

Analysis of Effects of Macroeconomic Variables against Return on Agriculture Stocks

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Abstract- The research was carried out on the stock index in the agriculture sector in the Indonesia Stock Exchange. Macroeconomic variables used were the exchange rate, interest rates, inflation, world oil prices, Industrial Production Index, and the amount of money supply. Methods of VAR/VECM were used to see the effect of macroeconomic variables on stock returns. The aims of this research are: To analyze the macroeconomic variables that affect the movement of the stock return in agriculture sector; To analyze the response of the agriculture sector stock returns if there are shocks of economic variables, and; to analyze the macroeconomic variables that contribute to the agriculture sector which affects the stock returns. Based on the research that has been done and in accordance with the purpose of research, interest rates show positive and significant impact in the long term towards the return on agriculture stock. The money supply, inflation, exchange rate, and world oil prices significantly produce negative effects in the long term. The results of IRF simulation show that agriculture stocks are fluctuating against shocks to achieve stability. Return on agriculture stocks becomes most vulnerable when there is shock in the exchange rate variable. Then, from the FEVD analysis, all variables have an influence on agriculture stock.

Index Terms- stock return, VAR/VECM, Macro economy, Agriculture Sector

I. INTRODUCTION

In decision for investing, investors pay more attention to one factor, namely the level of return. High stock return becomes one of attractions for investors to invest in the capital markets. Theoretically, return has a positive relationship on various securities. The greater the expected return is, the greater the risk that will arise. High return on stocks is related to the firm characteristics, the industry, and macroeconomic conditions (Santoso 2006).

When making an investment, investors have to be selective in choosing where to invest. It is very important for investors to get the relevant financial information, thereby helping investors in decision making. One alternative of place for investment is the agriculture sector, which is one of the potential real sectors to help the nation's economy by utilizing natural resources (Syaifudin 2006). The agriculture sector is multidimensional which not only involves economic and trade issues, but also social-culture issues in developing countries (Oktaviani 2006).

The sector has also become the primary among many sectors, because the products yielded from the agriculture sector are also needed by other sectors. It becomes the main reason for investment in this sector as it still provides an opportunity to get maximum benefit; in other words, the agriculture sector controls economy within a country, such as the foreign exchange receipts, as fulfillment of basic need (food), and absorption of labor (Sugiartawan et al. 2013).

One of advantages of this sector is its contributions to the gross domestic product. It can be seen from the data of Central Bureau of Statistics (BPS); over the period 2009-2013, the agriculture sector is experiencing growth. The GDP contribution of the agriculture sector by 2013 Indonesia reaches Rp. 339,890.0-trillion, thus this sector ranks the third in the Indonesia'S GDP structure, below the industrial processing and trade sector, and hotels and restaurants.

Stock performance in Indonesia is affected by several economic factors, such as declining exchange rate of Rupiah against foreign exchange, inflation, the amount of money supply, and high interest rates. Other factors that could affect the stock's price the world oil prices. The change in the world oil prices will greatly affect the firm's condition; when the oil prices go up, company's financing through producing goods will increase, so that it can affect the earnings gained by the company (Witjaksono 2010).

A subprime mortgage crisis that occurred in the United States in mid-2007 as well as the European crisis due to nonpayment by Greece in 2011 had caused the decline in the IDX despite relatively strong banking conditions, a relatively small debt (26.6% of GDP), as well as economic growth above 6%. In 2008, inflation raises by 11.06% due to the decrease in IDX. Inflation then becomes reduced in 2009 to 2.78% from the previous year and arises again in 2010 by 6.96%. The increase in inflation in 2008 pushed Bank Indonesia to increase BI rate up to 9.5% to control inflation. In the years 2009-2011, inflation tended to fall, so that the BI rate became stable between 6.5-6.75%. Suardani (2009) found that inflation has influenced negatively to stock prices. Studies on the influence of interest rates against the stock price by Buyuksalvarci (2010), Wijaya (2013), and Murwaningsari (2008) reveal the negative influence of interest rates on the stock prices.

