TRANSMISSION OF STOCK RETURN VOLATILITY IN INDONESIA (IHSG) TOWARDS USA (DJIA), HONGKONG (HSII), AND SINGAPORE (STI)

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This study will analyze how the stock market volatility transmission between Indonesia towads U.S. stock market, Hong Kong and Singapore. This study used the data stock market volatility in period 2000 to 2010. The dynamic response of the volatility of the stock market return in Indonesia of the stock market return volatility shocks in the United States, Hong Kong, and Singapore for 10 days after the shock occurs. On the stock markets of Indonesia, the response given when there are shocks to the volatility of the return of most consecutive returns is volatility in Indonesia itself (IHSG), followed by the volatility of return in Singapore (STI), return volatility in Hong Kong (HSII), and Last is the return volatility in the U.S. (DJIA). In addition, after the shocks, the volatility of stock index return will be relatively stable after a period-4. the variability of the volatility of stock returns in Indonesia due to the contribution volatility of stock returns of Indonesia itself in the first period by 73 percent. The second contribution is a contributor to the volatility of stock returns from Singapore by 22.3 percent, followed by the volatility of stock returns in Hong Kong (4.5 percent) and the volatility of stock returns in the United States (0.15 percent).

Keywords: Volatility Market Transmission, Return Volatility, Volatility Shocks.

INTRODUCTION

Investmen in the stock market is one alternative for investors to make investments. Along with globalization and advances in information technology development, today investors can invest either in the domestic stock market and the stock markets of other countries. In addition, information relating to the circumstances and conditions with regard to stock market investment climate and other countries that will enter the investor can be obtained with relative ease. Planting of investments in domestic and foreign stock markets is a form of international diversification by investors. This has implications for international diversification in reducing risk levels by eliminating the non-systematic volatility without sacrificing returns the expected results. It may be mentioned a free lunch, which is a lower risk but with higher income.

Free lunch from international diversification can occur if the correlations between stock markets lower. That is, if the stock market is decrease (*bearish*), other stock markets increase (*bullish*). However, we know that there are linkages between the stock market country to country. The evidence suggests that the U.S. stock market crash caused by the *subprime mortgage*

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immediately followed by the stock markets in other countries. Increasing integration of economies from country to country can be said to be one of the causes of stock market integration between countries. Another fact that can be captured from the situation on the ground of which is that if the U.S. stock markets closed higher, the stock market is likely other countries will also strengthen as well and vice versa. From the description above, it can be concluded that the incident that occurred while in the U.S. stock market affects the stock markets of other countries. In other words, there is a fairly high correlation between U.S. stock market with a market share of other countries. Moreover, Indonesia Stock Exchange (BEI) on October 8, 2008 due to declining stock index more than 10% are said to be caused by investor panic and do not behave rationally because of the financial crisis that occurred in the United States is also interesting to study and prove that if indeed there is influence between the two stock markets are influenced by events or other things that happened in the country, is not caused by events that occur abroad. In 2008, IHSG yield of -50.64%. When compared with 2006 and 2007, IHSG yield respectively by 55.10% and 52.10%. The composite index reached the peak in the second week in January 2008, reaching 2830.26 and daily had reached 2838.48. The financial crisis triggered by subprime mortgage crisis in the United States, IHSG continues to decline. In late October 2008 stock index hit 1111.39. Meanwhile, at the end of 2008 Composite Index closed at 1355.41.

Many studies have examined the movement of this stock market volatility. However, in general, most studies carried out on stock market volatility in the United States and Japan. Meanwhile, there has been no research done to examine the volatility spillover between the stock market with some of Indonesia's main stock markets in the world. Limitations or the lack of research done to examine the movement of stock market volatility with some of Indonesia's main stock markets in the world makes me interested in doing research. The main stock markets studied were selected for the U.S. stock market, Hong Kong and Singapore. U.S. stock market is one of the most influential stock market in the world. As already explained in the beginning, the stock market collapse spread to the United States entered the stock markets in different countries of the world. Meanwhile, Hong Kong and Singapore stock market is one of the most influential stock markets in Asia.

