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A Multivariate Regression with Time Series Error in Forecasting Jakarta Composite Index and Stock Prices of Banking Industry in Indonesia by Considering COVID-19 Effect

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Abstract. The stability of the financial system in Indonesia and the world has been severely disrupted by COVID-19. With the unstable financial system conditions, there were drastic fluctuations in the composite stock price index and other stocks. This study focuses on stocks of the banking industry in Indonesia, especially banks that are State-Owned Enterprises. The main objectives of this study are to evaluate the significant effect of COVID-19 on the price of the Jakarta Composite Index (JCI) and some stocks in the banking industry, determine the dependence between the prices of these shares, and forecast the price of JCI and other stock prices in the banking industry. The method used in this study is Multivariate Regression with Time Series Errors, a multivariate technique for analyzing time series data. One of the interesting independent variables included in the model is a variable representing three phases of the COVID-19 pandemic, based on newly confirmed cases. The results indicate a significant impact of the pandemic on the Jakarta Composite Index (JCI) and stock prices of state-owned banks. Furthermore, the study reveals a dependency between the JCI and the stock prices of these banks.

Keywords: Banking industry; COVID-19; Financial system stability; Jakarta Composite Index; Multivariate regression with time series error

1. Introduction

Coronavirus Disease 2019 (COVID-19) has been designated as a pandemic by WHO due to its rapid spread in almost all parts of the world (Cucinotta and Vanelli, 2020). The increasing number of countries affected by the COVID-19 virus over the world has made the global economic situation worse (Mofijur *et al.*, 2020). The International Monetary Fund (IMF) predicts the global economy to have a minus 3% growth (Puspasari, 2020). This is one of the focuses of the Sustainable Development Goals (SDGs) because every economic impact that occurs is the key to realizing sustainable economic growth.

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In Southeast Asia, the COVID-19 pandemic has been found in all states and has had a serious influence on all aspects, especially on the economy (Amul *et al*., 2021). The country in Southeast Asia that has had a sharp increase in COVID-19 cases in Indonesia. The number of confirmed COVID-19 cases in Indonesia has even exceeded the number of cases in China, where the virus originated (Worldometers, 2021).

Indonesia recorded a GDP growth of only 2.97% in the first quarter of 2020, which represents a significant slowdown compared to the previous achievement of a 4.97% growth rate (Setianto and Kurniawan, 2020). The contraction occurred due to activity restrictions and lockdowns to control the spread of the COVID-19 pandemic (Ministry PPN RI, 2020). This condition disrupts financial system stability. The unstable and inefficient financial system will affect the allocation of funds. The fund allocation will not work properly, so it can obstruct economic growth. Based on the experience, an unstable financial system, especially if a crisis happens, will require high costs for recovery (OJK, 2021; Galbraith, 2015). The financial system also includes transactions in the stock market that are predicted to be affected by this pandemic (Chu *et al.*, 2022; Zhang, Hu and Ji, 2020).

Therefore, some efforts are needed to model stock prices in Indonesia to produce very useful predictions for investors and the government as a reference for making policies. This study focuses on stocks of the banking industry in Indonesia, especially banks that are State-Owned Enterprises (BUMN). The goal of this study is to examine the significant effect of COVID-19 on the price of the Jakarta Composite Index (JCI) and some stocks in the banking industry. In addition, this study also wants to determine the dependence between the prices of these shares so that later several recommendations will be formulated for Bank Indonesia as one of the controlling financial stabilities in Indonesia. The final objective is to forecast the JCI price and other stock prices in the banking industry based on the modeling results obtained.

A stock price index is a number that is used to express changes in stock prices within a certain time interval and becomes a measuring instrument for the situation in the capital market (Damajanti, Yulianti, and Rosyati, 2018).The Composite Stock Price Index (abbreviated as JCI, or also known as the Jakarta Composite Index (JKSE)) is a stock price index to measure the combination of all common and preferred shares listed at the Indonesia Stock Exchange (IDX) (Andreas, Rahmayanti, and Ulyah, 2021; Robiyanto *et al.*, 2019). Stocks are capital market instruments that provide attractive benefits so that they are in demand by investors (Zhao, *et.al.*, 2023; Parameswaran, 2007).