A good macroeconomic condition certainly will encourage investment in the stock market. Global crises which took place a few years ago also had impact on the domestic financial market namely changes in stock prices, a drop in the exchange rates, skyrocketing world oil prices, inflation and high interest rates.

Investors who want to invest in stocks will certainly see such variables as a consideration in the decision to buy or sell shares. Thus, in this study, the researchers will focus on analyzing the effect of macroeconomic variables on stock return in the agriculture sector. Macroeconomic variables chosen are exchange rates, interest rates, inflation, world oil prices, amount of money supply, and the industrial production index. This study is also to identify the influence of macroeconomic variables in the form of exchange rates, interest rates, inflation, world oil prices, money supply, and industrial production index on the stock return in the agriculture sector; hence, investors are expected to be able take the right investment decisions to reduce the risk of uncertainty of the return obtained, that is, by knowing the level of risk for such investment.

The objectives of in this study are to analyze the macroeconomic variables that affect the movement of the stock return in agriculture; To analyze the response of agriculture stock return when there is a shock to economic variables, and; to analyze the macroeconomic variables that contribute in influencing stock return in agriculture sector.

For the actors in IDX, especially investors, this study is fruitful to help understand the macroeconomic factors which affect stock return in agriculture sector, and also becomes consideration before making a decision to invest. For regulators, the results of this research are expected to be input to estimate to what extent the macro policy made can affect the stock return on the agriculture sector. For researchers, this can be beneficial to assist in the learning process to become more critical in analyzing relevant cases.

II. RESEARCH METHODOLOGY

Types and Sources of Data

Data on stocks used in this study are agriculture firms and components listed on the Indonesia Stock Exchange within the study period 2007-2014. The number of agriculture companies which have registered in BEI until 2014 is 25 issuers, which consist of subsectors, namely plantation, farm, and forestry. However, the data taken from Yahoo Finance shows only 10 issuers listed during 2007-2014.

Table 1 Types, sources, and units of data used in the research

Types of Data	Sources of Data
Closing price	IDX
Inflation	Bank Indonesia
Interest rates	Bank Indonesia
Exchange rates	Bank Indonesia
World oil prices	WTI, Indexamundi
Money supply	Bank Indonesia
IndustrialProduction Index	BPS

Macroeconomic factors included inflation, interest rates, the exchange rate of Rupiah against U.S. Dollar, world oil prices, money supply, and the IndustrialProduction Index (IPI). The research was carried out using data from the period 2007 until 2014. The data was in the form of public data, which had been published and could be proven. The data was obtained through historical monthly data on Indonesian stock index and annual reports of companies.

Data Processing Techniques and Data Analysis

Data acquired was processed and analyzed both qualitatively and quantitatively by using several methods and approaches. Methods of analysis used in this study were both descriptive and quantitative by using VAR (Vector Auto regression)/VECM (Vector Error Correction Model) models.

Vector Autoregression (VAR)

The VAR model was introduced by Christopher Sims in 1980 about a macronometric framework. VAR belongs to multivariate time series in the context of modern econometrics. Dynamic changes in multiple time series are captured systematically in a credible and easily understood approach in describing the data, forecasting, structural inference, as well as policy analysis (Firdaus2011).

VECM Model

VECM (Vector Error Correction Model) is a restricted VAR. This additional restriction should be present because the data form is not stationary but co-integrated. When two or more variables that are visible in a given equation on data level are not stationary, there is a chance for co-integration in the equation (Verbeek 2010). If there is co-integration equation in our model after co-integration test is done, it is advisable to include co-integration equation in the model. Most time series data have a I (1) or become stationary in the first difference.