LITERATURE REVIEW

Eun and Shim (1989) analyze daily returns on stock markets in Australia, Hong Kong, Japan, France, Canada, Switzerland, Germany, the United States, and Britain. They found that there are substantial interdependencies between each of the stock market with the United States became the most influential market. In that condition occurs in the United States, throughout Europe and Asia Pacific markets responded strongly with one day *lag*. Most of the response of *shock* is completed in two days. Hamao, Masulis, and Ng (1990) using the data stock prices daily and intra-daily in the Japanese stock market (Nikkei 225), Britain (FTSE), and the U.S. (S & P 500) over three years (from 1 April 1985 until March 31, 1988). They conducted research on the interdependence of prices and price volatility among the three stock markets.

In conducting the study, the calculation is done by comparing the closing price to opening price, and price opening to the closing price. The study uses *GARCH-M* model (1.1). The results of these studies concluded that there are significant spillover effects from stock market to the U.S. and UK stock markets of Japan, but not vice versa. Mougoue and Bond (1991) conduct

tests on nine stock markets, as researched by Eun and Shim in 1989. They used a VAR model to examine the issue of causality between the nine stock markets, including the United States. The results showed that there were no single national stock markets which could affect the U.S. stock market. Park and Fatemi (1993) investigated the relationship between the stock market countries of the Pacific Basin region with the United States, Britain, and Japan. U.S. market is the most influential compared to the UK, and Japan. In that study, it is found that Australia is the most sensitive to the U.S. market. Singapore, Hong Kong, and New Zealand into the next group that showed mid-level relationships of these markets. Meanwhile, Korea, Taiwan, and Thailand showed small relation to those markets. Pacific Basin economy has a unique structure that is different from countries that have developed and the movement of the stock market is influenced by domestic factors. Lin, Engle, and Ito (1994) conducted a study to investigate how the yield and volatility of stock index mutual correlation between the stock markets of Japan and the United States. The data used are daily data from the Nikkei 225 and S & P 500 index. From these data can be calculated daytime return (ratio between the opening price to closing price), and the overnight return (comparison between the previous closing price to opening price).

Studies that use GARCH-M model is also used by Hamao, Masulis, and Ng (1990) found that daytime return from abroad may affect domestic overnight returns significantly. It is mentioned that the U.S. stock market influence the Japanese stock market but not vice versa. However, in a study conducted by Lin, Engle, and Ito was found that the interdependence between markets in terms of returns and volatility is a bi-directional between the stock markets of Japan and the United States. Janakiramanan and Lamba (1998) examined the empirical relationship between the stock markets in the Pacific Basin region. The results show that the United States affecting all stock markets, except Indonesia stock market is still relatively isolated. Markets which are geographically and economically close to show a significant influence one to another. In general, the influence of the United States market for Australia-Asia market decreased in recent years, and Indonesia developed markets become increasingly integrated with these markets. Ng (2000) examined the magnitude and change the source of volatility spillover from Japan and the United States to six countries the stock market the Pacific Basin region. It is found that regional and global factors are important for stock market volatility in the Pacific Basin region, although the effects appear larger world market. The importance of regional and world stock markets are affected by liberalization. The proportion of stock market volatility states Pacific Basin region obtained from these factors is a small regional and global level. In four of the six Pacific Basin countries, the shock of Japan and the United States together is less than 10% of the weekly variation in yields. Indrawati (2002) use VAR and VEC models with GNC approach to examine the dynamic relationship between macroeconomic variables, monetary and stock market indices. Research results show that the Indonesian stock market is integrated with the U.S. stock market. 1% rise in U.S. stock market will affect the stock index rise by 0.32%. From these studies, it is also concluded that the Indonesian stock market with stock markets of Thailand, Taiwan, and South Korea occurred Granger cause bidirectional relationship. In addition, it is also concluded that all the stock markets (Indonesia, Thailand, Taiwan, and South Korea) is integrated with the U.S. stock market.

Balasubramanyan and Premaratne

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(2003) conducted a study using daily return data from January 1, 1992 until August 26, 2002 to investigate the *volatility spillover* and *comovement* between the Singapore stock market with the stock market the United States, Britain, Hong Kong, and Japan. Balasubramanyan and Premaratne conducted research using *Univariate GARCH model, Vector Auto Regression (VAR), Multivariate GARCH*, and *Multivariate GARCH* with *GJR extensions*. In analysis using *Univariate GARCH*, Balasubramanyan and Premaratne using *GARCH models* (1,1), *EGARCH*, and GJR model. GJR model is more suitable to capture the dynamics of volatility on stock markets in Singapore and Hong Kong. Meanwhile, the EGARCH model is better at capturing the dynamics of stock market volatility in the United States, Britain, and Japan. In general, the shock is transmitted to the Singapore stock market last longer than the stock markets of other countries. It can be shown that the inefficiency of markets in Singapore compared to other markets as the effects of shock last longer. Singapore stock market showed a greater leverage effect compared with other stock markets. The influence of bad news has greater impact on the Singapore stock market compared to other major stock markets.

