MODELING OF SHARE RETURN VOLATILITY: STUDY ON INDONESIAN STOCK EXCHANGE

Dian Fordian, Universitas Padjadjaran
Mohammad Benny Alexandri, Universitas Padjadjaran
Suryanto, Universitas Padjadjaran
Suhal Kusairi, Universiti Malaysia Trengganu

ABSTRACT

This study aims to create a stock return volatility model on the Indonesia Stock Exchange. The object of this study is the volatility of stock returns and weekly composite composites. The data used is secondary data in the form of weekly composite stock price index data. Data analysis uses multiple volatility, symmetric and asymmetrical GARCH modeling. The results of this study indicate that the TGARCH asymmetric model can present stock return volatility. In addition, in the Indonesian stock market there is an asymmetrical effect that shows a negative shock has a more pronounced effect than a positive shock on the stock market.

Keywords: Volatility, GARCH, Stock Return.

INTRODUCTION

Indonesian capital market performance is still very good amid the dynamics of the financial sector due to various external factors that occur. Composite Stock Price Index (CSPI) is calculated every day at which the transaction takes place, using the last share price that occurred on the trading floor. Investments that are already running well are expected to be one of the drivers of Indonesia's economic growth. Good economic growth depends not only on the amount of consumption, but also on the ability of investment and production. Nevertheless, investment experienced a pretty heavy condition in 2018. The trade war between China and the United States made the investment climate less supportive, especially in developing countries. This condition is coupled with the Fed's benchmark interest rate, which has risen up to 4 times, making the US capital market faltering. Slowing world economic conditions also contributed to the severity of the investment climate. In addition, the economic slowdown that occurred in China had an impact on falling commodity prices and directly affected investment in Indonesia given China's position as Indonesia's main trading partner.

Stock price index is an indicator that describes the movement of stock prices. As a statistical scale, the stock price index is also often used to describe and predict market trends. Along with the domestic economy which is still growing positively and is supported by macroeconomic conditions that are maintained and monetary policies that tend to be loose and the improved financial performance of listed companies from the results reported, the confidence of market participants is still quite strong. Stock price indices are often used as stock indicators used by investors to sell and buy shares. Changes in the stock price index can occur due to changes in stock prices on the exchange or because of changes in the total value of the basic shares. Investing in the stock market is often faced with high risk because the stock price is volatile and stochastic. Stock prices move in a matter of seconds and minutes, then the index value also moves up and down in a matter of fast time too, this movement is known as stock price volatility. The existence of volatility will lead to greater risks and uncertainties faced by investors, so that investor interest in investing becomes unstable.

Investors must be able to estimate the movements of stock prices, so investors can know the right time to sell and buy shares. Market participants can control and reduce market risk of traded assets, such as shares, by estimating volatility through the modeling process. Volatility modeling can be done with the early generation of generalized autoregressive conditional heteroscedasticity (GARCH) models, such as the autoregressive conditional heteroscedasticity (ARCH) model from Engle (1982) and GARCH models from Andersen & Bollerslev (2006), which can reveal the existence offrom Engle (1982) and GARCH models from Andersen & Bollerslev (2006), which can reveal the existence ofengle (1982) volatility clusteringvolatility clustering, namely shocks, namely shocks that. big followed by big shock too. However, the early generation of the GARCH model cannot express asymmetrical effects which refers to the fact that bad news increases volatility more than good news. One explanation related to this fact, which is the first time emphasized by Black (1976) in (Epaphra, 2017), which states that the fall in stock values (returns negative) increases financial leverage, which makes stocks more risky and in turn increases volatility. Often asymmetric volatility is also called leverage effect. Leverage effect which means that negative shocks have more real effects than positive shocks in the equity market (Živkov et al., 2016).

