INDONESIAN CAPITAL MARKET EFFICIENCY

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ABSTRACT

The capital markets have an important role in the economy of a country. Some of the conditions of the economy reflected in the movement of the stock price index from the capital markets, along with capital market efficiency. This study tested the movement of the Jakarta Composite Index (JCI) at the Indonesia Stock Exchange (IDX) during the period 2000 – 2015 technical basis by using time series analysis and mathematical.

The research results reveal that the pattern of movement of the JCI in the Indonesia Stock Exchange (IDX) during the research period are predictable with a model of the ARCH/GARCH. On the study also identifies that the Indonesia capital market can be categorized as a weak form of the efficient market is not. It does not correspond to an efficient capital market theory presented Fama (1970) states that an efficient capital market is the capital markets that can not be predicted by using a particular forecasting model in the pattern of movement of its stock indices, this is due to the efficient capital markets, have a random variance and high volatility in the pattern of movement is making it difficult to forecast.

Keyword: technical analysis, JCI

INTRODUCTION

The movement of the stock price index in one country can be used as one of the yardsticks to look at the condition of the country's economy in a macro. The shares price index of a country that is experiencing a decline is usually caused by the condition of the economy of the country was having problems. Instead, the stock price index increase indicates a performance improvement of the economy in the country (Adisetiawan, 2011).

Indonesia Stock Exchange (IDX) is Indonesia capital market, in it there is some kind of capital market instruments that are offered, one of which is a share. Investors carry out transactions of buying and selling stocks with relatively high frequency in the stock exchange. In the process of such transactions, any investor requires a strong foundation in decision-making, especially involving a large amount of investment. Most use the intuitive approach in stock transactions. Others use the techniques of analysis, from the most simple to the most complex. In other words, investors will do the forecasting to predict developments in stock prices and return in the future (Hermawan and Heru, 2006; Soetanto, 2009, and Hatidja, 2011).

Addressing the situation in the future is full of uncertainty, then the investor requires knowledge of concepts and techniques of forecasting can help decision making is relatively more precise. As long as it is known two types of analysis to predict stock price movements, namely fundamental analysis and technical analysis (Nachrowi and Usman, 2007 in Adisetiawan and Hasminidiary, 2011). Fundamental analysis to predict stock price movements with translating various information state of the economy, including news, reports and policies issued by the Government, and also other information relevant, while technical analysis using mathematical and statistical analysis in doing basic forecasting on historical data (Sa'adah and Yunia, 2006 in Widjaja and Heru, 2008).
An efficient capital market theory, developed since 1965 Eugene Fama (Wiyanto, 2002; Ie and Pancoro, 2002 in Soetanto, 2009) mentions that an efficient capital market is a market that when prices of securities fully reflect the information known to the public. Based on this theory, it can be said that investors react to information in the market. These reactions can be a subjective reaction to over-react or under-react. In other words, the prices of the securities becomes a subjective that is not predictable and random walk.

Review Literature

Efficient Market Hypothesis

Fama (1970) in classifying form Soetanto, 2009 an efficient market into three Efficient Market Hypothesis (EMH), namely: (a) weak form efficient, means all information in the past will be reflected in the price that is formed now. Therefore, the historical information (such as price and trading volume in the past) can no longer be used to predict future price change coming, as already reflected in the current price. The implication is that investors will not be able to predict future stock market value comes with the use of historical data, such as is done in technical analysis; (b) efficient in form of half strong, is a form of market efficiency that is more comprehensive, because in this form along with stock prices are influenced by the market data (stock price and trading volume of the past), it is also influenced by all the published information (such as earning, dividends, stock split announcements, issuing of new shares, and financial difficulties experienced by the company). In an efficient market in the form of the half strong, investors can't hope to have abnormal return if a trading strategy that is carried out only based on information that has been published. Conversely, if the market is not efficient, then there will be a lag in the process of price adjustment to information, and this can be used to obtain investor return abnormal. In the presence of lag like this, investors can do fundamental analysis for the abnormal return obtained on the market that are not efficient in the shape of a half; and (c) efficient in the form of a strong, efficient markets in strong form, all information either published or unpublished, are already reflected in the price of securities today. In the form of efficient strong like this there will not be an investor who can get return abnormal.