Research using VAR model by Balasubramanyan and Premaratne aims to understand how the shock and the volatility of one market is transmitted to other markets is clear. Although the VAR is not a model to examine the volatility, but the VAR can provide insight into what happens to the level of multilateral interaction between stock markets and the interdependence structure simultaneously. From the results of studies using the VAR model, the results of variance decomposition showed that the Hong Kong stock market gives the effect of 22% of the forecast error variance of the stock market in Singapore. Meanwhile, the influence of the U.S. stock market, Japan, and England respectively were 12%, 4%, and 1%.

Countries that have economic and geographic proximity such as Singapore and Hong Kong showed a strong relationship. Against the shock that comes from the U.S. stock market, Japan, and Britain, Singapore stock market response lasted for one day and then become insignificant. While the shock of coming from Hong Kong has effects for three days on the Singapore stock market. The study uses multivariate GARCH model shows that the presence of high levels of *volatility comovement* between Hong Kong and the United States, followed by Japan and the UK. There is also a level of very high *volatility comovement* between Singapore, Hong Kong, and the United States.

The results are remarkable that there is significant volatility spillover from Singapore stock market to Hong Kong, Japan and the United States. In terms of influence and domination of the market, the stock market of Hong Kong, Japan and the United States is much more powerful and dominant than the stock market in Singapore. Most studies conducted led to the conclusion that the spillover effect will be significant from a dominant market to the smaller markets, and the only direction.

It becomes interesting to see the results of Balasubramanyan and Premaratne research was found that the volatility spillover is small, but significant, from the Singapore stock market to the stock market of Hong Kong, Japan and the United States. Veiga and McAleer (2004) conducted a study to prove the existence of volatility spillover between the S & P 500, FTSE 100, Nikkei 225 and by using intra-daily data from October 12, 1992 until July 7, 2003. By using a *vector autoregressive moving average asymmetric generalised autoregressive heteroskedasticity* (*VARMA-AGARCH*) devel-

oped by Chan, Hoti and McAleer in 2002, they found that the return spillover occurs in all markets from other markets. While the results of Veiga and McAleer research related to the volatility spillover indicates that there is volatility spillover from the FTSE 100 to the S & P 500 and Nikkei 225. As well, there is also a volatility spillover from the S & P 500 to the FTSE 100.

Mukherjee and Mishra (2008) conducted a study on the volatility spillover to stock markets of India with 12 other Asian stock markets (ie: China, Hong Kong, Indonesia, Japan, Korea, Malaysia, Pakistan, Philippines, Singapore, Sri Lanka, Taiwan, and Thailand) using data from July 1997 until April 2008. In general, Mukherjee and Mishra divide research into two major parts namely spillover research by using daily data (the ratio of the opening price with closing prices), and overnight (the closing price comparison with the opening price). Their study uses GARCH model (1.1). The results related to the intraday information / volatility spillover of intraday volatility indicates that a significant spillover from the stock markets of Hong Kong, Indonesia, Korea, Singapore, and Thailand that affect intraday volatility in the stock market of India. Meanwhile, the volatility spillover from the stock market Indian stock market is just to Pakistan and Sri Lanka. Meanwhile, the overnight information / volatility spillover suggests that there are significant spillover overnight volatility of stock markets of Hong Kong, Korea, Pakistan, Taiwan, and Thailand to the Indian stock market. There is also a significant overnight volatility spillover from the stock market stock market India to China, Hong Kong, Malaysia, Pakistan, and Sri Lanka.

From this research, we can conclude that the *volatility spillover* between India and Pakistan to Hong Kong is two-way. From the description of previous research that has been discussed above.

METHODOLOGY RESEARCH

Data

Data in this paper is the daily return data from the IHSG, DJIA, HSII and STI transmission and volatility in the stock market return volatility in Indonesia (IHSG), USA (DJIA), Hong Kong (HSII), and Singapore (STI) in the period January 2000 through December 2010. Analysis of transmission of stock return volatility will use a combination of ARCH / GARCH and VAR.