Specification of the VECM restricts long term relationships between endogenous variables in order to be convergent in the co-integration relationship, while still allowing the short-term dynamics. The term of co-integration is also known as the error, since deviation toward long-term equilibrium is corrected gradually through a series of partial short-term adjustments. The VECM equation is represented by the following mathematical equation (Verbeek 2010):

$$\Delta Y_t = \sum_{i=1}^{k-1} \Gamma_i \Delta Y_{t-i} - \gamma \beta Y_{t-i} + \varepsilon_t$$

where:

Γ = coefficient of short term relationship

β = coefficient of long term relationship

γ =speed adjustment

Analytical Framework

This research was encouraged by the thinking about the prospects of stock development after global financial crisis in 2008. The global financial crisis in 2008 did have an effect on the stock price fluctuations in Indonesia capital market. The Indonesia Stock Exchange as the capital market in Indonesia was also experiencing shocks, including stocks in agriculture sector. The return and the risk levels were irrelevant; high risk should be followed by high return, but this did not happen at that time.

Companies included in the agriculture sector had a high sensitivity to changes in macroeconomic conditions. Therefore, there is a need to do research on the macroeconomic factors affecting agriculture stock return and to what extent the influences using VAR/VECM methods as a consideration for investors in determining appropriate measures when investing in the agriculture sector. Based on the above explanation, the analytical framework of this research can be seen in Figure 1.

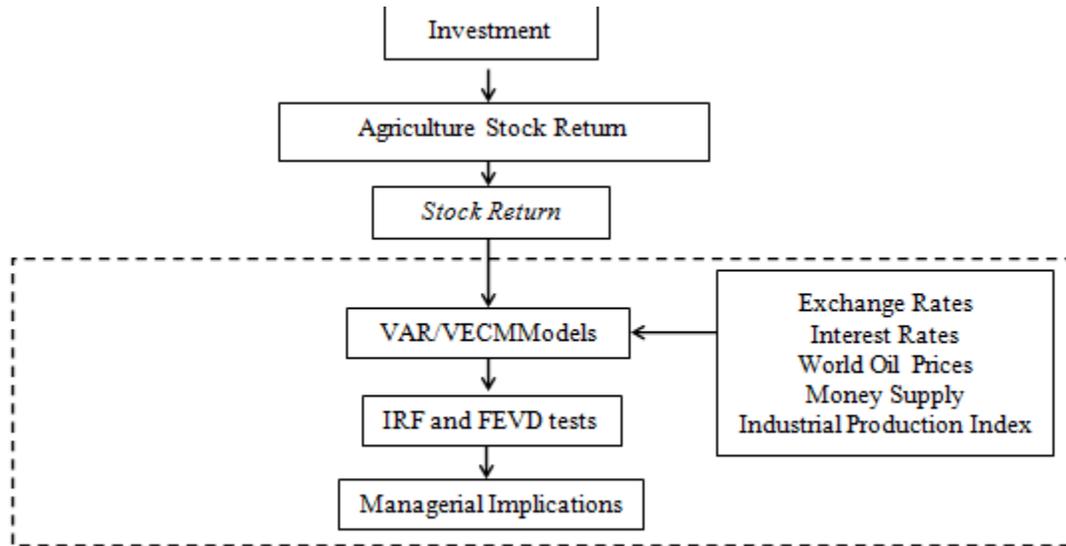


Figure 1: Analytical Framework

III. RESULTS AND DISCUSSION

VECM Estimation Results

The results of the cointegration test indicate that return of agriculture stock and macroeconomic variables are best analyzed with Vector Error Correction Model, because all the models are cointegrated; also, there are analytical tools, namely Impulse Response Function (IRF) and Forecasting Error Variance Decomposition (FEVD) to help answer the problem of this research.

Based on the table, it can be seen that in the short term, there are no variables that influence stock return on agriculture sector. Nonetheless, in the long term, all variables have impact on the stock return (Fayyaz *et al* 2012). This happens because a variable takes time (lag) to react to other variables and in general, the reaction of a variable against other variables occur in the long term. Cointeq1 variable produces significantly negative influence to return on agriculture stock. This means there is an adjustment mechanism from the short-term to the long term as shown with the significant and negative co-integration errors.