Several studies related to volatility return stock, research by Luo et al. (2016), predicting stock market volatility that is always changing over time is important in financial data modeling. Lestano & Kuper (2016) conducted a study examining the dynamic relationship between stock returns and exchange rate changes using daily data from January 1994 to September 2013 for six East Asian countries (Indonesia, Malaysia, Philippines, Singapore, South Korea, and Thailand). Aggarwal (2018), examines market efficiency and the persistence ofvolatility stock return weeklyfrom the Korea Composite Stock Price Index (KOSPI) from July 1997 to September 2016. Chang et al. (2019) proposed Generalized Autoregressive Conditional Heteroscedasticity (GARCH) withprediction model Gray a modifiedto study the transmission of volatility throughanalysis error terms. Cheteni (2016), examines the relationship between returns stockand volatility in South Africa and the Chinese stock market. Umutlu & Shackleton (2015) examine the short-term relationship between volatility of stock returns and daily equity trading by several groups of investors on the Korea Stock Exchange. Mousa & Elamir (2018) assessed the company's forward-looking disclosure by measuring four attributes, namely the number of disclosures, the scope of disclosures, the concentration of disclosures, and the quality of disclosure, through a sample of 34 companies listed on the Bahrain Exchange from 2014 to 2017. Stock return volatility has a relationship statistically significant negative with three forward-looking disclosure attributes, namely the quantity of disclosures, disclosures, coverage and quality of disclosures. Tripathy & Gil-alana (2015) model the time-varying volatility in one of India's major stock markets, namely, the National Stock Exchange (NSE) located in Mumbai, the symmetrical and asymmetrical GARCH model shows that the volatility of NSE returns is persistent and asymmetrical and has been increased as a result of the global financial crisis. Sikhosana & Aye (2018) analyzed volatility spillovers asymmetricbetween the real exchange rate and returns stockin South Africa. The Multivariate Generalized Autoregressive Conditionally Heteroscedastic (EGARCH) model with other asymmetric GARCH models (GJR GARCH and APARCH) uses monthly data from 1996 to 2016 to test the relationship of these variables. The results show that there is aeffect volatility spillovers two-waybetween the two markets in the short term. Based on several previous studies, predicting volatility using the twodimensional GARCH model, for research to be conducted at the Indonesia Stock Exchange (IDX) the model used is still the same using the GARCH model. But the GARCH model that will be used in this study uses three-dimensional multivariate GARCH, so using this model volatility estimation can be more accurate because it can see the effects of transmission of volatility from global stock markets, the Indonesian stock market (Indonesia Stock Exchange), and sectoral shares on the IDX .

Volatility on financial markets, especially on the stock market, is one of the most interesting phenomena because of its impact on the existence of global financial markets. The existence of volatility is related to the risk of a stock. In the current era of globalization, international finance is becoming increasingly integrated and open, which in turn will cause greater capital mobility from one country within it to other countries. Therefore, the unlimited world financial markets make it possible to increase risk through shocks that occur in certain markets, making it increasingly difficult to isolate from other markets. The impact of shocks in one country can be spread (spill over) to other countries' markets through the transmission mechanism of assets or credit, so that the related markets will experience financial instability. As a result, analysis of the existence of volatility in a market is often not enough for market participants, so it is necessary to conduct further studies related to the transmission of inter-market volatility.

The problem that arises from the volatility modeling process of a market is that each market has different performance, size, and characteristics, so that the specification estimation model needs to be done to get the best model. The selection of the best model is done so that the estimated value of stock return volatility can be obtained precisely and accurately. The more precise the model used in describing the volatility of stock returns, the more it will make companies and investors right in making decisions because the risk forecast of an investment will be close to its actual value. In turn, this information will be utilized by an investor in taking appropriate anticipatory steps in investing, such as whether an investor must maintain or release his investment in a certain situation.

LITERATURE REVIEW

Stock Volatility Stock

Return volatility explains the level of return trends to change. Factors such as the financial crisis can easily affect volatility. This unexpected change means the risk is uncertain and is not liked by most stock market players (Bint Omar & Halim, 2016). Increasing financial market integration and interdependence, supports the portfolio theory which states that an investor should diversify his portfolio. This is done in order to minimize risks by distributing risks that can arise as a result of only investing in one particular type of portfolio or in the context of an integrated market, avoiding the risks arising in certain markets. Ownership of a cross-country asset will make investors better protected from systemic risks that specifically arise and are isolated in the markets of a particular country. Another fact that must be faced with regard to the impact of the increasing flow of globalization is the unlimited world financial markets which allow for increased risk through shocks that occur in certain markets to become increasingly difficult to isolate from other markets. The impact of shocks in one country can spread (spill over) to other countries' markets through transmission mechanisms, so that related markets will experience financial instability and make diversification of assets across countries as an effort to minimize investment risk less effective. In turn, the process of risk transmission can weaken financial market stability.

Volatility is a common behavior in stock exchanges throughout the world. volatility is related to changes in conditional variants of stock returns over time Volatility is fluctuation in up and down movements in stock prices. Volatility is related to changes in conditional variants of stock returns over time. The existence of volatility allows to get return a higher, but the reality is that a high level of volatility also causes doubts among investors because it creates more risk for them and also causes inefficiency in the market (Khan, 2016).

Market risk is one of the things that must be considered by market participants such as companies and investors in making investment decisions. Stock price index moves in seconds and minutes, then stock returns also move up and down in a matter of time fast too, this movement is known as stock return volatility. The existence of volatility will lead to greater risks and uncertainties faced by investors so that investor interest in investing becomes unstable. High volatility reflects unusual supply and demand characteristics. A volatile market will make it difficult for companies to raise their capital in the capital market because it has a higher level of uncertainty from the stock returns obtained.