The aim of ARCH / GARCH Method is to select the best model for every stock market in a country. Best of each model will be obtained as a residual variable that reflects the volatility of return. If the residual variable that is used on a level stationary or I (0), then the VAR method can be used. Residuals of each model is best will then be analyzed by the method of VAR to identify the response of the volatility of stock market returns in the United States, Hong Kong, and Singapore to shocks in the stock market return volatility of Indonesia and the role of stock market volatility of returns in other countries in explaining the variability of stock market return volatility in Indonesia.

Market return is a picture of the return provided by the market. Market return measure, in consideration of an investment activity. To form the required model data in the form of return. Therefore, data in the form of prices, nominal or index must be first converted into a form of return relative to value stocks in the previous period. Stock index data on any stock exchange stated in advance in the form of relative return. Level of stock index return period is defined as follows:

$$R_t = \ln\left(\frac{I_t}{I_{t-1}}\right) = \ln I_t - \ln I_{t-1} \qquad (1)$$

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Where,
R_t : Stock Return in day-*t*
I_t : Stock Index in day-*t*
I_{t-1} : Stock Index in-t-1

The first step taken in this study is registered entire stock market return data using the technique of OLS (Ordinary Least Square) or also called the least squares analysis. Assumptions underlying the OLS estimation method, among others, must be free of residual autocorrelation and heteroscedasticity problems. The OLS analysis using this assumption is violated, so that the results obtained are not BLUE (Best Linear Unbiased Estimator), by using the software Eviews 6.0, Augmented Dickey-Fuller test (ADF) showed that all the data return was stationary at the level of the real level of 1%, so that in modeling the OLS method can be directly used data level. In Table 1, the Breusch-Godfrey through test and the test will be disclosed whether White Heteroschedasticity OLS model contains autocorrelation and heteroscedasticity problems.

If the variance model is heteroscedasticity, volatility estimation better using ARCH / GARCH. Return the stock index can be expressed in a State of multifactor models that contain variables other State a stock index return and the conditional mean models that are heteroschedasticity. General model of ARCH / GARCH to be used in this analysis are:

$$R_{jt} = \gamma_0 + \gamma_v R_{vt} + e_t, \quad v \neq j \tag{2}$$

$$\sigma_t^2 = \alpha_0 + \alpha_i e_{t-i}^2 + \beta_i \sigma_{t-i}^2 \tag{3}$$

Where,
R_t : Stock Return index in day-*t*
e_t : Error in day -*t*
σ_t^2 : Conditional variance in day-*t*

The model was chosen after a diagnosis test in a remnant. If the diagnosis is not there a remnant effect of ARCH / GARCH (ARCH / GARCH-effect), then the model obtained is correct (fix). One way that can be used to determine whether or not the effects of ARCH / GARCH estimation of the model, namely through the ARCH-LM test.

Selection of The Best Model in ARCH / GARCH

The estimation of GARCH model parameters (p, q) using the maximum probability method or Quasi Maximum Likelihood (QML). This simulation combines the value of p = 0, 1, and 2 with a value of q = 1 and 2, to form 6 (six) for each model range of the stock market.

Table 1 Model Selection of ARCH / GARCH for Indonesia Stock Return

Coefisien	ARCH (1)	ARCH (2)	GARCH (1,1)	GARCH (1,2)	GARCH (2,1)	GARCH (2,2)
c	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
α_1	0.354*	0.320*	0.155*	0.219*	0.284*	0.277*
α_2		0.086*			-0.186*	-0.237*
β_1			0.785*	0.283*	0.869*	1.234*
β_2				0.412*		-0.285*
AIC	-5.897	-5.907	-5.948	-5.954	-5.958	-5.959
SC	-5.883	-5.891	-5.932	-5.936	-5.940	-5.938
ARCH -effect	No	No	no	no	no	no

Note: * significant in real level at 1%, ** significant in real level at 5%

Table 2 shows some of the alternative models of ARCH / GARCH to stock returns Indonesia. Based on the smallest value of AIC and SC, as well as the significance of the coefficient on the model, it tries to be selected GARCH model (2.2) as the best model of stock returns Indonesia. Moreover, in this model there is no more remaining ARCH effects based on ARCH-LM test with a probability value of 0:54 is larger than the real level 5%.

