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Asymmetric volatility and macroeconomic factors on Indonesian government bond returns

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Abstract

Macroeconomic are important variables influencing volatility in the bond market. Some of the challenges faced such as default risk, liquidity risk, interest rate risk, inflation risk, and exchange rate risk. This study is aimed at examining asymmetric volatility using the EGARCH model and at estimating macroeconomic variables which influence the return of Indonesian Government bonds. The asymmetric volatility can be measured by determining the best order value of the EGARCH model. Based on the findings of the study, EGARCH (2.1) is the best model for assessing volatility in short-term SUN returns, EGARCH (3.1) for medium-term SUN and EGARCH (2.3) for the long term. The asymmetric volatility pertains in the returns of short, medium and long-term government bonds. In addition, the negative information has a greater impact than positive information in the short, medium and long term. The deposit rate and return of the Composite Stock Price Index have a significant positive effect on short, medium and long term bond returns. The effective federal funds rate or FED interest rate has a significant positive effect on the return of short and long-term SUN bonds while in the medium term it has no effect. Exchange rates have a significant negative effect on short, medium and long term bond returns.

Abstrak

Ekonomi makro adalah variabel penting yang mempengaruhi volatilitas di pasar obligasi. Beberapa tantangan yang sering dihadapi seperti risiko gagal bayar, risiko likuiditas, risiko suku bunga, risiko inflasi, dan risiko nilai tukar. Penelitian ini bertujuan untuk menguji volatilitas asimetris menggunakan model EGARCH dan memperkirakan variabel-variabel ekonomi makro yang mempengaruhi return *obligasi Pemerintah Indonesia. Volatilitas asimetris dapat diukur dengan menentukan nilai urutan terbaik dari model EGARCH. Berdasarkan temuan penelitian ini, EGARCH (2.1) adalah model terbaik untuk menilai volatilitas dalam pengembalian SUN jangka pendek, EGARCH (3.1) untuk SUN jangka menengah dan EGARCH (2.3) untuk jangka panjang. Volatilitas asimetris berkaitan dengan pengembalian obligasi pemerintah jangka pendek, menengah dan panjang. Selain itu, informasi negatif memiliki dampak yang lebih besar daripada informasi positif dalam jangka pendek, menengah dan panjang. Suku bunga deposito dan pengembalian Indeks Harga Saham Gabungan memiliki efek positif yang signifikan terhadap pengembalian obligasi jangka pendek, menengah dan panjang. Tingkat dana federal yang efektif atau tingkat suku bunga* the Fed *memiliki efek positif yang signifikan terhadap pengembalian obligasi SUN jangka pendek dan jangka panjang, sedangkan dalam jangka menengah tidak berpengaruh. Nilai tukar memiliki efek negatif yang signifikan pada* return *obligasi jangka pendek, menengah dan panjang.*

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1. Introduction

As a matter of fact, the Indonesian economic growth in 2017 hit 5.07 percent due to higher growth investment, international trade sector, infrastructure development in various regions and higher demand and commodity prices (OJK, 2017). State projects will have an impact on the government budget. In order to fund the budget, government use funding resources from debts and incomes. A common form of debt is government bonds (SUN). According to UU No. 24 of 2002, SUN is divided into two: treasury bills (SPN) and government bonds (ON). SPN is a form of SUN issued by the government and valid up to 12 months with discounted interest payments. Meanwhile, ON valid more than 12 months using either coupons or discounted interest payments. Based on data of January 2019, the total number of ON issued by the government is 3,650 trillion which can be traded and regulated using rupiah denomination with a fixed coupon amounts IDR. 1.873 trillion (DJPPR Ministry of Finance, 2019).

