Short Term Forecasting Method: Covid 19 and Capital Market in Indonesia

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Abstract

This study aimed to predict the short-term confirmed Covid 19 and Jakarta Composite Index (JCI) cases in Indonesia. The prediction uses ARIMA and SutteARIMA methods, and the data processed with R software. Researcher using time series data from April 2nd, 2020 (the date of covid 19 detected in Indonesia) to September 30th, 2020. We are fitted the data with the data from October 1st to October 10th, 2020. Based on the fitted data, we could forecast the cases from October 11th to October 31st, 2020. We applied the Mean Absolute Percentage Error (MAPE) to predict accuracy measures to evaluate forecasting methods. Based on forecasting with ARIMA and SutteARIMA methods, the SutteARIMA method is more suitable than ARIMA to calculate the daily forecasts of negative Covid 19 in Indonesia with MAPE value of 0.156 (smaller than 0.21 compared to MAPE value of ARIMA). At the same time, the ARIMA method is more suitable than SutteARIMA to calculate the daily forecasts of positive Covid 19 and JCI in Indonesia. The MAPE value of 0.06 (smaller than 0.104 compared to MAPE value of SutteARIMA for positive Covid 19) and MAPE value of 0.012 (smaller than 0.021 compared to MAPE value of SutteARIMA for JCI Indonesia).

Abstrak

Penelitian ini bertujuan untuk memprediksi jangka pendek dari kasus terkonfirmasi Covid 19 dan IHSG Indonesia. Prediksi dilakukan dengan menggunakan metode ARIMA dan SutteARIMA dan diolah dengan software R. Peneliti menggunakan data time series dari 2 Maret 2020 (tanggal terdeteksi covid 19 di Indonesia) sampai 30 September 2020. Data tersebut di fitting dengan data dari 1 October 2020 sampai 10 October 2020. Berdasarkan fitting data, kami dapat melakukan forecasting untuk tanggal 11 October 2020 sampai 31 October 2020. Untuk evaluasi metode forecasing, kami menggunakan pengukuran akurasi prediksi Mean Absolute Persentage Error (MAPE). Berdasarkan prediksi ARIMA dan SutteARIMA, Metode SutteARIMA lebih cocok dibandingkan ARIMA untuk memprediksi kasus negatif Covid 19 harian di Indonesia dengan nilai MAPE sebesar 0.06 (lebih kecil dari 0.21 nilai MAPE ARIMA). Sedangkan metode ARIMA lebih cocok dibandingkan SutteARIMA untuk memprediksi kasus positif Covid 19 dan IHSG harian di Indonesia. Nilai MAPE 0.06 (lebih kecil dari 0.104 nilai MAPE SutteARIMA untuk kasus positif Covid 19 dan nilai MAPE 0.012 (lebih kecil dari 0.021 nilai MAPE SutteARIMA untuk IHSG Indonesia).

Keywords: Covid 19, JCI, ARIMA, SutteARIMA

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Pendahuluan

In Indonesia, Covid 19 cases were detected from March 2nd to September 30th, 2020. The number of confirmed positive cases was 287,008, with 10,740 deaths and 214,947 recoveries (who. int, 2020). Until now, the number of confirmed positive covid 19 continues to increase in Indonesia. Many analysts predicted that the economy would be under heavy pressure, even a global recession. According to Goodell (2020), Covid 19 causes a bad global economy in every region of the world. Many countries must face the impact of Covid 19, such as the impact of capital cost, government role in protecting the financial system, and political stability in society. Covid 19 has the most significant impact on the financial and investment business sector in Indonesia for example Composite Stock Price Index or JCI (Rakhmawati et al., 2019). According to Anggraeni (2020), on March 3rd, 2020, the JCI is predicted to continue its 8-day weakening streak. This is because JCI failed to rebound, after the announcement of the first case of Covid 19 in Indonesia. Home index collapsed 91.46 points or 1.68% to 5,361.25. In the other side, the government decided to relax fiscal policy by widening budget deficit to around 2.5% of GDP from planned initially at 1.76% of GDP in 2020 (Djalante et al., 2020). During 2020, there has been a significant net foreign capital outflow, reached for Rp115.1 trillion in portfolio instruments in Indonesia. On March 23rd, 2020, JCI had touched a level below 4,000 or the lowest since 2012. This sharp decline was partly due to the sell-off or massive selling on the stock market. These financial market conditions occurred due to investor's concerns about the impact of Covid 19 so that investor's capital moved to safe-haven assets. The sell-off happened after Indonesia reported its first case due to Covid 19 on March 2nd, 2020. From mid-February to March 20th, 2020, only five times foreign investors recorded a daily net buy (Potensi & Ekonomi, 2020), and until September 30th, 2020, JCI touched 4,870 (ojk.go.id).

