The Impact of Macroeconomic Variables on JCI's Stock Return Volatility in Pre and Post Global Economic Crisis

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Abstract- The purpose of this paper is to investigate the impact of macroeconomic factors on the JCI's stock return volatility in pre and post the 2008's global economic crisis (2002-2014). International macroeconomic variables used in this study are Dow Jones Industrial index and gold price, while the domestic macroeconomic variables used are the exchange rate, interest rate and inflation rate. This study uses the ARCH-GARCH method to see the effect of macroeconomic variables on JCI's return volatility. Based on the results of this study, it is found that two variables, namely DJI and the exchange rate have significant positive effect on JCI's return volatility, while three variables which are gold price, interest rate and inflation have no significant effect on JCI's return volatility.

Index Terms- risk; stock return volatility; macroeconomics variables; arch-garch

I. INTRODUCTION

There are two factors considered by investors before investing in stocks: stock's returns and stock's risks. Return is the investor profits on stock investment, while the risk is the difference in expected return from the actual return. Return and risk of securities theoretically have positive relationship, the greater the expected return is received, the greater the risk is obtained, and vice versa. Return and risk are high on the stock relates to the characteristics of the condition of the company, industry and macroeconomic conditions (Santoso 2005). With globalization and financial integration, macroeconomic factors that affect stock return and risk are not only domestic macroeconomic factors but are also non-domestic (international) macroeconomic factors.

Table 1 Changes in Stock Price Index in November 2008 Global Exchange

Country	Stock Price Index	Changes in Stock Price Index Per 21 Nov 2007-21 Nov 2008 (%)
Indonesia	Jakarta Composite Index (JCI)	↓ 55,29
Hongkong	Hang Seng Index (HSI)	↓ 52,44
Singapore	Straits Time Index (STI)	↓ 50,34
Japan	Nikkei 225 Index (N225)	↓ 46,68
France	Cotation Assistee en Continu (CAC 40)	↓ 46,98
Germany	Financial Times Stock Excange Index (FTSE)	↓ 37,72
USA	Standard and Poor's 500 (S&P500)	↓ 43,53
	Dow Jones Industrial Average (DJI)	↓ 37,13

In mid 2007, the United States was having subprime mortgage crisis that peaked in September 2008, when several giant financial institutions like Lehman Brothers, Merrill Lynch, AIG and other financial institutions declared bankruptcy. The impact of subprime mortgage in USA, where US dollar repatriation makes global financial crisis including Indonesia (Pranowo *et al*) This caused the entire world stock markets experienced a sharp correction. The financial crisis did not only occured in the United States, but also spread into other continent Europe and Asia, including Indonesia. JCI commencing from 21 November 2007 to 21 November 2008 decreased by 55.29% during the period of the subprime mortgage crisis. Like JCI, other stock price index in the global stock markets experienced a sharp correction as shown in Table 1. The empirical results of Achsani's research show that shocks in the developed markets are immediately transmitted to other markets, while shocks in the emerging markets are also transmitted to other markets but without such a big effect compared to those developed markets (Achsani 2004).

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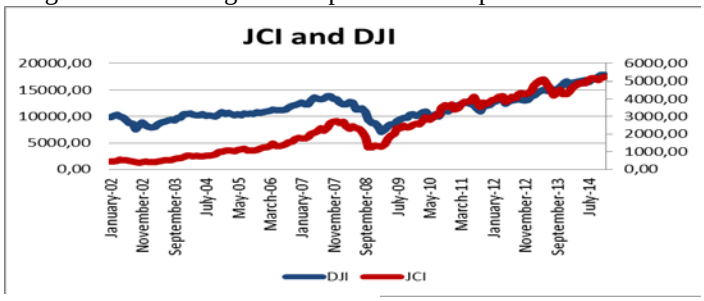
Shocks in the US have strong impact on the European markets as well as on the Asian markets, but influence of the US markets to Europe is stronger than to Asia (Achsani 2006). As a growing capital market, Indonesia Stock Exchange is allegedly affected by world stock market indexes, such as Dow Jones Industrial Average (DJI) of the US stock market. DJI is the composite stock price index on the stock exchanges of New York Stock Exchange. The linkage indexes in the global stock markets are shown in Table 1, where during the 2008's global financial crisis, the stock price index in the global exchange both developing countries and developed countries, experienced a sharp correction, in Figure 1, more specifically is shown the relationship between the US stock market (DJI) with stock markets in Indonesia (JCI).

