FORECASTING OF INDONESIA'S GROSS DOMESTIC PRODUCT AMID COVID-19 PANDEMIC

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Abstract: The Indonesian economy since the first quarter of 2020 has declined. The Covid-19 pandemic has suppressed Indonesia's economic growth. The Ministry of Finance stated that the Indonesian economy in 2020 is estimated to reach minus 1.7 percent to 0.6 percent. The purpose of this study is to determine the prediction of Indonesia's GDP amid Covid-19 pandemic. This type of research is a quantitative study using secondary data with a sample size of 22 samples. The data analysis technique used is the ARIMA method. The results showed stationary data at the second level. Identification of the Bob-Jenkins model selected the ARIMA model (4,2,1). The forecast results show that Indonesia's GDP in the second quarter of 2020 until the second quarter of 2023 will continue to decline. Therefore, policies to promote economic recovery are required. This policy must support the improvement of the health system to reduce the impact of the Covid-19 pandemic on activities and community works. Long-term impacts can be maintained by improving administration, facilitating a more investor-friendly business environment, and increasing budgets to improve education and health facilities.

Keywords: ARIMA, Covid-19, Forecasting, Gross Domestic Product.

Abstrak: Perekonomian Indonesia sejak triwulan IV-2020 telah mengalami penurunan. Pandemi Covid-19 telah menekan

pertumbuhan ekonomi Indonesia. Kementerian Keuangan menyatakan, perekonomian Indonesia pada 2020 diperkirakan mencapai minus 1,7 persen hingga 0,6 persen. Tujuan penelitian ini adalah untuk mengetahui prediksi Produk Domestik Bruto (PDB) Indonesia. Jenis penelitian ini adalah kuantitatif dengan menggunakan data sekunder dengan jumlah sampel sebanyak 22 sampel. Teknik analisis data yang digunakan adalah metode ARIMA. Hasil penelitian menunjukkan bahwa data stasioner pada tingkat kedua. Identifikasi model Bob-Jenkins terpilih model ARIMA (4,2,1). Hasil peramalan menunjukkan bahwa PDB Indonesia triwulan II-2020 smpai dengan triwulan II-2023 terus mengalami penurunan. Oleh karena itu, diperlukan kebijakan yang mendorong pemulihan ekonomi. Kebijakan tersebut harus mendukung peningkatan sistem kesehatan untuk mengurangi dampak pandemi Covid-19 pada aktivitas dan pekerjaan masyarakat. Dampak jangka panjang dapat dikurangi dengan perbaikan tata kelola, lingkungan bisnis yang lebih ramah kepada investor dan meningkatkan anggaran untuk memperbaiki fasilitas pendidikan dan kesehatan.

Kata Kunci: ARIMA, Covid-19, Forecasting, Produk Domestik Bruto.

INTRODUCTION

Every nation has a goal to improve the welfare of its people. The state's welfare strives for is reflected in various activities carried out through the development process to achieve economic growth. Economic growth is an effort to increase economic activities within a country (Bappenas, 2008). The financial condition of a country is measured by looking at the Gross Domestic Product (GDP) that has achieved both constant price and current price GDP. GDP is the total value of goods and services that the state can produce in one year. Constant price GDP shows the actual condition of a country's economy (Syahputra et al., 2017).

The 2019 Corona Virus Disease (Covid-19) pandemic has affected various sides of human life, including social, economic, etc. Covid-19, which is spreading rapidly, has propelled the government to adopt a policy of limiting access in and out of various areas. Covid-19 has hampered multiple community activities and made it difficult for them to make ends meet (Nadhira Salsabila, 2020). The government's policy to limit community activities due to the Covid-19 pandemic has reduced national economic performance. The impact is not only felt by a small business owner but also by large-scale businesses (Hadiwardoyo, 2020).

