Impact of Exchange Rate Volatility to Stocks' Return in Indonesia: The Augmented Markov-Switching Egarch Approach

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Abstract

The stock price is one indicator that represents the economic performance in a country. Changes in stock prices, including various factors, as an example, is the exchange rate changes as the representation from the foreign exchange market. The fluctuating exchange rate price also influences the volatility of the stock price. Furthermore, volatility has different high and low regime stages that will cause a disparate impact on the outcome of the relationship changes. This study aims to examine the presence of asymmetric volatility and its effects on the volatility of LQ45 stock returns, as well as the changes in exchange rates of Rupiah against USD from 1997 to 2017. Using the Augmented Markov Switching EGARCH approach, the results of this study indicate an asymmetric behavior in the volatility of LQ45 stock returns. High volatility regimes are more dependent and more unstable than low volatility regimes, and low volatility regimes dominate the duration compared to the high volatility regime. The good and bad news give different impact on LQ45 stock return volatility and exchange rate changes. Moreover, the unstable economies will respond faster than the stable economies in terms of facing the exchange rate changes.

1. Introduction

According to Yuliman (2003), the capital market functions as a medium used to transfer funds from parties with surplus resources to those in need. The Indonesia Capital Market Institute or TICMI (2016) further defined it as a media that connects investors with companies or government institutions, enabling them to carry out long-term financial instruments such as stocks, bonds, and others. Based on the definitions, it can be concluded that the capital market is a place where long-term security instruments are sold.

It is also a benchmark for measuring investment performance accurately. The Indonesian capital market comprises 25 different indices categorized into the composite, sectoral, and thematic index (TICMI, 2016). A subsection of the thematic index is the LQ45 thematic effect index, a collection of 45 liquidly selected stocks with the largest market capitalization in Indonesia. Furthermore, every six months, the LQ45 absorbs new shares.

Changes in the stock price index of commodities traded on the market, the volatility state, and the overall rise or fall of the economy

can be determined (Ang, 1997:218). Volatility in stock prices can be represented as a standard deviation or risk. The higher the volatility or standard deviation, the higher the level of uncertainty obtained.

One of the factors that influence stock returns is the exchange rate. When the currency keeps depreciating, investors are less likely to invest, resulting in an economic depreciation. This will lead to a decrease in stock price and stock return (Yang, 2004; Kanas, 2005; Scotti *et al.*, 2007; Wang, 2008; Aydemir,2009; Chkili, 2014; Riadevi, 2016). The relationship between the exchange rate and the stock return will vary due to differences in the bearish regime (low volatility) and bullish (high volatility) concerning the exchange rate volatility. However, there are periods the economy experiences continuous exchange rate appreciation and periods of sustained exchange rate depreciation (Heriqbaldi *et al.*, 2014). This underlies the Markov-Switching model, which represents a non-linear approach to LQ45 stock returns, used to estimate the bullish and bearish period.

The varying behavioral volatility changes between regimes is one of the critical factors used by economic actors to make investment decisions. Dumas and Solnik (1995), in their research, have found that there is a strong relationship between exchange rates and stock market volatility. From the investor's point of view, a depreciating rupiah is a sign that the prospects for the Indonesian economy are down, so investors will avoid that risk and sell its shares. The sale will drive the JCI decline in the Indonesia Stock Exchange (IDX). The same research results produced by Riadevi (2016). In line with the empirical studies that have been carried out by Yang (2004), namely the correlation between stock prices and exchange rates will get higher when the stock price rises.

Research on the effect of exchange rates on stock returns has been carried out by numerous researchers with a higher percentage, confirming the role of exchange rates on stock returns changes. Various methods were also used to analyze these studies. For instance, (Adjasi et al., 2011; Jiranyakul, 2012; Vo, 2018) made use of vector autoregression (VAR), cointegration and impulse response analysis; Moore (2014) and Wong (2017) utilized the dynamic conditional correlation (CC); Bahmani-Oskooee and Saha (2015) employed the autoregressive distributed lag (ARDL); while Salisu (2018) as well as Dahir *et al.*, (2018) applied the panel data analysis. Some studies have also been engaged with GARCH or EGARCH, i..e Joseph (2006); Brooks *et al.*, (2010); Lim (2013) as well as Sikhosana (2018).