The purpose of differentiating three types efficiently Fama is to classify the empirical research towards market efficiency. The third form of efficient markets is interconnected in the form of tiers that are cumulative, meaning that the weak form is part of the shape of the half strong and powerful half shape is part of a strong form. This cumulative level has implications that the market is efficient form half strong was also a weak form of the efficient market. Strong form efficient markets is also efficient market forms a half-strong and weak form of the efficient market. This implication does not hold the opposite, namely a weak form of the efficient market must not mean the market efficient form half strong. An efficient capital market theory is often associated with the Random Walk theory which States that the price changes occur randomly and that past data is not reliable for predicting the direction of the next movement (Hermawan and Heru, 2006; Nachrowi and Usman, 2007 in Adisetiawan and Hasminidiarty, 2011).

Analysis of Stock Price Movements as The Basis of Investment

Basically there are two types of analysis of price movements of securities, namely: (1) Technical Analysis, that analysis using statistical methods and mathematical analysis to study market opportunities based on past data. The tools used, usually as a Chart, Trend Line, Fibonacci, Camarilla, Pivot Point, Candlestick Pattern and method of regression, of AR, MA, ARMA, ARIMA, ARCH, GARCH, Fuzzy Logic, and others; (2) Fundamental Analysis, i.e. predicting price movements with translating various information state of the economy, including news, financial reports, government policies, and other relevant information are (Hermawan and Heru, 2006; Nachrowi and Usman, 2007 in Adisetiawan and Hasminidiarty, 2011).
The existence of the securities analysts are always looking for new information and conduct an analysis of that information, will help to achieve a more efficient market, as securities analysts competition activity will result in increasing the efficiency of the capital markets. Thus, the situation faced in an efficient capital market will make the financiers will be difficult to get the advantage over normal levels on a consistent basis. The level of profits earned investors just enough to cover the risks that will be passing on. Thus, the analysis made by securities analysts was not aiming to look for stocks whose price is incorrect, but to select stocks that match the characteristics of the financiers. Even so, it's not that efficient capital markets in no need for stock analysis. Thus the activities of securities analysts that competition will make the market becomes efficient (Hermawan and Heru, 2006; and Soetanto, 2009).

Time Series Model of Economic and Financial Data

General time series model assumptions; AR(p); MA(q) and ARMA(p,q) is a variety of homoscedastic nature. In fact, especially in most of the data in the field of economics and finance, the nature of the variety heteroscedastic (Engle, 2001 in Faridah, 2010). Therefore, Lo (2003) in Simanjuntak (2009), autoregressive model used is pleased to recommend heteroscedastic (ARCH) and the model of Generalized Autoregressive Heteroscedastic Conditionals (GARCH) and retaining the properties of heteroscedastic data. Data analysis on economic and financial time series using method of ARCH/GARCH, which became the center of attention is the price fluctuations that occur. According to Surya and Situngkir (2004) in Faridah (2010), price fluctuations is the variable which shows the ups and downs of prices as a form of causal and market mechanisms that occur.

Model of Autoregressive Conditional Heteroscedastic (ARCH)

If $Y_t, Y_{t-1}, ..., Y_i$ is the time series data and $F_t$ is the set of $Y_t$, then the model order Autoregressive Conditional Heteroscedastic on $q$ or ARCH(q) on $Y_t$ is defined as:

$$Y_t | F_{t-1} \sim N(0, h_t)$$

where $q > 0, \omega > 0$ and $\alpha_i \geq 0$ for $i = 1, 2, ..., q$. Terms of $\omega > 0$ and $\alpha_i \geq 0$ is required to ensure that the $h_t > 0$ (Lo, 2003 in Sadeq, 2008). The model of the ARCH(q) provide information that the range of data in the current data was influenced by the square on the $q$ period ago. The simplest model is the ARCH(1) as follows:

$$Y_t | F_{t-1} \sim N(0, h_t)$$

where $h_t = \alpha_0 + \alpha_1 Y_{t-1}^2$ (2)

the model of the ARCH(1) provide information that the range of the data affected by the square of the data at one period ago. According to Enders (2004) in Faridah (2010), the data can be modeled into the $Y_t$ model ARMA(p,q):

$$Y_t = C + \sum_{i=1}^{p} \omega_i Y_{t-i} + \sum_{j=1}^{q} \theta_j Y_{t-j} + \varepsilon_t$$

for example, $Y_t$ modelled into a model of ARMA(1,0) are:

$$Y_t = C + \omega_1 Y_{t-1} + \varepsilon_t$$

in this case $\varepsilon_t$ will be white noise if there are no properties heteroscedastic on $Y_t$ or $\varepsilon_t \sim N(0, \sigma^2)$. If forecasting is done against the $Y_{t+1}$, then the average conditional of $Y_{t+1}$ can be written:

$$E(Y_{t+1}|Y_t) = E(Y_{t+1}) = C + \omega_1 Y_t$$

while the conditional range from $Y_{t+1}$ are:

$$\text{Var}(Y_{t+1}|Y_t) = \text{Var}(Y_{t+1}) = E((Y_{t+1} - C - \omega_1 Y_t)^2) = E(\varepsilon^2_{t+1}) = \sigma^2$$

