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ASEAN-5 STOCK PRICE ANALYSIS

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Abstract

The capital market can encourage stock investors to invest. One way to find out which stocks are good to invest is by modeling. The purpose of this research is to form the ASEAN5 country stock price modeling, namely, Indonesia, Malaysia, Singapore, Philippines and Thailand. The sampling technique in this study uses purposive sampling technique. The sample used in this study is the ASEAN5 countries composite stock price index in 2017. The ASEAN5 country stock price index consists of IHSG (Composite Stock Price Index) for Indonesia, KLSE (Kuala Lumpur Stock Exchange) for Malaysia, STI (Strait Time Index) for Singapore, SET (Stock Exchange Thailand) for Thailand, and PSEI (Phillipines Stock Exchange Index) for the Philippines. Data analysis method in this study uses a multivariate time series analysis method, VARMA (Vector Autoregressive Moving Average). The VARMA model is used for time series economic modeling and can predict more than one variable. This study produces a VARMA model (1,0,0), the results of the stock price index forecasting with one step forecast produce a small RMSE value, where the JCI and PSEI have a small RMSE value on the VARMA model (1,0,0), KLSE , STI and SET have small RMSE values on the VARIMA (1,1,0) model. This shows that Indonesian and Philippine stock price movements have the same pattern. Malaysia, Singapore and Thailand group have the same stock price movements.

Keywords: ASEAN5, Stock Price, VARMA, VARIMA

Introduction

Globalization is a concept that has been known by almost all circles of society, especially in the sphere of social sciences as well as being a hot topic to be discussed until now. There are several perceptions or perspectives on globalization itself. There are some people who equate globalization with a movement of universality, some others see globalization as a borderless relationship, and some still do not understand the true meaning of globalization itself (Muzammil, 2011). The capital market can be an indicator of the development of a country's economy. A good economy in a country will be reflected in its foreign trade balance. The capital market also has an important role and can provide facilities to bring together two interests, namely those who have excess funds and those who need funds. Those who have excess funds can invest these funds in the hope of obtaining profits, while companies that need these funds are used for investment purposes without waiting for the availability of operational funds. The existence of a capital market also encourages stock investors to invest. One way to find out which stock is good is by modeling, modeling aims to forecast stock prices in the future period. A good economic model can be used to see the influence of one variable on another variable based on the underlying economic theory. In general, economic variables are non-stationary and are influenced by previous observations, so these conditions need to get attention before drawing up or forming models (Suharsono, Guritno & Subanar, 2014).

Various previous studies on ASEAN stock linkages, namely Sharma & Wongbapao (2002) examined the linkages of ASEAN-5 markets by using cointegration techniques, the results of their research showed long-term cointegration between the stock markets of Indonesia, Malaysia, Singapore, Thailand, except the Philippines. Manning (2002) uses the Johansen Maximum Likelihood approach and the Haldane technique and the Kalman Filter Hall to test the co-movement of the ASEAN-5 stock market and outside the region, namely the US, South Korea, Hong Kong and Japan. Rahim & Nur (2007) used VAR analysis to test the dynamic structure of international transition in ASEAN-5, Korea, Japan and Hong Kong stock returns. Cheung & Ho (1991). With the existence of various previous studies, the Indonesian stock prices were modeled with neighboring countries including developed and developing countries such as Malaysia, Singapore, Thailand, Philippines. These

countries are the founding countries of ASEAN (Association of South Asian Nations), where the modeling of stock prices uses multivariate times series analysis. The data used is daily closing stock price index data. The stock price is described by the ASEAN stock price index data in 2008 because at that time the United States experienced a global financial crisis due to the subprime mortage crisis which also affected the world crisis, including ASEAN countries (Iskan, 2009). The ASEAN country stock price index includes the Composite Stock Price Index (JCI) or JKSE Indonesia, including the Composite Stock Price Index (JCI) or JKSE Indonesia, the Kuala Lumpur Stock Exchange (KLSE) Malaysia, the Singapore Straits Index (STI), Thailand Stock Exchange (STE) Thailand, Philippine Stock Exchange Index (PSEI) Philippines. The countries that have the stock price index are countries that have a close relationship with Indonesia in terms of trade. Indonesia's trade relations with other countries have even begun since the colonial period. Like the data put forward by Hasbullah (2012) that Indonesia's export destination countries in 1993 varied. In addition to the Netherlands, as the main objective of several ASEAN countries, namely Singapore, Malaysia, Thailand and the Philippines are also important export destinations for Indonesia. At present, the main main export destinations include Tiogkok, Japan, the United States, India, Australia, South Korea and Taiwan. Exports and imports have an important role in determining trade, including trading in stock prices.