Nevertheless, those studies are still not concerned with the volatility of exchange rates against stock returns, with regards to the bearish and bullish regimes. Therefore, this study would like to fill the gap by utilizing exponential GARCH (EGARCH) to model the volatility that occurs in the return stock market and volatility in changes in exchange rates. Markov-Switching is used to analyze if there is a change in behavior between regimes on stock market volatility. Augmented Markov-Switching is used as a final model for analyzing the impact of shock exchange rate changes on LQ45 stock returns. Markov-Switching itself is a popular method used in analyzing volatility. Several studies have used this method to study the volatility of the real estate markets

(Gibb *et al.*, 2014; Liow,2018) industry portfolios and asset pricing (Tudor, 2013), the yield spread for real economic growth (Evgenidis and Siriopoulos, 2016), the stock price (Wang *et al.*, 2015; Huang and Zeng, 2016) , service system (Hsieh and Chen, 2017) , as well as crude oil market (Wu *et al.*, 2010). Using Indonesia as a case study, the Augmented Markov Switching EGARCH, was used to analyze the effect of exchange rate volatility on stock returns.

Behavior resulting from different volatility changes between regimes is one of the essential factors for economic actors in making investment decisions, so researchers are interested in discussing the transition regime change events that exist between exchange rate volatility and

LQ45 stock index volatility. Accordingly, this study aims to discuss regime change transition events between exchange rate volatility and the volatility of LQ45 stock index returns. This research has been divided into four parts. The first part introduces the capital market and its constituents. Section 2 summarises the literature review on the relationship between exchanger rate and stock return. Part 3 presents the data and the econometric method applied in the empirical analysis. And part 4 describes the results of the empirical study, and the last section concludes the paper.

2. Literature Review

The grand theory used in this study is the Theory of Black-Scholes and Switching Regime. Two European economists, Fischer Black, and Myron Scholes, found the traditional Black-Scholes Models model that aims to determine the theoretical value of stock returns using current stock prices, expected dividends, time options expiration, and expected volatility. This model embraces the Brownian geometric model, a behavior that assumes a constant variation in stock prices and volatility or also called the Independent Lognormal (ILN) model. The assumptions of the Black-Scholes model are: (1) no transaction costs, (2) risk-free rate and volatility are known to be constant, (3) normally distributed returns, (4) dividends not paid before time runs out. The Black-Scholes model used to estimate implied volatility can be denoted as follows:

$$C = SN(d_1) - N(d_2)Ke^{-rt} \quad (1)$$

$$d_1 = \frac{\ln(S/K) + (r + s^2/2)t}{s.\sqrt{t}} \quad (2)$$

$$d_2 = d_1 - s.\sqrt{t} \quad (3)$$

Where:

C = call premium; S = current stock price; t = time until option exercise; K = option striking price; r = risk-free interest rate; N = cummulative standard normal distribution; e = exponential term; s = standard deviation; and Ln = natural log.

The right switching regime for non-linear threshold problems in finance has two models, namely Hamilton's Markov model, and Tang's Threshold Autoregressive (TAR) model. The TAR model, according to Tong (1990), can provide an analysis of complex stochastic processes by simplifying into smaller sub-systems. The Markov Switching model was first introduced by Hamilton in 1989. This model can not only analyze structural changes but also consider the chance to survive on one model or move on to another (Rahman et al., 2014). (Brooks *et al.*, 2010) says that market behavior is divided into m states, which means that the state distribution at any time t depends on time t-1, and is unaffected from t-2, t3, and so on. The Markov model can be formulated as follows:

$$P[a < y_t \le b | y_1, y_2, \ldots, y_{t-1}] = P[a < y_t \le b | y_{t-1}] (4)$$

In the traditional approach, the exchange rate will lead to the stock price. However, the portfolio balance approach suggests that the exchange rate is determined by market mechanisms, which may mean that changes in stock prices may impact exchange rate movements (Granger, Huangb and Yang, 2000).

According to Walid *et al.*, (2011), the theoretical approach to this relationship is divided into the flow-oriented path, and the stock oriented approach. In the flow-oriented method, the exchange rate is determined by the trade balance. This model assumes that the exchange rate affects international competitiveness and trade balance, and will affect real income and inputs. This model finds a positive relationship between exchange rates and stock prices.

While in the stock oriented approach, the exchange rate is determined by the demand and supply of financial assets such as equities and bonds. This approach is subdivided into two models, namely, portfolio balance and monetary models. A portfolio balance divided into direct and indirect channels states that the exchange rate and stock prices have a negative relationship. The direct channel mechanism is an increase

in domestic stock prices will increase foreign investor demand for domestic stocks, buy more domestic assets, and sell foreign assets. It will cause the local currency to depreciate.