Table 3 shows the various alternative models for the U.S. stock returns. Based on Table 3, the GARCH (2.1) was chosen as the conditional variance. GARCH model selection (2.1) as a model of the U.S. stock returns because it has the smallest value of AIC and SC, as well as no longer remaining ARCH effects based on the ARCH-LM test with a probability value of 0.80 is much larger than the real level 5%.

Table 2 Model Selection of ARCH / GARCH for U.S. Stock Return

Coefisien	ARCH (1)	ARCH (2)	GARCH (1,1)	GARCH (1,2)	GARCH (2,1)	GARCH (2,2)
c	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
α_1	0.344*	0.240*	0.093*	0.065*	0.051*	0.051*
α_2		0.345*			0.055*	0.054*
β_1			0.897*	1.290*	0.882*	0.891*
β_2				-0.362*		-0.008*
AIC	-5.970	-6.077	-6.266	-6.266	-6.267	-6.266
SC	-5.956	-6.061	-6.249	-6.247	-6.248	-6.245
ARCH -effect	No	No	no	no	no	no

Note: * significant in real level at 1%, ** significant in real level at 5%

Table 4 shows that the GARCH (2.1) is selected as worthy of conditional variance. GARCH model selection (2.1) as the best model Hong Kong stock returns because it has the smallest value of AIC and SC, as well as no longer remaining ARCH effects based on the ARCH-LM test with probability values greater than 0:20 the real level 5%.

Further in Table 5, several alternative models of stock returns, selected GARCH (2.1) as the conditional variance. GARCH model selection (2.1) as the best model stock returns in Singapore because it has the smallest value of AIC and SC, as well as no longer remaining ARCH effects based on the ARCH-LM test with probability values greater than 0:58 the real level 5%.

Table 3 The Model Selection of ARCH / GARCH for Hong Kong Stock Return

Coefisien	ARCH (1)	ARCH (2)	GARCH (1,1)	GARCH (1,2)	GARCH (2,1)	GARCH (2,2)
c	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
α_1	0.294*	0.329*	0.051*	0.074*	0.093*	0.093*

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α_2		0.211*			0.049*	0.046*
β_1			0.945*	0.400*	0.952*	0.897*
β_2				-0.519*		-0.052*
AIC	-6.156	-6.201	-6.347	-6.348	-6.348	-6.347
SC	-6.142	-6.185	-6.331	-6.329	-6.330	-6.326
ARCH -effect	No	No	no	no	no	no

Note: * significant in real level at 1%, ** significant in real level at 5%

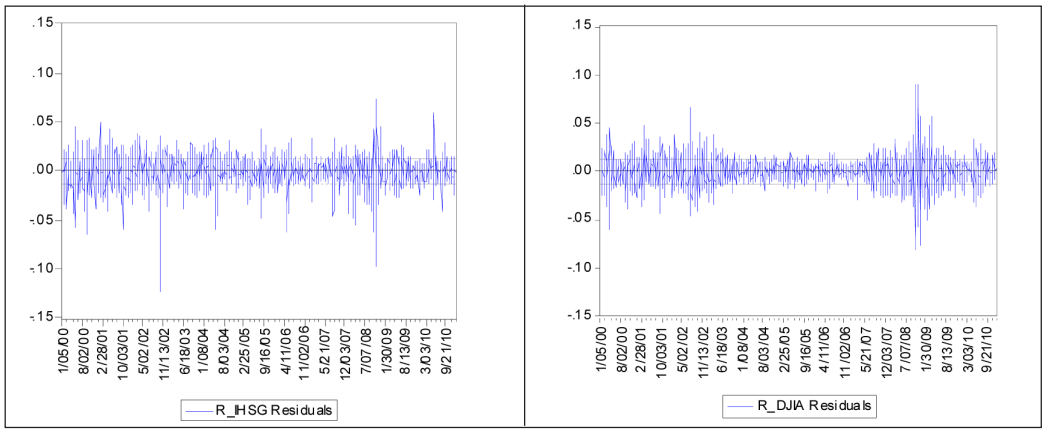
Table 4 The Model Selection of ARCH / GARCH for Singapore Stock Return