The Covid-19 pandemic has spread rapidly and infected millions of people, and resulted in economic loss, which is the biggest economic shock that the world has experienced in decades. According to the World Bank, the global economic prospects will suffer damage both in the short and long term due to the Covid-19 pandemic. Global GDP is estimated to experience a contraction of 5.2 percent in 2020 (Worldbank, 2020a). Indonesia's GDP in the fourth quarter of 2019 decreased by 1.7 percent from the previous quarter. Indonesia's GDP continues to decline until the second quarter of 2020. In the second quarter of 2020, Indonesia's GDP has reached IDR 2,589,647.3 billion (BI, 2020). The development of Indonesia's GDP can be seen as follows.

Figure 1. Indonesian GDP 1ˢᵗ Quarter 2015 –2ⁿᵈ Quarter 2020
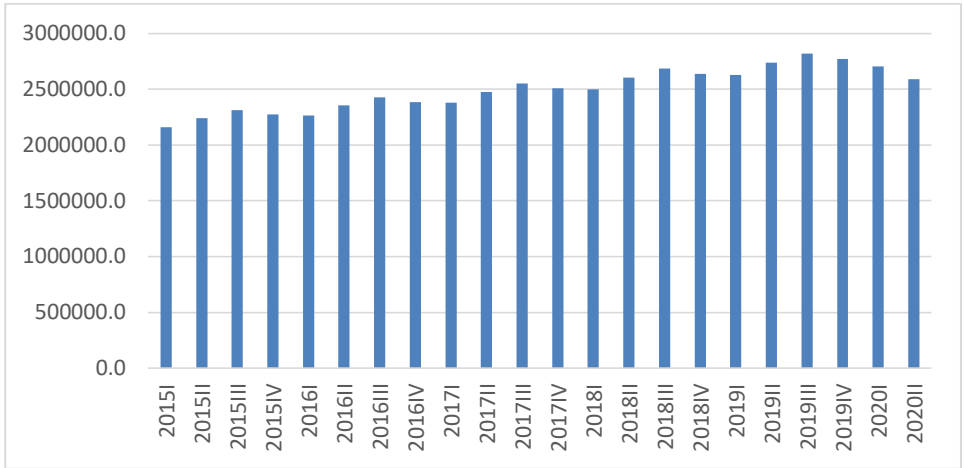
Sources: www.bi.go.id, 2020.

Figure 1. above shows that Indonesia's GDP for three quarters has decreased. The Indonesian economy in the second quarter of 2020 against the previous quarter experienced a growth contraction of 4.19 percent (BPS, 2020). This circumstance is undoubtedly not hoped to be extended. Indonesia's economic losses also impact the financial sector, such as the Jakarta Composite Index (IHSG), which continues to weaken and followed by a weakening rupiah value that will take a long time to recover (Pitaloka et al., 2020). GDP is the most important macroeconomic indicator for determining economic conditions and the level of prosperity of the people in a country (Desy Yuliana Dalimunthe, 2017).

Forecasting Indonesia's GDP using ARIMA is expected to provide an overview of Indonesia's economic growth and performance. Forecasting Indonesia's GDP is essential as a basis/reference for policy-makers in planning long-term development programs. Also, forecasting Indonesia's GDP is essential to calculate

the budget. For the benefits obtained from forecasting Indonesia's GDP, it is felt that it is crucial to research in the hope that the government as the policy-maker can do things that are preventive in realizing a better economy.

LITERATURE REVIEW

National income has a significant role in the economy of a country. Assessing the efficiency of the resources used in the economy and producing goods/services are known by looking at national income. According to Sadono Sukirno, national income is the amount of income obtained by production factors applied to produce goods and services in one year (Sukirno, 2010). GDP is the total value of all goods and services that a country can produce in one period (Luthfiana & Nasrudin, 2018). The government, economic actors, and other parties need data on GDP development every year. GDP as a barometer of the country's economy is essential to anticipate future policies (Sutomo, 2016). Procedures in the economic, monetary, and banking sectors depend on developing a country's economic growth. Therefore, GDP is considered the best measure that describes a country's financial performance (Mankiw, 2011). The conventional economic approach states that GDP can be used as a measure of a country's welfare. If GDP increases, people's welfare will increase, and vice versa. Many economic figures criticize this criticism of GNP as a measure of interest that GDP is not a perfect measure of welfare which is explained by the concept of MEW (Measure of Economic Welfare).