Stock price modeling in this study uses multivariate time series analysis, namely VARMA (Vector Autoregressive Moving Average) and VARMAX (Vector Autoregressive Moving Average with Exogenous Variables). The procedure of VARMA representation is the initial strategy for time series economic modeling. The VARMA model is a combination of Vector Autoregressive (VAR) and Vector Moving Average (VMA). VAR model is a combination of several Autoregressive (AR) models, besides this method can be used to model stock market behavior (Suharsono & Susilaningrum, 2007). The VARMA modeling process is used if it meets assumptions, such as stationary both in flat and variance, which is done using a plot of corelation matrix function and plot samples, partial autoregression matrix function and white noise (Wei, 2006). If the assumption of normal multivariate distribution is not met in VARMA modeling, then the cause can be expected, namely the existence of outliers. Outliers can be detected with residual control diagrams, residual control diagrams are used to monitor together from 2 or more interrelated quality characteristics with the observation assumption is independent (Montgomery, 2009). The study of controlling the quality of multivariate processes was first done by Mason et al. (2003) which controls autocorrelated observations by modifying the T 2 Hotelling control chart and identifying autocorrelated observations that have a systematic pattern model of a single bowl for a long period. After the outlier is known, it is formed into a dummy variable and used with the original variable to create a new model. Model VARMAX (Vector Autoregressive Moving Average with Exogenous Variables) is a new model that is formed. The VARMAX model can be used to predict and determine the relationship between the stock price index. Model selection criteria using Root Mean Square Error (RMSE), the appropriate VARMA and VARMAX models are used to forecast the stock prices of ASEAN countries in the next period. However, as said by Makridakis & Hibon (2000) that more sophisticated or more complex statistical methods do not always provide more accurate estimates than simple methods.

Literature Review

Time Series Analysis

Time Series analysis was introduced by George Box and Gwilym Jenkins in 1976. Time Series is a series of observational data that occur based on time indexes sequentially with a fixed time interval. Time Series Analysis is one of the statistical procedures applied to predict probabilistic structures of circumstances that occur in the future in the context of decision making. The research data used is time-bound, so there is a correlation between current events and data from one previous period. Although closely related to the time sequence, it does not rule out the possibility of having a close relationship with other dimensions such as space. Time series is also applied in various fields, such as agriculture, business and economics, engineering, health, meteorology, quality control, and social sciences. In the business and economic fields, time series is applied in observing stock prices, interest rates, monthly price indices, quarterly sales, and annual income (Wei, 2006). The development of time series analysis which has more than one variable is called multivariate time series analysis which is used to model and explain the interaction and movement between time series variables. The multivariate time series analysis model

used in this study is VARMA (Vector Autoregressive Moving Average) and VARMAX (Vector Autoregressive Moving Average with Exogenous Variables).

ASEAN-5 Countries

ASEAN (Association of South East Asian Nations) is a geo-political and economic organization founded on August 8, 1967, namely Malysia, Singapore, Philippines, Indonesia and Thailand gathered in Bangkok and agreed to launch an ASEAN Declaration to form an association of Asian nations Southeast (Association of south East Asian Nation) (Bermand, 2012). In addition, collaboration II aims to increase the bargaining potential in the world, and various resources among members in the region. This collaboration was initiated by the ASEAN Free Trade Area (AFTA) in 1993. In 2009, ASEAN stepped forward for the ASEAN Economic Community (AEC) to build a market base and work together to strengthen the region (Sukcharoesnsin, 2013). The five stock markets which include associations of Southeast Asian countries consist of:

1. Indonesia has a stock exchange where there are 11 types of stock price indices that are continuously disseminated through print and electronic media. But in this case, only take one type of stock price index, namely the composite stock price index (CSPI) or also called the Jakarta Composite Index (JCI). JCI is a stock index that most often records investors when investing. This is due to the index list of all shares listed on the Indonesian stock exchange. With the movement of joint stock investors index can see whether market conditions move up or down. Many factors influence the behavior of medium stock market indices including the world stock market. JSI is calculated by the Indonesia Stock Exchange (IDX) and consists of all shares listed on the stock exchange. To ensure that the JCI always reflects the actual market conditions, IDX has the right to exclude certain shares in the JCI calculation process, namely the very small number of shareholders by public investors (free float), while the market capitalization is very large (Suharsono, 2012) .
2. Malaysia has a stock index, namely the kuala lumpur composite index (KLCI) is the market value of the weighted index. This index is one of the most followed by investors because KLCI represents the overall performance of shares listed on the Bursa Malaysia (KLSE). This index has generally been accepted as a barometer of the local stock market. KLCI which was introduced in 1986 is to serve as an indicator of the performance of the stock market and the Malaysian economy as a whole (Zakaria & Shamsuddin, 2012).
3. Singapore Exchange (SGX) was inaugurated on December 1, 1999, following the merger of two financial institutions namely the Singapore Stock Exchange (SES) and the Singapore International Monetary Exchange (SIMEX). On November 23, 2000, SGX became the first exchange in Asia-Pacific to be registered through public offerings and Private placements. Their shares are a component of the benchmark index such as the MSCI Singapore Index and the Straits Times Index (STI). The Straits Times Index (STI) consists of 30 shares listed on the SGX as a ranking based on market capitalization. this is widely regarded as Singapore's stock market index, and its main purpose is to reflect daily trading activities on the Singapore stock exchange (Hellman, Hetting & Tarighi, 2012).
4. The stock market officially began trading on April 30, 1975 and was named The Securities Exchange of Thailand. On 1 January 1991, the name of the exchange officially became the Thai Stock Exchange of Thailand. The index of the Thailand Stock Exchange is called the Stock Exchange Thailand (SET) Index. A SET index is a capitalization price index that is a composite market that compares the current market value (CMV) of all ordinary shares registered with their market value on the base date of April 30, 1975 (base market value or BMV) when the stock market was established (Sutheebanjard & Premchaiswadi, 2010).
5. The Philippine Stock Exchange (PSE) index was established on July 14, 1992, to anticipate the unification of the Manila Stock Exchange (MSE) and the Makati Stock Exchnage (MkSE). One market price exchange was achieved through a link-up of the two trading floors that existed on March 25, 1994. Overall, there were 189 listed companies with a market capitalization of Php 1.39 Trillion, the volume of shares traded from 704.27 billion and turnover of php value 364.30 billion (Crisostomo, Padila & Visda, 2013). Geographical proximity and similarity characteristics allow countries in the Asian region to have a very high contagion effect. The linkage also increases with the realization of the AFTA (ASEAN Free Trade Area). After the realization of AFTA, ASEAN, especially ASEAN-5, the IMF (International Monetaray Fund) states that Indonesia is one of the countries with the strongest economic conditions among the countries in ASEAN. This increased investor interest in investing in Indonesia, especially in the post-crisis

period, an increase in foreign investor transactions on the JCI occurred every year. Based on the fourth Quarter Monetary Policy report of 2012, it can be seen that the proportion of ownership by foreign investors reached 59.15% of the total shares traded in the country with the dominance of ownership by ASEAN investors (Octavia, 2014).

Research Method

This research is a quantitative research to model the ASEAN-5 stock price index. Data sources in the study were obtained through secondary data obtained through the IDX, KLSE, STI, STE and PSEI websites. The sampling technique used in this study was purposive sampling. The population in the study included the Composite Stock Price Index (CSPI) or JKSE Indonesia, Kuala Lumpur Stock Excchange (KLSE) Malausia, Singapore Strait Time Index (STI), Thailand Stock Exchange (STE) Thailand, Philippine Stock Exchange (PSEI) Philippines. The samples in the study were the Composite Stock Price Index (CSPI) or JKSE Indonesia, Kuala Lumpur Stock Excchange (KLSE) of Malausia, Singapore's Strait Time Index (STI), Thailand's Stock Exchange (STE) of Thailand, Philippine Daily Philippine Stock Exchange (PSEI) of 2017 The variables in this study consist of the stock price index variables described in the operational definition table as follows :

1. $Z_{1,t}$ = IHSG for indonesia day-t
2. $Z_{2,t}$ = KLSE for Malaysia day-t
3. $Z_{5,t}$ = PSEI for Filipina day ke-t
4. $Z_{3,t}$ = STI for singapore day-t
5. $Z_{4,t}$ = SET for Thailand day ke-t

Analysis and Discussion

Descriptive Analysis

This study uses 2017 daily closing stock price data obtained from Yahoo Finance database. Descriptive statistical analysis results from five stock data in the table as follows:

Table 4.1 Stock Price Index Descriptive Statistics

Variable	N Data	Minimum	Maximum	Mean	Std Deviasi
IHSG	180	1399.42	2830.26	2297.29	314.43
KLSE	180	905.23	1507.04	1212.09	138.95
STI	180	1878.51	3461.22	2905.31	308.51
SET	180	451.96	884.19	749.53	98.46
PSEI	180	611.86	939.92	857.43	62.55

Based on Table 4.1 it can be said that the stock price index which has the highest average stock price of the five variables is STI with an average value of 2905.31 where the highest stock price is 3461.22 on 10 October 2017 and the lowest is 1878.51 on 10 December 2017. While the value the lowest average is SET with an average value of 749.53, where the highest share price is 884.19 on April 11, 2017 and the lowest is 451.96 on November 19, 2017. The average value is one measure of data concentration. The size of the data distribution, in addition to the maximum and minimum values, can also be seen through standard deviations. The standard deviation value shows the level of diversity of stock price data in each of these variables. The standard deviation is directly proportional to the value of the variance, because the standard deviation is the result of the square root of the variance. Standard deviation values indicate that the level of diversity of the fifth daily stock price index data variable is not too high, with the highest level of diversity produced by the stock price index data is STI, which is 308.51 and the lowest is PSEI, 62.55. Graph of daily stock price data movements on these five variables is displayed in the form of a time series plot as shown below

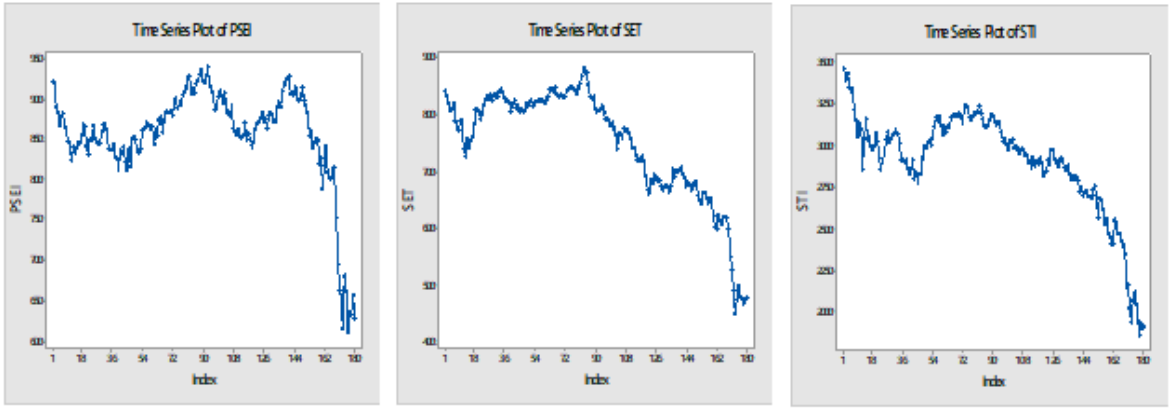

Figure 1a. Time Series Plot of ASEAN5 Stock Price Index

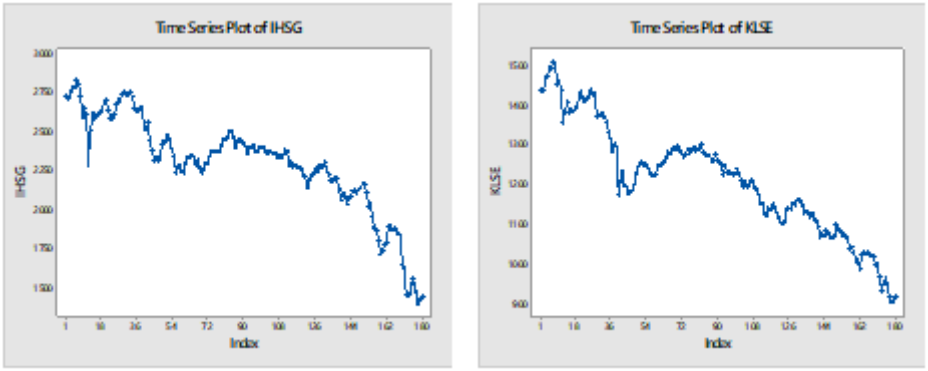

Figure 1b. Time Series Plot of ASEAN5 Stock Price Index

Modeling of Stock Price Index Data

Through this modeling can be used to determine the relationship between one variable and another. The modeling of ASEAN countries' stock price data uses multivariate time series analysis, namely VARMA and VARMAX. If the VARMA model does not meet the assumption of white noise, a control diagram is used to control the residuals of the model, if there is an outlier then a new model is created, VARMAX. For more details, it can be done with the following steps

Model Identification

The initial step is to identify the model, this identification aims to find out whether the data used has fulfilled the stationary assumption in the variance of the stock data. Based on the time series plot in Figure 4.1 to Figure 4.5, it can be seen that the data of the stock price index is stationary in the mean and variance. To find out that the stock price index data is stationary in variance, it can be seen through the cox transformation box in each country in Figure 4.6 to 4.10.