Al-awadhi, et al (2020) find that daily growth in the total of confirmed cases and total death caused by Covid 19 has significant negative effects on stock returns of 1579 stocks of companies from January 10th to March 16th, 2020. Ali, et al (2020) show that stock market volatility increased significantly from the epidemic in US, UK, Germany, and South Korea (December 2019 to March 10th, 2020) to the pandemic period (post-March 10th, 2020). Wang & Wang (2020) examine the market efficiency of the S&P 500 Index, gold, Bitcoin, and US Dollar Index decreases sharply and persistently during February-March 2020. Adekoya & Resources (2020) researched covid 19 and 30 world stock market, economic loss due to Covid 19 on stock prices movements shows that the cost can higher severely and quickly into global economic stress so controlled outbreak of the Covid 19 can significantly influence the world's economy in the short-term and long-term.

To see the impact of Covid 19, many researchers are forecasting data because time series data can change from time to time, so this estimate needs to be made. Several studies use mathematical models to predict this epidemic. For example according to Benvenuto, et al (2020), they used the daily

prevalence data of Covid 19 from January 20th to February 10th, 2020 and applied ARIMA model. The result shows increasing trend reaching epidemic level. Duan & Zhang (2020) tried to forecasting data from January 20th to April 26th,2020 in Japan and South Korea and the result shows that ARIMA Model is better to predict Covid 19 cases with a confidence level of 95%. Ilie (2020), used the daily prevalence data of Covid 19 from March 10th to July 10th, 2020 and find ARIMA model is suitable for making predictions during the current crisis. There is an urgent need to monitor, predict, and restrict Covid 19 with using ARIMA model to predict the epidemiological trend of Covid 19 in Ukraine, Romania, the Republic of Moldova, Serbia, Bulgaria, Hungary, USA, Brazil, and India. ARIMA and SARIMA are used to forecast the Covid 19, and trends for confirmed and recovered cases showed an exponential rise for top-16 countries (Arunkumar, et al., 2021). SARIMA developed to predict not only the movement of stocks, but also can forecast data on financial, insurance and time series data (Ali et al., 2020). The impact of the Covid 19 process in the stock market is full of uncertainty, so stock price forecasting is essential in finance and business. For example, for stockbrokers, understanding trends and support by prediction is very important for decision making. It is also supported by (Adekoya & Resources, 2020), the evolution of Covid 19 makes difficult for legislators to formulate a suitable macroeconomic strategy response. Time series data changes from time to time and sometimes changes suddenly. Forecasting is needed to see this change so that the problem formulation of this research is to predict the short term of Covid 19 and JCI in Indonesia.

The researchers tries to adopt the model used by Saleh & Boj (2020). They uses SutteARIMA method for forecasting the IBEX and negative Covid 19 in a period of 3 days in Spain. The results obtained from the researchers became the research gap from this study with Saleh & Boj (2020), namely 1) Researchers used a longer period of time which was 1 month. 2) Researchers tries to compare the forecasting model between ARIMA and SARIMA for positive and negative cases of covid and the JCI in Indonesia. 3) The results obtained are also different, the best method for forecasting JCI and Covid in Indonesia is ARIMA, while in Saleh & Boj (2020), the best model for forecasting is SutteARIMA.

Literature Review

1. Autoregressive Integrate Moving Average (ARIMA)

ARIMA is often used in research to predict future data based on the behavior of past data. The model of ARIMA (p, d, q) is a combination of p represents the autoregressive (AR) process, d for the differencing process, and q represents the moving average (MA) process (Ekananda, 2013).

1.1 White Noise Process

In time-series data {Zt, t ϵ $\mathbb{Z}$}, the first test performed is that the data must be stationary. There are two data stationarity behaviors :

(1) Mean stationarity means that the expected value of the time series does not depend on time, ϵ (Zt) does not depend on t, where t = time. Data is stationary on the order of 0 (zero) or at the "level" level. If it is not stationer at the level, first differencing and second differencing will be carried out to see to what extent the data is stationer.