This study used stock price data from state-owned banks, including Bank Rakyat Indonesia (BRI), Bank Negara Indonesia (BNI), Bank Tabungan Negara (BTN), and Mandiri Bank. These banks were selected because they are the state-owned banks with the largest assets in Indonesia. According to the bank's financial report as of the first quarter of 2020, BRI is ranked first with assets of Rp 1287.09 trillion, followed by Mandiri Bank with assets of Rp 1130.7 trillion, and BNI with assets of Rp 953.7 trillion. The positive stock return and a high number of assets make them attractive to investors. Moreover, these four banks have a long-standing history and have made significant contributions to the banking industry and the Indonesian economy (Herlin, 2018).

Previous studies in forecasting were done using classical regression (Smolak *et al.,* 2020; Zubakin *et al.,* 2015), exponential smoothing (Ostertagova and Ostertag, 2012; Hyndman *et al*., 2002), and ARIMA (Berawi *et al.,* 2018; Dhini *et al.,* 2015). Furthermore, a work involving exogenous variables was conducted by (Ulyah, Susilaningrum, and Suhartono, 2014), in which the exogenous variable used is the Eid al-Fitr dummy variable to predict the total number of motorcycle sales. Ulyah (2019) predicts the JCI and SRTG stock prices with the influence of the presidential election in Indonesia using the univariate

Autoregressive Integrated Moving Average (ARIMAX) and multivariate Vector Autoregressive with Exogenous Input (VARX) models. Then, Ulyah, Andreas, and Rahmayanti (2021) constructed a forecasting model of gold and oil prices with the effect of the US-China trade war. Besides, Pradita, Ongkunaruk, and Leingpibul (2020) utilized intervention analysis to forecast the demand of reefer containers. Unlike those previous studies, the exogenous variable in our study is a dummy variable based on the number of new confirmed COVID-19 cases. In addition, the method that will be used in this study is a multivariate method for time series data, namely Multivariate Regression with Time Series Errors. This model is a special case of the VARX model with several advantages in interpretation (Nicholson, Matteson, and Bien, 2017).

The use of exogenous variables that consider the COVID-19 pandemic with the Multivariate Regression with Time Series Errors method in predicting the stock price is the novelty of this study. This work produces statistical models and predictions of JCI prices and banking stock prices in Indonesia over a certain period. The results of this study can be used as a reference and statistical review in formulating policies in the capital market, especially in Indonesia.

The organization of the paper is as follows. Section 1 gives the motivation and the aims of this study. Section 2 provides some useful literature. Then, section 3 explains the dataset and the method used in this work. The results and discussion section elaborate the descriptive statistics, modeling, and forecasting. Finally, the last section summarizes this work.

2. Methods

2.1. Size of Dataset and Research Variables

This study used secondary data downloaded from Yahoo Finance and kawalcovid19.id website. These include the Jakarta Composite Index (JKSE or JCI), stock prices of Bank Negara Indonesia (BBNI), Bank Rakyat Indonesia (BBRI), Bank Tabungan Negara (BBTN), and Bank Mandiri (BMRI). The data used in this study are daily data from January 1st, 2018 to July 1st, 2021, and are expressed in Indonesian Rupiah (IDR). In addition, the data taken from the website kawalcovid19.id are daily data on the number of Indonesia's new positive COVID-19 cases. We split the data into two parts, which are training and testing data. Data from 1st January 2018 – 22nd June 2021 are called training data, and data from 23rd June – 1st July 2021 are considered testing data. Training data are used to construct the model, whereas testing data will be used for validation. The variables in this study were divided into endogenous (core) variables and exogenous variables. The endogenous variables include JCI (JKSE), BNI (BBNI), BRI (BBRI), BTN (BBTN), and Mandiri Bank (BMRI) stock prices. Then, the exogenous variables are the dummy variables representing the period of COVID-19 with a value of 1 (from 2nd March 2020-31st to July 2021) and zero otherwise. In general, the COVID-19 pandemic in Indonesia has formed several trends. The pandemic period was divided into three parts based on the trend and pattern in Figure 1.