MEW: *C –public expenditures –durable goods consumption –loss of welfare due to pollution, urbanization, and congestion + value of durable consumed during the year + value of non-market service + value of leisure* (Nurul Huda et al., 2018).

The MEW concept began to appear in 1972 but did not develop and still tends to use real GDP to measure welfare. Some of the criticisms of Islamic economic figures for this measure of interest are:

1. Products that enter the market are calculated in GNP, while products produced and consumed by themselves are not included in the calculation of GDP.

2. GNP does not include leisure time, even though leisure time has a significant effect on the level of welfare.

3. Bad events are also not included in the GNP, affecting welfare, such as natural disasters.

4. Pollution problems are also often not included in the GNP calculation. Many companies in their production activities generate negative externalities that are detrimental to society and can reduce the level of community welfare (Nurul Huda et al., 2018)

Time series uses a relationship pattern between the variables to be estimated and the time variable. Time series data or time series is a set of data observation sequences in time. Time series data has four kinds of patterns: horizontal, trend, seasonal, and cyclical (Hanke J. E & Wichers DW, 2005). Modeling using time series data must meet the

data stationery requirements. The stationarity of time series data is very important. Stationarity means that there is no growth or decline in data. In other words, the information stated to be stationary if the data fluctuates around a constant mean value, independent of time, and the variance of these fluctuations remains consistent over time (Makridakis et al., 1999).

METHODS

This research is conducted in Indonesia and is limited to forecasting Indonesia's GDP, which is one measure of Indonesia's economic performance. This research uses quantitative research methods. The data used in this study are time-series data from the first quarter of 2015 to the second quarter of 2020 with 22 samples. Data were taken from Bank Indonesia publications. The forecasting method used in this study is the Autoregressive Integrated Moving Average (ARIMA) model. The ARIMA method is a method that consists of two combined methods, namely AR (Autoregressive) and MA (Moving Average) (Premraj, 2019). The ARIMA method is one of the methods of forecasting data with excellent accuracy in the short term that does not form a structural model in a single or simultaneous equation based on economic theory or logic. Model-identification in the ARIMA method uses an iterative approach. The most suitable models are characterized by data that are randomly distributed or independent of one another. The general non-seasonal notation ARIMA (p, d, q) means that p is part of AR, degree d means the first difference, and q is part of MA. the complete model can be written as:

$$Y_t = c + \phi Y_{t-1} + \ldots + \phi Y_{t-p} + \phi \epsilon_{t-1} + \phi \epsilon_{t-p} + \epsilon_t, \epsilon \sim N(0, \sigma^2)$$

Where Yt is the differenced series, ϕ and € indicates the lagged value and errors. Selecting appropriate values for the parameters means that the model used is AR models and MA models (Hilde & Thorsrud, 2014). The steps in implementing the ARIMA method consist of 5, namely (Hartati, 2017).

1. Model Identification

   The first step that must be done is to test whether the time-series data to be used is stationary or not. If the data is fixed, it can be tested in the ARIMA model. Data that is not stationary is followed by differentiating or differencing.

2. ACF and PACF identification

   The second step is to determine the value of d and how many residual lag values (q) and dependent lag values (p) will be used in the model. These values can be identified by ACF and PACF and a correlogram that plots the ACF and PACF values against the lag.

3. Selection of the Best ARIMA Model

   After the first and second steps are carried out, several alternative options for the ARIMA model can be used. The next step is to estimate the autoregressive parameters and moving average in the model.

4. Diagnostic Checking

   The fourth step is carried out to test the feasibility of the selected model. Feasibility tests on the model need to be done to ensure whether the model specifications are correct or not.