Volatility is one important concepts in the field of finance. Volatility is measured by the standard deviation or variance of return and is used to measure the risk of a financial asset (Brooks 2002). High volatility indicates a stage wherein relatively high fluctuation, then followed by low volatility and high return (Juanda and Junaidi 2012).

Macroeconomic conditions affect the volatility of the stock in a country, this is due to macroeconomic conditions are factors that affect the company's day-to-day operations. The ability of investors to understand and forecast the future macroeconomic conditions will be very useful in making profitable investment decisions. Therefore, an investor should consider several macroeconomic indicators that may assist investors in making investment decisions (Kewal 2012). Macroeconomic indicators often associated with capital markets, fluctuations in interest rates, inflation, the exchange rate, oil prices and the world gold price.

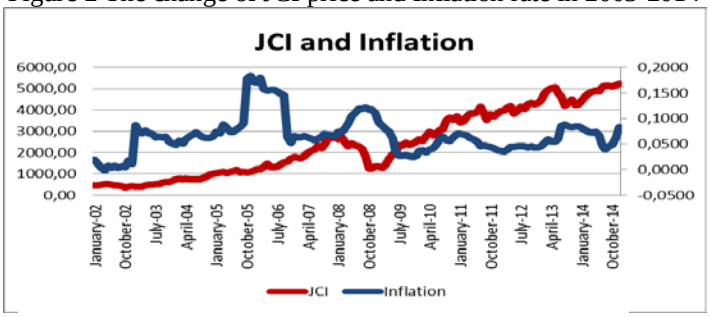
Figure 1. The change of JCI price and DJI price in 2001-2014



Source : Indonesia Stock Exchange

Inflation has always been one of the most important macroeconomic issues (Achsani 2010). At the 2008's global economic crisis, stock returns fell sharply, while fluctuations in the inflation rate has increased, as shown in Figure 2. However, according to Halim 2013, interest rate fluctuations and inflation rate do not significantly affect on stock return volatility. Slightly different from the results Halim (2013), according to Mardiyati & Rosalina (2013), the change in interest rates and inflation have a positive effect on stock return volatility but not significant.

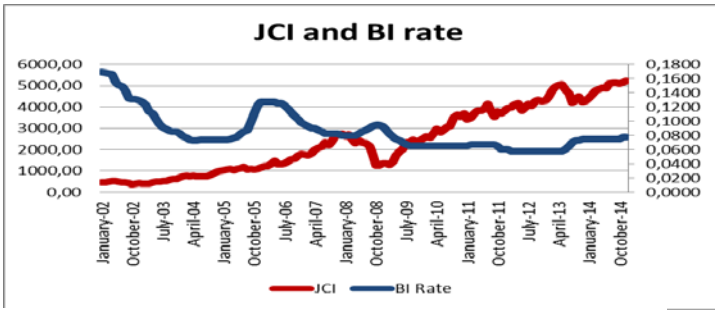
Figure 2 The change of JCI price and Inflation rate in 2003-2014



Source : Indonesia Stock Exchange and Bank of Indonesia

The interest rate is one of the attractions for investors to invest in deposits so that investment in stocks will be rivaled. According to Cahyono in Mardiyati & Rosalina (2013) there are two explanations why the interest rate rise could push stock prices down. First, an increase in interest rates changes the map of investment returns. Secondly, the increase in interest rates would cut corporate profits. The increase in interest rates would increase interest expense issuers, so that profits could be cut.

Figure 3 The change of JCI price and Interest rate (BI rate) in 2003-2014



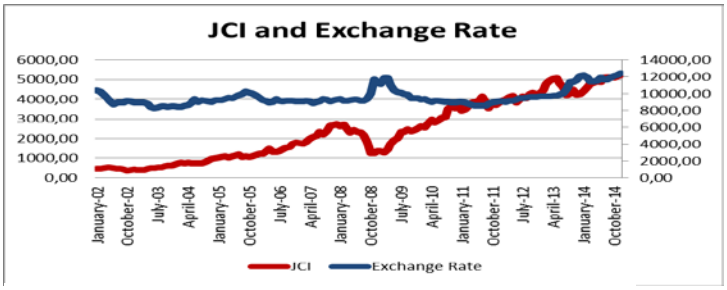
Source : Bank of Indonesia and the Indonesia Stock Exchange

Additionally, when interest rates rise, the cost of production will increase and prices will be more expensive so that consumers may be put off their purchases and save their money in banks. As a result, the company's sales will decrease and this will cause a decline in profits that would depress stock prices. In Figure 3 is shown in 2008's global economic crisis, stock returns fell sharply, while interest rate increased.