Figure 1 displays the behaviour of new confirmed cases in Indonesia. COVID-19 first infected Indonesia on March 2, 2020, and the number of cases gradually increased until late October 2020. This period was referred to as the first phase of the COVID-19 wave (T_1), during which there was an upward trend in cases, and people were concerned about the spread of COVID-19. The second phase of the COVID-19 wave (T_2) represents periods in which COVID-19 cases have a significant rising trend. This increase is more drastic than that of the T_1 period. Then, the third phase of the COVID-19 wave (T_3) was the period with decreasing trend of new confirmed COVID-19 cases.

The details about the dummy variables are as follows.

$$T_1 = \begin{cases} 1, 2^{nd} March\ 2020 - 31^{st}\ Oct\ 2020 \\ 0, others \end{cases}$$

$$T_2 = \begin{cases} 1, 1^{st} Nov\ 2020 - 31^{st}\ Jan\ 2021\ and\ 1^{st}\ June - 1^{st}\ July\ 2021 \\ 0, others \end{cases}$$

$$T_3 = \begin{cases} 1, 1^{st}\ Feb\ 2021 - 31^{st}\ May\ 2021 \\ 0, others \end{cases}$$

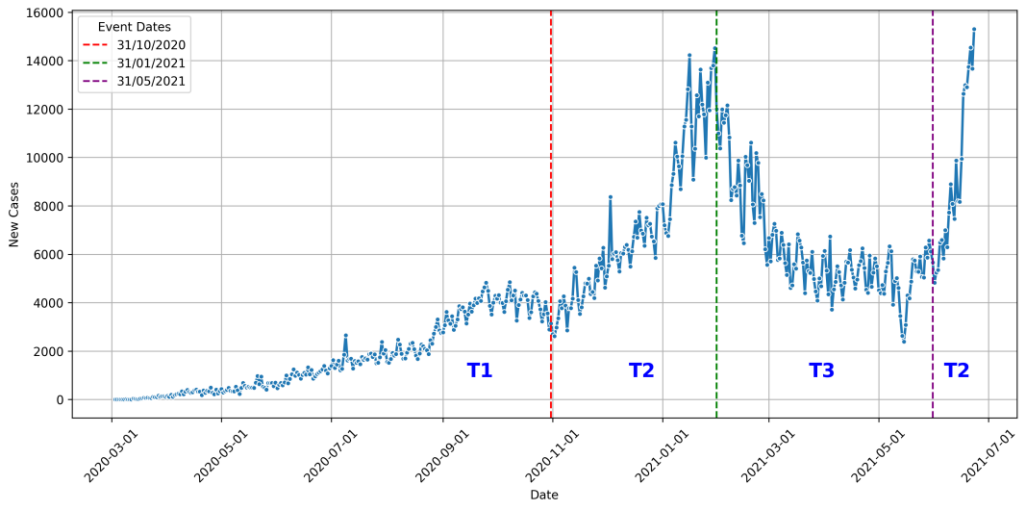

Figure 1 Time Series Plot of New Confirmed COVID-19 Cases

2.2. Procedure of Analysis

The analysis was carried out using the MINITAB 18 and RStudio software. The stages of analysis in this study are as follows:

a) Conducting exploration and visualization on each research variable. The descriptive analysis conducted in this study is the mean, standard deviation, diagrams, and correlations.

b) Multivariate modeling was conducted using multivariate regressions. Two regression models were developed. The first model included the COVID-19 dummy variable as a predictor to determine whether there were differences between the stock prices before and during the pandemic. The second model incorporated the T_1, T_2, and T_3 dummy variables as predictors to gain a better understanding of the price variations among the different patterns of the pandemic period.

c) Modelling and forecasting of the prices were conducted using Multivariate Regression with Time Series Errors. The steps included identifying data patterns through the results of descriptive statistics. The effect of the COVID-19 pandemic was removed from the response variable by fitting the multivariate regression equation with T_1, T_2, and T_3 predictors to obtain the residual. Subsequently, VAR modelling of the residuals was performed to obtain the best model that met all the residual assumptions.

d) Computing the accuracy of the forecasts using Mean Absolute Percentage Error (MAPE).

e) Performing model interpretation and giving the recommendation.