Furthermore, the indirect channel mechanism means that an increase in the assets of domestic stock will increase wealth. Demand from investors is rising, which will lead to a rise in interest rates. High-interest rates will increase foreign demand for the domestic exchange rate so that the national standard will appreciate.

The tidal condition of the Rupiah exchange rate will affect the capital market, as most issuers have debt in foreign currency. Indonesia has been through in the monetary crisis of 1997-1998. The exchange rate, as one of the macroeconomic measures, will affect the investment in the framework as follows: The appreciated Rupiah will result in a smaller value of exports than the cost of imports, resulting in Indonesia's trade balance declining, resulting in declining foreign exchange reserves, degrading investor confidence, and reduce investment one of the investment in the form of equity participation (Suta, 2000) .

Changes in exchange rates affect the company's competitive rate through the impact given to input and output prices (Joseph and Vezos, 2006). When the exchange rate appreciates, the exporters will lose their competitiveness in the international market, the exporter's sales and profit will decrease so that the stock price will drop.

Research that discusses the exchange rate and stock price index many have previously modeled the relationship that occurs between the exchange rate and the stock price index. However, there are other events that occur between the relationship of exchange rates and stock returns, namely the uncertainty caused by differences in the bearish regime (low volatility) and bullish (high volatility) found in volatility. This grouping of systems can have a different impact on each administration.

In previous speculative studies, changes in exchange rates tend to be non-linear with changes in economic fundamentals. In a certain period, the economy is characterized by a period of continuous appreciation of the exchange rate. Meanwhile, in other periods there was a tendency for periods of constant exchange rate depreciation (Heriqbaldi *et al.*, 2014). This underlies the Markov-Switching model, which represents a non-linear approach to IR LQ45 stock returns, which will be estimated during periods of high volatility (bullish), and periods of low volatility (bearish). Accordingly, the hypotheses of this study are that: there is asymmetric behavior in the volatility of the LQ45 stock price index return in periods of high volatility and low volatility; and the behavior of switching regimes on LQ45 stock volatility, which has been influenced by changes in the exchange rate of the Rupiah against the Dollar, has differences in dependencies between systems and differences in the probability of movement between regimes.

3. Data and Research Methods

This study makes use of two models consisting of endogenous and exogenous variables. EGARCH will be used to model volatility in LQ45 stock returns. At the same time, Augmented Markov-Switching analyzes the regime dependency behavior and the probability of inter-regime changes in the volatility of stock returns that have been affected by changes in exchange rates. Exponential GARCH is used to model volatility in the stock market returns, and instability in exchange rate changes. Markov-Switching is used to analyze whether there are behavioral changes between regimes in stock market volatility, then Augmented Markov-Switching is used as a final model that is useful for analyzing the impact given by the shock of exchange rate changes on the changing behavior of LQ45 stock return volatility regime. The variables used are as follows:

Table 1. The Definition of Variables

Variable		Definition	Source
First Model			
ER	Endogenous variable	Changes in the exchange rate of Rupiah against US Dollars. $$e_{it} = 100 \ x \ ln\frac{f_{it}}{f_{it-1}}$$ *e* is the rate of change in exchange rates, and *f* is the exchange rate.	Weekly exchange rate from FRED of St. Louis
RET	Endogenous variable	The LQ45 stock return. $$e_{it} = 100 \ x \ ln\frac{f_{it}}{f_{it-1}}$$ *r* is the stock return and *p* changes in stock prices.	Indonesia Stock Exchange in 1997 to 2017
Second Model			
VARRET2	Endogenous variable	The volatility of return obtained from the variance value generated from the estimation of the EGARCH model on the Return variable (RET).	-
VARER2	Exogenous variable	The volatility of the exchange rate obtained from the variance value generated from the estimation of the EGARCH model on the Exchange Rate (ER) variable.	-

In capturing the volatility value, the EGARCH model was used. One of the advantages of using this model is in its ability to capture clustering volatility using parameters properly. Asymmetrical volatility occurs because of the negative shock is more unstable than the positive shock (Walid, 2011). The EGARCH model is used to imitate the volatility of LQ45 stock returns, and GARCH is used to model the volatility of the Rupiah / Dollar exchange rate changes. EGARCH was adopted from Nelson (1991) and can be denoted as follows:

$$\log(h_t) = \omega + \alpha\left[\left|\frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}}\right| - \sqrt{2/n}\right] + \beta\log(h_{t-1}) + \delta\frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} \quad (5)$$

Where:

ε_{t-1} is exchange rate changes; is returned stock LQ45; are constant parameter.