According to Enders (2004) in Faridah (2010), if the range of the residue is not constant, then one simple way to predict the residues obtained from modeling into $Y_t$ model AR(p)

$$\varepsilon_t = K + A_1 \varepsilon_{t-1} + A_2 \varepsilon_{t-2} + ... + A_p \varepsilon_{t-p} + v_t$$

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where \( v_t \) is white noise. If \( A_1, A_2, ..., A_p \) is zero, then the conditional range \( Y_{t+1} \) is \( K \). But if \( A_1, A_2, ..., A_p \) is not null, then the conditional range \( Y_{t+1} \) can be expressed as:

\[
E(\tilde{\epsilon}_{t+1}^2) = K + A_1 \tilde{\epsilon}_{t}^2 + A_2 \tilde{\epsilon}_{t-1}^2 + ... + A_p \tilde{\epsilon}_{t-p}^2 \tag{8}
\]

because the \( E(\tilde{\epsilon}_{t+1}^2) \) is not constant, then the equations (7) can be expressed as the model of the ARCH (Bollerslev, 1986 in Hatane, 2011). Engle (1982) in the Enders (2004) and Hatane (2011) stated that the most easy and simple way to conduct a drilling program at \( A_1, A_2, ..., A_p \) in equation (7) is expressed in \( v_t \) mutliplikaif so that it becomes:

\[
\tilde{\epsilon}_{t}^2 = (K + A_1 \tilde{\epsilon}_{t-1}^2 + A_2 \tilde{\epsilon}_{t-2}^2 + ... + A_p \tilde{\epsilon}_{t-p}^2) v_t \tag{9}
\]

an example is the model of the ARCH(1) on the \( \tilde{\epsilon} \) stated:

\[
\tilde{\epsilon}_{t} = \sqrt{N}(K + A_1 \tilde{\epsilon}_{t-1}^2) \tag{10}
\]

with \( v_t \sim N(0,1) \); \( K > 0 \) and \( 0 < A_1 < 1 \). because \( v_t \) is a white noise and free from \( \tilde{\epsilon}_{t-1} \), then the conditional range from \( \tilde{\epsilon} \) is:

\[
E(\tilde{\epsilon}_{t}^2 | \tilde{\epsilon}_{t-1}, \tilde{\epsilon}_{t-2}, ... ) = K + A_1 \tilde{\epsilon}_{t-1}^2 \tag{11}
\]

Therefore, there is a heteroscadastic on residue. This is evidenced by finding the average conditional from \( Y_t \) in equation (4) If \( \tilde{\epsilon}_t \) is expressed by equation (10), namely:

\[
E(Y_t|Y_{t-1}) = E_{t-1}Y_t = C - \omega_1 Y_{t-1}
\]

\[
\text{Var}(Y_t|Y_{t-1}, Y_{t-2}, ... ) = E_{t-1}[(Y_t - C - \omega_1 Y_{t-1})^2 = E_{t-1}(\tilde{\epsilon}_t)^2
\]

\[
= E_{t-1}[\sqrt{N}^2(K + A_1 \tilde{\epsilon}_{t-1}^2)]
\]

\[
= E_{t-1}[N(K + A_1 \tilde{\epsilon}_{t-1}^2)]
\]

\[
= E_{t-1}[K + A_1 \tilde{\epsilon}_{t-1}^2]
\]

\[
= K + A_1 \tilde{\epsilon}_{t-1}^2 \tag{12}
\]

so the conditional range from \( Y_t \) as AR(1) model may be suspected of using conditional variety of residue modeled ARCH(1).