2.3. Multivariate Regression with Time Series Error Model

In general, every condition that occurs in the financial industry will have an impact on other variables. This is called an exogenous variable. By considering the effect of exogenous variables on the response variable, the analysis and forecasting of the response variable will be closer to the actual value. This concept has been applied in the univariate forecasting of gold prices and Brent crude oil prices using the Autoregressive Integrated Moving Average with Exogenous Input (ARIMAX) model. By considering the effect of the US-China Trade War, which had a significant effect on price movements, forecasting results with a good level of accuracy were obtained (Andreas, Rahmayanti, and Ulyah, 2021; Rahmayanti Andreas, and Ulyah, 2021). In addition, multivariate modeling by considering exogenous variables can also provide forecasting results with good accuracy. This is shown by (Ulyah Andreas, and Rahmayanti, 2021), which uses the Vector Autoregressive with Exogenous Input (VARX) model to predict gold prices and Brent crude oil prices multivariate.

The use of the ARIMAX model in multivariate cases is ineffective, especially if the response variables are correlated (Tsay, 2013; Cryer and Chan, 2008). In addition, the VARX model that applies to multivariate cases can be further developed, known as the multivariate regression model with time series error (Wei, 2019). This model is a generalization of the univariate model, namely the Autoregressive Integrated Moving Average with Exogenous Input (ARIMAX) and is a special case of the Vector Autoregressive with Exogenous Input (VARX) model (Warsono *et.al*, 2019). This regression model describes the contribution of each variable based on the lags it has. The mathematical form of the model is stated below.

$$\dot{y}_t = \sum_{i=1}^{p} \phi_i \dot{y}_{t-i} + \sum_{i=0}^{s} \Theta_i^* x_{t-i} + a_t,$$
$$\Phi(B)\dot{y}_t = \Theta^*(B)x_t + a_t, \quad (1)$$

where

$$\Phi(B) = I_k - \Phi_1 B - \cdots - \Phi_p B^p,\ \Theta^*(B) = I_k - \Theta_1^* B - \cdots - \Theta_s^* B^s,$$
$$\dot{y}_t = \big((y_{1t} - \mu), \ldots, (y_{kt} - \mu)\big)', a_t = (a_{1t}, \ldots, a_{kt})', x_t = (x_{1t}, \ldots, x_{rt})'.$$

Φ_i is a k x k coefficient matrix of autoregressive and Θ_i^* is a k x r coefficient matrix of moving average. The variable x in Equation 1 is an exogenous variable that can affect the endogenous variable y.

3. Results and Discussion

3.1. Statistical Features of The Data

Figure 2 presents the time series plots of the Jakarta Composite Index and some state-owned banks' stock prices. Overall, considering the time series plot of COVID-19 new confirmed cases in Figure 1, all the indexes and stock prices had a significant fall during the beginning period of the COVID-19 case in Indonesia (T_1). This condition happened because all people were panicking and facing the effect of the COVID-19 pandemic. Then, in the second period (T_2), when the cases rocketed significantly, the prices of index and stock prices started to rise, but the value was still lower than that before the pandemic. During this period, the Government introduced the "New Normal" and people were adapting to it. Therefore, the business has already adapted and adjusted and made good upward movements in the prices (Fridayani and Iqbal, 2020; Vaithilingam *et al.,* 2022). The third period is the period where COVID-19 cases are controllable (i.e., the decreasing number of new cases). However, the price of the index and stock prices have decreasing trends, although not as significant as the previous fall at the beginning of the pandemic. During this

period, vaccines have already achieved the final stage of development, and there was a prohibition of homecoming during the Eid Al-Fitr holiday period that had a significant impact on some business sectors such as land transportation, hotel, tourism, and amusement.

