA_RETURN	3031	.90631	0.5003
DJIA_RETURN does not Granger Cause JKSE_RETURN		0.15065	0.6979	DJIA_RETURN does not Granger Cause JKSE_RETURN		0.69085	0.6800
Pairwise Granger Causality - Before Crisis				Pairwise Granger Causality - After Crisis			
Lags: 2				Lags: 7			
Null Hypothesis:	Obs	F-Statistic	Prob.	Null Hypothesis:	Obs	F-Statistic	Prob.

JKSE_RETURN does not Granger Cause IXIC_RETURN	3984	0.57850	0.5608	JKSE_RETURN does not Granger Cause IXIC_RETURN	3031	156.715	0.1404
IXIC_RETURN does not Granger Cause JKSE_RETURN		242.880	0.0883	IXIC_RETURN does not Granger Cause JKSE_RETURN		0.81344	0.5760

Source: Eviews, processed data.

VAR Estimation Model

The VAR estimation equation result is as follows :

1. Pre Crisis

JKSE-DJIA

DJIA_Return = -0,035206 DJIA_Return (-1) + 0,000379

JKSE_Return = 0,175596 JKSE_Return (-1) + 0,000552

JKSE-IXIC

IXIC_Return = -0,071618 IXIC_return (-2) + 0,000483

JKSE_Return = -0,032967 IXIC_Return (-1) + 0,0177831 JKSE_Return (-1) + 0,014369 JKSE_Return (-2) + 0,000570

2. Post Crisis

JKSE-DJIA

DJIA_Return = -0,139875 DJIA_Return (-1) – 0,060582 DJIA_Return (-4) – 0,051920 DJIA_Return (-6) + 0,063755 DJIA_Return (-7) + 0,000510

JKSE_Return = 0,98039 JKSE_Return (-1) – 0,039069 JKSE_Return (-3) – 0,044978 JKSE_Return (-4) -0,036663 JKSE_Return (-6)

JKSE-IXIC

IXIC_Return = -0,128809 IXIC_Return (-1) – 0,41484 IXIC_Return (-4) – 0,036120 IXIC_Return (-6) + 0,047471 IXIC_Return (-7) – 0,042175 JKSE_Return (-6) + 0,000703

JKSE_Return = 0,097987 JKSE_Return (-1) – 0,040146 JKSE_Return (-3) – 0,045129 JKSE_Return (-4) – 0,037720 JKSE_Return (-6)

Impulse Response Function Analysis

1. JKSE-DJIA (before Crisis)

Impulse Response Function (IRF) in VAR modeling is used to figure out how significant the response of independent variables to some innovation, shocks, or quake that could be coming from its own past values (lag) or from other observed variables not only in a short time but can also gain some long-term information by analyzing some future horizons. We later examine the dynamic responses of each variable to shock or innovations. Figure 3 shows the IRF of the earlier sample of observation of return of JKSE and DJIA using lag 1. It indicates checking the response of DJIA return if a shock is applied to the return of DJIA as much as one standard deviation. The DJIA responds right away in the first period and will smoothen start from the third period until it remains constant in the fourth period. At the same time, DJIA responses to JKSE shocks start in the second observation period and then taper off from the fourth period. On the other side, the JKSE return is also reacting negatively directly to shocks given from the return of DJIA, with a different value of response given when shocks come from its past value in the first period, when it stabilizes starting in the fifth period from both shock responses. This shows that each variable responded less to shocks from other variables rather than its past value.