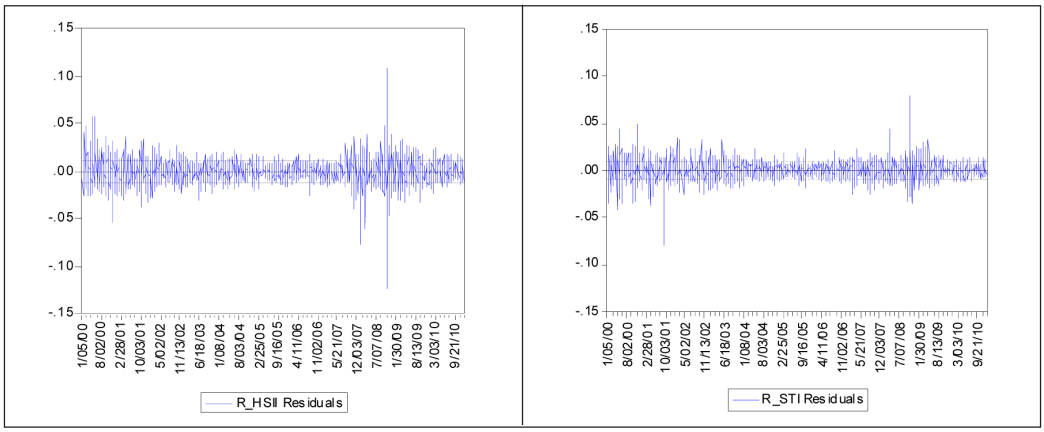
Coefisien	ARCH (1)	ARCH (2)	GARCH (1,1)	GARCH (1,2)	GARCH (2,1)	GARCH (2,2)
c	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
α_1	0.262*	0.238*	0.044*	0.065*	0.119*	0.118*
α_2		0.090*			-0.095*	-0.095*
β_1			0.953*	1.121*	0.973*	1.021*
β_2				0.808*		-0.047*
AIC	-6.619	-6.627	-6.738	-6.740	-6.743	-6.742
SC	-6.605	-6.610	-6.722	-6.721	-6.724	-6.721
ARCH -effect	No	No	no	no	no	no

Note: * significant in real level at 1%, ** significant in real level at 5%

After getting the best modeling for stock returns of each country, data taken from each model residualnya. These data reflect the residual stock return volatility of each stock market are analyzed in this study. Figure 1 shows the residual of each model for stock returns in each country.

Figure 1 Stocks Return Volatility in Indonesia, the United States, Hong Kong, and Singapore





Based on Figure 1, it can be seen that the stock market volatility in Indonesia has a relatively higher return than the stock market in the United States, Hongkong and Singapore. This condition has two consequences. On the one hand, this condition reflects a huge profit opportunity in a relatively short in the stock markets of Indonesia, but on the other hand, the stock market in Indonesia offers a high-risk investment, for investors who have the characteristics of the risk taker, then most likely to invest in the stock markets of Indonesia.

The next section will analyze the transmission of volatility in the stock markets of Indonesia. Basically the volatility transmission is to see how the movement of the volatility in the stock market can affect stock market volatility on the other. This study focused on analyzing the transmission that occurred in the Indonesian stock market. Therefore, the analysis of volatility transmission will be discussed. First, response to the volatility of stock market returns in Indonesia to shocks in the stock market return volatility given. Second, role of stock market return volatility in other countries in explaining the volatility of stock market returns in Indonesia. Research methods in the analysis of volatility transmission will use the method Vector Autoregression (VAR). Testing stages of pre-estimation, such as the Granger Causality test, virgin stationarity test, determining the optimal lag on this analysis the same way as the VAR method in the analysis of the factors that influence the volatility of stocks in Indonesia.

Pre-testing of VAR Estimation Ordering: Granger Causality Test

VAR method is a method that will determine its own dynamic structure of a model. After doing the test VAR, it is necessary to characterize the structure of the method can be dynamically generated by the VAR is clear. This test was conducted to examine the dynamic structure of the system variables in the model represented by the variables of innovation. This test consists of Impulse Response Function (IRF) and Forecast Error Decomposition Model (FEVD). IRF results are very sensitive to the ordering (ordering) variables used in the calculation. Therefore the variable ordering is done by putting the variables that have predictive value for other variables in the front next to each other.