Figure 2 Time Series Plots of Index and Stock Prices

Table 1 displays the statistical descriptive analysis, indicating that the average share price of BBNI is higher than those of JKSE, BBRI, BBTN, and BMRI. However, the standard deviation of BBNI's stock price is very large, reaching 23.8% of the average value. This suggests that the fluctuations that occurred during the last two years were very high. The same condition also occurs in BBTN's stock price, with a deviation of 33.6% from the average. In general, the skewness value of variables (except BBTN) is negative, which indicates that the data tends to skew to the left. In addition, the distribution of JKSE and BMRI data tends to be more pointed. The stock price of BBNI and BBRI tend to be flatter than the normal distribution (indicated by their respective kurtosis values), while the BBTN data is close to a normal distribution.

Moreover, based on the results of the correlation plot in Figure 3, it is concluded that the prices between stocks, both JKSE, BBNI, BBRI, BBTN, and BMRI, behave in the same direction, proven by the positive correlation among each other. All the stock prices of state-owned banks are highly correlated with JKSE, which means that the association between them is very strong. The least correlated stock price is between BBTN and BBRI, followed by the correlation between BBNI and BBRI. In contrast, BBNI has a strong correlation with BMRI and BBTN.

Table 1 Statistics Descriptive of The Data

Variable	Count	Mean	StDev	Minimum	Maximum	Skewness	Kurtosis
JKSE	841	5910.8	550.1	3937.6	6689.3	-1.19	3.60
BBNI	841	7108.8	1695.1	3160.0	10175.0	-0.35	2.08
BBRI	841	3765.7	583.5	2170.0	4890.0	-0.23	2.02
BBTN	841	2158.3	725.4	745.0	3840.0	0.38	2.87
BMRI	841	6775.2	999.2	3720.0	9050.0	-0.78	3.24

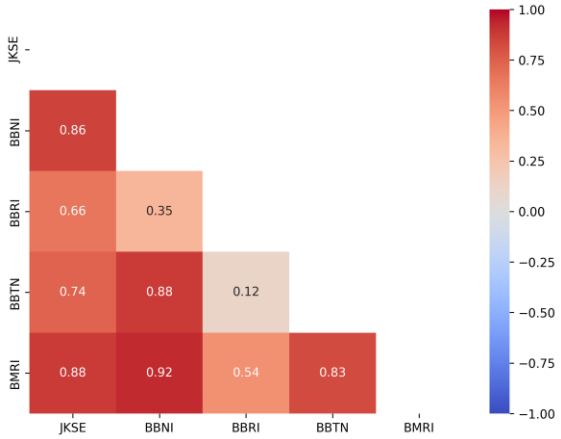

Figure 3 Correlation among Index and Stock Prices

3.2. Modelling of The Index and Stock Prices of Banking Industry with the Effect of COVID-19 Pandemic

In this subsection, we aimed to investigate whether there was a significant difference in price before and during the COVID-19 pandemic and quantify the magnitude of this difference. To achieve this, a multivariate time series regression was conducted. The regression included all variables as dependent variables, and the COVID-19 dummy variable was used as the independent variable. The results are presented in Table 2.

Table 2 Regression Results of Index and Stock Prices on COVID-19 Dummy Variable

Variable	Parameter	Estimate	s.d.	t-ratio	p-value
JKSE	Constant	6181.1	18.5	334.4	0
	COVID-19	-723.8	30.3	-23.93	0
BBNI	Constant	8236.3	37.4	220.09	0
	COVID-19	-3020	61.2	-49.31	0
BBRI	Constant	3800	25.4	149.85	0
	COVID-19	-91.6	41.5	-2.21	0.0275
BBTN	Constant	2576.9	21	122.79	0
	COVID-19	-1121.1	34.3	-32.64	0
BMRI	Constant	7351.2	28.9	253.98	0
	COVID-19	-1542.8	47.4	-32.57	0

According to Table 2, the p-values of all variables are significant at a 5% significance

level. It means that there is a significant difference between the prices before and after the pandemic. On average, the price of the JKSE index is IDR 723.8 less than that before the COVID-19 pandemic infects Indonesians. The most affected stock is the BNI stock price, with an average of IDR 3,020 less than the period before the pandemic came to Indonesia, followed by Mandiri Bank and BTN (IDR 1,542.8 and IDR 1,121.1, respectively). BRI became the least affected stock price with a difference of IDR 91.6 less than the period before the pandemic started in Indonesia. Considering the pattern in Figure 1, the time partition will be included as the independent variable to see the behavior of the index and stock prices in more detail. The same multivariate regression model is built with T_1, T_2, and T_3 dummy variables as predictors. The results are provided in Table 3.