Stability of the exchange rate is very important because it affects the level of the country's economy (Yuswandy 2012). Changes in exchange rates can impacts the indexes on Stock Exchange differently because the change of interest rate affects the performance of the company. Depreciation of the rupiah could increase the company's revenue for export company so that the value of the index on the Stock Exchange is increasing. But the depreciation of the rupiah can also lead to decrease in value of the index on the Stock Exchange for the money market can

generate a higher return, so investors more interested in putting their money in the money market (Asih 2013).

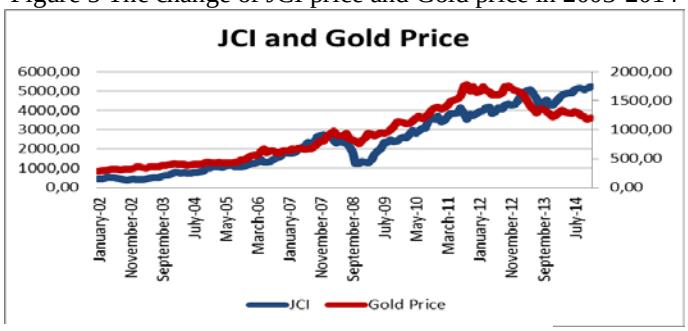
Figure 4 The change of JCI price and Exchange rate in 2003-2014



Source : Indonesia Stock Exchange and Bank of Indonesia

According to Mardiyati & Rosalina (2013) exchange rate has negative and significant impact on the stock price index. Contrary to the opinion of Mardiyati & Rosalina (2013), Aamir (2012) stated the exchange rate has significant and positive effect on the stock price volatility. The same thing is also clearly visible in Figure 4 where at the 2008's global economic crisis the JCI price was corrected sharply followed by the depreciation of the exchange rate against the dollar.

Figure 5 The change of JCI price and Gold price in 2003-2014



Source : Indonesia Stock Exchange and Indexmundi

Investment in gold is believed to be one of the profitable commodities because the price tends to increase, gold is also a form of investment that is very liquid, because it can be accepted on the territory or in any country. When the potential return invest in stocks or bonds are no longer attractive and considered unable to compensate the risks involved, investors will shift their funds into real assets such as precious metals or property which is considered more feasible and safe (Rusbariand *et al* 2012). Sutanto *et al* (2013) found that gold price has significant and positive effect on stock returns, the same thing also expressed by (Silim 2013). In Figure 5 is shown the change of JCI prices and gold prices over the last 11 years.

Research purposes

Based on the description in the background, some of the problems that can be identified are:

1. How does the US stock index (Dow Jones Industrial) affect the volatility return of the JCI in pre and post the global economic crisis?
2. How do the influence of macroeconomic variables (exchange rate, inflation and BI rate) and the price of gold affect the the volatility return of JCI in pre and post global economic crisis?

II. PEER REVIEW

Fauzi conducted a thesis research in 2009 which aimed to analyze the response of international stock price index to sub-prime mortgage crisis's shock . The model used were the VAR-VECM and ARCH-GARCH with the data from the world stock price indexes (JCI , KLCI , STI , SET , PSE , the Nikkei 225 index , SCI , KOSPI , HSI , TWI , FTSE 100 , CAC 40 , DAX , SMI and the S&P 500). Results of research showed that the stock market conditions in the United States affect the domestic (Indonesian) stock market and the response given to the shock of the United States is large enough for the stock market in the country in addition to external factors, the condition of the domestic stock market is also influenced by internal factors (domestic macroeconomic conditions) .

Thesis research conducted by Naditia (2013) aimed to analyze the characteristics of stock returns, to analyze the impact of the rupiah against the US dollar and the impact of oil prices to return and volatility of the stock, and to analyze the risks of equity investment firms in the mining sector. The model used by Naditia (2013) were EGARCH and VaR (*Value at Risk*) with daily stock price of data mining subsector ranging from 2008 to 2012. Based on the analysis of the influence of macroeconomic variables, it is concluded that the exchange rate has significant and negative effect on stock returns while the world oil prices has positive and significant effect on stock return in the mining sector. Macroeconomic variables influence on the exchange rate and world oil prices against the volatility of the stock showed that the exchange rate has no significant effect on the volatility of stock, while global oil prices has significant and negative effect on the volatility of the mining sector.