Table 2: Results of the VECM estimation model of stock return on agriculture sector

Long term		
Variable	Coef	t count
RETURN(-1)	0.292*	[-2.87820]
LNHMD(-1)	-0.291*	[3.05705]
INF(-1)	-0.030*	[2.91221]
LNNT(-1)	-1.128*	[3.65996]
LNLM2(-1)	-4.727*	[-5.16614]
IPI(-1)	-3.881*	[5.30910]
BIRATE(-1)	0.180*	[-4.63856]
C	56.437	
Short term		
CointEq1	-0.275*	[-2.87820]
D(RETURN(-1))	-0.292*	[-2.73364]
D(LNHMD(-1))	0.103	[0.69517]

D(INF(-1))	-0.003	[-0.15999]
D(LNNT(-1))	0.576	[1.21165]
D(LNM2(-1))	-1.099	[-1.65727]
D(IPI(-1))	0.781	[1.64028]
D(BIRATE(-1))	0.018	[0.26386]
C	0.010	

Source: Appendix

Note: sign (*) significant at alpha = 5% (| t count | > table (1.96))

In the long run, the interpretation of the VECM estimation in this research is the opposite of the coefficient sign. Return variable shows a positive and significant effect on the stock return itself. The variable with a previous month lag has indicated a positive and significant effect on the stock return of agriculture sector by 0.292, meaning that an increase in the agriculture stock return a month ago will improve agriculture stock return one month to come by 0.292%.

The influence of Inflation against the Agriculture Stock Return

Inflation variable displays a negative and significant effect on the model of agriculture stock return in the long run. The increase in inflation up to one percent causes a decline in the agriculture stock return by 0.030%. The finding indicates that inflation is one of the factors that affect investments in the agriculture sector. The influence of inflation against agriculture stock return can be understood that inflation is highly related to a decrease in the purchasing power of both individuals and corporates. This statement is consistent with research finding by Kuwornu (2012) that inflation significantly affects return on agriculture stock.

The Influence of Exchange Rates on Agriculture Stock Return

Exchange rates variable demonstrates a significant and negative effect in the long run against the agriculture stock return. The negative and significant relationship has been in accordance with the hypothesis proposed in the previous chapter. Exchange rate variable with previous month lag time results in a significant negative effect on the agriculture stock return by 1.128; it means depreciation in the exchange rate of Rupiah against the US Dollar a month ago would lower the agriculture stock return in the next month by 1.128%. Kapusuzoglu and Karan (2013) found there is a significant negative relationship between exchange rates and agriculture stock return.

The influence of Interest Rates on Agriculture Stock Return

Variable of Interest Rates has a positive and significant effect in the long term towards the model of agriculture stock return. The Interest Rates with a lag time of one month before indicates a significant and positive effect on the agriculture stock return by 0.180; in other words, the increase in interest rates a month ago will improve agriculture stock return for the next month that amounts to 0.180%. This is similar to Endri (2009), who found that there is a significant positive relationship between the level of interest rates and the return of stock.

The influence of World Oil Price on Agriculture Stock Return

The world oil price variable has a negative and significant influence in the long term on the stock return in the agriculture sector. When there is a 1% increase in world oil prices, the agriculture return stock would be down by 0.291%. The results of the research conducted by Hosseini (2011) show that world oil prices turn out to give a negative and significant effect on the stock exchange in India in the long term.

The influence of Money Supply on Agriculture Stock Return

Money Supply variable demonstrates a significant negative effect in the long term on the agriculture stock return model. Money supply with a lag time of one month before has shown a negative and significant effect on the agriculture stock return by 4.727; this means an increase in the amount of money supply one month ago will lower the agriculture stock return for the next one month by 4.727%.