In general the process of ARCH(q) on a range of conditional residues can be expressed as:

\[
\sigma_t^2 = K + \sum_{i=1}^{q} A_i \tilde{\epsilon}_{i-1}^2 \tag{13}
\]

with \( \tilde{\epsilon}_t = \sqrt{\sigma_t^2} \). Therefore, \( h_t \) in equation (1) can supposedly use \( \sigma_t^2 \) in equation (13) (Enders, 2004 in Faridah, 2010). According to Li (2002) in Hatane (2011), there is a tendency to model \( Y_t \) into its simplest form, namely, ARMA(0,0); by assuming the \( Y_t \) has average constant, so that equation (3) becomes:

\[
Y_t = C + \epsilon_t \tag{14}
\]

Equation (11) made a model of the ARCH(q) on \( Y_t \) can be expressed as follows: \( Y_t = C + \epsilon_t, \epsilon_t \sim N(0, \sigma_t^2) \)

\[
\sigma_t^2 = K + \sum_{i=1}^{q} A_i \epsilon_{i-1}^2
\]

with \( \epsilon_t = \sqrt{\sigma_t^2}, C = \text{average of the} \ Y_t, \ \text{and} \ K = \text{constant} \)

The model of the ARCH(q) provide information that range from \( Y_t \) is affected by quadratic residue on \( q \) period ago. The magnitude of the influence given by the quadratic residues can be seen from the magnitude of the coefficients of the model ARCH.

**Model of Generalized Autoregressive Conditional Heteroscedastic (GARCH)**

The model of Generalized Autoregressive Conditional Heteroscedastic with order \( p \) and \( q \), the GARCH(p,q) on \( Y_t \) is defined as:

\[
Y_t|F_{t-1} \sim N(0,h_t)
\]

with

\[
h_t = \alpha_0 + \alpha_1 Y_{t-1}^2 + \alpha_q Y_{t-q}^2 + \beta_1 h_{t-1} + ... + \beta_p h_{t-p}
\]

\[
= \alpha_0 + \sum_{i=1}^{q} \alpha_i Y_{t-i}^2 + \sum_{j=1}^{p} \beta_j h_{t-j}^2 \tag{15}
\]

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with \( q > 0, p \geq 0, \alpha_0 > 0 \) and \( \alpha_i > 0 \) for \( i = 1, \ldots, q \) and \( \beta_j \geq 0 \), for \( j = 1, \ldots, p \) and \( p \) and \( \alpha + \beta < 1 \) (Engle, 2001 in Faridah, 2010). The Condition of \( \alpha_0 > 0, \alpha_i \geq 0 \) and \( \beta_j \geq 0 \) required to ensure \( h_t > 0 \) (Lo, 2003). On the model of the GARCH\((p,q)\), in addition to being influenced by quadratic data on \( p \) period ago, range data is also affected by the range of data on the \( q \) period ago. Same is the case with the model of the ARCH\((q)\), conditional range \( Y_t \) at equation (15) can be suspected of using conditional range of residues, namely:

\[
\sigma^2_t = K + \sum_{j=1}^{p} G_j \sigma^2_{t-j} + \sum_{i=1}^{q} A_i \varepsilon^2_{t-i}
\]

(16)

with \( \varepsilon = \sqrt{\frac{2}{\sigma^2_t}} \). In General, the model of the GARCH\((p,q)\) on \( Y_t \), expressed as:

\[
Y_t = C + \varepsilon, \varepsilon \sim N(0, \sigma^2_t)
\]

with

\[
\sigma^2_t = K + \sum_{j=1}^{p} G_j \sigma^2_{t-j} + \sum_{i=1}^{q} A_i \varepsilon^2_{t-i}
\]

(17)

GARCH model in equation (17) provide information that range from \( Y_t \) is affected by quadratic residue on \( q \) period ago and also variety of \( Y_t \) at \( p \) periods ago.

**Forecasting Model of ARCH/GARCH**

ARCH and GARCH model treats heteroscedastic as nature needs to be modeled and predicted, which is useful in making decisions or policies, one of which determines the movement of the JCI. In this case to find out the value of JCI next period i.e. by using forecasting model of ARCH/GARCH. Forecasting of \( \sigma^2_t \) on the model of ARCH/GARCH for one of the upcoming period (the one step ahead forecast) is done by doing a renewal (updating) for one period. Forecasting of \( \sigma^2_t \) for the next period on one model of the ARCH/GARCH done with doing updates: \( \sigma^2_{t+1} = K + G_1 \sigma^2_t + A_1 \varepsilon^2_t \)

If \( \sigma^2_{t} \) and \( \sigma^2_{t+j} \) known on the \( t \), then the forecast for one of the upcoming period is \( K + G_1 \sigma^2_t + A_1 \varepsilon^2_t \), but the forecast for the coming period will be difficult \( j \) obtained. On the model of ARCH/GARCH value

\[
\varepsilon = \sqrt{\frac{2}{\sigma^2_t}} \text{ or } \sigma^2_t = \varepsilon^2 \sigma^2_t
\]