Volatility will cause the risks and uncertainties faced by market participants to increase, so that the interest of market participants to invest becomes unstable. In addition, the existence of volatility also impacts the existence of global financial markets because it is related to the idea of risk. The types of volatility that are often observed in the stock market are stock price volatility and stock return volatility. Stock price volatility describes changes in the closing price of a stock or a stock index that occurs during a certain observation period. Changing stock closing prices can occur due to internal and external factors. Internal factors that cause fluctuations in closing prices are related to the issuer's listed companies, for example changes in the profitability of the company. In addition, it is also seen from external factors that occur, such as shocks that occur on the foreign stock market, macroeconomic factors such as exchange rates and interest rates, as well as the issues that are developing within the stock market itself. Macroeconomic fundamental factors which include interest rates and foreign exchange or exchange rates, are very important factors in the assessment of investors (Hadady et al., 2018). Stock price volatility is very important to observe for investors, because it becomes the basis for calculating stock return volatility. Volatility of stock returns illustrates the fluctuation of the daily observation price difference in a particular observation period.

One of the fluctuations in the value of an instrument in the stock market can be caused by the influence of irrational factors that affect the demand and supply of a market (Maskur, 2009). This irrational factor can be a rumor that is developing in a market, following a dream, a friend's whisper, or a price game. Efficient markets are stable markets, which fluctuate because irrational actions are eliminated.

Stock market volatility has been an interesting topic in the financial literature for more than four decades. Starting with Fama (1970) pioneering the random walk model and the efficient market hypothesis (EMH), stock market volatility has become very important for all subsequent research related to market efficiency. In an efficient market, all available information is reflected in current stock prices so it is not possible to predict future prices. However, the existence of certain financial phenomena such as seasons, weekend effects, January effects, and clustering volatility make it possible to predict stock prices and the magnitude of stock price movements. Price predictability is considered as one of the most important aspects in generating abnormal returns, making stock market volatility an important analytical topic.

Volatility can be interpreted as a measurement of the average fluctuation of a time series data. This is developed into variance, which is a variable in statistics that illustrates changes in the value of fluctuations with the average of a series of financial data. It can be concluded that volatility is the value of the variance of data returns. The existence of this volatility raises the problem of heteroscedasticity in the various forms.models Linear trend, exponential smoother, ormodels autoregressive integrated moving average (ARIMA)have failed to see the phenomenon of high volatility (increase in variance), because these models assume a constant variance range (Montgomery et al., 2008). Initially, there was an opinion that the value of variance from time series data was constant so that it could be modeled using Autoregressive (AR), Moving Average (MA), or a combination of both, ARMA. But Engle denied this and stated that the variance ofdata time series is not constant, meaning that it can change based on time. In financial data with a fairly high level of fluctuation, themodel autocorrelation with variance changes is more realistic to model the value of volatility. ARCH has the assumption that variance the fluctuation datais influenced by a number of p data fluctuations before. The Bollerslev team developed the ARCH model into a better GARCH (Generalized Autoregressive Conditional Heteroscedasticity) than ARCH. The GARCH model (p, q) assumes that the variance of fluctuation data is influenced by the number of p data from previous fluctuations and the number of q data of previous volatility. GARCH (1,1) which is used as a basis for modeling of volatility spillover assumes that the variance of data fluctuations at time t is influenced by data fluctuations at t-1 and volatility at t-1. This is due to the fluctuations in the data T-1 and T-1 volatility has contained elements of a data fluctuation t-2 and T-2 Data volatility and so on.

Stock Returns

Returns are the results obtained from investments. Whereas shares are proof of ownership of the assets of companies that issue shares. By owning shares of a company, then the investor will have the right to the income and wealth of the company, after deducting payment of all company obligations. return Stockis the result of profits earned by investors from a stock investment is done. returns Stockcan be a return realization has occurred or return expectations that have not happened yet, which is expected to happen in the future (Jogiyanto, 2016).

Stock return = *capital gain (loss)* + *Yield*

Capital gain (loss) is the difference from the current stock price relative to the share price of the previous period.

$$\textit{Capital gain} \text{ or } \textit{capital loss} = \frac{P_t - P_{t-1}}{P_{t-1}}$$

Whereas yield is a percentage of periodic cash receipts to the investment price of a certain period of an investment. For stocks, the yield is the percentage of dividends to the previous period's stock price. Thus the total return can also be stated as follows:

$$\text{Stock return} = \frac{P_t - P_{t-1} + yield}{P_{t-1}}$$

For ordinary shares paying periodic dividends of Dt rupiahs per share, the yield is Dt / Pt-1 and total returnscan be expressed as (Choudhry et al., 2010):

$$\text{Stock returns} = \frac{P_t - P_{t-1} + D_t}{P_{t-1}}$$

This research uses a formula to calculate stock returns, as once used by Bint Omar & Halim (2016) and Rossi & Gunardi (2018) who defined returns stock priceas follows: $r_t = \ln\left(\frac{S_t}{S_{t-1}}\right)$ where: r_t=stock returns at the t-t price, St=share price in period t and St-1 stock price in period t-1. According Jogiyanto (2016) return is divided into two kinds, namely: first, the return realization (Tirrenusreturn),a return that has occurred. returns are Realizedcalculated using historical data. returns are Realizedimportant because they are used as a measure of the company's performance. Return realization or return historicalis also useful as a basis for determining the return expected(expectedreturn)and risk in the future. Second, return expectations(expectedreturn), return is expected to be obtained by investors in the future. In contrast to the returns realization ofthat have already taken place, returns expectationhave not occurred. In this study usingrealized returns, i.e. returns that have occurred or returns that actually occurred.