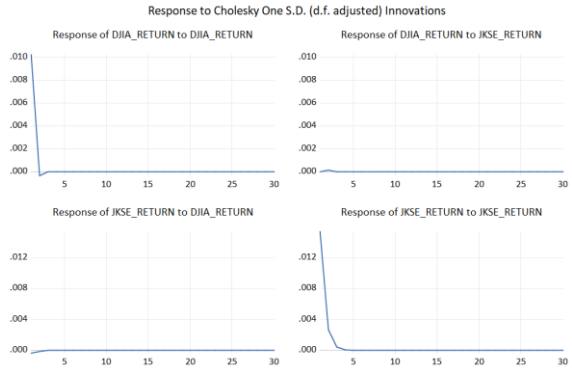

Figure 3. Impulse Response Function JKSE-DJIA Before Crisis

2. JKSE-IXIC (before Crisis)

From the observation of the return of JKSE and IXIC variables, as shown in figure 4, we found a similar response from what DJIA return has shown above, with IXIC responding immediately to shocks given from its past yet no response applied if shocks given to return of JKSE. The response of IXIC decreases starting from the fifth period and remains constant from the sixth period of observation. The same response also happens on the JKSE return. When shocks are given to the IXIC, it responds negatively with a minimal value but positively responding when the shock is given to its own past value and responding positively from the first period. Both variables stabilize in the fifth period.

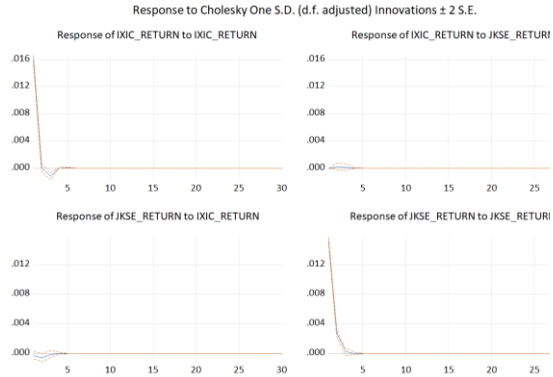

Figure 4. Impulse Response Function JKSE-IXIC Before Crisis

3. JKSE-DJIA (after crisis)

Figures 5 and 6 illustrate the dynamic response of JKSE and DJIA, and IXIC's return right after the Lehmann Brothers, known as the starting point of Global Financial Crisis, collapsed on September 15, 2008. The graph shows that the DJIA return responses right away on the 1st period, while it does not respond to the shock given to JKSE return in the first period. The DJIA return from JKSE shock is starting to respond in the second observation period. The response return of DJIA will remain volatile until it smoothens and become constant in the 15th period. On the other side, the JKSE return responds directly in the first period for both the DJIA return and its past value shocks. However, the responding value from shocks given to DJIA return is insignificant. The response return of JKSE also remains volatile until it decreases and becomes constant in the 15th period.

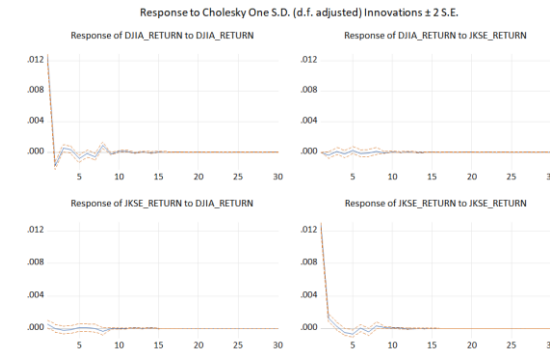

Figure 5. Impulse Response Function JKSE-DJIA After Crisis

4. JKSE-IXIC (after crisis)

A shock on IXIC's past value brings a direct response to the IXIC return positively in the first period, while it does respond when JKSE is given any shocks in the second period. The response tapering down in the 10th period then goes constant in the 15th period. JKSE responds directly from IXIC and JKSE given shocks, with the value from its own past higher than the IXIC. The response will smoothen near the ninth period and decrease and reach the constant in the 15th period.

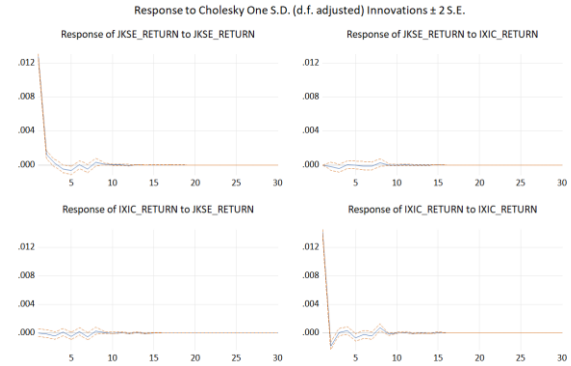

Figure 6. Impulse Response Function JKSE-IXIC After Crisis

Forecast Error Decomposition Variance (FEDV) Analysis

Forecast Error Decomposition Variance Test is used to figure out how big the change in variance happened because of shocks and how significant each variable's contribution is in explaining the variability of other variables.