(18)

If done updates for the upcoming period \( j \) on equations (18), then \( \varepsilon^2_{t+j} = \varepsilon^2_{t} \sigma^2_{t+j} \) with \( E_i(\varepsilon^2_{t+j}) = E_i(\varepsilon^2_{t+j} \sigma^2_{t+j}) \), because the \( E_i(\varepsilon^2_{t+j}) = 1 \), then:

\[
E_i(\sigma^2_{t+j}) = E_i(\varepsilon^2_{t+j}) \sigma^2_t
\]

(19)

Equation (19) can be used to predict \( \sigma^2_t \) on the model of ARCH/GARCH. On the model of ARCH/GARCH updates for the upcoming period \( j \) can be written as:

\[
\sigma^2_{t+j} = K + G_1 \sigma^2_{t+j-1} + A_1 \varepsilon^2_{t+j-i}
\]

with, \( E_i(\sigma^2_{t+j}) = K + G_i E_i(\sigma^2_{t+j-1}) + A_i E_i(\varepsilon^2_{t+j-i}) \)

and distribute the equation (19) into equation (20), then it is obtained:

\[
E_i(\sigma^2_{t+j}) = K + (A_1 + G_i)E_i(\sigma^2_{t+j-1})
\]

\[
= K + (A_1 + G_i)[E_i + (A_1 + G_i)E_i(\sigma^2_{t+j-1})]
\]

\[
= K[1 + (A_1 + G_i) + \ldots + (A_1 + G_i)^{q-1}] + (A_1 + G_i)\sigma^2_t
\]

If \( A_1 + G_i > 1 \), then the forecast for \( \sigma^2_{t+j} \) will be converging towards \( E(\sigma^2_t) = (k/(1 – A_1 – G_i)) \). Through the same way can be foreseen \( \sigma^2_t \) for model ARCH\((q)\). If the update is performed in one period on \( \sigma^2_t \) for model ARCH\((q)\), it will be retrieved: \( \sigma^2_{t+j} = K + A_1 \varepsilon^2_t + \ldots + A_q \varepsilon^2_{t-q+1} \).

If done the renewal of two periods on the model of the ARCH\((q)\), it will be retrieved: \( \sigma^2_{t+2} = K + A_1 \varepsilon^2_{t+1} + \ldots + A_q \varepsilon^2_{t-q+2} \).

With:

\[
E_i(\sigma^2_{t+2}) = K + A_1 \varepsilon^2_{t+1} + \ldots + A_q \varepsilon^2_{t-q+2}
\]

\[
= K + A_1 E_i(\varepsilon^2_{t+1}) + \ldots + E_i(A_q \varepsilon^2_{t-q+2})
\]
If, \( E_i(\hat{\sigma}^2_{t+j}) = E_i(\hat{\sigma}^2_{t+j}) \), then:
\[
E_i(\hat{\sigma}^2_{t+j}) = K + A_1 E_i(\hat{\sigma}^2_{t+1}) + \ldots + E_i(A_q \hat{\sigma}^2_{t-q+2})
\]
(21)

From equation (20) and equation (21) noticeable that the forecast for the coming period both for the \( j \) model ARCH/GARCH can be obtained recursively against the previous period (Enders, 2004 in Faridah, 2010). Forecast against the variety makes the value of \( Y_t \) at \( j \)'s upcoming period are:
\[
C - \hat{\sigma}^2_{t+j} \leq Y_{t+j} \leq C + \hat{\sigma}^2_{t+j}
\]

**The Islamic View of Forecasting**

Statistics is a branch of mathematics that work on data collection, data processing, data analysis, conclusion and withdrawal. The main activities in statistics is the collection of data, in this case stated in Qur'an Sura Al-Qamar(54):52, which reads:

وَكُلُّ شَيْءٍ فَعَلُوهُ فَيْنَابِيٌّ

Meaning: "and everything they've done is recorded in the record books". Forecasting is a skill to calculate or judge something based on previous events. One example of existing forecasting in the Qur'an is a matter of the economy that is expressly stated in the Qur'an in Sura Yusuf(12): 47-48, which reads:

قال نزرعوا سبع سنين دابة فما حصدتم فذروه في سبيله إلا قليلاً ما تأكلون

فم باني من بعد ذلك سبعة سنين عدداد يأكلين ما قد مثمن هن إلا قليلاً يأكلون

Meaning: "(47) Joseph said: " that ye may cultivation of seven years (ever) as usual; Then reap what you yourselves let dibulirnya except a bit to eat, (48) then after that will come seven years very hard, who spent what you save to deal with it (hard year), except a little bit of (wheat germ) which you save".