Several studies on returns stockand their relationship to volatility, Cheteni (2016) examined the relationship between returns stockand volatility in South Africa and the Chinese stock market. The Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model is used to estimatevolatility return stock, that is, the FTSE/JSE Albi Johannesburg Stock Exchange and the Shanghai Stock Exchange Composite Index. The sample period was used from January 1998 to October 2014. Empirical results show evidence of high volatility on the JSX market, and the Shanghai Stock Exchange. Furthermore, this analysis reveals that volatility remains constant in both exchange markets and resembles themovement return same. Consistent with moststudies return stock, Cheteni (2016) found that the movements of the two markets seem to have the same flow or pattern.

Umutlu & Shackleton (2015) examines the short-term relationship betweenvolatility return stockand daily equity trading by several groups of investors on the Korea Stock Exchange. This study also investigates whether trading characteristics and trading styles can explain the potential for different volatility effects of this group of investors. For large stocks, it was found that trading is a purchase or sale and whether it is a contrarian or trading momentum does not play a role in the relationship between volatility and trading. It is informed institutional investor trading against non-informed individual investors that drives volatility and produces a negative volatility effect. Net foreign trade has an increasing impact on volatility although it is not always significant. The results were found to be strong for alternative volatility measures and were obtained after controlling for volatility persistence, total volume, and slow stock returns.

He et al. (2015) by considering inconclusive evidence about the relationship between market volatility and returns stock propose a multi-factor volatility model and examine its impact on cross-sectional prices. He et al. (2015) also evaluated the sample and the economic significance of multi-factor volatility. His findings are thatsize conditional variances and dynamic factor values produce positivepositive variance risk premia and significant. In addition, multi-factor volatility can significantly increase the predictability of return-of-sample returns with positive economic gains in asset allocation.

Moussa et al. (2016) evaluates the impact of demand and supply information on returns and volatility in the stock market. In this study using a proxy for requests for information that comes from weekly internet search volumes. The latest is taken from the Google Trends database, for the 25 largest shares traded on the CAC40 index, between April 2007 and March 2014. We use headlines as a proxy for providing information. Empirical findings indicate: First public information has an impact on returns stockbut its impact on volatility is far more important. Second, the effect of requests for specific information to the company persists even by adding demand for market information and supply of market or company information. Finally, by applying Multiple Correspondence Analysis (MCA). MCA on the results found, it can be concluded that the impact of public information on returns stockand volatility is conditioned by two elements: Company and market news disclosure, and the second element relates to the characteristics of market participants, more precisely their news interpretation and aversion to their risk.

Market Efficiency Efficient

Capital markets have been widely used to describe the characteristics of capital market activities. Fabozzi & Mondigliani (1996) distinguish between capital markets that areoperationally efficient or internally efficient and pricing efficient (externally efficient). Efficient operational capital markets, are markets where investors can obtain transaction services that reflect the true costs associated with providing or providing these services. An efficient capital market pricing, ie a market where prices at all times fully reflect all available information that is in accordance with securities valuation. If the market is efficient in pricing, the strategies investors use to influence the market will not generate high returns, after considering the risks and transaction costs.

According to Fama (1970), to test whether capital markets are efficient or not in pricing, two definitions are needed. First, it is necessary to define what is meant by prices that fully reflect information. The second means a set of relevant information, which is assumed to be fully reflected in price. Fama, defines fully reflect the(expected returnexpected return) of share ownership. Expected income during the period of share ownership equals the expected dividend plus the expected price change, all divided by the initial price. The price formation process is interpreted by Fama, that the expected income one period from now is a stochastic variable (random) which has considered a group of relevant information.

Deciphering group of relevant, where the price should reflect this, Fama (1970) classify the pricing in the stock market into three forms, namely: a weak form (weak form), semi-strong form (semi-strong form), and form strong (strong form). The difference between these forms lies in the group of hypothesized relevant information that includes the stock price. The form of market efficiency is weak in the nature of historical data information, semi-strong (historical data plus other public information), while strong (historical data, public information, and private information)