The influence of IPI on Agriculture Stock Return

IPI variable indicates a negative and significant effect on the agriculture stock return in the long term. It is in accordance with the research by Cota et al (2011) that there is a relationship between IPI and agriculture stock return in the long run. An increase of 1% on the IPI will be responded by decrease in the agriculture stock return by 3.881%. The negative response indicated by the IPI variable against the agriculture stock return model suggests that the stock is still not favoured by the market when the economy improves. This gives a challenge for companies in determining the right strategy so that investors are more attracted to invest in the agriculture stock in Indonesia Stock Exchange.

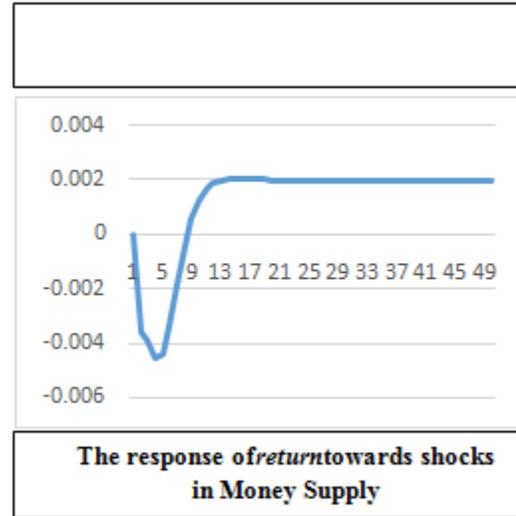
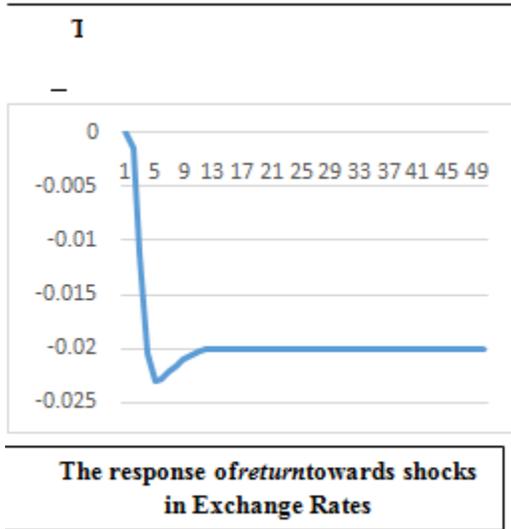
Analysis of Impulse Response Function

IRF analysis is a method that is used to study the influence of a dependent variable when facing shocks from the independent variable with one standard deviation. IRF aims to isolate a shock to make it more specific, which means that a variable can be affected by a specific shock. If a variable is unable to be affected by the shock, the specific shock would not be known, but a general shock (Firdaus 2011).

IRF analysis on the research is designed to see the response of the volatility of agriculture stock return on macroeconomic variables. This transmission is seen by observing how fast or slow the response of stock return volatility against the impulse of shocks from macroeconomic variables.

Figure 2 shows the impulse response of agriculture stock return within 50 periods. On the figure, the volatility of agriculture stock return reaches stability on the 14th to the 21st period. The shocks from world oil prices and the IPI reach

stability in the 14th period. Meanwhile, the shocks from inflation, exchange rates, money supply, and interest rates achieve stability in the 21st period.