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Table 5 Causalities test Granger for Transmission Volatilities Model

	resid_ihsg	resid_djia	resid_hsii	resid_sti
resid_ihsg		0.48548	5.82422*	3.48459*
resid_djia	3.33810*		72.2302*	14.7875*
resid_hsii	2.38828**	1.62884		8.20475*
resid_sti	3.04064*	0.74698	2.34571**	

Note: * significant in real level at 5%, ** significant in real level at 10%

Based on Table 6, it can be seen that the variable that most affects the other variable is a variable resid_djia (residual stock return model the United States). Furthermore resid_ihsg, resid_hsii, and resid_sti occupy the same position, which is affecting the other two variables.

Stationarity Test Data

Tests conducted by the Augmented Dickey-Fuller test (ADF). This test is very important to do in order to avoid spurious regression if the data is not stationary. ADF test results for volatility transmission model can be seen in Table 7.

Table 6 The result of test for Transmission Volatilities Model

Variables	ADF Test Statistic in Level	
	Constanta without trend	Constanta with trand
resid_ihsg	-45.22032**	-45.24421**
resid_djia	-41.07558**	-41.06937**
resid_hsii	-38.75329**	-38.74700**
resid_sti	-52.17744**	-52.17099**

ADF test comparing with MacKinnon table,
** is reject the null hypothesis atlevel of 1%.

Based on Table 7, the unit root test results at the level indicated that all variables have been stationary at the 1% level using either a real constant without trend or constant with the trend. If all data are stationary in level, the estimated VAR to the data can be directly used on the level. It can be concluded that this analysis will be done using the VAR level.

Determination of Optimal Lag

Determination of optimal lag is important because the method of optimal VAR lag of endogenous variables are the independent variables used in the model. Based on testing performed, it was found that the VAR model for the transmission of volatility is found lagnya maximum is 288. Determination of optimal lag in this study based on criteria that provide the shortest lag, it is intended to simplify the model are obtained. Optimal lag test results are shown in Table 8.

In Table 8 we can see based on the criteria that the information provided in Schwarz Information Criteria (SC), the selected lag is the lag-1. Therefore, the equa-

tion will be tested with the VAR lag 1 as the optimal lag.

Sorting of variables in the analysis of IRF on volatility transmission analysis is also based on Cholesky factorization. On the Granger causality test has been known that the residual model of stock return volatility of the United States has a significant probability that most of the influence of other variables. Therefore, the variable ordering resid_djia will be placed at the front, and the order is determined based on the probability of a second most significant, and so on.

Table 7 The result of Lag Optimal test for Transition Volatilities Model

Lag	LL	LR	FPE	AIC	
0	27880.89	NA	1.31e-16	-25.21655	-25.20623
1	28130.97	499.0262	1.06e-16	-25.42829	-25.37671*
2	28189.12	115.8293	1.02e-16	-25.46641	-25.37359
3	28218.32	58.04514	1.01e-16*	-25.47835*	-25.34426
4	28231.05	25.27217	1.01e-16	-25.47540	-25.30005
5	28242.98	23.63817	1.02e-16	-25.47172	-25.25512
6	28259.91	33.47391	1.02e-16	-25.47256	-25.21470
7	28270.59	21.07750	1.02e-16	-25.46774	-25.16863
8	28287.00	32.34155	1.02e-16	-25.46812	-25.12775
9	28300.85	27.23010	1.02e-16	-25.46617	-25.08454
10	28324.80	47.00263	1.02e-16	-25.47336	-25.05047

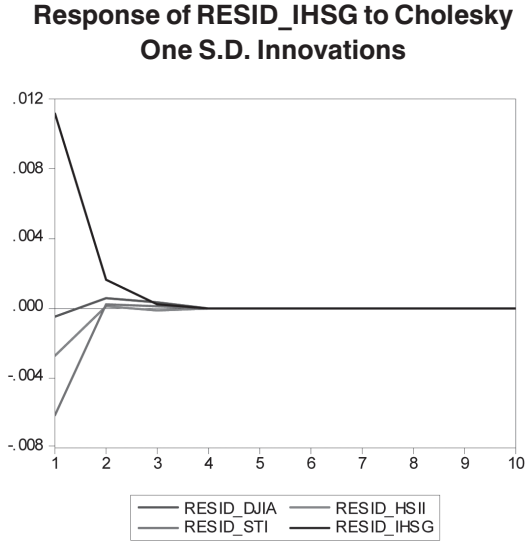
Note: * is the null hypothesis that rejected at the real level 5%

Impulse Response Function Analysis of Stock Market Return Volatility Indonesia

Figure 2 shows the dynamic response of the volatility of the stock market return in Indonesia of the stock market return volatility shocks in the United States, Hong Kong, and Singapore for 10 days after the shock occurs. On the stock markets of Indonesia, the response given when there are shocks to the volatility of the return of most consecutive returns is volatility in Indonesia itself (IHSG), followed by the volatility of return in Singapore (STI), return volatility in Hong Kong (HSII), and Last is the return volatility in the U.S. (DJIA). In addition, after the shocks, the volatility of stock index return will be relatively stable after a period-4.