After obtaining the value of volatility parameters, they were combined in the EGARCH augmented Markov-switching model. This model analyzes the regime-switching that occurs in the stock returns, which also affected the exchange rate. Walid *et al.*, (2011) adopted Augmented MS-EGARCH models can be formulated as follows:

$$\emptyset(L)r_t = \mu_{it} + \varepsilon_t, \varepsilon_{t\sim N(0,h_{it})} \quad (6)$$

$$\log(h_{it}) = \omega_i + \alpha_i\left[\left|\frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}}\right| - \sqrt{\frac{2}{n}}\right] + \beta_i\log(h_{t-1}) + \delta_i\frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} + \emptyset_i e_{t-1} \quad (7)$$

Where is changed in the exchange rate, is stock market return, are constant parameter

The probability of regime change inherent the stock return can be expressed as follows:

$$p^{00} = \frac{\exp(\theta_0 + \theta_1 e_{t-1})}{1 + \exp(\theta_0 + \theta_1 e_{t-1})} \text{ for low volatility} \quad (8)$$

$$p^{00} = \frac{\exp(\gamma_0 + \gamma_1 e_{t-1})}{1 + \exp(\gamma_0 + \gamma_1 e_{t-1})} \text{ for high volatility} \quad (8)$$

Where is transition probabilities held by regime one or low volatility regime, and is transition probabilities that are owned by regime two or high volatility regime.

According to Filardo (1994), the probability display values 0 to 1. Parameters 0 and 1 are representations of exchange rates. A positive value at the exchange rate of 1 > 0 means that LQ45 stock returns are more constant in regime 1 (high mean-low volatility), and 1 < 0 ways that positive shock at exchange rate causes LQ45 stock return to system 2 (low mean-high fluctuations).

4. Empirical Results and Discussions
4.1 Empirical Results

The descriptive statistics carried out on LQ45 stock index price and Rupiah / Dollar exchange rate, resulting in the following: 1033 total observation, 403.5979 mean LQ45 index price data, an exchange rate data of Rp 9252,00, maximum value stock index data of 960,7800, an exchange rate data of Rp 15,350.00, the minimum value of stock price index of -50,760 and an exchange rate data of Rp 2,394.00.

The study, which comprises of two stages, was estimated using STATA 14 tools to obtain the volatility value, and E-Views 8 to get the result of regime-switching estimation. Based on the first volatility regression, the return variable LQ45 has asymmetric tendency because the significance of the parameter value of probabilities (0.000) is smaller than the alpha 0.05. Asymmetrical volatility means there is a leverage effect value of -1. Meanwhile, the volatility of exchange rate variables does not have an asymmetric effect. Therefore, it only takes regression up to GARCH only.

The stationarity test is performed using the Augmented Dickey-Fuller test because of the delay in the kestality of data. In the observed stationarity test is the ratio of the ADF Stat value with the critical value or the comparison of the P-value with Alpha. Time coherent data is said to be stationary if the amount of ADF Stat is smaller than MacKinnon CV, or the P-Value is more significant than the alpha value (0.05). Based on the estimation exchange rate return variable, the two variables (P-value and alpha) can be said to be stationary. Hence, it does not need to be lowered.

After the data has been fixed, the normality test is performed. The normality test is conducted to determine the distribution of stock returns LQ45 and exchange rate changes.

If the Normality test using the Shapiro Wilk test shows a probability value of 0.000 smaller than alpha 0.05, then LQ45 stock return data is not normally distributed. The mean value of 0.178323 means that the price trend increases during the study period. A valuable skewness of -0.163617 means that the income distribution in the market has a higher chance of generating a return greater than its mean. A value of more than three kurtoses implies that the back is a more massive tail than a normal distribution. Normality test results in exchange rate change data have unhealed results typical with an enormous tail, which means the exchange rate has been experiencing a positive trend. This is in line with the nominal exchange rate that is rising along with inflation. According to Figure 1, if the LQ45 stock index price is low, the volatility experienced will be more volatile than when the stock price is high—visible high volatility return with the ore line A, and low volatility with the ore line B.