(2) The autocovariance function is defined as Cov (Yt, Yt + k) for each lag k is only a function k and not time; that is, γ (Yt, Yt + k), or γ (Yt, Yt + k) independent of t for every k or is called variance stationarity σ^2. If the variant is not stationary, the data will be transformed.

1.2 Autoregresive Model (AR)

AR is a process where we assume the variable has a relationship with the previous variable. In general, the previous data can distributed (distributed lag) and (non-distributed lag). The form of the AR process (p) according to Wei (1994):

$$Z_t = \phi_1 Z_{t-1} + \phi_2 Z_{t-2} + ... + \phi_p Z_{t-p} + \alpha_t, \alpha_t \sim WN(0,\sigma^2), \phi_i \in R, t \in Z$$
$$Z_t = \phi_1 B Z_t + \phi_2 B^2 Z_t + ... + \phi_P B^P Z_t + \alpha_t, \alpha_t \sim WN(0,\sigma^2), \phi_i \in R, t \in Z$$
$$(1 - \phi_1 B - \phi_2 B^2 - ... - \phi_P B^P) Z_t = \alpha_t, \alpha_t \sim WN(0,\sigma^2), \phi_i \in R, t \in Z$$

equation (1)

Equation 1 can be simplified to $\varphi_p(B)Z_t = a_t$

1.3 Moving Average (MA)

MA is a process where γt is generated from the forecast error of the previous period. The form of MA (q) according to Wei (1994) :

$$Z_t = \alpha_t - \theta_1 \theta_{t-1} - \theta_2 \theta_{t-2} - ... \theta_q \theta_{t-q}, \alpha_t \sim WN(0,\sigma^2), \phi_i \in R, t \in Z$$
$$Z_t = \sum_{i=0}^{q} \phi_i \theta_{t-i}, \theta_0 = 1, \alpha_t \sim WN(0,\sigma^2), \phi_i \in R, t \in Z$$

equation (2)

Equation 2 can be simplified into :

$$Z_t = \theta_q(B)\alpha_t, \alpha_t \sim WN(0,\sigma^2), \theta_q \in R, t \in Z$$
$$\theta_q(B) = (1 - \theta_1 B - \theta_2 B^2 - ... - \theta_q B^q)$$

1.4 Autoregressive integrated moving average ARIMA (p,d,q)

Zt process in the autoregressive-moving average or ARMA (p,q) is according to Wei (1994) :

$$\phi_p(B)Z_t = \theta_q(B)\alpha_t, \alpha_t \sim WN(0,\sigma^2), \phi_p, \theta_q \in R, t \in Z \qquad \text{equation (3)}$$

Where: $\varphi_p(B) = (1-\varphi_1 B-\varphi_2 B^2 -...-\varphi_p B^P)$ for AR(p)

$\theta_q(B) = (1-\theta_1 B-\theta_2 B^2 -...-\theta_q B^q)$ for MA(q)

If there is a difference, the Autoregressive integrated moving average or ARIMA model becomes :

$$\varphi_p(B)(1-B)^d Z_t = \theta_q(B)\alpha_t, \alpha_t \sim WN(0,\sigma^2), \varphi_p, \theta_q \in R, t \in Z$$

$\varphi_p(B) = (1-\varphi_1 B-\varphi_2 B^2 -...-\varphi_p B^P)$ for AR(p)

$(1-B)^d$ for differencing

$\theta_q(B) = (1-\theta_1 B-\theta_2 B^2 -...-\theta_q B^q)$ for MA(q)

2 α -Sutte Indicator

The α-Sutte indicator uses the principle of forecast the previous data. The Sutte indicator uses four previous data (Zt − 1, Zt − 2, Zt − 3, and Zt − 4) as supporting data for forecasting and making the decision (Ahmar et al., 2018).

$$Z_t = \frac{\gamma\left(\frac{\Delta x}{\frac{\gamma+\delta}{2}}\right)+\beta\left(\frac{\Delta y}{\frac{\beta+\gamma}{2}}\right)+\alpha\left(\frac{\Delta z}{\frac{\alpha+\beta}{2}}\right)}{3} \qquad \text{equation (4)}$$

Where :

$\delta = Z_{t-4}$

$\gamma = Z_{t-3}$

$\beta = Z_{t-2}$

$\alpha = Z_{t-1}$

$\Delta x = \gamma - \delta = Z_{t-3} - Z_{t-4}$

$\Delta y = \beta - \gamma = Z_{t-2} - Z_{t-3}$

$\Delta z = \alpha - \beta = Z_{t-1} - Z_{t-2}$

Zt = data at t time

Zt-k = data at (t - k) time

3 SutteARIMA

SutteARIMA is a combination of α -Sutte Indicator with ARIMA. The result of sutte ARIMA is the average forecast of α -Sutte Indicator with ARIMA.