Thesis research conducted by Ajireswara (2014) aimed to analyze the existence of return volatility in some world stock indexes as well as sectoral index on IDX, to analyze the speed of response of return volatility of JCI and IDX sectoral indexes to transmission of the volatility of other indexes as well as analyze the decomposition of the volatility source in the stock index as well as IDX sectoral indexes. The model used were EGARCH and VAR (Vector Autoregression Model). Ajireswara research indicated the negative existence of asymmetric return volatility. Indexes with relatively high return volatility were the index of Japan, Hong Kong and Indonesia, while the indexes with relatively low volatility were the index of the UK, Singapore and the United States. The impulse response function test showed that the greatest volatility came from Singapore and the United States. Variance decomposition results showed that the volatility of returns on JCI and sectoral indexes were predominantly influenced by internal factors (JCI itself) as well as the sectoral indexes.

III. METHODS

To support this research, ARCH-GARCH data analysis methods models was used with the help of software Eviews 6 and Microsoft Excel 2010. ARCH (Auto Regressive Conditional

Heteoscedasticity) was first introduced by Engle (1982) to model the residual volatility that often occurs in the finance data.

Composite return volatility of Stock Price Index can be expressed in multifactor models that contain variables: JCI, DJI, inflation, exchange rate, BI-rate and the price of gold and the conditional mean models that are heteroskedastic. The equation can be written as follows:

$$VRJCI = \alpha_0 + \alpha_1 DJI_t + \alpha_2 ER_t + \alpha_3 Gold_t + \alpha_4 IR_t + \alpha_5 I_t + \varepsilon_t$$

Description:
VRJCI : Return volatility of Jakarta Composite Index (JCI)
DJI : Dow Jones Industrial Index
ER : Exchange Rate
Gold : Gold Price
IR : Interest Rate
I : Inflation
ε_t : error for *t* period
σ_t^2 : conditional variance

GARCH can be estimated with the maximum likelihood method. This modelling requires several stages of data testing to determine the data are significant to the model. The testing model processes are:

Stasionarity Test

Statistical test to determine the data to be in stationary condition or not, can be proven by the Unit Root Test. Dickey-Fuller test is used to do this test method or Augmen Dickey-Fuller test (ADF). Hypothesis used for testing Augmented Dickey Fuller (ADF) are as follows:

H_0 : There is a unit root/data is not stationary
H_1 : No unit root/data is already stationary

If the probability value > α = 5% then reject H_0 or mean data is stationary. Conversely, if the probability value < α = 5% then accept H_0 or meaningful data is not stationary.

Multicolinearity Test

Multicolineary test is used to determine whether the independent variable *X* is associated with the other independent variable *X*. to regress each independent variable *X* with Multicolinearity test used is the auxiliary regression method is to perform a regression of each independent variable *X* with the rest of the independent variables *X*. After performing auxiliary regression, the regression of coefficient of determination $R^2_{X1X2X3..Xk}$ auxiliary compared to the coefficient of determination R^2 of the original model (*Y*) with independent variable *X*. If the coefficient of determination $R^2_{X1X2X2..Xk}$ auxiliary regression is greater than R^2, the model contains elements of multicolinearity between variables independent and otherwise there is no correlation between the independent variables (Widarjono, 2005).

Autocorrelation Test

This test can be done with Breusch-Godfrey test. This test is also known as Lagrange Multiplier test (multiplier lagrange). Hypothesis used in Breusch-Godfrey test are:

H_0 : Autocorrelation contained in the residual
H_1 : There is currently no autocorrelation in residuals.

If the probability value > α = 5%, reject H_0 or it means data does not contain the problem of autocorrelation.

Heteroscedasticity Test

Heteroscedasticity process can be performed with Wihe Test. To determine whether a residual is heteroscedastic or homoscedastic, statistical test is done by using the following hypotheses:

H_0 : residuals are homoscedastic
H_1 : residuals are heteroscedastic

If the probability value Obs*R-square < α = 5% then reject H_0 or it means residuals are heteroscedastic.

Model Selection Criteria

This test is to determine the best model. There are several stages of testing such as: feasibility/validity of the model, tests of significance, the coefficient sign test, ARCH effect test and AIC values and SC test.