Framework Development

Engle (1982) models conditional variance with the ARCH model with functions linear of lag squared lags. The ARCH model (l) is shown as follows (Montgomery et al., 2008):

$$e_t^2 = \alpha_0 + \sum_{i=1}^{l} \alpha_i e_{ti}^2 + a_t$$

a_t is *white noise* with a zero mean andconstant range σ_{aa}^2

Furthermore generalized model of ARCH will consider the picture of the alternative proposed by Engle (1982), which assume that the residual can be represented as:

$$e_t = \sigma_t \omega_t$$

ω_t is free stochastic identical (bSI) with mean zero and variance equal to 1, and

$$\sigma_t^2 = \beta_0 + \sum_{i=1}^{l} \beta_i e_{ti}^2$$

β_0 is averages, σ_a^2 is *conditional volatility*, e_t is *white noise* representing the remainder of time series. Specifications econometric model used in this study is the GARCH (l,k)proposed by Bollerslev (1986) is shown as follows (Montgomery et al., 2007):

$$\sigma_t^2 = \beta_0 + \sum_{t=1}^{k} \beta_i \sigma_{t-1}^2 + \sum_{j=1}^{t} \alpha_j e_{t-1}^2$$

σ_t^2 is the *conditional variance*, e_{ti}^2 is the remaining quadratic lag, and σ_{ti}^2 is the *lag conditional variance* that distinguishes between the GARCH and ARCH models. Then α_j and e_{tj}^2 are ARCH components, β_i and σ_{ti}^2 are GARCH components and β_o, β_i, and α_j are positive.

METHODOLOGY

This research was conducted using quantitative research methods, in practice this research was conducted in a descriptive and verification form. Descriptive research was conducted to obtain a description or description of the characteristics of variables, while verification was used to test hypotheses using statistical calculations. The data used in this study is the weekly composite stock price index data on the Indonesia Stock Exchange from April 9, 1990 to December 30, 2019. The data used in this study were sourced from secondary data. Secondary data were obtained through www.jsx.co.id , www.bi.go.id , www.finance.yahoo.com, www.blumberg.com, and the Institute for Economic Financial and Research which published the Indonesian Capital Market Directory (ICMD) . ICMD is data and information on financial statements of companies that go public in Indonesia.

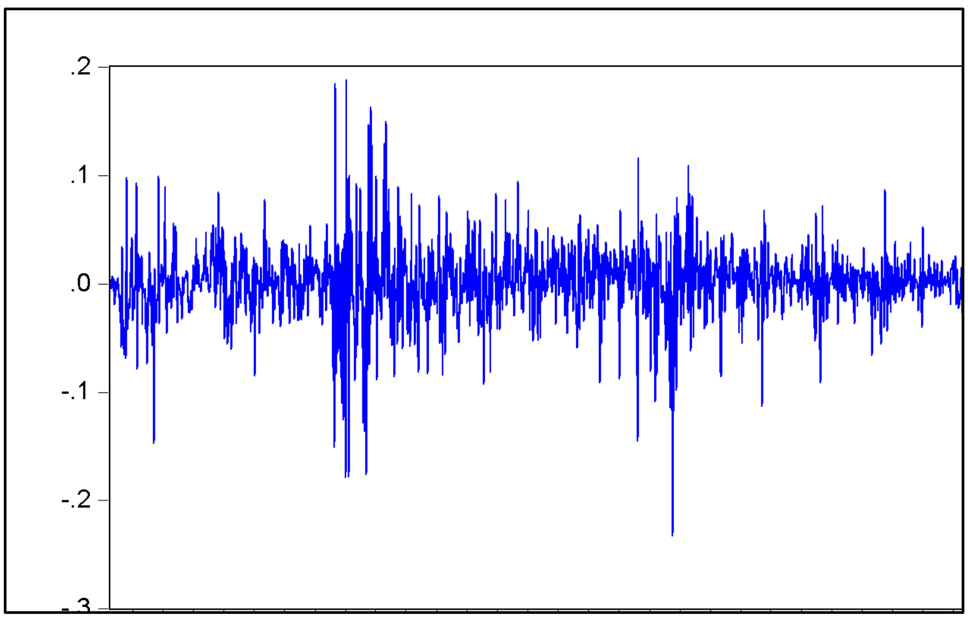
Data Analysis

Descriptive analysis of stock returns is used to analyze the characteristics of stock returns on the Indonesia Stock Exchange. Table 1 summarizes the descriptive value of stock return statistical information based on Table 1, the average value of stock returns is 0.001475. The value of kurtosis is 8.904125and it is 3 out of 3, indicating that the return distribution has a leptokurtic form. Leptokurtic is a form of the middle part of data distribution which has a pointed peak. Skewness value shows the skewed data, stock returns on the Indonesia Stock Exchange have a positive skewness value, meaning that the data series tends to have a leaning towards the right (long right tail). This illustrates the asymmetry of the normal distribution. This is supported by the results of the Jarque-Bera test, which is used to detect normality of data distribution. The test results, showing a probability of 0,000 less than 5%, meaning the null hypothesis is rejected. In other words, stock return data is not normally distributed at the 5% level.