1. JKSE-DJIA (before Crisis)

Figure 7 shows the Decomposition Variance between DJIA and JKSE before the crisis. Based on the result, the return of DJIA is only influenced by the shock in the past return of DJIA itself in the first period and then declining gradually but still above 99,98% in the third period. On the other hand, the return of JKSE started to contribute to shock in return of JKSE in the second period by the amount of 0,0172% and gradually increased till it reached 0,176% in the third period and then remained constant afterward. Meanwhile, the JKSE is already influenced by the DJIA's past return since the first observation period and remains constant from the fifth period for the remaining period.

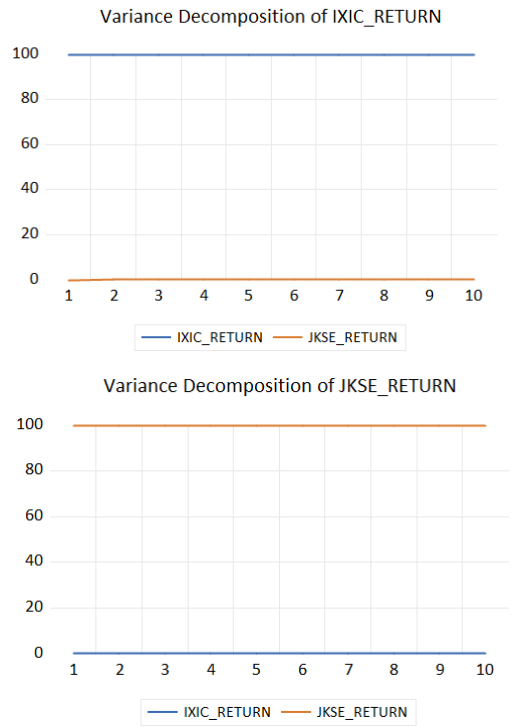

Figure 7. Forecast Error Decomposition Variance JKSE-DJIA Before Crisis

2. JKSE-IXIC (before Crisis)

For the IXIC-JKSE decomposition variance analysis, we found that each JKSE and IXIC before Crisis only contributes to themselves significantly. JKSE's contributions to IXIC return were relatively small, starting to influence in the second period; it ended up with only 0,028% contributions in the fifth period of observation, then remained constant. The IXIC contribution to the JKSEs is also tiny, with only 0,162% in the sixth observation period.