Autocorrelation test was conducted using the Breusch-Godfrey LM test to determine volatility clustering on LQ45 stock return and exchange rate changes. The results indicate the presence of autocorrelation or volatility clustering. The best ARMA estimation using the Box-Jenkins model was performed after conducting the analysis using the return variable and the stationary exchange rate. The Autocorrelation Function (ACF) and Partial Autocorrelation Function (PACF) are used to define a temporary model so that each model in the return and ER variables produces several model stacks. The composition of the combination for the RET variable was obtained using ACF and PACF. The AR had 1,5,7,9 variables, the ER = 1,2,5,6, MA = 1,2,3,5 for each RET and ER with 256 model layouts. The AIC results are used to ensure the ARMA model is the best. Therefore, we obtain the best model for the RET variable with order (1,1) and ER variable with order (1,1).

Table 2. Estimation Results GARCH ER and EGARCH RET

Variants	ω	α_1	β_1	γ_1
GARCH ER				
RET	0.0431581	0.2793166	0.7927781	-
ER	0.045	0.0000	0.000	-
EGARCH RET				
RET	0.0431581	0.2793166	0.7927781	0.9421088
ER	0.045	0.0000	0.0000	0.0000

Source: Author Calculation
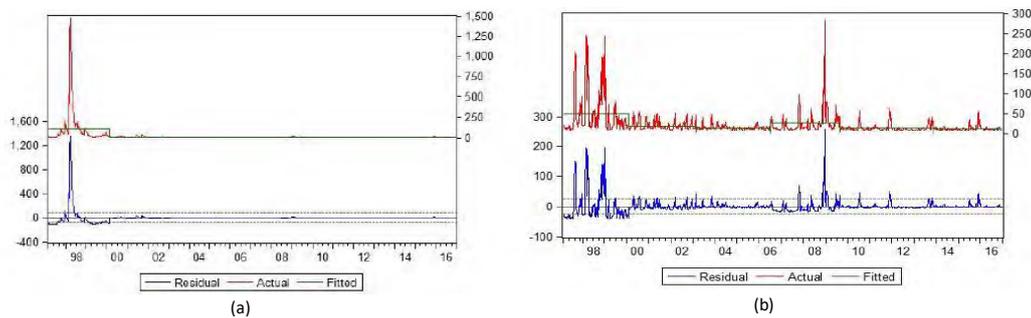
Figure 1. The plot of Change Period Bai Perron RET (a) and ER Regime (b)
Source: Author Calculation

Table 3. Augmented Markov-Switching Regression Result

Regime-dependent intercepts	Coeff	t-Value	t-Prob
C(1)	18.67	9.62	0.00
C(2)	40.32	20.07	0.00
Autoregressive coefficients			
AR-1	1.18	35.97	0.00
AR-2	-0.02	-0.53	0.59
AR-3	0.20	-4.23	0.00
AR-4	0.42	9.49	0.00
AR-5	-0.41	-14.48	0.00
Log(sigma)	0.71	32.38	0.00
	5.28	11.71	0.00
	-2.11	-4.48	0.00

Source: Author Calculation

The Lagrange Multiplier test is also carried out to determine if any GARCH effect. GARCH model test results on the RET variable indicate no GARCH effect, which means the model is good. The LM-test results on ER variables also show a useful model with a higher probability of 0.958802 than alpha 0,05. Here is a table of Lagrange Multiplier test results on RET fan ER. To find out whether or not there is the volatility that behaves asymmetrically on LQ45 stock return data, the EGARCH process is performed. This is similar to the GARCH procedures, which use the EGARCH to determine the smallest AIC value. The results depict the best EGARCH RET

order to be(1,1). The variants were obtained after testing GARCH (1,1) on the ER and EGARCH (1,1) on the RET variable.

In the EGARCH estimation result, LQ45 stock returns found the existence of asymmetric volatility. The estimation results from GARCH and EGARCH will bring up the value of variance that will be used as data from volatility. Furthermore, it then continued with a regime-switching test. A structural change test was performed with a Chow Breakpoint Test to ensure that there is indeed a fundamental change in the volatility data. In Table 8 below, a P-Value of 0.000 smaller than alpha 0.05 can be seen. This means that there is a structural change in LQ45 stock return data. The result obtained from the Chow Breakpoint Test structure in the Rupiah / Dollar exchange rate data shows the same effect, which means the changes in the construction of the data are identical. In the next step, the Bai Perron method is used to determine the number of states of the structure change.