ARCH Effects Test

Selection of eligibility/validity of a model of ARCH-GARCH done with residual correlogram test that includes squared residuals testing and ARCH LM test. This test is done to see if the model still has ARCH effect or not. The existence of ARCH effect can be seen from the AC and PAC that were not significant (greater than 0.05) as well as the significance level that is less than the degree of confidence (α = 5%) (Agus Widarjono 2005). The model is a fit model if it does not contain ARCH effects with significant value of AC and PAC (less than 0.05).

Value of SC and AIC Test

The analysis of the data, we can have some of the good models that can represent the analyzed data. If there is more than one alternative model that has been good, there should be comparative statistical information. Statistical information which can be used as a comparison among other AIC (Akaike Information Criterion) and SC (Scharz Criterion). The second form of the equation of these parameters are:

$$AIC = log\left(\frac{\sum \varepsilon_1^2}{n}\right) + \frac{2k}{n} \quad \text{.....(3.2)}$$

$$SC = log\left(\frac{\sum \varepsilon_1^2}{n}\right) + \frac{k \log n}{n} \quad \text{.....(3.3)}$$

Description
K : number of estimated parameters
n : number of observations
$\sum \varepsilon_1^2$: Residual sum of squares

The best model is the model that has the smallest value of AIC and SC.

IV. STUDIES AND FINDING

Stationarity test

Table 2 shows that the data for the independent variable interest rate (BI rate) is already stationary at level while the dependent variable and the others independent variables DJI stock index, exchange rate, gold price and inflation are not stationary so it is needed to do the first differencing for the data in order to be stationary. After the first differencing, all of the data are stationary at the 5% significance level.

Table 2 Result of the stasionary test

Variable	ADF Value	Critical Value (alpha =%)	Probability	Description
JCI	-1,218713	-2,880211	0,9739	Not stationary
First Difference JCI	-9,702089	-2,880211	0,0000	Stationary at level 1
DJI	-0,383219	-2,880211	0,9079	Not stationary
First Difference DJI	-11,13806	-2,880211	0,0002	Stationary at level 1
LNExchange Rate	-1,322573	-2,880211	0,6183	Not stationary
First Difference LNKurs	-9,093813	-2,880211	0,0000	Stationary at level 1
LNGold	-1,960513	-2,880211	0,3041	Not stationary
First Difference LNGold	-11,12305	-2,880211	0,0000	Stationary at level 1
Inflation	-2,798474	-2,880211	0,0608	Not stationary
First Difference Inflation	-11,07905	-2,880211	0,0000	Stationary at level 1
BI rate	-3,512973	-2,880211	0,0089	Stationary at level

Multicolinearity test.

Table 3 Results of Auxiliary regression

Regression	R^2	R^{2*}
DJI	0,152379	0,463256
Exchange Rate	0,221566	
Gold	0,104705	
Inflation	0,005965	
BI Rate	0,102052	

Description : R^{2*} is the main model R^2

The results of the auxiliary regression found that the value of R^2 is smaller than the main model regression R^{*2} so it is concluded that there was no existence of multicolinearity problem among independent variables.

Model For Measuring JCI's Volatility Return

To establish a model for measuring the JCI stock index return volatility it is required data such as DJI stock index, exchange rate, gold price, interest rate (BI rate) and inflation. In this study, data were taken from the period January 2002 to December 2014.

Autocorrelation Test

Breusch-Godfrey test produced *Obs*R-squared* probability value of 0.1366, this value is greater than 5% significance level so that it can be concluded to reject H_0. It means that the data do not contain the problem of autocorrelation.

Heteroscedasticity Test

Tests on the conditional mean squared residual equation with *White test* probability values showed that *Obs * R-square* of 0.0011 is smaller than $\alpha = 5\%$, so it can be concluded to reject H_0 or in other words the data is heteroscedastic so it is better to use ARCH-GARCH to estimate the volatility.

Model

Parameter estimation of ARCH-GARCH (p, q) model used *maximum likelihood* methods or *Quasi Maximum Likelihood* (QML). This model combines simulation $p = 0$, 1 and 2 with a value of $q = 0$, 1 and 2. The results of the estimation of all alternative models of ARCH-GARCH then compared to one another, the first thing noticed is the feasibility/validity of the model, then in terms of significance, the sign of coefficients, AIC and SC with the smallest value are selected as the best model.