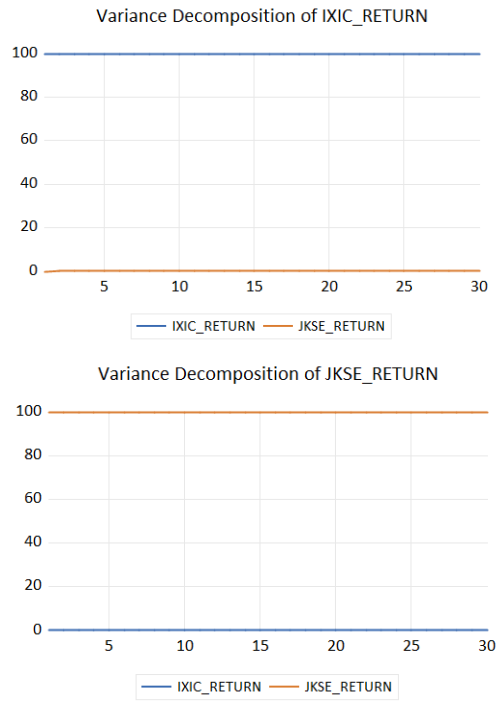

Figure 8. Forecast Error Decomposition Variance JKSE-IXIC Before Crisis

3. JKSE-DJIA (after crisis)

Figure 9 and figure 10 show the Decomposition Variance between JKSE-DJIA and JKSE-IXIC in the later period of observations. Based on the result, the return of DJIA is only influenced by the shock in the past return of DJIA itself in the 1st period and then declining gradually until it reaches 99,76% in the 21st period. Compared to the JKSE composition in the earlier data set, the contribution is higher with almost 0,24% in the 21st period. Meanwhile, the JKSE is already influenced by the DJIA's past return since the first observation period and remains constant from the fifth period for the remaining period. The return of DJIA also plays a more significant portion in JKSE return than the earlier period of observation, with the constant contribution of 0,303% late after 20 periods of observation.

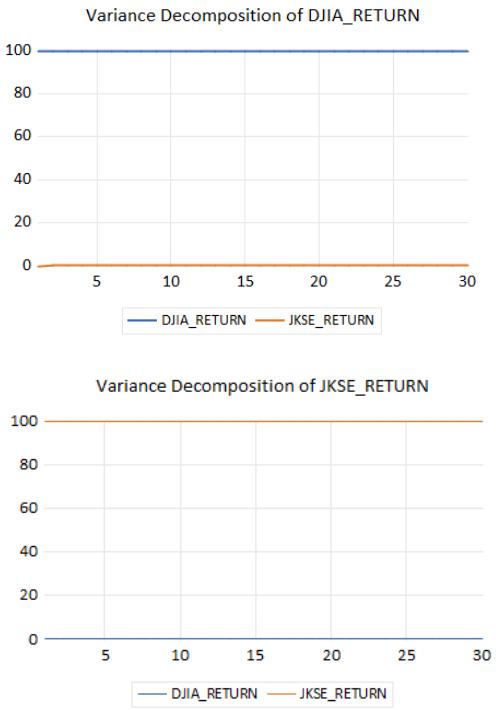

Figure 9. Impulse Response Function JKSE-DJIA Before Crisis

4. JKSE-IXIC (after crisis)

In the IXIC-JKSE decomposition variance analysis, we found that each JKSE return influences the forming of IXIC return more than the other way around. IXIC's contribution to JKSE can prove this is only 0,18% in the 27th period of observation, compared to IXIC's contribution to JKSE return which accounted for almost 0,4% in the 27th period of observation.

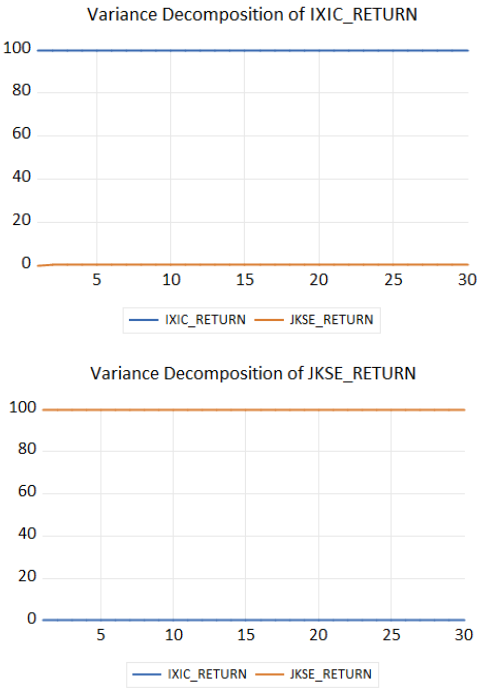

Figure 10. Forecast Error Decomposition Variance JKSE-DJIA &JKSE-IXIC After Crisis

GARCH BEKK ESTIMATION EQUATION

The GARCH BEKK Estimation Equation Results are as follows :