Equation 2.3 can translated into :

$$(1-\phi_1 B-\phi_2 B^2-...-\phi_p B^p)Z_t=(1-\theta_1 B-\theta_2 B^2-\theta_q B^q)\alpha_t$$

$$Z_t-\phi_1 BZ_t-\phi_2 B^2 Z_t-...-\phi_p B^p Z_t=\alpha_t-\theta_1 B\alpha_t-\theta_2 B^2\alpha_t-...-\theta_q B^q\alpha_t \quad \text{equation (5)}$$

While equation (5) can be reduced by using a backward shift operator so that :

$$Z_t-\phi_1 Z_{t-1}-\phi_2 Z_{t-2}-...-\phi_p Z_{t-p}$$
$$=\alpha_t-\theta_1\alpha_{t-1}-\theta_2\alpha_{t-2}-...-\theta_q\alpha_{t-q}Z_t$$
$$=\phi_1 Z_{t-1}+\phi_2 Z_{t-2}+...+\phi_p Z_{t-p}+\alpha_t-\theta_1\alpha_{t-1}-\theta_2\alpha_{t-2}-...-\theta_q\alpha_{t-q} \quad \text{equation (6)}$$

if :

$$\delta=Z_{t-4}$$
$$\gamma=Z_{t-3}$$
$$\beta=Z_{t-2}$$
$$\alpha=Z_{t-1}$$

Then equation (2.6) becomes :

$$Z_t=\phi_1\alpha+\phi_2\beta+\phi_3\gamma+\phi_4\delta+...+\phi_p Z_{t-p}+\alpha_t-\theta_1\alpha_{t-1}-\theta_2\alpha_{t-2}-...-\theta_q\alpha_{t-q} \quad \text{equation (7)}$$

And equation (4) can be simplified into :

$$Z_t=\frac{\gamma\left(\frac{\Delta x}{\gamma+\delta}\right)+\beta\left(\frac{\Delta y}{\beta+\gamma}\right)+\alpha\left(\frac{\Delta z}{\alpha+\beta}\right)}{3}$$

$$Z_t=\frac{\frac{\gamma\Delta x}{\gamma+\delta}+\frac{\beta\Delta y}{\beta+\gamma}+\frac{\alpha\Delta z}{\alpha+\beta}}{3}$$

$$Z_t=\frac{\frac{\gamma\Delta x}{3\gamma+3\delta}+\frac{\beta\Delta y}{3\beta+3\gamma}+\frac{\alpha\Delta z}{3\alpha+3\beta}}{2}$$

$$Z_t=\frac{2\gamma\Delta x}{3\gamma+3\delta}+\frac{2\beta\Delta y}{3\beta+3\gamma}+\frac{2\alpha\Delta z}{3\alpha+3\beta}$$

$$Z_t=\gamma\frac{2\Delta x}{3\gamma+3\delta}+\beta\frac{2\Delta y}{3\beta+3\gamma}+\alpha\frac{2\Delta z}{3\alpha+3\beta}$$

Equation (4) above is added to equation (7) so that it becomes :

$2Z_t =$

$$\phi_1\alpha + \phi_2\beta + \phi_3\gamma + \phi_4\delta + \ldots + \phi_p Z_{t-p} + \alpha_t - \theta_1\alpha_{t-1} - \theta_2\alpha_{t-2} - \ldots - \theta_q\alpha_{t-q}$$

$$+ \gamma\frac{2\Delta x}{3\gamma + 3\delta} + \beta\frac{2\Delta y}{3\beta + 3\gamma} + \alpha\frac{2\Delta z}{3\alpha + 3\beta}$$

$$Z_t = \alpha\left(\frac{\phi_1}{2} + \frac{\Delta z}{3\alpha + 3\beta}\right) + \beta\left(\frac{\phi_2}{2} + \frac{2\Delta y}{3\beta + 3\gamma}\right) + \gamma\left(\frac{\phi_3}{2} + \frac{2\Delta x}{3\gamma + 3\delta}\right) + \frac{\phi_4\delta}{2} + \ldots + \frac{\phi_p Z_{t-p}}{2} + \frac{\alpha_t}{2} - \frac{\theta_1\alpha_{t-1}}{2} - \frac{\theta_2\alpha_{t-2}}{2} - \ldots - \frac{\theta_q\alpha_{t-q}}{2}$$

equation (8). This equation is the formula of sutteARIMA.