The issuance of SUN by the government is regarded as a fiscal instrument to obtain any potential funding resources for state budget which are greater than capital market investment. Besides, the SUN is also used as an investment instrument that is relatively risk-free of default and provides an opportunity for investors and market players to diversify their investment in order to reduce any risks. In addition, UN investors have a potential capital gain in trade transactions in the secondary market of the SUN (DJPPR Ministry of Finance, 2019)

The capital market in Indonesia, particularly the bond market, is still vulnerable to both domestic and global turmoil's which eventually leads to either positive or negative sentiment among investors in the bond market. A turmoil itself can be used as an opportunity to obtain capital gains and to predict risks among investors. Monetary policy shock can affect short-term bond returns (Evans & Marshall, 1998). In addition, Engle & Li (1998) also state that macroeconomic shocks on the announcement day have more impact on the volatility of bond returns in the short term. It is similar to a study of Barr & Campbell (1997), stating that monetary policy affects short-term bonds and has no effect on the long run. A more advanced bond market is usually associated with stronger macroeconomic fundamentals, more stable financial system, stronger institutional framework, more open economy, loyal investors, increasing demands of bonds, especially those with a long period of time (Smaoui, Grandes, & Akindele, 2017). For that matter, the dynamics of the bond market with a high level of volatility until recently have been caused by the uncertainty of the Fed raising interest rates in 2018. Since the start of 2018, the yields of US Treasury have been increasing which also creates another increase in other yields of other government bonds. Indonesia, which initially withstood against positive sentiment with a rating increase held by Fitch Ratings, finally fell off (Market Business, 2018). Volatility is the magnitude of price changes of an investment instrument or the percentage of price changes of an investment instrument. Volatility has two types: symmetric volatility and asymmetric volatility. Asymmetric volatility occurs when negative or positive information produce the same amount of volatility within the same magnitude (Engle & Ng, 1993); while Asymmetric volatility occurs if positive and negative information produce different amounts of volatility at the same magnitude (Brooks, 2007). There are two factors used for identifying asymmetric volatility: leverage effect and volatility feedback. Leverage effect occurs when a decrease in return causes an increase in financial leverage, leading to more risky capital markets and increasing volatility. Volatility feedback occurs when price volatility, particularly in a situation when an anticipated increase in volatility causes an increase in the requested return, leading to a decrease in prices (Wu, 2001).

In both the money market and capital market, the volatility of error occurs more frequently after negative shock than positive shock. This is called asymmetric volatility. The EGARCH model

can be used to estimate asymmetric volatility from data. Engle & Ng (1993) assert that EGARCH models could receive different effects from both positive and negative information, while the general model of GARCH unable to capture it. Furthermore, EGARCH models can capture large shocks that can have a large impact on volatility. Mehrara & Abdoli (2005) state that EGARCH is the best model in measuring volatility due to the impact of news or shocks. In the 2017 United Nations Conference on Trade and Developments (UNCTAD) released a survey of prospects for investment destination countries in 2017-2019. It showed that Indonesia's ranking as the most prospective investment destination in the 2017-2019 period increased from 8th to 4th in the year 2016. In particular, the Indonesian capital market is still one type of investment destinations that captures foreigners' interests. SUN ownership based on foreign ownership shows an increasing trend every year. Until December 2017, there was 39.8 percent or equivalent to IDR. 836.15 trillion held by foreign investors (DJPPR Ministry of Finance, 2017). The magnitude of foreign investor ownership for SUN with a long-term tenor leads to stabilization of Indonesia's macroeconomic. However, it has not fully served a reliable investment climate. The investment risk in Indonesia has not yet reached a certain limit in which foreign investors could perform as risk-takers (Rahma, 2017). Sarmiento et al. (2017) state that the bond market with a tenor less than five years will be more efficient when receiving positive information and become inefficient when receiving negative information. Chee & Fah (2013) mention two of the eight macroeconomic variables that have a strong influence on bonds are interest rates and exchange rates. The negative relationship is stronger in the long run. Capital markets in emerging countries are more vulnerable to negative information which results in uncertain economic conditions, resulting in the asymmetric volatility in the capital market (Raza et al., 2016).