1. Pre-Crisis JKSE-DJIA

$$H_t = \begin{bmatrix} 7{,}31\,x10^{-7} & 0 \\ -7{,}65\,x10^{-8} & 2{,}68\,x10^{-6} \end{bmatrix}\begin{bmatrix} 7{,}31\,x10^{-7} & 0 \\ -7{,}65\,x10^{-8} & 2{,}68\,x10^{-6} \end{bmatrix}' + \begin{bmatrix} 0{,}221176 & 0 \\ 0 & 0{,}341756 \end{bmatrix}\begin{bmatrix} \varepsilon^2_{indo,t-1} & \varepsilon_{indo,t-1}\varepsilon_{us,t-1} \\ \varepsilon_{us,t-1}\varepsilon_{indo,t-1} & \varepsilon^2_{us,t-1} \end{bmatrix}\begin{bmatrix} 0{,}221176 & 0 \\ 0 & 0{,}341756 \end{bmatrix}' + \begin{bmatrix} 0{,}972328 & 0 \\ 0 & 0{,}939486 \end{bmatrix} H_{t-1} \begin{bmatrix} 0{,}972328 & 0 \\ 0 & 0{,}939486 \end{bmatrix}',$$

2. Post Crisis JKSE-DJIA

$$H_t = \begin{bmatrix} 2{,}74\,x10^{-6} & 0 \\ 9{,}20\,x10^{-8} & 2{,}06\,x10^{-6} \end{bmatrix}\begin{bmatrix} 2{,}74\,x10^{-6} & 0 \\ 9{,}20\,x10^{-8} & 2{,}06\,x10^{-6} \end{bmatrix}' + \begin{bmatrix} 0{,}366579 & 0 \\ 0 & 0{,}278957 \end{bmatrix}\begin{bmatrix} \varepsilon^2_{indo,t-1} & \varepsilon_{indo,t-1}\varepsilon_{us,t-1} \\ \varepsilon_{us,t-1}\varepsilon_{indo,t-1} & \varepsilon^2_{us,t-1} \end{bmatrix}\begin{bmatrix} 0{,}366579 & 0 \\ 0 & 0{,}278957 \end{bmatrix}' + \begin{bmatrix} 0{,}918519 & 0 \\ 0 & 0{,}954052 \end{bmatrix} H_{t-1} \begin{bmatrix} 0{,}918519 & 0 \\ 0 & 0{,}954052 \end{bmatrix}',$$

3. Pre-Crisis JKSE-IXIC

$$H_t = \begin{bmatrix} 6{,}69\,x10^{-7} & 0 \\ -1{,}25\,x10^{-7} & 3{,}14\,x10^{-6} \end{bmatrix}\begin{bmatrix} 6{,}69\,x10^{-7} & 0 \\ -1{,}25\,x10^{-7} & 3{,}14\,x10^{-6} \end{bmatrix}' + \begin{bmatrix} 0{,}206206 & 0 \\ 0 & 0{,}356450 \end{bmatrix}\begin{bmatrix} \varepsilon^2_{indo,t-1} & \varepsilon_{indo,t-1}\varepsilon_{us,t-1} \\ \varepsilon_{us,t-1}\varepsilon_{indo,t-1} & \varepsilon^2_{us,t-1} \end{bmatrix}\begin{bmatrix} 0{,}206206 & 0 \\ 0 & 0{,}356450 \end{bmatrix}' + \begin{bmatrix} 0{,}977523 & 0 \\ 0 & 0{,}933523 \end{bmatrix} H_{t-1} \begin{bmatrix} 0{,}977523 & 0 \\ 0 & 0{,}933523 \end{bmatrix}',$$

4. Post Crisis JKSE-IXIC

$$H_t = \begin{bmatrix} 4{,}36\,x10^{-6} & 0 \\ 9{,}46\,x10^{-8} & 2{,}04\,x10^{-6} \end{bmatrix}\begin{bmatrix} 4{,}36\,x10^{-6} & 0 \\ 9{,}46\,x10^{-8} & 2{,}04\,x10^{-6} \end{bmatrix}' + \begin{bmatrix} 0{,}346938 & 0 \\ 0 & 0{,}280520 \end{bmatrix}\begin{bmatrix} \varepsilon^2_{indo,t-1} & \varepsilon_{indo,t-1}\varepsilon_{us,t-1} \\ \varepsilon_{us,t-1}\varepsilon_{indo,t-1} & \varepsilon^2_{us,t-1} \end{bmatrix}\begin{bmatrix} 0{,}346938 & 0 \\ 0 & 0{,}280520 \end{bmatrix}' + \begin{bmatrix} 0{,}924416 & 0 \\ 0 & 0{,}953485 \end{bmatrix} H_{t-1} \begin{bmatrix} 0{,}924416 & 0 \\ 0 & 0{,}953485 \end{bmatrix}',$$