Appraisal/authenticity of ARCH-GARCH models is done with residual test including squared residual correlogram test, histogram-normality test and ARCH-LM test. Based on the *Correlogram squared residuals test* and ARCH-LM *test* as shown in Table 4, six models are free of ARCH effect and the data is not distributed normally. Then the next phase is comparing the significance, sign of coefficients, and the value of AIC and SC. From The result of estimation appeared that the model ARCH (1), ARCH (2), GARCH (1,1) and GARCH (1,2) and GARCH (2,2) have two significant variables while GARCH (2,1) has three significant variables

Table 4 *Residual Test*

	ARCH (1)	ARCH (2)	GARCH (1,1)	GARCH (2,1)	GARCH (1,2)	GARCH (2,2)
Cor Squared Residual	No Yes	No Yes	No Yes	No Yes	No Yes	No Yes
ARCH LM test	No Yes	No Yes	No Yes	No Yes	No Yes	No Yes
Normality Test						
Normality	Not Normal	Not Normal	Not Normal	Not Normal	Not Normal	Not Normal

The coefficient sign test results showed that the coefficients sign of model ARCH (1) and ARCH (2) have two variables that have the same coefficient sign as the sign of hypothesis variable coefficients, which are variable DJI and Gold. GARCH (1,1) and GARCH (1,2) have three variables that have the same coefficient signs as hypothesis variable coefficients signs, which are variables DJI, Gold and BI rate. While GARCH (2,1) and GARCH (2,2) have four variables that have the same coefficient signs as hypothesis variable coefficients sign, which are variable DJI, Gold, BI rate and inflation.

The best model is the model that has the smallest value of AIC and SC. Based on the AIC and SC test, GARCH (2,1) is the model that has the smallest AIC and SIC compared to five other models. So, GARCH (2,1) was chosen as the best model for analysis.

Interpretation Results

Based on the feasibility test, GARCH (2,1) is the best model that will be used for this study. The following Table 5 presented a statistical test/test of significance of the regression results GARCH (2,1).

Tabel 5 Results of regression models GARCH (2,1)

Variable	Koefisien	t-Statistic	Probability
C	0.006547	0.000865	0.0000
DJI	0.637169	0.050550	0.0000
Exchange Rate	0.028932	0.013012	0.0262
Gold	0.014785	0.008038	0.0659
BI rate	-0.007279	0.010925	0.5053
Inflation	-0.000326	0.034570	0.9925
R^2			0.455558
F-statistic			13.48083
Prob (F-statistic)			0.000000

The F-statistic

As shown in Table 5, the value of F-statistic obtained at 13.48083 and the value of the probability of F is 0.0000 which is smaller than the value of α = 5% (0.05). This means that the independent variable DJI, the exchange rate, the price of gold, interest rate (BI rate) and inflation simultaneously have significant effect on the dependent variable (JCI).

T-test statistics.

The Dow Jones Industrial Average Index

DJI variable has smaller value than the probability of the level of 0.05 which is 0.00. It means that variable DJI has significant effect on JCI return volatility. Coefficient value of DJI is 0.637169, which means that if the risk rate of DJI return stock index rises 1%, the risk level of the JCI stock index return will increase by 0.637169%, cateris paribus. The results obtained in this study is consistent with the hypothesis that has been built at the beginning, that the return volatility of Dow Jones Industrial index has significant positive effect on JCI's return volatility.

Globalization and economic integration cause the economy of a country are related so that enable volatility's transmission from one country to another. Therefore, changes in the stock exchanges will also be transmitted to other countries, where the larger exchanges (NYSE) will affect the smaller exchanges (IDX). The results in this study obtained that the DJI index return volatility significantly affect JCI, this proves that there is an integration between the stock market in the US with stock market in Indonesia in the period of the study.

Exchange Rate

Exchange rate variable has smaller value than the probability of 0.05 level which is 0.0262. Based on the value of the exchange rate variable, it has a significant influence on JCI. The coefficient value of the exchange rate is 0.028932, which means that if the exchange rate rises (depreciated) by 1% then the level risk at JCI stock index will rise by 0.028932% cateris paribus. The results obtained in this study contradicts with the hypothesis that has been established at the beginning that the exchange rate has significant and negative effect on JCI's return volatility.

The results are consistent with the results obtained by Jayadin (2012) which concluded that the exchange rate positively affect the volatility of stock returns of energy and mining in Indonesia Stock Exchange and the study result by Prio (2010) which stated that the exchange rate positively affect the JCI's return volatility.