Studies related to the capital market have been carried out in a lot of developed countries. Many research in Indonesia is now concerning on capital market, particularly the bond market. However, there are still some studies that investigate the asymmetric volatility of bonds both price and return. Macroeconomic variables are some important variables influencing volatility in the bond market because bond markets are more quickly affected by macroeconomic news than other information (Goeij & Marquering, 2006). In addition, the bond market meets some challenges such as default risk, liquidity risk, interest rate risk, inflation risk, and exchange rate risk. Evans & Marshall (1998) state that monetary policy can affect short-term bond returns. This is also supported by Engle & Li (1998) who state that macroeconomic shocks on the announcement day bring more impacts on the volatility of returns in the short term. This is similar to a study Barr & Campbell (1997) that monetary policy affects short-term bonds and have no effect on the long term.

Along with the development of the bond market in Indonesia, this study is expectedly used as a reference for the bond portfolio among investors. For the government, this study can be used as a reference in policy making of markets to reduce any potential risks. Research about the capital market has been carried out in some developed countries and there is an increasing many of research on the capital market, particularly the bond market. However, there are many studies focusing on the asymmetrical information of bonds both in price and in return using the EGARCH model. It is necessary to conduct this study due to the growth of the bond market in Indonesia and the increasing foreign ownership in the Indonesian government bond market. This is because the increasing number of foreign ownerships will make Indonesian bond market more susceptible to any pressures. One of the pressures is the sudden withdrawal of foreign capital which can lead to asymmetric volatility in the Indonesian government bond market. Besides, this study can be used as a benchmark for any investors to engage with the bond portfolio. As for the government, this

study is used as a benchmark among policymakers to reduce any risks in the market.

2. Hypotheses Development

Goeij & Marquering (2006) explain that macroeconomic announcements have a strong influence on increasing bond market volatility. Macroeconomic announcements have more accelerating implications than other information. Several macroeconomic variables that can affect the bond market are interest rates and exchange rates (Chee & Fah, 2013). Meanwhile, Masyhuri (2016) states that interest rates, exchange rates, and the Indonesia Composite Index (ICI) influence the bond market. The macroeconomic variables used in this study are deposit rates, the Fed interest rates, exchange rates, and JCI. Meanwhile, the interest rate used in this study is deposit rates; and JCI is used to identify the movement effects of investment instruments. The interest rate of The Fed is used as an international indicator. The bond returns will be affected by interest rates.

When the interest rate increases, the price of bonds will decrease, leading to lower returns of bonds and vice versa. Changes in interest rates will be inversely proportional to prices which further impacts the return (Mishkin, 2008). Moreover, Sukanto (2009) state that deposit rates have a significant negative effect on bond prices. Ervina (2015) explains that bond returns will be more responsive to global shocks than of domestic one. According to Goeij & Marquering (2006), announcements from the FOMC (Federal Open Market Committee) are very important for bond market volatility because it is usually associated with macroeconomic shocks. As a matter of fact, announcements from the FOMC, particularly related to changes in the interest rate of The Fed or Effective Federal Funds Rate (EFFR) will affect the US Dollar exchange rate against all currencies, resulting in the depreciation of Rupiah in the short term. The strength of exchange rates is not only determined by global factors but also the economic fundamentals of a certain country. The government and Bank Indonesia (BI) need to improve economic fundamentals both in fiscal and monetary terms (Ministry of Finance, 2016).

H_1: deposit rates have a negative effect on bond returns.

H_2: the Fed's interest rate has a negative effect on bond returns.

The foreign currency markets facilitate international trade and transactions. The changes in exchange rates are caused by changes in the foreign exchange market's demand and supply. The law of demand and supply in economics also apply to the foreign exchange market; and if there is a change in demand & supply, it will have an impact on exchange rates. The changes in exchange rates can be divided into two types i.e., depreciation and appreciation. Exchange rate depreciation occurs if the value of domestic currency against foreign currencies declines. While appreciation occurs when the value of the domestic currency against foreign currencies increases.