5. Forecasting
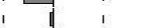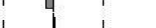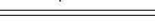
After the best model is obtained, the final step can be done, namely forecasting.

RESULT AND DISCUSSION

Before performing the analysis, it must be ensured that the time series data used are stationary. The data stationarity test can be done by looking at the AC plot, PAC, and unit root. The output of the correlogram and stationarity test is as follows.

Figure 2. The output of Correlogram and Stationary Test

Date: 10/20/20   Time: 09:09
Sample: 2015Q1 2020Q2
Included observations: 22

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.845	0.845	17.966	0.000
		2	0.675	-0.138	29.996	0.000
		3	0.591	0.209	39.709	0.000
		4	0.485	-0.180	46.620	0.000
		5	0.307	-0.251	49.547	0.000
		6	0.158	-0.028	50.372	0.000
		7	0.088	0.068	50.648	0.000
		8	-0.000	-0.119	50.648	0.000
		9	-0.138	-0.154	51.422	0.000
		10	-0.239	-0.061	53.929	0.000
		11	-0.271	0.014	57.456	0.000
		12	-0.319	-0.085	62.819	0.000

Sources: Results Data, 2020.

Figure 2 shows the first lag autocorrelation line on the AC 1,2,3,4 chart, and PAC 1 is outside the Bartlett line and decreases exponentially or slowly. The result shows that Indonesia's GDP is not stationary. To solve the problem of data instability, a differentiating process is carried out. Differencing is calculating the change or difference in the observed value. The data obtained with the first level of differencing are then plotted and tested again to see if it is

stationary. The results of the second level of differencing using the line portrayed as follows.

Figure 3. Second Level Stationary Test
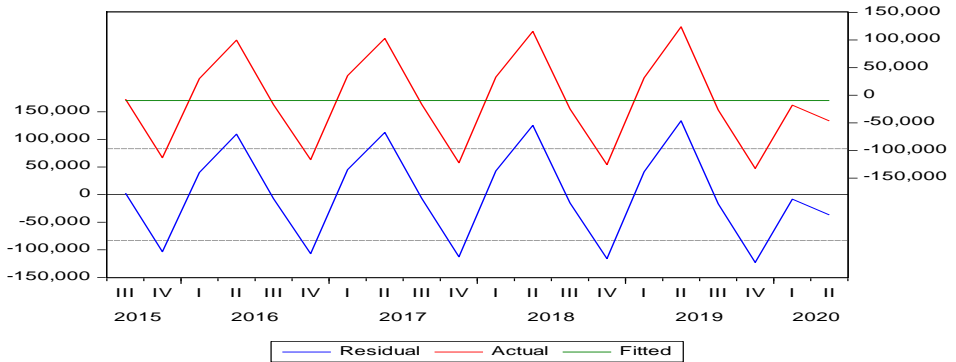
Sources: Results Data, 2020.

Figure 3 above shows a constant residual line. This means that Indonesia's GDP data at differencing at the second level is static. The next step that will be taken is the identification of the model using the Box-Jenkins method. The Box-Jenkins method is also known as the ARIMA (Autoregressive Integrated Moving Average) model. This method bases analysis of past data and does not show other variables, so it is also called the authorize method or a method that is not based on theory (Wing Wahyu Winarno, 2009). Some of the models that will be used are the ARIMA 101, 104, 401, 402, 220, 420, 620, 820, 221, 222, 223, 224, 421, 422, 423, 424, 821, 822, 823, 824 forms. Model verification by comparing the results of various previously analyzed models. The table of model verification results is as follows.