Table 6 resumes the GARCH-BEKK estimation results. For both the earlier and later sample of observation, each of the current returns of Indonesia and the U.S (both the DJIA and IXIC) are significantly affected by their own past shock effect and their own past conditional volatilities, as the p-Value is significant at 5% level, this result is persistent for the before and after the crisis, might because many factors could explaining the relationship form of those variables and might be a reflection that the market is dependent not only to other market's movement but also from the domestic economic variables such as interest rate, GDP growth and industrial data announcement growth that could affect the economics condition.

JKSE-DJIA	Before Crisis				After Crisis			
	Coefficient	SE	z-Statistic	p-Value	Coefficient	SE	t-Statistic	p-Value
cIDJKSE	0,0000	0,00000	10,209	0,0000	0,0000	0,0000	7,2328	0,0000
cUSDJIA	0,0000	0,00000	- 0,644	0,5193	0,0000	0,0000	0,6259	0,5314
cIDUS	0,0000	0,00000	6,319	0,0000	9,6182	0,0000	9,6182	0,0000
aIDJKSE	0,3418	0,00835	40,912	0,0000	0,2790	0,0102	27,2365	0,0000
aUSDJIA	0,2212	0,00833	26,557	0,0000	0,3666	0,0128	28,6557	0,0000
gIDJKSE	0,9395	0,00254	369,648	0,0000	0,9541	0,0033	287,6907	0,0000
gUSDJIA	0,9723	0,00229	425,617	0,0000	0,9185	0,0053	174,7309	0,0000
JKSE-IXIC	Before Crisis				After Crisis			
	Coefficient	SE	z-Statistic	p-Value	Coefficient	SE	t-Statistic	p-Value
cIDJKSE	0,0000	0,00000	10,593	0,0000	0,0000	0,0000	7,3238	0,0000
cUSIXIC	0,0000	0,00000	- 0,892	0,3721	0,0000	0,0000	0,5306	0,5957
cIDUS	0,0000	0,00000	5,316	0,0000	0,0000	0,0000	8,8366	0,0000
aIDJKSE	0,3565	0,00852	41,834	0,0000	0,2805	0,0106	27,6179	0,0000
aUSIXIC	0,2062	0,00707	29,167	0,0000	0,3469	0,0135	25,7445	0,0000
gIDJKSE	0,9335	0,00271	344,099	0,0000	0,9535	0,0033	292,8258	0,0000
gUSIXIC	0,9775	0,00163	601,558	0,0000	0,9244	0,0057	163,5926	0,0000

Table 6. GARCH BEKK Analysis

To summarize, the Indonesia stock return and U.S. stock returns do not create a directional relationship between each variable. This is because there may be other indices that could explain variables toward observed variables. This could also come from the volatility in the various economic variables, such as news and interest rate announcement (Campbell & Ammer, 1993).

4. CONCLUSION AND LIMITATION

We found that pre-crisis If a shock is given to each of the aggregate returns of the two stock markets (JKSE-DJIA and JKSE-IXIC), each responded right away with its own return compared to the cross return. However, it is found that U.S aggregate return from both indexes is slightly more sensitive towards shock given to Indonesia's return than Indonesia's return sensitivity towards shock given to U.S.'s return even though the value is not that significant. Post-crisis, if a shock is given to each aggregate return of the two-stock market (JKSE-DJIA and JKSE-IXIC), each responds right away by its own return compared to the cross return. However, aligned with the pre-crisis result, U.S. aggregate return from both indexes is slightly more sensitive towards shock given to Indonesia's return than Indonesia's return sensitivity towards shock given to U.S.'s return even though the value is not significant.