Sura Yusuf to the above, in it's implied meaning that the Prophet Yusuf ruled by God to plan the agricultural economy for a period of fifteen years, this was done to cope with the onset of the food crisis thoroughly or famine. because the Qur'an is flexible, then forecasting can also be used to predict the economy experienced the nation of Indonesia, for example, to see the ups and downs of the stock price traded on the Indonesia stock exchange can be seen fluctuation of JCI, so it can be known whether the market is in a State of bullish (strong) or bearish (weak) in Indonesia Stock Exchange (Adisetyawan, 2011). In addition, by forecasting can also find out the price of shares in the capital market of Indonesia.

Forecasting done man is an attempt to locate the handle in the taking of a decision. In this case the man banned carelessly decided a matter (stuff) before clear information obtained because of something that's already a human disconnect must be accounted for, as the word of God sura Al-Isra'(17):36, which reads:

ولا تَقَفُّوا مَا لَيْسَ لَدَكُمْ عَلَمٌ إِنَّ السَّمَعَ وَالْبَصَرَ وَالْفَؤَادَ كَلِّهِ مَلَائِكَةٌ كَانَ عَنْهُ مَسْئُولاً

Meaning: "and do not follow what you have no knowledge about it. The real hearing, vision and heart, they will be asked to answer coverage".

Humans can only plan, as well as forecasting is done man is attempts to locate the handle in the taking of a decision but a result of the human plan can be changed depending on the efforts they do to become better, as the word of God in sura Al-Ra'du(13):11, which reads:

إِرْبَةُ اللَّهِ لَ أَغْيَبُ مَا يَقْرَؤُونَ حَتَّى يَغْيِرُوا مَا يَأْتِيَهُمْ

It means: "God will not change the fate of a person if he does not seek to change his fate".
the Hypothesis

Although no method guarantee the accuracy in predicting a stock market, but the results of this research are expected to enrich the efforts being done to predict a capital market, in order to be of benefit to investors in putting investment portfolio. Therefore, the null hypothesis (H0) in this study suggested that the movement of the JCI in the Indonesia Stock Exchange (IDX) during the period 2000 – 2015 are predictable.

METHOD

This research was conducted with the following steps:
a. Data JCI exploration;
b. The average prediction model parameters, then select the best model based on coefficients of real and best model criteria (SIC minimum) (Hatane, 2011). After that is done the average model diagnostics;
c. Do the modelling range of residues with model ARCH/GARCH, by means of: (1) testing heteroscedastic residue (of the average variety) uses ARCH Lagrange Multiplier (LM) test; (2) the parameter prediction model of ARCH/GARCH using the method of Maximum Likelihood; (3) the selection of the best models based on real coefficient and the best model criteria (SIC minimum); and (4) of the selected model diagnostics is to test the influence of the presence of ARCH back through the LM. If the assumptions are met then the model has valid and usable.
d. The measurement accuracy of the model, i.e., match the right model to actual guesses with the model through a test of Paired Samples T test, i.e. an average of two different pairs (Ie and Pancoro, 2002; Wiyanto, 2002 in Soetanto, 2009); on the real extent of 0.01.

RESULTS

Data Exploration

Figure 1 provides information that daily time series data JCI does not normally spread. This is shown from the value of the probability Jarque-Bera test of 0.000. Average total positive value indicating the onset of a rise in JCI movement throughout the period 2000 – 2015.
Figure 2 shows that the JCI movement tends to rise in early 2002 to mid-2008, experienced a significant decline in June until the end of 2008, a decrease caused the onset of the financial crisis that hit the United States eventually penetrated into Indonesia in mid-2008, but the trend of a decline was JCI last long, uphill back in May 2009 and in December 2009; JCI is back to its original position before a downturn in 2008. April 2010 the JCI movement already surpassed in 2008. JCI started to demonstrate normal growth, this is because the condition of the global economy and domestic start tend to be improved (Adisetiawan, 2011).