Table 1 DESCRIPTIVE STATISTICS OF STOCK RETURNS	
	Return IDX
Mean	0.001475
Median	0.002357
Maximum	0.18803
Minimum	-0.232971
Std. Dev	0.034158
Skewness	-0.38925
Kurtosis	8.904125
Jarque-Bera	2293.387
Probability	0.0000
Observations	1552

Source: processed data

Figure 1 shows the movement of stock returns of the Indonesia Stock Exchange, which has a fairly high fluctuation in return. The volatility of the return volatility changes with time and also shows a positive serial correlation or volatility clustering. This can be interpreted that large changes tend to be followed by large changes, and small changes also tend to be followed by small changes.



Source: Data processed

FIGURE 1
PLOT TIME SERIES OF STOCK RETURNS

Following the strategy for the model to mean the model has been obtained from the examination stage of the plot, the next step is the analysis of the model mean. In the illustrative data, it can be assumed from the examination of the mean model that the mean model is Yt=c+εt. From Table 2 the mean model is obtained as follows:

$$Return = 0.001475 + e_t$$

GARCH Estimation (1, 1)

Estimated GARCH model (1, 1), in this estimation the null hypothesis is the GARCH element of significant data (Table 2). Estimation results obtained significance level of the coefficient of ARCH and GARCH are very significant. It can be seen that the ARCH (1) coefficient value is 0.127 and GARCH (1) is 0.859 close to 1 and the coefficient value (0.000) less than 1 indicates that the stationary data requirements are met. Besides itu dapat visits probability limit for the variance equation 0.0000 all these coefficients show significant.

Table 2
ESTIMATES THE DATA BY THE GARCH METHOD (1,1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.002367	0.000604	3.917943	0.0001
RETURN -0.008422 0.024929 -0.337858 0.7355				(-1)
Variance Equation				
C	2.29E-05	3.88E-06	5.903832	0
resid			(-1) ^ 2 0.127497 0.011244 11.33914	
GARCH 0.859960 0.010805 79.59052			(-1)	0
R -squared	-0.00023	Mean dependent var		0.001477
Adjusted R-squared	-0.000876	SD dependent var		0.034168
SE of regression	0.034183	Akaike info criterion		-4.229291
Sum squared resid	1.810014	Schwarz criterion		-4.212055
Log likelihood	3284.815	Hannan-Quinn criterion.		-4.222881
Durbin-Watson stat	2.039496			

Source: Data processed

Estimated GARCH Mean (1, 1) Variance

Table 3
THE ESTIMATION RESULTS WITH THE GARCH-M METHOD (1, 1) VARIANCE

Variable	Coefficient	Std. Error	z-Statistic	Prob.
GARCH	0.891173	1.116062	0.798498	0.4246
C	0.000956 1.838744 0.0660			0.001757
RETURN -0.007536 0.025407 -0.296624 0.7668				(-1)
Variance Equation				
C	2.27E-05	3.88E-06	5.855638	0
resid			(-1) ^ 2 0.127669 0.011280 11.31825	
GARCH (-1)	0.860044	0.010808	79.57379	0
R-squared	-0.000829	dependent varMean		0.001477
Adjusted R-squared	-0.002122	SD dependent var		0.034168
SE of regression	0.034205	Akaike information criterion		-4.228538
Sum squared resid	1.811098	Schwarz criterion		-4.207855
Log likelihood	3,285,231	criter Hannan-Quinn.		-4.220846
Durbin-Watson stat	2.034437			

Source: Data processed

In this estimate the null hypothesis is the GARCH element in the significant mean equation. This model makes it possible for the conditional mean to depend on its conditional variance, meaning that investors who are happy about risk will want more compensation when holding risky assets, for example the higher the risk the higher the compensation. If the risk captured by volatility in this case is conditional variance, then conditional variance can enter the conditional mean function. The results of the GARCH-M estimation (1, 1) variance are shown in Table 3 above:

From Table 4 it appears that the GARCH coefficient is quite high at 0.891 and significant at the mean with a probability of 0.000, which means the effect of the effect of variance on the large mean or the null hypothesis is rejected.

GARCH-M Estimation (1.1) Standard Deviation

The null hypothesis of this estimate is that the data examined the value of risk can be captured in the mean equation. The results of the GARCH-M (1.1) standard deviation are shown in Table 4 as follows:

Table 4
RESULTS OF THE GARCH-M ESTIMATION (1.1) STANDARD DEVIATION

Variable	Coefficient	Std. Error	z-Statistic	Prob.
@SQRT (GARCH)	0.072682	0.080219	0.906045	0.3649
C	0.002055 0.287252 0.7739			0.00059
RETURN -0.007649 0.025437 - 0.300685 0.7637				(-1)
Variance Equation				
C	2.25E-05	3.86E-06	5.823199	0
resid			(-1) ^ 2 0.127575 0.011277 11.31255	
GARCH 0.860429 0.010784 79.78577			(-1)	0
R-squared	-0.00186	dependent varMean		0.001477
Adjusted R-squared	-0.003155	SD dependent var		0.034168
SE of regression	0.034222	Akaike information criterion		-4.228707
Sum squared resid	1.812964	Schwarz criterion		-4.208024
Log likelihood	3,285,362	Hannan-Quinn criter.		-4.221015
Durbin-Watson stat	2.033745			

Source: Processed data

SQR standard deviation (GARCH) has a significance of 0.3649 which looks far from the 5% significance level. It can be said that the results of the estimated GARCH value on the GARCH-M (1,1) variance estimate and in the previous estimation are significant, so economic actors can obtain premium results from stock risks faced due to volatility.