It is also found that the pre-crisis return of U.S variability is wildly influenced by its own return. On the other hand, the return of Indonesia's variability is getting a little influenced by shock in U.S return. The return of Indonesia's variability is also wildly influenced by its own return. On the other hand, the return of the U.S's variability is getting minuscule by shock in Indonesia's return. Post-crisis, the return of Indonesia's variability is wildly influenced by its own return.

On the other hand, the return of the U.S's variability is getting a little influenced by shock in Indonesia's return. The return of the U.S's variability is also wildly influenced by its own return. On the other hand, the return of Indonesia's variability is getting a little influenced by shock in U.S's return. It is found that the variability of U.S return is slightly more sensitive towards Indonesia's return than Indonesia's return variability towards U.S.'s return both before and post crisis even though the response is on a minuscule scale. It is concluded that Indonesia's aggregate stock return has a slightly more significant influence on U.S. aggregate stock return compared to U.S.'s aggregate return influence on Indonesia's aggregate stock return.

For Indonesia's return, there is a slight increase in the effect before the crisis compared to after the crisis; it indicates that after the crisis, the JKSE aggregate return is slightly more affected by its own past shock effect. On the other hand, there is a subtle decrease in the effect on the U.S after the Crisis compared to the pre-crisis of both indexes (DJIA & IXIC), which indicates that after the Crisis, DJIA and IXIC aggregate return is less affected by its own past shock effect. Indonesia's aggregate return experienced a slight decrease after the crisis compared to pre-crisis on the dependency of past conditional volatilities. Both U.S aggregate stock return indexes experience a modest increase in the dependency of past conditional volatilities. It indicates that Indonesia's aggregate return is slightly less affected by its own past conditional volatilities after the crisis, contrary to the U.S aggregate return, which is slightly more affected by its own past conditional volatilities in the period after the crisis. To summarize, even though the relationship between the two stock market returns is not that significant, Indonesia's stock market returns are most likely to have greater influence over united states stock market returns for both indexes compared to U.S stock market return influencing Indonesia's stock market return.

The limitation of these studies is that they only figure out the relationship between the two stocks market return between Indonesia and United States, and they only use the two most significant indexes of the U.S, which are the Dow Jones Index and NASDAQ. Also, because of the limitations of the tools, these studies cannot figure out the cross-relationship of

volatility between the two countries' stock returns as e-views only allowed Diagonal-BEKK analysis, not Full BEKK. Therefore, there is still much room for improvement. Future studies could explore the relationship of stock market return between Indonesia and the United States using different indexes aside from DJIA and IXIC; the studies of co-movement of stock market return between both countries are still left to be explored.

5. REFERENCES

Abd Majid, M. S., & Kassim, S. H. (2009). Impact of the 2007 U.S. financial crisis on the emerging equity markets. International Journal of Emerging Markets.

Ameer, R. (2006). Integration of the South and East Asian stock markets: how long to go?. Journal of Financial Reporting and Accounting.

Campbell, J. Y., & Ammer, J. (1993). What moves the stock and bond markets? A variance decomposition for long-term asset returns. *The journal of finance*, *48*(1), 3-37.

Chen, P. (2018). Understanding international stock market co-movements: A comparison of developed and emerging markets. International Review of Economics & Finance, 56, 451-464.

Chong, C. Y. (2011). Effect of subprime crisis on U.S. stock market return and volatility. Global Economy and Finance Journal, 4(1), 102-111.

Click, R. W., & Plummer, M. G. (2005). Stock market integration in ASEAN after the Asian financial crisis. Journal of Asian Economics, 16(1), 5-28.

Hermanto, Siregar, H., Sembel, R., & Nurmalina, R. (2014). Dampak Penggabungan Bursa Efek Jakarta dan Bursa Efek Surabaya Terhadap Likuiditas Perdagangan Saham dan Rasio Keuangan. Jurnal Ekonomi & Kebijakan Publik, 5(2), 161-172.