To evaluate the forecasting method, we applied two measures of forecasting accuracy, namely Mean Absolute Percentage Error (MAPE) and Average Percentage Error (APE).

$$MAPE = \frac{1}{N}\sum_{t=1}\left|\frac{A_t - F_t}{A_t}\right|$$

equation (9)

Where :

At = Actual value at t time.

Ft = estimated value at t time.

The empirical reviews in this researches are mostly related to Covid 19. Jamir & Imtinungsang (2020) used a forecast model with the Box-Jenkins method on India's GDP growth rate from Q2 of 2020 to Q4 of 2022. The result indicates that India will continue to decrease GDP growth till the Q4 of 2022. Mubarok & Fadhli (2020) used monthly data from 1996 to 2020 with ARIMA and ARCH. The results showed that the industrial sector on the Indonesia Stock Exchange was inefficient. Researchers focus on Saleh & Boj (2020) show that forecasting in Spain, the SutteARIMA model is the most suitable compared to ARIMA to predict Covid 19 and the stock market for the next three days.

Furthermore, Science, et al (2020) studied the forecast of the spread of Covid 19 in China, Italy, and France using the SIRD model. Roosa, et al (2020) studied the forecast of Covid 19 with a logistic growth model (LGM) in China. Benvenuto et al (2020) researched the forecast for Covid 19 using ARIMA. Kufel (2020) used the ARIMA model for predicting the dynamics of Covid-19 incidence at different stages of the epidemic. Koczkodaj, et al (2020) predicted 1,000,000 Covid 19 cases outside of China by by March 31st, 2020 based on a simple heuristic (exponential curve) and WHO situation reports. In Indonesia, there are several studies that discuss forecasting on the capital market using ARIMA but not many have used SutteARIMA. Rakhmawati, et al (2019) see the movement of the JCI, due to the Covid

19 outbreak used Non-Seasonal ARIMA model and find that ARIMA is the best model for JCI data when the Covid 19 pandemic until the new normal.

Method

Data

This research focused on the short-term forecasting of Covid 19 and JCI in Indonesia. We are used secondary data in time series from March 2nd, 2020 (the date of detection of Covid 19 in Indonesia) to September 30th, 2020. Data is obtained from covid19.go.id and ojk.go.id. That data was fitted with the data from October 1st to October 10th, 2020. Based on the fitted data, we can conduct short term forecast for the one-month future period. To facilitate data processing, we are used R Software with tseries, forecast, and SutteForecastR packages.

Statistical Analysis

Several types of methods in forecasting such as ARIMA, Holt-Winters, Double Exponential Smoothing, α-Sutte, SutteARIMA, and others (Hanck, et al., (2020) and (Heiss, 2016). Researchers have used ARIMA and SutteARIMA methods. Based on a preliminary study of Saleh & Boj (2020), the SutteARIMA can predict data trends.

Model

The general form of the ARIMA model can be expressed in the following equation :

$$\emptyset_p(B)\nabla^d Z_t = \xi + \theta_q(B)\varepsilon_t \dots\dots\dots\dots (10)$$

Dimana :

ϕ_p : Parameter *Autoregressive*

B : Operator geser mundur

d : Parameter *Differencing*

Z_t : Nilai pengamatan saat t

ξ : Parameter konstan

θ_q : Parameter *Moving Avarage*

ε_t : Nilai error

Results and Analysis

Short-term daily estimates are important for making strategic decisions for the future. Daily forecasting can provide information to decision-makers to find a way to prevent the spread of Covid 19. Positive and cumulative Covid 19 daily data in Indonesia shows an increasing trend despite implementing social distancing (PSBB), Work From Home (WFH), School From Home (SFH), the obligation to wear masks, and others (covid19.go.id). In forecasting, previous data experiences are use as prediction data that will be used as research data, short-term forecasting that is in line with the Covid 19 case is for October 11th to 31st, 2020. Based on this description, the fitting and forecasting result process can be seen as follows:

Table 1

Fitting dan Forecasting Result for Daily Negative Covid 19, Daily Positive Covid 19 and JCI

Variable	**Negative Covid 19**					**Positive Covid 19**					**JCI**				
Date	**Actual**	**ARIMA**	**APE**	**Sutte-ARIMA**	**APE**	**Actual**	**ARIMA**	**APE**	**Sutte-ARIMA**	**APE**	**Actual**	**ARIMA**	**APE**	**Sutte-ARIMA**	**APE**
1/10/20	22657	23873	0.05	29163	0.29	4174	4456	0.07	4544	0.09	4870	4898	0.01	4905	0.01
2/10/20	19805	23988	0.21	22626	0.14	4317	4430	0.03	4612	0.07	4970	4916	0.01	4893	0.02
3/10/20	17598	24103	0.37	22862	0.30	4007	4306	0.07	4694	0.17	5070	4932	0.03	4861	0.04
4/10/20	18815	24218	0.29	18255	0.03	3992	4192	0.05	4351	0.09	5170	4946	0.04	4829	0.07
5/10/20	22531	24333	0.08	24705	0.10	3622	4147	0.15	3894	0.08	4926	4960	0.01	4788	0.03
6/10/20	28111	24448	0.13	25331	0.10	4056	4174	0.03	3635	0.10	4958	4972	0.00	4977	0.00
7/10/20	28363	24563	0.13	27776	0.02	4538	4240	0.07	4055	0.11	4999	4983	0.00	4969	0.01
8/10/20	34268	24678	0.28	25745	0.25	4850	4308	0.11	4374	0.10	5004	4993	0.00	4968	0.01
9/10/20	29581	24793	0.16	31523	0.07	4094	4354	0.06	4689	0.15	5039	5002	0.01	4952	0.02
10/10/20	17869	24909	0.39	22861	0.28	4294	4375	0.02	4721	0.10	5073	5011	0.01	4935	0.03
		MAPE	**0.21**	**MAPE**	**0.16**		**MAPE**	**0.07**	**MAPE**	**0.10**		**MAPE**	**0.01**	**MAPE**	**0.02**

Source: Processed data, 2020

Table 1 shows that for Negative Covid 19, the MAPE value of SutteARIMA is about 0.16, smaller than 0.21 compared to the MAPE value of ARIMA (0,1,1). It means that the SutteARIMA method is also the most appropriate method for time series than the ARIMA method. And for Positive Covid 19, the MAPE value of ARIMA (2,1,2) is about 0.07, smaller than 0.10 compared to the MAPE value of SutteARIMA. It means that the ARIMA method is the most appropriate method for time series than the SutteARIMA method. For JCI Indonesia, the MAPE value of ARIMA (0,1,1) is about 0.01, smaller than 0.02 compared to the MAPE value of SutteARIMA. It means that the ARIMA method is the most appropriate method for time series than the SutteARIMA method.

Table 2

The result of Forecasting of Daily Negative Covid 19, Positive Covid 19, and IHSG with ARIMA and SutteARIMA

Variable	Negative Covid 19		Positive Covid 19		JCI	
Date	ARIMA	SutteARIMA	ARIMA	SutteARIMA	ARIMA	SutteARIMA
11/10/2020	25024	23307	4380	4868	5019	4891
12/10/2020	25139	15970	4382	4433	5026	4836
13/10/2020	25254	26957	4391	3846	5033	4784
14/10/2020	25369	27718	4409	3450	5039	5046
15/10/2020	25484	32153	4433	4082	5045	5043
16/10/2020	25599	26616	4459	4611	5050	5054
17/10/2020	25714	34441	4483	5102	5055	4965
18/10/2020	25829	22869	4504	4997	5060	4944
19/10/2020	25944	24093	4522	5099	5064	4888
20/10/2020	26060	13333	4539	4436	5068	4815
21/10/2020	26175	32258	4557	3680	5071	4749
22/10/2020	26290	33126	4577	3118	5075	5117
23/10/2020	26405	40387	4597	4128	5078	5131
24/10/2020	26520	27410	4617	5015	5081	5161
25/10/2020	26635	38153	4637	5794	5084	4951
26/10/2020	26750	22489	4657	5404	5087	4922
27/10/2020	26865	25675	4677	5344	5090	4837
28/10/2020	26980	15415	4696	4314	5092	4775
29/10/2020	27095	45319	4715	3396	5095	4695
30/10/2020	27211	46053	4735	2661	5097	5214
31/10/2020	27326	56273	4755	4324	5099	5254