GARCH Threshold Estimation (1, 1)

In this estimation the null hypothesis is the daily return is asymmetrical data, the following is the GARCH Threshold estimation result (1.1):

Table 5
T-GARCH CALCULATION RESULTS (1.1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.001919	0.000648	2.961327	0.0031
RETURN (-1)	0.001651	0.025477	0.064789	0.9483
Variance Equation				
C	2.49E-05	3.84E-06	6.468899	0
RESID (-1) ^ 2	0.07577	0.013023	5.818304	0
RESID (-1) ^ 2 * (RESIDES (-) 1) 0.079621 0.015092 5.275772			<0)	0
GARCH 0.865629 0.010497 82.46414			(-1)	0
R-squared	-0.00027	dependent varMean		0.001477
Adjusted R-squared	-0.000916	SD dependent var		0.034168
SE of regression	0.034184	Akaike information criterion		-4.237917
Sum squared resid	1.810086	Schwarz criterion		-4.217234
Log likelihood	3292.505	Hannan-Quinn criterion		-4.230225
Durbin-Watson stat	2.062678			

Source: Data processed

From Table 5 it looks for the assumption that there is an asymmetrical effect evident from the RESID coefficient value (-1) ^2*(RESID (-1) <0) of 0.079 greater zero (positive) and statistically significant, meaning the return of shares in the Indonesian stock Exchange is asymmetric to the news, which is bad news a bigger influence on the volatility of returns compared with the good news (Epaphra, 2017; Živkov et al., 2016).

The Choice of the Model Best Suited

After estimating the data return with several models, the most appropriate model can be chosen, for that all estimation models are shown in Table 6 below:

Table 6
COMPARISON OF VARIOUS MODEL ESTIMATES

Mean equation	GARCH (1,1)	GARCH-M (1,1) variance	GARCH -M (1,1) standard deviation	TGARCH (1,1)
Return (-1)	-0.0084	-0.0075	-0.00764	0.0016
Stdev	0.0249	0.0254	0.0254	0.0257
Prob	0.7355	0.7668	0.7637	0.9487
Variant equation				
ARCH	0.1276 0.1275 0.0757			0.1274
STDEV	0.0112	0.0112	0.0112	0.013
Prob	0	0	0	0
GARCH	0.8599	0.86	0.8604	0.8656
STDEV	0.0108	0.0108	0.0107	0.0104
Prob	0	0	0	0
SSR	1.810014	1811	1.8129	1.810086
Log likelihood	3285.23 3285,367 3292,505			3,284,815

Source: Data processed

The purpose of the comparison table is to compare the sum of square resid (SSR) and log likelihood of all models used. The smallest SSR value and the largest log likelihood will be chosen. From Table 6 researchers chose to use the TGARCH model (1.1) because the SSR value was the smallest (not too much different from GARCH (1, 1)) and the log log likelihood was greatest.

CONCLUSION

This study aims to determine the model in describing the volatility of stock returns and to identify asymmetrical effects on the Indonesian stock market. Based on the results of data analysis conducted in this study, it can be concluded as follows:

TGARCH (1.1) asymmetric model presents an estimation of return volatility better than other models used in this study.

The observed Indonesian stock market shows the existence of asymmetrical effects on stock returns. This means that there is a difference between bad news or good news on the volatility of return in the observed period, so that the modeling of stock return volatility using the symmetric GARCH model becomes less relevant in describing market conditions. Even if the GARCH symmetric model is still used, it is possible to generate risk forecasting from an investment that is not quite right and can make market participants wrong in disclosing the conditions that previously occurred in a market.

Implication

1. For investors need to observe fluctuations in stock returns and benefits that occur in previous periods. This is necessary so that investors are able to control and reduce market risk of the assets traded. Investors can be more careful in determining investment steps, such as whether to buy or release assets owned.
2. For policy authorities, investment actors are very easily influenced by negative sentiments in the market, it is necessary to have a policy to protect market conditions from negative sentiments, for example about rumors of exchange rates, interest rates, and issues that develop at that. It needs to be done because negative sentiment can cause fluctuations in excessive stock returns which results in investor interest in investing.