Figure 1 shows (a), the stock return variable has two fractures, namely the regime which has a high mean-low variance (high volatility) in system 1, (a study conducted between 1997-2000 and 2007-2009). While administration 2 is a regime with low mean-high volatility (low volatility) - meaning that when the variance is calmer, the economy is turbulent. In Figure 1 (b), it can be seen that only one fault occurs in the period at the beginning of the study. The error also divides the difference in exchange rate changes into two regimes, with the first occurring during the global crisis of 1997 to 1998, and the second occurring in a more stable economic condition compared to that of the former. Based on the results of the tests for normality, heteroscedasticity, and serial correlation, the regime change test can be analyzed with MS specifications (1) AR (5). Therefore, the results of the Augmented Markov-Switching regression are obtained.

4.2 Discussions
4.2.1 Asymmetric Volatility

The results of the normality test on the exchange rate change and LQ45 stock return data get the effect that the data is not generally distributed with more massive tails. The heavier tail is by the theory of volatility that cannot be captured by ordinary linear modeling, namely the inability to achieve fat tails, volatility clustering, and asymmetric volatility. This means that the distribution of stock returns and the distribution of changes in exchange rates are generally not distributed, and there is an increase in the mean.

The involvement of the exchange rate in the movement of changes in the LQ45 stock price index return is an inseparable relationship. The condition of these two economic variables together became an indicator of the good and bad of the financial system at that time. Currency market conditions are reflected in Rupiah / Dollar exchange rate movements, while capital market conditions are indicated in LQ45 stock index returns.

The relationship between exchange rates and stock returns can be represented through indirect channel transmission. Changes in the exchange rate, which will affect domestic export sales up or down, then modify the value of the profits obtained and ultimately will affect the rise and fall of stock prices. Rising or falling stock prices will affect the cost of the stock returns to investors.

The relationship that occurs between stock returns and changes in exchange rates has been widely discussed by previous studies such as research conducted by Chkili (2014), found that the shock caused by the exchange rate did not affect changes in the volatility regime of stock returns, while Henry's research (2009) found that the trauma of changes in exchange rates affects the behavior of regime changes on the volatility of stock returns. The difference in results underlies this study, which aims to look at the impact found in changes in volatility in LQ45 stock returns to changes in the exchange rate of the Rupiah against the US Dollar.

Following the results of the EGARCH estimation performed on the LQ45 stock return variable, the results show asymmetric volatility. The situation was proved by the significance of the parameter □ value of 0.94. The parameter □ with a probability value of 0.00 means a leverage effect

of an amount of $\square_{\square - 1}$. This asymmetrical effect can occur due to differences in the results brought from responding to good news (strengthening the Rupiah exchange rate) and bad news (weakening the Rupiah exchange rate) to the volatility of the stock return value that will be known after the final augmented test.

Asymmetric behavior that occurs in stock return volatility means that there is a negative or inverse relationship with stock return volatility, and the value of stock returns themselves. When stock prices or returns are declining, volatility will increase, meanwhile when stock prices or returns are increasing, the volatility will decrease even calmer. These results are by research conducted by Karmakar (2007). Negative returns that occur will increase financial leverage that will increase stock risk and spur increased volatility. Falling stock prices will increase the leverage ratio so that the leverage effect that occurs will increase ongoing volatility and costs that will increasingly fall.

The collapse of the company's stock price continues to cause market perception will be worse until undervalued. This position is vulnerable to the stock price falling below the Initial Public Offering (IPO) price. This will cause a correction in the company's capital due to the withdrawal of significant investments (Herlianto, 2013:124). If this happens to 45 blue-chip stocks on the LQ45 index, then economic growth will slow down because companies lack capital for production, which will undoubtedly affect the productivity of the financial sector.

4.2.2 Switching regime

The Markov-Switching EGARCH (MS-EGARCH) model in this study has the capability of being able to capture regime change behavior making it capable of answering questions not answered using the linear regression model in the previous time. The model introduced by Henry (2009) can capture value changes in parameters that describe system dynamics and volatility. It can also investigate the relationships that occur during each regime in the market. There is a change in volatility behavior that arises in LQ45 stock returns and exchange rate changes that are distinguished in two systems, namely high volatility or low-variance and low volatility or high mean-low variance regimes. This is following previous research conducted by Walid *et al.*(2011), which states that there are differences in regime results in developing countries that are the object of his study.