Table 1. Model Verification of ARIMA

No	ARIMA	AIC	SC
1	1.0.1	25.12649	25.32486
2	1.0.4	25.26494	25.46331
3	4.0.1	25.66486	25.86323
4	4.0.2	26.12777	26.32614
5	4.0.3	26.11660	26.31498
6	2.2.0	24.52530	24.67466
7	4.2.0	24.68086	24.83022
8	6.2.0	24.91464	25.06400
9	8.2.0	25.08956	25.23892
10	2.2.1	24.59600	24.79515
11	2.2.2	24.61066	24.80981
12	2.2.3	24.60477	24.80392
13	2.2.4	24.60277	24.80191
14	4.2.1	24.42184	24.62098
15	4.2.2	24.60127	24.80041
16	4.2.3	24.78011	24.97926
17	4.2.4	24.84779	25.04694
18	8.2.1	25.07981	24.91954
19	8.2.2	24.89142	25.09057
20	8.2.3	25.18603	25.38518
21	8.2.4	24.77666	24.97581

Source: Results Data, 2020.

Model verification is done by comparing the Akaike Info Criterion (AIC) values and Schwarz Criterion (SC). Models with small AIC and SC values are of better quality, and it is these models should be applied for further analysis. Table 1 shows the values of Akaike Info Criterion (AIC) and Schwarz Criterion (SC.) ARIMA models to be identified. Based on the AIC and SC values of the ARIMA models, it is found that the ARIMA (4.2.1) form model has the lowest value. Thus, the best model chosen for further analysis is

the ARIMA model (4.2.1). The estimation results of the ARIMA model (4.2.1) are as follows.

Table 2. Model Estimation of ARIMA (4.2.1)

Dependent Variable: D(D(PDB_HARGA_KONSTAN))
Method: ARMA Maximum Likelihood (OPG - BHHH)
Date: 10/20/20   Time: 10:22
Sample: 2015Q3 2020Q2
Included observations: 20
Convergence achieved after 39 iterations
Coefficient covariance computed using the outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-31617.34	74779.19	-0.422809	0.6781
AR(4)	0.888257	0.124728	7.121555	0.0000
MA(1)	0.835929	0.344328	2.427710	0.0274
SIGMASQ	1.16E+09	3.67E+08	3.153265	0.0062

R-squared	0.823048	Mean dependent var	-9714.235
Adjusted R-squared	0.789870	S.D. dependent var	82987.03
SE of regression	38041.21	Akaike info criterion	24.42184
Sum squared resid	2.32E+10	Schwarz criterion	24.62098
Log likelihood	-240.2184	Hannan-Quinn criter.	24.46071
F-statistic	24.80673	Durbin-Watson stat	1.336521
Prob(F-statistic)	0.000003		

Inverted AR Roots	.97	.00+.97i	-.00-.97i	-.97
Inverted MA Roots	-.84			

Source: Results Data, 2020.

The following step is carried out after the best model is selected, in other words, Diagnostic Checking. The test performed was the ARCH-LM (Lagrange Multiplier) test, Robert Engle popularized this test. The ARCH-LM test aims to test the homogeneity of the residual variance on the data. The concept of this test is that the residual variance is not entirely a function of the independent variable

but also depends on the residual squared in the previous period. The ARCH-LM test is helpful in detecting the effect of ARCH in estimating the Bob-Jenkins test (Desvina & Rahmah, 2017). The terms of the ARCH-LM test are as follows (Syarif, 2014).

1. If the probability value of the F-statistic and Chi-Square is smaller than the value of α = 5 percent, then the null hypothesis is rejected.

2. If the probability value of the F-statistic and Chi-Square is greater than the value of α = 5 percent, then the null hypothesis is accepted.

Table 3. Output ARCH-LM

Heteroskedasticity Test: ARCH

F-statistic	3.693650	Prob. F(1,17)	0.0715
Obs*R-squared	3.391347	Prob. Chi-Square(1)	0.0655

Source: Result Data, 2020

Based on table 3 above, it can be determined that the probability value of 0.0655 is smaller than the value of α = 5 percent, so it can be concluded that Indonesia's GDP data does not contain heteroscedasticity. After the Diagnostic Checking is carried out, the last step is forecasting using the ARIMA (4.2.1) selected model. Forecasting is carried away to determine Indonesia's GDP for the next 12 quarters. Forecasting results are as follows.