Source: Processed data, 2020

Table 2 shows that the result of forecasting of Daily Negative Covid 19 used ARIMA from October 11th to 31st, 2020 tends to be in interval value 25024-27326 cases per day. Meanwhile, SutteARIMA tends to fluctuate. And the result of forecasting daily positive Covid 19 used ARIMA from October 11th to 31st, 2020 tends to be in interval value 4380 - 4755 cases per day. The forecast of JCI Indonesia used ARIMA from October 11th to 31st, 2020 tends to be in interval value 5019 - 5099 per day. Meanwhile, SutteARIMA tends to fluctuate.

Since Covid 19 was declared a pandemic by WHO, lockdown or social distancing decisions taken by the government will impact to economic development. One of them is the stock market because investors are starting to panic about buying stock, so selling stock impacts the decline in stock prices. Based on WHO Data on September 30th, 2020, Indonesia is in the top 10 with the highest Covid 19 cases in Asia and is among the top 25 globally (www.worldometers.info). The closing price of the JCI stock market has decreased from the beginning of Covid 19 in Indonesia (March 2nd, 2020) and began to stabile on July 1st, 2020, at around 5,000 per share (ojk.go.id)

Conclusion

Based on the results of the Short Term Forecasting Method for October 11th to 31st, 2020 in the Covid 19 and JCI cases in Indonesia, it can be concluded that:

1) Negative Covid 19

SutteARIMA method is most appropriate for estimate Negative Covid 19 with MAPE value of Sutte ARIMA, which is about 0.16, smaller than 0.21 compared to the MAPE value of ARIMA (0,1,1). The result of forecasting negative Covid 19 with the ARIMA method tends to be in interval value 25024-27326 cases per day. Meanwhile, SutteARIMA tends to fluctuate. This may be because the number of individuals who comply with government regulations regarding health protocols has not been identified (Mandatory Social Distancing, Work and School From Home, wear masks, etc.)

2) Positive Covid 19

ARIMA method is most appropriate for estimate Positive Covid 19 with MAPE value of ARIMA(2,1,2), which is about 0.07, smaller than 0.10 compared to the MAPE value of SutteARIMA. The result of forecasting positive Covid 19 with the ARIMA method tends to be in interval value 4380 - 4755 cases per day. This may be because since many individuals have not consistently implemented health protocols. So Daily Positive Covid 19 of Indonesia still increase.

3) JCI

ARIMA method is most appropriate for estimating JCI Indonesia with the MAPE value of ARIMA (0,1,10), which is about 0.01, smaller than 0.02 compared to the MAPE value SutteARIMA. The result of forecasting of JCI Indonesia with the ARIMA method tends to be in interval value 5019 - 5099 per day. JCI Indonesia has strengthened due to good news regarding the success of the corona vaccine clinical trial. So the estimation that the domestic financial market will strengthen again because market players have responded positively to the good news. It is considering that Indonesia has a big population and a large target market for the corona vaccine.

Stock market has helped drive economic growth in Indonesia. However, the high level of volatility coupled with economic uncertainty makes investors need to implement strategies in investing in the capital market. The evolution of Covid 19 and its economic impact on regional financial markets is highly uncertain, which makes it difficult for legislators to formulate appropriate macroeconomic strategic responses. Based on forecasting results, the movement of JCI in Indonesia fluctuated daily at the beginning of the forecasting period. Stakeholders are expected to be more active in the market by buying and selling, especially the contraction of shares. It is hoped that the controlled Covid 19 outbreak can significantly affect the world economy both in the short and long term.

From the results of the study, it can be concluded that the best method used in predicting negative and positive cases of Covid 19 and JCI in Indonesia is ARIMA compared to SutteARIMA. According to Makridakis et al., (1999), ARIMA is a very good model in short-term forecasting compared to long-term, and this is in accordance with the research objectives).

Utilization of forecasting Covid 19 JCI in Indonesia can contribute to policymakers making decisions and further studies in the future. For further exploration, this method can be compared with other methods, for example, with the Neural Network or other forecasting methods, and see the impact of Covid 19 Indonesia's short and long-term economy.

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