If another condition is deemed constant or ceteris paribus, the depreciation of state currency makes some goods cheaper for foreign countries while the price of foreign goods becomes more expensive for foreign parties. On the contrary, appreciation makes more expensive goods for foreign parties while the price of foreign goods is lower for domestic parties (Masyhuri, 2016). Changes in exchange rates will have a significant negative effect on the returns of capital market (Tsen, 2017). Chow, Lee, & Solt (1997) state that bond returns will be susceptible to any changes in exchange rates in both the short and long term. In addition, Masyhuri (2016) explains that the exchange rate has a negative effect on the bond market.

H_3: exchange rates negatively affect on bond returns.

The stock price index is used as a barometer of national economic health and serves as a basis for statistical analysis of the latest market conditions (Masyhuri, 2016). The increasing index indicates that stock prices have increased as well. Widoatmodjo (2007) shows that stock prices will be directly proportioned with the bond market. An increase in stock prices will influence the price of bonds which will lead to an increase in bond returns.

H_4: the return of the Indonesia Composite Index has a positive effect on bond returns.

3. Method, Data, and Analysis

This study uses secondary data obtained from Bank Indonesia, Indonesia Stock Exchange, and Indonesia Capital Market Directory (ICMD). Observations are completed over a period of 5 years with a range of periods from 1 January 2013 to 31 December 2017 in order to optimally distinguish the volatility of short, medium and long term SUN movements. The examined bond series are a series of bonds issued by the Indonesian government no later than January 2013; in a form of fixed coupon rate or FR series with the due date of a short, medium and long term for comparison. FR series of SUN are SUN FR 0066, FR 0031, and FR 0050. The macroeconomic variables used in this study are inflation, deposit rates, exchange rates, the Fed's interest rate, the return of the Indonesia Composite Index (JCI).

According to Tsay (2005), the calculation for estimating returns is:

$$r_{it}=\frac{CP_t-CP_{t-1}}{CP_{t-1}} \quad (1)$$

Where: r_{it}= bond series return i in period t; CP_t = closing price in period t; CP_{t-1} = closing price in period t-1

Quantitative analysis using the model of Autoregressive Conditional Heteroscedasticity (ARCH) and the model of Generalized Autoregressive Conditional Heteroscedasticity (GARCH) was employed.

As for the general ARCH / GARCH model, it is elaborated as follows:

$$\sigma_t^2 = \omega + \sum_{i=1}^{q} \alpha_{i-1}\, \varepsilon_{i-1}^2 + \sum_{j=1}^{p} \beta_j\, \sigma_{t-j}^2 \quad (2)$$

Prior selection of the best model of ARCH/ GARCH, comparison of some family models of ARCH / GARCH needs to be taken. There are three stages that must be followed when estimating the best model of ARCH/GARCH (Juanda & Junaidi, 2012). The first stage is to perform stationarity testing on the data using the ADF test, then to detect the ARCH effect on the residuals and the heteroscedasticity in the time series data. Heteroscedasticity testing is performed using the ARCH-LM test. The second stage is to estimate the model by selecting the best one. The best model should have the maximum Log Likelihood value and the smallest Aikake Information Criterion (AIC) and Schwarz Information Criterion (SIC). The third stage is to evaluate the model by reexamining the heteroscedasticity using the ARCH LM test. The fit model does not have ARCH effects.

After a range of stages used to estimate the best model of ARCH/GARCH for this study, the best model is eventually selected, which is the Exponential Generalized Autoregressive Conditional Heteroscedasticity (EGARCH). This is a family model of Autoregressive Conditional Heteroscedasticity (ARCH) and Generalized Autoregressive Conditional Heteroscedasticity (GARCH). The EGARCH model used in this study is based on a model developed by Nelson (1991):

$$\sigma_t^2 = \alpha_0 + \alpha_1 \left|\frac{e_{t-1}}{\sigma_{t-1}}\right| + \phi_1 \left|\frac{e_{t-1}}{\sigma_{t-1}}\right| + \ldots. + \alpha_p \left|\frac{e_{t-p}}{\sigma_{t-p}}\right| +$$

$$\phi_p \frac{e_{t-q}}{\sigma_{t-q}} + \lambda_1 \mathrm{h}\, \sigma_{t-1}^2 + \ldots \lambda_q \mathrm{h}\, \sigma_{t-q}^2 \quad (2)$$