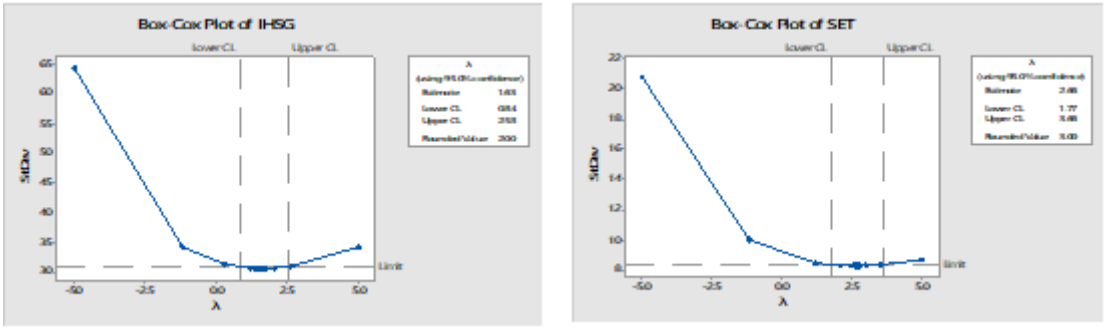

Figure 4.3 Box Cox Transformastion IHSG dan SET

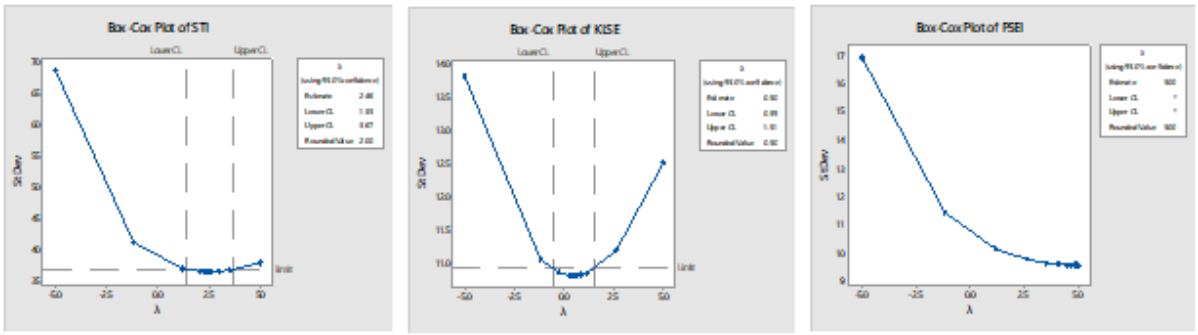

Figure 4.4 Box Cox Transformastion STI, KLSE dan PSEI

Figure 4.3 - IHSG informs that the rounded value generated in the Cox transformation box is 1 with an upper limit of 2.58 and a lower limit of 0.84. Absolute value Rounded value greater than 1 indicates that the data is stationary in variance. Through Figure 4.3 it is proven that JCI data is stationary in variance. Figure 4.3 - SET informs the Rounded value generated in the Cox transformation box is 1 with the upper limit of 3.66 and the lower limit of 1.77. Absolute value Rounded value greater than 1 indicates that the data is stationary in variance. Through Figure 4.3 it is proven that the SET data is stationary in variance.

The rounded value of the 4.4 –STI image that is generated in the Cox transformation box is 1 with the upper limit of 3.67 and the lower limit of 1.35. Absolute value Rounded value greater than 1 indicates that the data is stationary in variance. Through Figure 4.4-STI it is proven that the STI data is stationary in variance. Rounded value of 4.4-KLSE image generated in the Cox transformation box is 1 with an upper limit of 1.51 and a lower limit of -0.59. Absolute value Rounded value greater than 1 indicates that the data is stationary in variance. Through Figure 44-KLSE it is proven that KLSE data is stationary in variance. Theound value of 4.4-PSEI image generated in the Cox transformation box is 1 with the upper and lower bounds undetectable. Absolute value Rounded value greater than 1 indicates that the data is stationary in variance. Through Figure 4.4-PSEI it is proven that the PSEI data is stationary in variance. The identification results show that all the series in the stock price index are stationary in variance