Limitation of the Study

Considering data used weekly as a research sample, so that if possible for further research can use daily data so that the time series is longer. Other GARCH asymmetric models can be used as stock returns modeling, for example EGARCH, PARCH, TARCH, IGARCH so that they can get the best model for estimating stock returns.

REFERENCES

Aggarwal, D. (2018). Random walk model and asymmetric effect in Korean composite stock price index. *Afro-Asian Journal of Finance and Accounting, 8*(1), 85-104.

Akhtar, S., & Khan, N.U. (2016). Modeling volatility on the Karachi stock exchange, Pakistan. *Journal of Asia Business Studies, 10*(3).

Andersen, T.G., & Bollerslev, T. (2006). Answering the Skeptics: Yes, Standard Volatility Models do Provide Accurate Forecasts. *International Economic Review*.

Bint Omar, N.A., & Halim, F.A. (2016). Modeling volatility of the Malaysian stock market using garch models. *2015 International Symposium on Mathematical Sciences and Computing Research, ISMSC 2015 - Proceedings*, 2015, 447-452.

Chang, T.C., Wang, H., & Yu, S. (2019). A GARCH model with modified gray prediction model for US stock return volatility. *Journal of Computational Methods in Sciences and Engineering, 19*(1), 197-208.

Cheteni, P. (2016). Stock market volatility using GARCH models: Evidence from South Africa and China stock markets. *Munich Personal RePEc Archive*. Retrieved from: https://mpra.ub.uni-muenchen.de/77355/

Choudhry, M., Joannas, D., Landuyt, G., Pereira, R., & Pienaar, R. (2010). *Capital Market Instruments - Analysis and Valuation*. Palgrave Macmillan UK, New York.

Engle, R.F. (1982). Autoregressive conditional heteroscedasticity with estimates of the variance of United Kingdom Inflation. *Econometrica, 50*(4), 987.

Epaphra, M. (2017). Modeling exchange rate volatility: Application of the GARCH and EGARCH Models. *Journal of Mathematical Finance, 7*(01), 121-143.

Fabozzi, F.J., & Mondigliani, F. (1996). *Capital Market (2nd Edn)*. Prentice Hall, Inc, New Jersey.

Fama, E.F. (1970). Efficient capital markets: A review of theory and empirical work. *The Journal of Finance, 25*(2), 383-417.

Hadady, H., Warinangin, J., & Muharam, H. (2018). Symmetric and asymmetric shock models of stock return volatility in Indonesia stock exchange. *International Journal of Civil Engineering and Technology (IJCIET), 9*(8).

He, Z. L., Zhu, J., & Zhu, X. (2015). Multi-factor volatility and stock returns. *Journal of Banking & Finance, 61*, S132-S149.

Jogiyanto, H. (2016). *Portfolio Theory and Investment Analysis (10th Edn.)*. BPFE Yogyakarta, Jogyakarta.

Lestano, & Kuper, G.H. (2016). Correlation dynamics in East Asian financial markets. *Emerging Markets Finance and Trade, 52*(2), 382-399.

Luo, L., Pairote, S., & Chatpatanasiri, R. (2017). GARCH-type forecasting models for volatility of stock market and MCS test. *Communications in Statistics-Simulation and Computation, 46*(7), 5303-5312.

Maskur, A. (2009). Stock Price Volatility Between Conventional and Sharia Shares. *Financial and Banking Dynamics, 1*(2), 82-94.

Montgomery, D.C., Jennings, C.L., & Kulahci, M. (2008). *Introduction to Time Series Analysis and Forecasting*. John Wiley & Sons.

Mousa, G.A., & Elamir, E.A.H. (2018). The relationship between corporate forward-looking disclosure and stock return volatility. *Problems and Perspectives in Management, 16*(3), 130-149.

Moussa, F., Delhoumi, E., & Ouda, O. B. (2017). Stock return and volatility reactions to information demand and supply. *Research in International Business and Finance, 39*, 54-67.

Rossi, M., & Gunardi, A. (2018). Efficient market hypothesis and stock market anomalies: Empirical evidence in four European countries. *Journal of Applied Business Research, 34*(1), 183-192.

Sikhosana, A., & Aye, G. C. (2018). Asymmetric volatility transmission between the real exchange rate and stock returns in South Africa. *Economic Analysis and Policy, 60*, 1-8.

Tripathy, T., & Gil-alana, L.A. (2015). Modeling time-varying volatility in the Indian stock returns: Some empirical evidence. *Journal of Advanced Research, 5*(2), 91-97.

Umutlu, M., & Shackleton, M.B. (2015). Stock-return volatility and daily equity trading by investor groups in Korea. *Pacific Basin Finance Journal, 34*, 43-70.

Živkov, D., Njegić, J., & Pavlović, J. (2016). Dynamic correlation between stock returns and exchange rate and its dependence on the conditional volatilities - the case of several eastern European countries. *Bulletin of Economic Research, 68*(2005), 28-41.