Where: σ_t^2 = conditional variance; α_0, α_1, ϕ_1, α_p, ϕ_p = coefficient $\frac{e_{t-q}}{\sigma_{t-q}}$ = sign effect $\frac{e_{t-q}}{\sigma_{t-q}}$ = magnitude effect

The sign effect shows the difference in influence between positive and negative shocks in period t on current variances. The magnitude effect shows the magnitude of volatility effect within the t-p period on current variances. The existence of asymmetric volatility can be identified if the coefficient ≠ 0, negative asymmetric volatility occurs if the coefficient < 0, while asymmetric volatility is positive if the coefficient is > 0.

Ervina (2015) said that the regression model can be used to estimate the effect of macroeconomic variables on bond returns. Therefore, in this study regression model is used and formulated as follow:

$$r_{it} = \beta_0 + \beta_1\, DPST + \beta_2\, EXR + \beta_3 EFFR + \beta_4\, RIHSG + \varepsilon_t$$
$$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5 < 0 \quad (4)$$

Where: = bond series return i in period t; β_0 = intercept; β_1,....β_n = constant; DPST = deposit rates (%); EXR= exchange rates (%); EFFR= the Fed's interest rates (%); RIHSG= return of JCI (%); ε_t= *error*

If problems with autocorrelation and heteroscedasticity occur in multiple linear regression models, the ARCH GARCH family method can be used to solve this problem (Tanjung et al., 2014). In the ARCH/GARCH method, the regression equation can be derived as follows:

$$r_{it} = b_0 + \Sigma\, b_i\, x_{it} + e_t \quad (5)$$

$$\sigma_t^2 = \alpha_0 + \alpha_1 e_{t-1}^2 + \lambda \alpha_{t-1}^2 \quad (6)$$

Where: b_i=regression coefficient i; x_{it}= independent variable

4. Results

Data stationery can be observed through trends of data. If the data fluctuate, it is assumed as non-stationary. ADF t-stat value or Unit Root Test is used to perform stationary testing's. The data can be assumed as stationary if the value of the bond price return from ADF t-stat > MacKinnon critical values; or the ADF statistical probability value is significant to the critical value of the real level used (Juanda & Junaidi, 2012), which is displayed in Table 1. Based on the test results, the value of ADF t-statistic> critical value at the real level of 10%; thus, it can be assumed that the data is stationary at the level of 10%.

The next stage is to detect the effect of ARCH on the residual data. In other words, the heteroscedasticity can be identified using time series data. One common method used to test ARCH effects is the ARCH-LM test. Based on the results of the ARCH-LM test, Obs R-squared and the probability value of each SUN can be seen in Table 2.

Obs R-squared values and Chi-square probabilities obtained from the three FR series SUN are

Table 1. Stationery test

Variable	ADF Statistical Value	Critical Value (10%)	Information
FR 0066	-10.03231	-2.593551	Stationer
FR0031	-7.094491	-2.594027	Stationer
FR 0050	-9.534085	-2.593551	Stationer

smaller than the real level of 10%. Therefore, it can be concluded that all selected ARMA models contain heteroscedasticity or there are ARCH effects which can be taken to the further stage using the ARCH-GARCH method. Studies by Engle & Ng (1993) and Mehrara & Abdoli (2005) explain that the ARCH-GARCH model cannot capture overall information from the data, particularly asymmetric effects while the EGARCH models can identify the existence of such asymmetric effects. The EGARCH model can identify both positive and negative news that bring different impacts on volatility, in a situation where other GARCH base models unable to do it. After several stages to choose the best model of ARCH/GARCH in which one of them is by comparing several ARCH/GARCH family models, the finding shows that the EGARCH model is the best for the three series of SUN bonds. The EGARCH models used for FR 0066, 0031, and FR 0050 SUN bonds are EGARCH (2.1), EGARCH (3.1), and EGARCH (2.3). Based on Table 3, EGARCH is the best model for the three series of bonds of SUN which are elected based on the smallest AIC and SIC values and the largest Log Likelihood value.