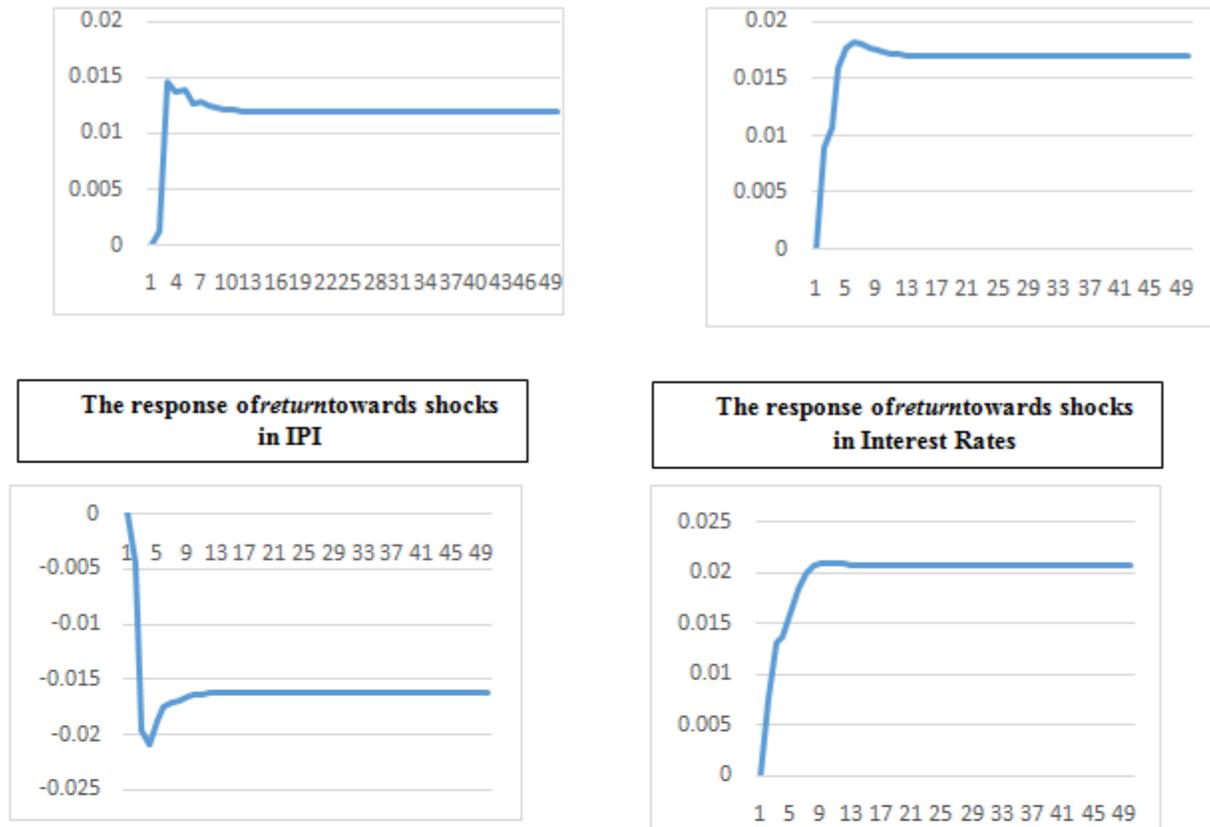


Figure 2 Result of impulse response of agriculture stock return

Analysis of Forecast Error Variance Decomposition (FEVD)