Figure 2

Stock Market Return's Volatility Response in the United States, Hong Kong, and Singapore to Indonesia Stock Market's Return Volatility.



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The Analysis of Forecast Error Variance Decomposition (FEVD) Indonesia Stock Market Return Volatility

In Table 8 and Figure 3 show that the variability of the volatility of stock returns in Indonesia due to the contribution volatility of stock returns of Indonesia itself in the first period by 73 percent. The second contribution is a contributor to the volatility of stock returns from Singapore by 22.3 percent, followed by the volatility of stock returns in Hong Kong (4.5 percent) and the volatility of stock returns in the United States (0.15 percent). Until the end of the period, the variability of the volatility of stock returns is caused by the contribution Indonesia remains internal factors, which amounted to 73.2 percent.

Figure 3

FEVD Volatilities Return Indonesia Stock Market

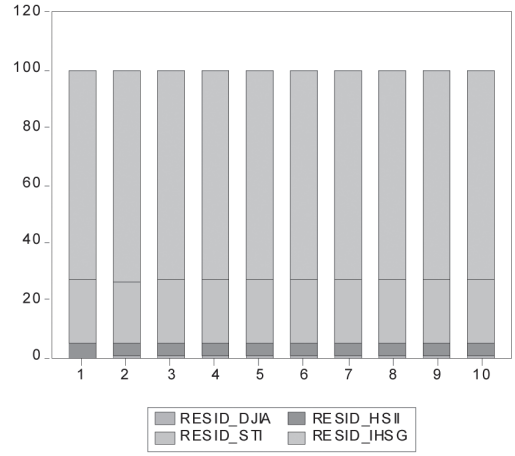

Table 8 The Analysis of Forecast Error Variance Decomposition (FEVD) Indonesia Stock Market Return Volatility

Period	S.E.	RESID_DJIA	RESID_HSII	RESID_STI	RESID_IHSG
1	0.012811	0.147817	4.525894	22.33207	72.99422
2	0.012956	0.345664	4.453202	21.94353	73.25761
3	0.012958	0.423638	4.453979	21.92429	73.19809
4	0.012958	0.423934	4.454073	21.92418	73.19781
5	0.012958	0.423937	4.454073	21.92418	73.19781
6	0.012958	0.423937	4.454073	21.92418	73.19781
7	0.012958	0.423937	4.454073	21.92418	73.19781
8	0.012958	0.423937	4.454073	21.92418	73.19781
9	0.012958	0.423937	4.454073	21.92418	73.19781
10	0.012958	0.423937	4.454073	21.92418	73.19781

Cholesky Ordering: RESID_DJIA RESID_HSII RESID_STI RESID_IHSG

CONCLUSION

Variables that most influence the other variables are residual stock return model of the United States, then the stock return model Indonesia, Hong Kong and Singapore. The result shows the dynamic response analysis of IRF return volatility of the stock market in Indonesia for the stock market return volatility shocks in the United States, Hong Kong, and Singapore for 10 days after the shock arise. In the stock markets of Indonesia, the response was given when there are shocks to the volatility of the return of most consecutive returns

is volatility in Indonesia (IHSG), followed by the volatility of return in Singapore (STI), return volatility in Hong Kong (HSII), and Last is the return volatility in the U.S. (DJIA). Based on these results, investors of stock market volatility in Indonesia need to pay attention to the stock market that occurred in the United States, Hong Kong and Singapore which may affect the volatility of the domestic. The existence of stock market volatility spillover from the three countries may affect the volatility of the stock market that occurred in Indonesia. Meanwhile, for the development of further research it may be advisable to use a multivariate *GARCH* model to be able to see the interaction between the three stock markets together. Can be considered to examine how the influence of European stock markets of Indonesia. Thus it can be seen how the stock market Indonesia interaction with the major stock markets in the world, and know which are the major stock market that gives effect to the volatility of the stock markets of Indonesia.

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