Table 3 Regression Results of Index and Stock Prices on T_1, T_2, T_3 Dummy Variable

Variable		Estimate	s.d.	t-ratio	p-value
JKSE	β_0	6181.1	11.3	546.97	0
	T_1	-1259.7	23.4	-53.79	0
	T_2	-253	32	-7.9	8.6E-15
	T_3	-85.7	31.3	-2.74	0.00633
BBNI	β_0	8236.3	32.7	251.51	0
	T_1	-3688.9	67.9	-54.36	0
	T_2	-2290	92.8	-24.68	0
	T_3	-2358.2	90.7	-26	0
BBRI	β_0	3800	19.6	193.43	0
	T_1	-680.1	40.7	-16.71	0
	T_2	431.9	55.7	7.76	2.5E-14
	T_3	603.1	54.4	11.08	0
BBTN	β_0	2576.9	19.7	130.96	0
	T_1	-1391	40.8	-34.12	0
	T_2	-876.3	55.7	-15.72	0
	T_3	-807	54.5	-14.81	0
BMRI	β_0	7351.2	24.5	300.26	0
	T_1	-2108	50.7	-41.55	0
	T_2	-844.5	69.4	-12.18	0
	T_3	-1061	67.8	-15.65	0

Overall, on average, the price of the JKSE index and some bank stocks are falling in T_1 (the period when COVID-19 started infecting Indonesians, and the new confirmed case was increasing). This fall is the largest compared to T_2 and T_3. BBRI has a different pattern from others. Its price in the second and third phases of COVID-19 (T_2 and T_3) is IDR 431 and IDR 603, greater than that before the pandemic, while the average prices of others (JKSE, BBNI, BBTN, BMRI) are less than those before the pandemic.

BBRI's share price shows a similar pattern but has a higher amplitude than that of other state-owned banks. In comparison to other banks, the share price of BBRI started to increase significantly during T_2. There was a consistent trend for BBRI's share price to go back to its initial stock price prior to the pandemic during the T_2 period. The following are the possible reasons for that. The Micro Small Medium Enterprise (MSME) and small trader groups utilize BBRI more frequently because of market confidence. From 2014 to 2022, BBRI became the largest distributing bank for "Kredit Usaha Rakyat" (People's Business Credit), with a contract value of IDR 899.07 trillion (Putri, 2022). On the other hand, MSMEs are directly impacted by government incentives, resulting in a proportionate decline in the non-performing loans of BBRI. In the T_3 phase, economic activity is continuing to increase, and the stock price is relatively stable because of the decreasing trend of new confirmed COVID-19 cases, and during this period, the vaccine has already achieved the final stage of development.

3.3. Forecasting The Index and Stock Prices of Banking Industry with The Effect of COVID-19 Pandemic

In this section, we conducted a multivariate regression with time series errors. We

used the regression model from the previous subsection, in which the predictors were the T_1, T_2, and T_3 period partitions. The regression results presented in Table 3 were utilized, and the residuals of the model were modeled using multivariate time series modeling. The residuals are modeled with vector autoregressive (VAR). Lag order 1 is selected based on the minimum value of some Information Criterions (AIC, BIC, HQ). The optimal order for VAR(p) based on AIC is 2, while BIC and HQ are 1. Therefore, the possible models for the regression model residuals are VAR(1) and VAR(2). After modeling, the model that has the minimum AIC and BIC values and satisfies the residual assumption is VAR(1). In the modeling process, All the insignificant estimates are removed from the model with a 5% level of significance. Therefore, there are 28 significant parameters in predicting the price of the index and stocks. Mathematically, the final model with the significant parameter estimates can be written in a matrix form as follows.