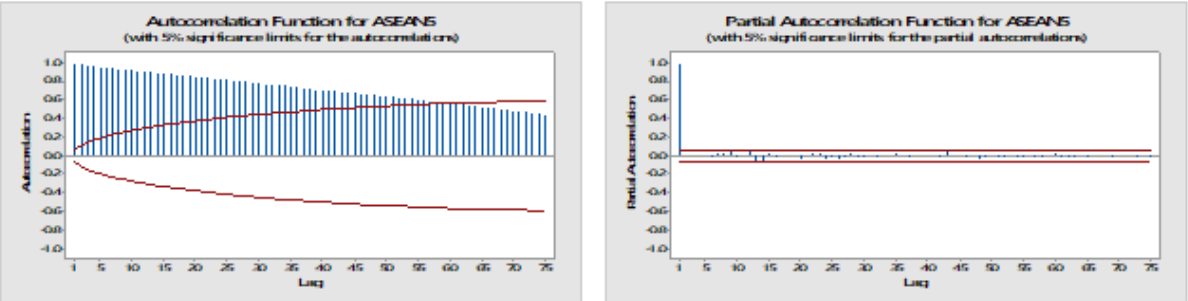

Figure 5. ACF dan PACF ASEAN5

Table 4.2 Minimum Information Criterion Stock Price Index Data

LAG	MA0	MA1	MA2	MA3	MA4	MA5
AR 0	310.631	312.135	317.23	317.947	318.27	312.628
AR 1	307.019	307.283	309.507	309.885	311.989	309.606
AR 2	310.368	316.125	308.33	319.231	317.818	318.231
AR 3	311.69	311.078	307.65	315.765	315.201	317.019
AR 4	309.31	312.152	318.656	319.936	315.658	313.756
AR 5	318.598	311.93	309.655	307.276	309.408	315.797

From the Sample Correlation Matrix Function plot and plot the Partial Autoregression Matrix Function indicates that the model of the five stock price indexes is the nonstationary VARIMA and VARIMAX models. Based on Table 4.2 it is known that in AR (1), MA (0) is the smallest AIC value. This supports the expected model obtained is VARIMA (1,1,0). The parameter estimation results from the VARIMA model (1,1,0) indicate that the model has 36 parameters. However, if it is seen from the p-value of each of these parameters it can be seen that apparently not all parameters have a significant influence on the model. To overcome the existence of variables that are not significant in this model, the variables are restricted. The restrict order is carried out on one step at a time, the parameters are not significant in stages, starting from the variable with the highest p-value, until all variables that are not restricted indicate p-value is smaller than the significance value (0.05) $\alpha =$. If the p-value of each variable is smaller than α then it can be said that these variables are significant to the model.

Table 4.3. Comparison of RMSE VARMA (1,1,0) and VARIMA (1,1,0) values

Stock Price Index	RMSE	
	VARMA (1,0,0)	VARIMA (1,1,0)
IHSG	801.876	813.256
KLSE	145.098	157.980
STI	587.134	567.445
SET	307.234	309.987
PSEI	180.987	165.908

Based on Table 4.3 forecasting stock prices by means of one step forecast to produce small RMSE values, in addition, the RMSE values obtained from all methods also show relatively small numbers. This indicates that all the models obtained are very good. Among the two models it turns out that the RMSE value is not too far away, often in some methods it says that more complicated methods will produce better accuracy, but the reality is not always so. It can be seen from the table above that JCI and PSEI have a small RMSE value on the VARMA

model (1,0,0), KLSE and STI have a small RMSE value on the VARMA model (1,1,0), and SET has the RMSE value small on both models.

Conclusion and Suggestion

The results showed that the model obtained in this study was the VARMA (1,0,0) and VARIMA (1,1,0) models. The results of the stock price index forecasting with one step forecast produce a small RMSE value, where the JCI and PSEI have a small RMSE value on the VARMA (1.0.0) model, KLSE, STI and SET have a small RMSE value on the VARIMA model (1,1,0). This shows that Indonesian and Philippine stock price movements have the same pattern. Malaysia, Singapore and Thailand group have the same stock price movements. For further research can involve all the shares of ASEAN countries and compare with world stocks. Using a method to detect outliers in multivariate time series if there are outliers in the processing.

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