The Chief Executive of the capital markets supervisory The financial services authority, Nurhaida revealed that the movement of capital markets (JCI) on the Indonesia stock exchange in 2009 to 2013 showed instability (up and down), look on the graph that the JCI movement tends to increase, although had decreased in the year 2012 (Wijaya, 2013). The growth of JCI are sharp enough look earlier in the year 2013 to may 2013; It can be seen from the slope rises more steeply than in the period before. During the period of this study, the closing price highest JCI occurred in April 2015 reached Rp 5523.29; After that the stock index returns has decreased until September 2015. But in the long term movement until the end of 2015, the JCI movement shows a tendency to increase, and it is very profitable to invest long-term (Augustine, 2015).

The JCI movement by 2015 had showed that in line with the movement of global and Asian exchanges, as world oil prices weakening again (Gorta, 2015). The end of 2015, JCI indicates reinforcement, it is revealed Analyst LBP Enterprises Lucky Bayu Purnomo as saying that the rise in JCI in the end of year 2015 caused window dressing activity at the end of the year 2015 and expectations of a better economy in the coming year. This is driven by a number of economic policy package has been released by the Government of Indonesia now (Afriyadi, 2015).

Investors in investing capital, more interested in the return on investment, because the return measure the magnitude of the advantage for investing in one period. Apart from the rate of return, an investor in investing is also considering the risk that will be received, the magnitude of risk is reflected in the value of volatility (Adisetiawan, 2012). According to Jorion (1997) in Adisetiawan (2012), the magnitude of the risk can be measured by the standard deviation (σ), the standard deviation is also called...
Volatility. High volatility indicates a high level of risk. Therefore, investors should be careful in analyzing risks to the future (prediction) in investments (Haruman and Hendrawan, 2009).

Figure 3 shows that the pattern of movement of the JCI in the Indonesia Stock Exchange (IDX) during the period of 2000 – 2015 fluctuate up and down throughout the period. Mid-2006 to the end of the research period began a fairly large fluctuations occur when compared fluctuations in the previous period. High fluctuations indicates that data has a value of JCI the variance of the residual (error term) tend to be not constant throughout the period of observation so that the plot visually indicating the presence of heteroscedastic symptoms on JCI data.

Table 1 describes the data that research during the period of the JCI experience stationary after differencing first. The calculation results show the value of the t-Statistic greater than the critical. This indicates that the data in the JCI then can affect the data now in the JCI (Murwaningsih, 2008 in Adisetiawan, 2011; and Soetanto, 2009).

Identification of the Influence of the ARCH

According to Wang et al (2005) in Faridah (2010), revealed that the presence of heteroscedastic process (ARCH) can be detected through testing of LM (Langrange Multiplier). Table 2 corroborating that the results of the calculation of ARCH-LM test statistic on the model showed significant, means...
there is an element of the ARCH in the pattern of movement of JCI during periods of observation. So the model that will be used in this study is a model of ARCH/GARCH (Soetanto, 2009 and Hatane, 2011).

### Table 2

<table>
<thead>
<tr>
<th>Test ARCH at Lag 1</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>F-statistic</td>
<td>76.78742</td>
</tr>
<tr>
<td>Obs*R-squared</td>
<td>75.43453</td>
</tr>
</tbody>
</table>

### Forecasting

Figure 4 shows that the pattern of movement of JCI results forecasts are green line following the pattern of actual random JCI streaked with red. Based on the evaluation in Figure 4, that the results of the forecast shows the direction of the movement that is almost the same as the actual JCI. Of proof in Figure 4 there are at Table 3, calculations by using Paired Samples T test on the real extent of 0.01; the results of calculations indicate that average between actual data and forecast JCI did not differ significantly (0.47921), the second the variable correlation results yielded the number 1.000 with probability value 0.000. This proves that actual data with JCI data forecasting is very significant. In other words, the JCI movement patterns in Indonesia stock exchange during the period of observation of 2000 – 2015 can be predicted, which means the null hypothesis (H0) in this study failed declined. Thus, the Indonesia capital market can be categorized as a weak form of the efficient market does (Soetanto, 2009).

### Table 3

<table>
<thead>
<tr>
<th>Paired Sample T-Test Results</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Correlation</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1 Aktual &amp; Forecast</td>
<td>-0.8474898</td>
<td>37.8142162</td>
<td>1.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>
Table 4 is a prediction model parameters by using the method of maximum likelihood.