$$\begin{pmatrix} JKSE_t \\ BBNI_t \\ BBRI_t \\ BBTN_t \\ BMRI_t \end{pmatrix} = \begin{pmatrix} 6155.762 \\ 8241.130 \\ 3793.737 \\ 2562.428 \\ 7364.351 \end{pmatrix} + \begin{pmatrix} -1044.152 \\ -3620.080 \\ -695.144 \\ -1362.151 \\ -2111.501 \end{pmatrix} T_1 + \begin{pmatrix} -153.417 \\ -2303.213 \\ -421.670 \\ -859.783 \\ -822.509 \end{pmatrix} T_2 + \begin{pmatrix} 0 \\ -2335.330 \\ 584.568 \\ -832.591 \\ -1033.064 \end{pmatrix} T_3 +$$
$$\begin{pmatrix} 0.964 & 0.008 & 0 & 0 & -0.019 \\ 0 & 0.968 & 0 & 0 & 0 \\ 0 & 0 & 0.976 & -0.019 & 0 \\ 0 & 0 & 0 & 0.984 & 0 \\ 0 & 0 & 0.032 & 0 & 0.937 \end{pmatrix} \begin{pmatrix} JKSE_{t-1} \\ BBNI_{t-1} \\ BBRI_{t-1} \\ BBTN_{t-1} \\ BMRI_{t-1} \end{pmatrix} + \begin{pmatrix} a_{1,t} \\ a_{2,t} \\ a_{3,t} \\ a_{4,t} \\ a_{5,t} \end{pmatrix}. \quad (2)$$

Equation 2 is the final model in which all non-zero coefficients are significant. In general, the dummy variables from the 3 phases of COVID-19 significantly affect stock prices, both the Jakarta Composite Index and shares of state-owned banks. The interpretation of the model of each stock is as follows. Today's JCI is dependent on the first and second phases of COVID-19, JCI one day earlier, and the share price of BNI and BRI on the previous day. Then, today's share of BNI is dependent on all three phases of COVID-19 and the stock price of BNI one day earlier. Moreover, today's share of BRI is dependent on all three phases of COVID-19. It also depends on its share price and BTN's share price on the previous day. For BTN today's share of BTN is dependent on all three phases of COVID-19. It also depends on its share price on the previous day. Furthermore, today's share of Mandiri Bank is dependent on all three phases of COVID-19. It also depends on its share price and BRI share price on the previous day.

After having the final model, the next step is to forecast and calculate the accuracy of the forecast results against the testing data using the Mean Absolute Percentage Error (MAPE) which is defined as the average of $|(Forecast\text{-}Actual)/Actual| \; x \; 100\%$. The results of the MAPE calculation for the next 7 days (testing data) for JKSE, BBNI, BBRI, BBTN, and BMRI are 1.3%, 7.9%, 3.2%, 7.1%. 5.9%, respectively. These MAPE values are quite small, which means that the forecasting results have high accuracy. Then, the 30-day step-ahead forecasts are obtained using the model in Equation 2 by assuming the second phase of COVID-19 (i.e., T_2 is equal to 1). The forecasts show that all share prices of the state-owned Bank will have a slightly increasing trend.

4. Conclusions

The COVID-19 pandemic has had a significant influence on the movement of the JCI and stock prices in the Indonesian banking industry. BBRI has a different trend among others, where it has good performance in the second and third phases of COVID-19. The prediction results show that the JCI value will tend to decrease slightly, while the stock

price of the Indonesian banking industry has an increasing trend with the assumption that there will still be an increase in the number of positive cases of COVID-19 in Indonesia. The recommendations for the governments are (1) to take more serious action in dealing with COVID-19 cases as it affects JCI and the stock prices, (2) to encourage people to invest, and (3) to minimize the gap between the local interest rate and the Federal Reserve fund rate. The limitation of the study is that the data for the analysis is limited to the range specified in Section 2. More updated data may have different results. Therefore, the future study can consider more updated data to be carried out using another time series or machine learning approach to improve the accuracy of the forecasts.

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