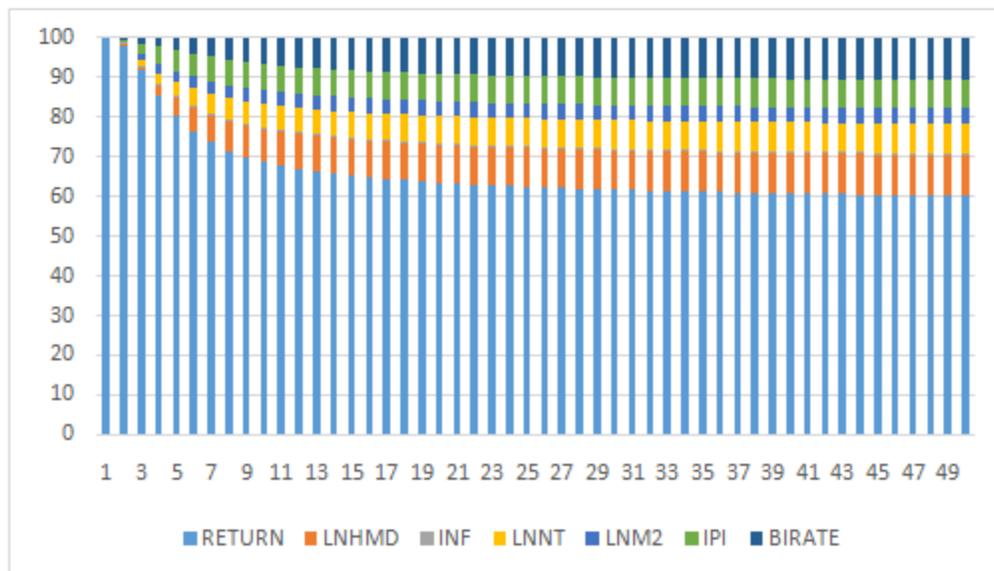


Figure 3 Results of FEVD analysis on agriculture stock return

According to the results of the variance decomposition of return on agriculture stock, this study suggests that the volatility of agriculture stock return is influenced mostly by itself than by other variables; the rest is influenced by macroeconomic variables. In details, it can be seen that the volatility of agriculture stock return is impacted from the stock return with an

average score of 98.5%. The rest is influenced by exchange rate (0.68%), interest rates (0.5%), IPI (0.18%), inflation (0.03%), world oil prices (0.09%), and the amount of money supply (0.01%).

Managerial Implications

From the results of the macroeconomic variables analysis on agriculture stock return, some policy implications can be formulated: In making investment, investors in general need to consider macroeconomic conditions and pay attention to the conditions of return offered by the stock market, whether it has been in accordance with the characteristics of the investors or not. Macroeconomic factors which are important to note are the exchange rates and interest rates. When there is a shock in exchange rates and interest rates, we suggest the investors to intensively monitor the movement of agriculture stock return in order to minimize losses.

The IRF test indicates that agriculture stock is affected by macroeconomic variables, namely exchange rates, money supply, world oil price, and BI rate, thus shocks in macroeconomic variables will directly impact return on agriculture stock. Investors who want to invest in the agriculture sector must observe the movement of the macroeconomic variables that influence the return of the stock both in the short term and in the long term to maximize return while minimizing risk at the same time.

Issuers in agriculture stocks need to observe significant macroeconomic variables to the return, in this case, the exchange rates, inflation, world price, and interest rates. Hence, the issuers can do hedging to anticipate and minimize losses in case of shocks on a variable.

The Central Bank must always issue policy capable of stabilizing inflation. Changes in inflation rates in this study affect negatively to agriculture stock return. An increase in inflation will cause decreasing agriculture stock return; thus, Bank Indonesia (BI) should pay attention to and maintain the inflation rate. BI as the Central Bank also must always support for the creation of a conducive investment climate by making policy to maintain the stability of Rupiah. This study also suggests that exchange rate influences negatively to agriculture stock return. Fall in the exchange rate will make a declining stock return. Therefore, the exchange rate should be kept stable, not to depreciate.

IV. CONCLUSIONS

From the results of the research that has been done and in accordance with the objectives of the research, several things can be summed up as follows: the interest rate effect is positive and significant in the long term on the agriculture stock return; the amount of money supply shows a significant and negative effect in the long term; inflation produces a negative and significant effect in the long term on the agriculture stock return. The exchange rate of Rupiah against the U.S. Dollar demonstrates a significant negative effect in the long term. Meanwhile, world oil prices show a significant negative effect in the long term on the return.

Analysis on Impulse Response Function (IRF) simulation shows that agriculture stock experiences fluctuation on shocks to achieve stability. Averagely, the time required to achieve stability is between the 14th to the 21st period. The return is identified as most vulnerable when there is a shock in exchange rate. Balance in agriculture stock volatility toward a shock in exchange rate is to be obtained on the 21st period.

The analysis on FEVD indicate that all variables have an influence on agriculture stock. In the first period, 100% agriculture stock is affected by the stock return itself. However, in the 50th period, the most influential variables against the stock are the interest rates (10.7%), world oil prices (10.5%), exchange rate (7.5%), IPI (7.1%), M2 (3.9%), and inflation (0.13%).

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