Table 4. Result of Forecasting Indonesian GDP (Billion Rupiah)

Quarter	Forecast	Quarter	Forecast
III-2020	2.545.847,27	I-2022	1.656.256,37
IV-2020	2.384.115,88	II-2022	1.447.077,41
I-2021	2.283.696,31	III-2022	1.209.840,06
II-2021	2.155.666,06	IV-2022	870.230,81
III-2021	2.086.056,80	I-2023	508.609,63
IV-2021	1.916.363,00	II-2023	188.692,32

Source: Results Data, 2020.

Table 4 above shows the results of forecasting Indonesia's GDP for the next 12 quarters, starting from quarter III-2020 to quarter II-2023. In the first quarter of 2021, Indonesia's GDP is predicted to be valued at IDR 2,283,696.31 billion in the fourth quarter of 2022, it will continually decline to IDR 870,230.81 billion. The results of forecasting Indonesia's GDP for the next 12 quarters show that Indonesia's GDP is experiencing a slow decline.

GDP occupies an essential position in macroeconomics. The positive growth of GDP can be utilized to illustrate that economic activity is also experiencing positive growth. The Covid-19 pandemic has made the world economic climate have the potential to move towards negative growth. The Covid-19 pandemic has hit the global economy with restrictions on public access, resulting in reduced economic activity, which is a combination of profound economic shocks experienced by many countries. Since the fourth quarter of 2019, Indonesia has begun to experience an economic decline.

Countries with inadequate health systems and substantial degrees of dependence on global trade, tourism, and commodity exports will be severely hit. In the short term, the impact that will be felt includes lower investment, increased unemployment, and decreased global trade activity. In the long term, this impact will have the potential to reduce economic growth and labor productivity (Worldbank, 2020b). Massive preventive actions taken by various countries to reduce the spread of Covid-19 had a significant impact on numerous sectors of the economy. One of them is the development of the world of tourism in many countries. The World Tourism Organization UN, WTO (UNWT) stated that the Covid-19 pandemic had caused a decrease in foreign tourist arrivals by 60 percent to 80 percent throughout 2020 (Haryanto, 2020).

The steps that must be taken to recover the economic damage suffered must meet various aspects. Policy in the economy is not enough. The procedures taken must support the improvement of the health system to reduce the impact of the Covid-19 pandemic on community activities and jobs. Long-term adverse effects can be mitigated by comprehensive reforms in governance and a friendlier business environment to investors and the public. Investments in education and health also need to be made by increasing the budget, developing and improving education and health facilities. Fiscal policy through government spending can increase the demand side of the economy, which impacts increasing output seen in the achievement of GDP (Terminanto & Rama, 2017).

The declining economic activity in Indonesia has caused the level of people's income to decline and has the potential to reduce the level of social welfare. Islamic fiscal policy that should be implemented to overcome this condition is through the use of funds derived from zakat, waqf, infaq, and alms. These funds can be used by distributing direct cash assistance. In addition, it can also be done by strengthening cash waqf, productive waqf, and other types of waqf (Iskandar et al., 2020). Zakat as worship that is vertical and horizontal is a potential and source of the economy of Islamic society, which has a vital role in realizing the welfare of society (Afrina, 2020) (Bastomi, 2018). The potential for Indonesian zakat receipts is enormous, in 2011, it had reached IDR 217 trillion a year (Triantini, 2015). This potential can be maximized with optimal zakat management for the welfare of the community. Zakat collected at zakat collection institutions can be distributed in the form of assistance and venture capital to help people get out of economic downturns (Amalia & Mahalli, 2012).

CONCLUSION

The results showed that Indonesia's GDP data does not contain heteroscedasticity, so that the ARIMA model analysis can be applied. Indonesia's GDP forecasting results show that Indonesia's GDP will be decreased slowly over the next 12 quarters, starting from quarter III-2020 to quarter II-2023. Policies encouraging economic improvement due to the Covid-19 pandemic must overcome the short-term impacts and anticipate more severe damage in the long term.

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