Rahma (2017) asserts that the parameter of data volatility can be analyzed based on β_i coefficients (coefficients of *LOG (GARCH (-1)). The results of estimated positive significant values show bond returns volatility which remains strong and persistent. Meanwhile, the asymmetrical parameter can be observed from γ_i coefficient (coefficient of * RESID (-1)/@SQRT (GARCH (-1). The estimation results of negative significant values indicate negative shocks which have a larger impact on bond returns. On the contrary, the positive significant value indicates positive news have larger impacts on SUN series return than negative news.

Based on Table 4, the estimation results show the volatility for returns of the three series of bonds remain strong and persistent, with a probability value of 10% at a real significant level with a positive coefficient. The return volatility of the three series of bonds is asymmetric with a significant probability value of 10 percent. Negative coefficient value on the asymmetric parameter of the three series of bonds indicates that negative news and negative shocks could bring greater effect on the SUN returns in term of short, medium and long than positive news at the same magnitude.

Table 2. Heteroscedasticity test (ARCH-LM test)

Variable	Obs*R-squared	Prob. Chi-Square
FR 0066	12.06905	0.0005
FR 0031	9.914619	0.0016
FR 0050	4.649689	0.0311

Table 3. The best EGARCH Model for SUN

SUN	(p,q)	Log-Likelihood	AIC	SIC
FR 0066	2,1	180.35	-5.876	-5.629
FR 0031	3,1	139.63	-4.462	-4.180
FR 0050	2,3	116.36	-3.639	-3.322

Table 4. Parameters of asymmetric volatility in return SUN

Variable	(p,q)	The Best EGARCH Coefficient			
		Volatility Parameters		Asymmetric Parameters	
		Coefficient	Probability	Coefficient	Probability
FR 0066	(2,1)	0.883564	0.0000	-1.470244	0.0001
FR 0031	(3,1)	0.806889	0.0000	-0.278900	0.0007
FR 0050	(2,3)	0.539802	0.0035	-0.544987	0.0076

To estimate the macroeconomic variables that influence the return of SUN bonds, it is necessary to use multiple regression methods. The result estimation of SUN FR 0066 return using multiple linear regression models indicate few variables with a significant real value of 10 percent, that are deposit rates, exchange rates, and JCI returns. For the return of SUN FR 0031 and 0050, only JCI has a significant value at 10 percent. In addition, the R-squared value obtained from the estimation of multiple linear regression models on the return of the three series of SUN bonds is lower than 50 percent.

After a residual test, heteroscedasticity problem was found in the model. The problem was identified from the ARCH-LM value in the three series of SUN bonds. The probability value obtained from the residual test is smaller than the real level of 10 percent. Therefore it can be concluded that all multiple linear regression models in the study have heteroscedasticity or ARCH effects which need to be further processed using the ARCH-GARCH family model. The estimation result using the ARCH-GARCH family model reveals the EGARCH model as the best model for estimating macroeconomic variables that affect the return of the three series of SUN bonds.

Therefore, the best EGARCH model chosen for SUN FR 0066 bond returns is EGARCH (3.3).

Table 5. The estimation result of FR 0066 returns using EGARCH (3.3)

Macroeconomics Variable	Coefficient	Probability
DPST	0.008127	0.0000
EXR	-0.001226	0.0220
EFFR	0.004167	0.0574
RIHSG	0.106470	0.0019
AIC		-6.319700
SIC		-5.865925
Maximum Log-Likelihood		202.5910

Table 6. The estimation result of FR 0031 return using EGARCH (2.3)