The results of GARCH and EGARCH estimates will generate the value of variance that will be used as data from volatility. The study then continued with the regime-switching test. Before the MS-EGARCH major augmented model test, a Chow Breakpoint test was performed to verify that there is indeed a structural change in the volatility data. The result of the Chow breakpoint test results showed that both exchange rate volatility and stock return volatility have structural reforms and there is a change of volatility behavior that occurs in LQ45 stock returns and exchange rate changes distinguished in two regimes, namely high volatility or low mean-high regime variance, and low volatility or high-low-variance regimes.

The MS-EGARCH augmented test results revealed that the dependent regime intercept is higher at a volatility regime phase of 40.32 and lower at a volatility regime phase of 18.67. It means that the economic shocks in this study are represented by changes in exchange rates. However, coming with the same terminology in regimes one and regime 2, but have different effects on the volatility of both. The shocks that occur in administration 2 produce more volatility than those coming to system 1.

Based on the results obtained, it can be analyzed that the matrix shows a transition estimation probability indicating that no regime is permanent. The opportunity of stock return process LQ45 and exchange rate change remain in administration 1 with a value of0.993. Chance return process LQ45 stock and change of exchange rate movements on regime two after regiment 1 obtained a value of 0.007, while system 2 is 0.828, and the probability of return process of LQ45

stock and exchange rate change in regime one after regime 2 is 0.174. The results of this study can lead to the conclusion that system 2 is less persistent than regulatory stability 1. Scheme 1 has a persistent estimate for 142.12 weeks, while regime 2 has a persistent view of 5.83 weeks. Estimated persistence of government I was obtained from PII) for i = 1,2 (Henry, 2009). Regime 1 occurs for an average of 142 weeks to move on to the state of system 2, while administration 2 occurs for an average of six weeks to move on to the state of the regime 1. It can be concluded that a stable economic state has a more extended period than the period of the shaky economy.

Volatility changes tend to persist or to remain in their different regime of origin. System 2, also known as a regime with low mean-high variance (high volatility), has a weaker persistence when compared to government 1. Therefore, the low volatility regime in the first regime is more stable than the second. This is due to the presence of asymmetric volatility and the differences in the behavior of investors. Markets tend to be more responsive in responding to positive news (rising stock prices or strengthening exchange rates) rather than negative news (declining stock prices or weakening exchange rates).

During 1997 to mid-1998, the Indonesian crisis, the country was in a state of high volatility. The positive news about the floating currency system's changes became restrained into a free-floating currency system, which gave market participants a positive outlook on the state of the exchange rate market and affected the economy faster. The situation is different when the economy is calm; a slight change in the exchange rate will not give immediate effect to changing market conditions.

5. Conclusions

From the results of the discussion, it can be concluded that there is asymmetrical behavior of volatility at the stock return of LQ45 and change of exchange rate. The good news (exchange rate) and bad news (exchange rate weakness) do not have the same effect on LQ45 stock return volatility and exchange rate changes. There are different dependencies between regimes. Unstable economic systems are more dependent than stable industrial governments. There is a difference in the probability of transition between administrations, that is, unstable economies move faster than a stable economy; when given exchange rate changes, a stable economy becomes unstable. There is a waiting time gap in whether the decline will only be short or continuous. The low volatility regime predominates the average duration occurring in each phase, i.e., for approximately 14 weeks compared to the high volatility regime that is only for about five weeks. This is because the tendency of stable economic conditions is less susceptible to shock, whereas the shaky economy is more vulnerable to the slightest change.

Accordingly, for investors and economic actors concerned with shares, it is better to pay attention to the structure of volatility that occurs between the exchange rate market and the stock market. Based on the results of this study, differences in stock return volatility and exchange rates that occur between these regimes can also be used as a benchmark for investors in making investment choices, whether hold, buy, or sell. For economic regulators, more attention can be paid to movements in the exchange rate market, because the trend of this dual society is a substitution between investment in the currency market or the stock market. The central bank can pay attention to policies that might create a ceiling price system for stock prices and reduce risk bubbling of stock prices, which will one day break and cause a crisis. For further research, this research can be developed by adding independent variables that would have an impact on stock price movements and can be improved with the Extended Augmented MS-EGARCH model to analyze the exact value of the different probability of regime change of LQ45 stock return volatility caused by positive news and adverse exchange rate news.

6.   References

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