In contrast to these results, the results of research conducted by Erdogen & Ozale (2005) which stated that the

weakening (depreciation) in value of the currency in the country (Turkey) resulted in a decrease in the volatility of stock returns before and during the crisis period of 1994. The results of the same study also stated by Naditia (2013) and Muthia (2014) that the exchange rate has significant and negative effect on the existing shares in the Indonesia Stock Exchange.

Gold Price

Gold variable has greater value than the probability of 0.05 level which is 0.0659. Based on the value, the variable gold does not have a significant impact on JCI with coefficient value of gold is 0.014785.

The results obtained in this study is consistent with the results of research conducted (Lawrence 2013) which stated that the price of gold does not significantly influence on Jakarta Composite Index (JCI). The same thing also expressed by Rusbariand (2012), in his research he found that the price of gold has no significant effect on Jakarta Islamic Index (JII).

Interest Rate of Bank Indonesia (BI Rate)

Interest rate has greater value than the of 0.05 level which is 0.5053. Based on the value, Interest rate has no significant effect on the JCI with coefficient value of -0.007279. The results are consistent with research conducted by Abd, Kadir, Selamat, Masuga and Taudi (2011). In their research Abd, Kadir, Selamat, Masuga and Taudi (2011) found that the effect of the interest rate on the return volatility of Kuala Lumpur Composite Index (KLCI) is not significant so that the strength of the interest rate variable in predicting the volatility of stock returns is weak.

Results of the study (Wijaya 2008) found that the ineteres rate (BI rate) has significant and negative effect on mining subsector stock returns in the Indonesia Stock Exchange. The same thing was also found by Nazir *et al* (2010), Eryigit (2012), Javed & Akhtar S (2012), they concluded that the interest rate has significant and negative effect on stock returns.

Inflation

Inflation variable has greater value than the probability of 0.05 level which is 0.9925. Based on the value, the inflation variable does not have a significant impact on JCI with coefficient of inflation is -0.000326.

Amaefula and Asare (2014) stated that many previous studies discussed inflation relationship with stock returns. Some studies were theoretically consistent with the hypothesis of classical economics while the others were based on empirical findings. Engle (2004), Engle and Rangel 2005) and Rizwan (2007) found that inflation has strong predictive power for stock market volatility and stock market returns.

While the research of Habibullah et al. (2009) examined the effect of inflation on return volatility and stock markets in Asian countries, such as India, Japan Korea, Malaysia and the Philippines. Their study found that changes in macroeconomic factors which measured inflation has weak predictive power of the against volatility and stock market return.

Contrary to these results, a research conducted by Skendra (2005) found that inflation significantly affect the return of blue chip stocks. Meanwhile, Thobarry (2009) found that inflation has significant and negative effect on stock returns property. The same thing was also expressed by Nazir *et al* (2010).

Test Coefficient of Determination (R^2)

The regression results obtained that R^2 value is 0.455558, this means that for 45.56% of the variation of JCI return volatility movement over the study period can be explained by variations in the five independent variables used in this research. While the remaining 54.44% is explained by other variables outside the model. Other factors that may affect the JCI stock are the company's fundamentals, other domestic macroeconomic factors outside the used variables, such as unemployment, the condition of Indonesian politics, world oil prices and other global macroeconomic factors (Wijaya 2010).

V. CONCLUSION

The variables used in this study have high volatility and are heteroscedastic so OLS regression models unfit to use in this research. For the data is volatile and heteroscedastic, ARCH-GARCH model is a better alternative method to analyze the data. The best ARCH-GARCH model chosen in this study is GARCH (2,1).

With global economic integration, the volatility of the JCI stock index in is not only affected by the condition of the domestic macroeconomic variables but is also affected by the conditions of the international macroeconomic variables. One of the international macroeconomic variables that affect the JCI's return volatility is the international stock index (Dow Jones Industrial Average). DJI has positive and significant effect on JCI's return volatility. This means that an increase or decrease in Dow Jones Industrial Average stock index will affect JCI stock index in Indonesia Stock Exchange.

Domestic macroeconomic variable that affect JCI's volatility return is exchange rate. This variable has positive and significant effect on JCI's volatility return, this means that the increase in exchange rate (depreciation of rupiah against the US dollar) would increase the level of risk in stocks that are members of JCI, and vice versa. While BI rate, inflation, and gold price do not have significantly effect on JCI's return volatility.

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