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Std. Error</th>
<th>z-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C(1)</td>
<td>0.500381</td>
<td>7.67E-05</td>
<td>6522.149</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variance Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
</tr>
<tr>
<td>ARCH(1)</td>
</tr>
<tr>
<td>GARCH(1)</td>
</tr>
</tbody>
</table>

R-squared: 0.999479
Mean dependent var: 2298.132
Adjusted R-squared: 0.999479
S.D. dependent var: 1657.686
S.E. of regression: 37.83735
Akaike info criterion: 9.092772
Sum squared resid: 5965750
Schwarz criterion: 9.098848
Log likelihood: -18958.98
Durbin-Watson stat: 1.116633

Table 4 explains that the value of the coefficient K of 1.239198 with the value of the z statistic its significant (7.562309) with probability values (0.0000). The value of the coefficient of ARCH(1) (A1) of 0.137313 with the value of the z-statistic its significant i.e. of 19.96305 and the value of the probability of 0.0000 under α = 0.01; The value of the coefficient GARCH(1) (G1) of 0.879152 with the value of the z-statistic its significant i.e. of 174.5386 and the value of the probability of 0.0000 under α = 0.01. So the equation model in this study can be written to:

\[ Y_t = 0.500381 + \varepsilon_t \]

\[ \varepsilon_t \sim N(0, \sigma_t^2) \]

\[ \sigma_t^2 = 1.239198 + 0.137313 \varepsilon_{t-1}^2 + 0.879152 \sigma_{t-1}^2 \]

This means that the data the JCI in the period of t is defined by a constant (0.500381) and the residue in the period t, where the residual period of t Gaussian with the average of zero and varansi t. To variansi in the period to t is determined by a constant (1.239198) and the quadratic residues in the previous period with the proportion of 13.7313% and variansi the previous period with the proportion of 87.9152%.

The JCI movement pattern in the Indonesia capital market are predictable, it is possible any existing business sectors in Indonesia stock exchange has a distinctive pattern (likely homokedastisitas), even keeping volatilitasnya is not too high. For example, mining sector, demand for energy will be always available and is relatively stable, and particularly oil, the OPEC Organization maintaining the stability of the world oil prices. For the property sector and finance tend to be sensitive to interest rates and global issues, regional, or national, volatilitasnya tend to be low, because interest rates are likely to be stable. So the change in stock price can then be used to estimate the change in the price of shares in the future. With respect to the theory of the Efficient Market Hypothesis, then this indicates that investors can still profit above normal, can use information and forecasting tools.

In the theory Efficient Market Hypothesis (EMH) mentioned also that the stock prices fluctuate randomly around the value of intrisiknya. Stock prices adjust rapidly to information recently happened randomly too. Likewise in hypothesis weak form efficiency; in an efficient market, the price change will be independent and random. This means that new information occurs on a random and independent, and stock prices adjust rapidly to information. Therefore, the Indonesia capital market can be categorized as capital markets are not efficient form is weak. The results of this study are inconsistent with the theory of the Efficient Market Hypothesis which States that investors will have difficulty to predict future stock prices. That is, investors were not able to take advantage of changes in price and then to profit above normal at present and in the future.
Hermawan and Subiantoro (2006) presents some of the results of research that discusses the Weak Form Efficient Market Hypothesis (WFEMH) in developing countries, it turns out there is a variation of the test results against WFEMH in some developing countries. Consistency in WFEMH contained on the Kuala Lumpur Stock Exchange (Branes, 1986); the main stock market in Asia (Chan et al, 1992); Nairobi Stock Exchange (Dickinson and Muragu, 1994); four capital markets Latin America (Ojah and Karemera, 1999). In contrast, some research is also inconsistent or rejection of WFEMH, the capital markets Korea and Taiwan (Cheung et al, 1993); World Bank study in 1997; Saudi Arabia's financial market (Kababa, 1998); Johannesburg Stock Exchange (Roux and Gilbertson, 1978); Indian Stock Exchange (Poshakwale, 1996; Gupta and Yang, 2011); The Dhaka Stock Market (Mobarek and Keavin, 2000). In Indonesia, this research is consistent with Utama (1992) and Wiyanto (2002) in the Soetanto (2009) reveals that the Indonesia capital market categorized as capital markets are not efficient form is weak. But the results of this research are different with Ie and Pancoro (2002), which categorize Indonesia capital market as an efficient form of capital market is weak. The difference is due to the results of the study time period used previous research is shorter and different models.

CONCLUSION

Based on the results of data analysis that has been done, then it can be inferred that the movement of the stock price index on the Indonesia capital market during the period of 2000 – 2015 are predictable, and the models used can be used as consideration for investors in making investment decisions. The results of this study are inconsistent with the theory of the Efficient Market Hypothesis (EMH) which States that investors could not predict above normal profit on the capital market is efficient.

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