Macroeconomic Variables	Coefficient	Probability
DPST	0.006509	0.0002
EXR	-0.001154	0.0048
EFFR	-0.001940	0.5094
RIHSG	0.204589	0.0000
AIC		-4.966720
SIC		-4.547851
Maximum Log-Likelihood		161.0016

Table 7. The estimation result of FR 0050 return using EGARCH (2.3)

Macroeconomic Variables	Coefficient	Probability
DPST	0.008079	0.0000
EXR	-0.002607	0.0592
EFFR	0.011855	0.1430
RIHSG	0.361334	0.0000
AIC		-3.71121
SIC		-3.257435
Maximum Log-Likelihood		124.3363

Based on the estimation results in Table 5, some significant macroeconomic variables at the 10 percent level are deposit rates, exchange rates, effective federal funds rate, and JCI return, leaving the exchange rate coefficient as the only negative one and other three coefficient variables with positive values.

The best EGARCH model for SUN FR 0031 bond returns is EGARCH (2.3). Based on the estimation results in Table 6, some significant macroeconomic variables at the level of 10% are deposit rates, exchange rates, and JCI returns, while the effective federal funds rate (interest rate of the Fed) variable has no significant effects. Only the exchange rate variable has a negative coefficient while the other two variables have a positive coefficient value.

The best EGARCH model for SUN FR 0050 bond returns is EGARCH (2.3). Based on the estimation results in Table 7, all macroeconomic variables used in the study are significant at the real level of 10 percent. As similar to the previous two series of SUN bonds, there is only the exchange rate with negative coefficient values, while the other three variables have a positive coefficient value.

Discussion

In general, the best model for measuring the return of the three series of SUN bonds is the EGARCH model. This is in line with previous studies of Engle & Ng (1993) and Mehrara & Abdoli (2005) that the ARCH-GARCH model cannot capture complete information from the data, particularly related to asymmetric effects, while EGARCH models are able to identify the asymmetric effect. The EGARCH model can analyze both positive and negative news with various effects on volatility in which basic models of GARCH are unable to perform this action. From the findings of this study, it shows that negative news or negative shocks have bigger impacts on returns of SUN bonds in short, medium and long term than those of positive news with the similar level of magnitude. This is similar to a previous study of Goeij & Marquering (2006), showing that the volatility of bond returns will be higher when absorbing negative news than those of positive news. The study of Engle & Li (1998) also concludes that negative shocks will lead to asymmetric volatility. Most macroeconomic variables have a significant relationship with the return of SUN bonds. In SUN FR 0031, the only deposit interest rate is insignificant at the real level of 10 percent while other variables have significant effects, which differ from SUN of FR 0066 and FR 0050; as both have macroeconomic variables with a significant effect on the real level of 10 percent.

The coefficient value of deposit rates, effective federal funds rate, and the return of positive JCI illustrate that any increase in these variables will result in the increase in the tree bonds of SUN. At the same time, the negative coefficient value on the exchange rate illustrates that every increase in the exchange rate will reduce the returns of three bonds of SUN under study.

Deposit rates have a significant influence on the returns of SUN bonds. This is similar to a study of Sukanto & Widaryanti (2015) that deposit rates have a significant effect on bonds. The increase in bonds performance of both government and coop after the increase in interest rate may occur when the exchange rate is stable. The positive impact can occur despite insignificant value due to a lot of negative sentiments that may affect the domestic bond market movement. The positive relationship between deposit rates and returns of SUN bonds likely occur due to better liquidity of SUN bonds than those of deposits. OJK (2018) shows that the deposit can be liquidated or disbursed after the expiration period. The time period for deposits generally starts from 1, 3, 6, 12, to 24 months. If deposits are disbursed before the due date, investors will be fined. It attracts investors to continue their investment in the bond market because they can immediately receive returns from bonds without waiting for a due date.