Huyghebaert, N., & Wang, L. (2010). The co-movement of stock markets in East Asia: Did the 1997–1998 Asian financial crisis really strengthen stock market integration?. China Economic Review, 21(1), 98-112.

In, F., Kim, S., Yoon, J. H., & Viney, C. (2001). Dynamic interdependence and volatility transmission of Asian stock markets: Evidence from the Asian Crisis. International Review of Financial Analysis, 10(1), 87-96.

Ivanov, V., & Kilian, L. (2005). A prectitioner's guide to lag order selection for VAR impulse response analysis. Studies in Nonlinear Dynamics & Econometrics, 9(1).

Kenani, J. M., Purnomo, J., & Maoni, F. (2013). The impact of the global financial crisis on the integration of the Chinese and Indonesian stock markets. International Journal of Economics and Finance, 5(9), 69-81.

Kholisoh, L. (2017). Liquidity and volatility on indonesia stock exchange (idx): An evidence of jsx and ssx merger. Economics, 5(5), 492-498.

Lee, C. H., & Chou, P. I. (2020). Structural breaks in the correlations between Asian and U.S. stock markets. The North American Journal of Economics and Finance, 51, 101087.

Luchtenberg, K. L. & Vu, Q. V. (2015). The 2008 financial crisis: Stock market contagion and its determinants. Research in International Business and Finance,Volume 33,Pages 178-203. https://doi.org/10.1016/j.ribaf.2014.09.007.

Morales, L., & Andreosso-O'Callaghan, B. (2012). The current global financial Crisis: Do Asian stock markets show contagion or interdependence effects?. Journal of Asian Economics, 23(6), 616-626.

Nezky, M. (2013). The Impact of US Crisis on Trade and Stock Market in Indonesia. Buletin Ekonomi Moneter Dan Perbankan, 15(3), 83-96. https://doi.org/10.21098/bemp.v15i3.428

Patel, J. B. (2003). Inter-temporal relationship between The U.S. stock market and the emerging markets of Asia. Journal of Business & Economics Research (JBER), 1(10).

Purbawati, N. L. K., & Dana, I. M. (2016). Perbandingan Volatilitas Indeks Harga Saham Gabungan (IHSG) Sebelum dan Setelah Krisis Subprime Mortgage. E-Jurnal Manajemen, 5(2).

Purnomo, B., & Rider, M. W. (2012). Domestic and foreign shocks and the Indonesian stock market: time series evidence. Georgia State University, 1-28.

Robiyanto, R. (2018). Indonesian Stock Market's Dynamic Integration with Asian Stock Markets and World Stock Markets. Jurnal Pengurusan (UKM Journal of Management), 52. Retrieved from https://ejournal.ukm.my/pengurusan/article/view/15362

Samarakoon, L. P. (2011). Stock market interdependence, contagion, and the U.S. financial crisis: The case of emerging and

frontier markets. Journal of International Financial Markets, Institutions and Money, 21(5), 724-742.akoon L (2011)

Shabri Abd. Majid, M., Kameel Mydin Meera, A., & Azmi Omar, M. (2008). Interdependence of ASEAN-5 stock markets from the U.S. and Japan. Global Economic Review, 37(2), 201-225.

Suppakittiwong, T., & Aimpresittichai, S. (2015). A Study of a Relationship Between The U.S. Stock Market and Emerging Stock Markets in Southeast Asia (Dissertation). Retrieved from http://urn.kb.se/resolve?urn=urn:nbn:se:lnu:diva-46781

Thee, K. (2012). The Impact of the Global Financial Crisis on the Indonesian Economy and the Prospects for the Resumption of Rapid and Sustained Growth. In *Indonesia's Economy since Independence* (pp. 126-136). ISEAS–Yusof Ishak Institute.

Wong, W. K., Penm, J., Terrell, R. D., & Lim, K. Y. C. (2004). The relationship between stock markets of major developed countries and Asian emerging markets. Advances in Decision Sciences, 8(4), 201-218.

Yang, A. S., & Pangastuti, A. (2016). Stock market efficiency and liquidity: The Indonesia Stock Exchange merger. Research in International Business and Finance, 36, 28-40.