The exchange rate has a significant negative effect on the returns of SUN bonds. This is similar to a study of Chow, Lee, & Solt (1997) explaining that a return of bonds is influenced by exchange rates in both short and long term. Based on a study by Masyhuri (2016), the exchange rate negatively influences the bond market. From the investors' point of view, the depreciation of the Rupiah exchange rate against Dollar turns negative went the return declines. Asih (2012) shows that the exchange rate of Rupiah against US Dollar influences the return in the capital market. If the exchange rate of Rupiah against Dollar depreciates or decreases, the value of the currency against other currencies will lead to a decrease in prices and returns. By way of explanation, the investors will sell their portfolios and turn into US Dollar investment. The depreciation of the Rupiah exchange rate against foreign currencies, particularly US Dollars will negatively influence the economy and capital market.

The effective federal funds rate (interest rate of the Fed) significantly influences the return of SUN bonds issued by the government. It is supported by a study of Chulia et al. (2010) on the asymmetric impact of the FOMC announcement on the federal funds rate in the S&P 100 stock market return. The findings of the study show that the stock markets respond differently to positive and negative news from the FOMC announcement. It brings impact on the Indonesian Capital Market considering the existence of capital market integration which can be interpreted as a relationship that occurs between capital markets between two or more countries. If one market experiences shock it will have an effect both in the long term and short-term on the integrated state capital markets (Ferdiansyah & Tin, 2016). The flows of international bonds to emerging markets are more susceptible to interest rate shocks (Cenedese & Malluci, 2016).

The JCI return has a significant and positive relationship on the returns of SUN bonds. This is in line with a study of Masyhuri (2016) that JCI has a significant positive effect on the bond markets because both have different market shares so they do not substitute with each other. The difference in market share is based on the size of the risk appetite of an investor on the investment instruments. The investors who have a high-risk appetite will prefer investing in the stock market, while the investors who have low-risk appetite will prefer to invest in the bond markets.

5. Conclusion, Limitations, and Suggestions

Conclusion

Based on a study of asymmetric volatility and macroeconomic variables that influence the return of government bonds, there is asymmetric volatility in the return of SUN bonds in the short, medium and long term. Negative news has a greater impact on asymmetric volatility in short, medium and long term SUN bond returns compared to positive news at the same magnitude. After comparing some ARCH/ GARCH family models, the best model is selected, that is EGARCH (2.1) model which is deemed as the best model for assessing asymmetric volatility in short-term SUN, EGARCH (3.1) for medium-term SUN, and EGARCH (2.3) for long-term SUN. The interest rate of deposits and the return of JCI have a significant and positive relationship with the return of SUN bonds both short, medium and long -term. The effective federal funds rate or the Fed's interest rate have a significant positive influence on the return of SUN bonds in the short and long term, despite being ineffective in the medium term. The exchange rate has a significant negative influence on the return of short, medium and long term SUN bonds.

Limitation and suggestions

For both investors and the government, the asymmetric volatility needs to be considered. Macroeconomic instability can be one of the triggers for

asymmetric volatility. By learning the existence of asymmetric volatility, investors can assess and anticipate the risks they have on bonds. Besides, investors use asymmetric volatility to obtain capital gains from their bonds. Nevertheless, investors must be deliberate in selecting bonds for the portfolio since the bond market, particularly government bonds, are vulnerable to any positive and negative news on the market. As a bond issuer and a policymaker, the government may use the asymmetric volatility as a benchmark in the making of policies to avoid risks in the bond market. The goal of bond issuance is to earn greater income for state budget. The government hopes that the bond market will become a long-term investment for investors, not as a place to get capital gains. Thus, the government should make policies that can attract investors to get involved in the bond market in the distant future. Based on the findings of study and its limitation, it is necessary to conduct a further study related to asymmetric volatility and macroeconomic variables that affect bond returns. As for further studies, extending periods of research to get more samples should be considered. The bond market is not only affected by macroeconomic variables but also microstructural factors and government policies. Therefore it is necessary to develop a dummy variable to study the effect of government policies on bond returns in the capital market to consider other policies that may be excluded in this study. Additionally, further research may consider the effect of macroeconomic variables on the return of dollar-denominated bonds or other foreign currencies in order to determine the movement of volatility by other forms of bonds.

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