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Forecasting The Open Unemployment Rate in Central Sulawesi Province Using The Autoregressive Integrated Moving Average (ARIMA) Method

Rifdah Apriliani [1], Zhafirah Tri Nursagita [2], Uswatun Hasanah [3], Moh. Iqra Taulama[4], and Mohammad Fajri[5]
[1,2,3,4,5] Tadulako University, Indonesia
rifdah.aprilianii@gmail.com, zgitha3@gmail.com, atunhasanah07@gmail.com, mohiqrataulama@gmail.com, m.fajri@untad.ac.id

Abstract—The Open Unemployment Rate is one of the problems in Central Sulawesi Province. The higher the level of open unemployment, the more impact it will have on the economy and social welfare. The Open Unemployment Rate in Central Sulawesi Province according to BPS data for 2022, is 3,00%. Efforts are needed to overcome the increasing percentage of unemployment rates, namely by forecasting the Open Unemployment Rate in Central Sulawesi Province in the next few periods using time series forecasting analysis with the Autoregressive Integrated Moving Average (ARIMA) method. From the results of the forecasting analysis for the next 5 years from 2023-2028, the MAPE value was obtained at 11,82307%, which is in the range of 10%-20%, which means that the ability of the forecasting model for the open unemployment rate in Central Sulawesi Province in the next 5 years is good. The graph that is formed shows that the forecast percentage is increasing so that the growth of the workforce is not balanced with job opportunities and the limited job opportunities are influenced by economic growth. It is hoped that the results of this research can be used as a policy consideration and reference tool so that it can overcome the percentage of Open Unemployment Rate in Central Sulawesi Province.

Keywords : Central Sulawesi Province, Open Unemployment Rate, Autoregressive Integrated Moving Average (ARIMA)

I. INTRODUCTION

Unemployment is one of the second biggest problems in Indonesian. The unemployment rate must be addressed immediately because it can lead to an increase in poverty in Indonesian. Unemployment is a very complex problem because it affects and is influenced by several factors that interact with each other following patterns that are not always easy to understand and to date have not been able to be overcome by the national government or regional governments. A high level of unemployment has an impact or influence on the economic situation, such as a decrease in people's purchasing power because people do not have income so they cannot carry out economic activities, which causes a decrease in demand for goods and services. Economically, unemployment is a waste of labor resources that cannot be utilized to move the wheels of the national economy [1].

According to BAPPENAS data for August 2022–February 2023, it shows that the open unemployment rate in Central Sulawesi Province has increased from 3,00 to 3,49 and this figure is still far from the RKP target. According to data from the Badan Pusat Statistik (BPS) in Central Sulawesi Province from 2008–2022, the open unemployment rate has fluctuated and was at its highest in 2008. The unemployment rate also increased in 2020 by 0,66% from 2019 due to COVID-19 which causing an increase in the level of open unemployment. From these data, it is necessary to forecast the number of open unemployment rates in the future with the aim of reducing the open unemployment rate so that it can reduce the number of unemployed. From the predicted or

forecasting values, it can then be used to consider developing strategies and policies to overcome the level of open unemployment which is still one of the problems in Indonesian.

In this research, forecasting of the open unemployment rate will be carried out in Central Sulawesi Province using the Autoregressive Integrated Moving Average (ARIMA) method to find out the results of accurately forecasting the unemployment rate in 2023-2028. It is hoped that the results of the research carried out can be used as reference material in overcoming the problem of unemployment in Central Sulawesi Province.

II. MATERIALS

A. Open Unemployment Rate

Unemployment is a macroeconomic problem that directly affects human life. According to [2] the unemployment rate is one of the indicators used to measure the progress of a region, meaning that a higher unemployment rate indicates a worse economic condition. The high rate of open unemployment in Indonesia is due to the large number of companies or job opportunities that are not suitable for those seeking workers, many companies are looking for diploma or bachelor graduates [3]. When the problem of unemployment continues to be ignored and increases every year, it will have a negative impact on a region or country, examples of several cases caused by unemployment are crime and poverty [4]. If the unemployment problem continues, it will affect economic growth because the increase in the unemployment rate causes economic growth to decrease, meaning that no output is produced [5].

As the years go by, the problem of unemployment becomes increasingly crucial because in economic development the creation of job opportunities cannot be faster than the increase in population [6]. To reduce labor problems, the government needs to increase economic growth, which is one of the development goals. Economic development is an effort to improve people's standard of living, expand the workforce and direct income distribution as measured by the level of real per capita income.

B. Autoregressive Integrated Moving Average (ARIMA)

Autoregressive Integrated Moving Average *(*ARIMA*)* is a time series model that is used to predict a problem. The ARIMA method is a statistic that is suitable for forecasting quickly, flexibly with an effective level of accuracy so it is very appropriate to use in short-term forecasting and only requires historical data in forecasting. ARIMA is a univariate model which is a combination of the Autogressive Moving Average (ARIMA) model [7]. The ARIMA model assumes that a time series can be described as follows:

$$Z_t = \emptyset_0 + (1 + \emptyset_1)z_{t-1} + (\emptyset_2 - \emptyset_1)z_{t-2} + \cdots + (\emptyset_p - \emptyset_{p-1})z_{t-p} - \emptyset_p z_{t-p-1} + a_t - \theta_1 a_{t-1} - \cdots - \theta_q a_{t-q} \quad (1)$$

Where each component of the equation above consists of:

Z_t : Data ontime t, t = 1, 2, 3, …, n
B : Backshift operator
$(1-B)^d Z_t$: Time series stationary at the second differentiation
a_t : Error in period t,t = 1, 2, 3, …, n
p : Orders (AR)
d : Order differentiation
q : Orders (MA)

III. METHODS

The research method used in this research is quantitative, with the type of data in the form of time series data. Time series data is used to see the effect of changes within a certain time period. The model used by researchers to analyze the Open Unemployment Rate dataset from 2008 to 2022 uses Autoregressive Integrated Moving Average (ARIMA) to measure the performance of the analysis process used to predict. Forecasting is an estimate of future demand based on several predictor variables. To measure the level of accuracy of forecasting results, you can use the Mean Absolute Percentage Error (MAPE). This is because the MAPE value is easier to

interpret compared to other measuring instruments. MAPE interpretation can be seen from the intervals in table 1.

Table 1. Interpretation Of MAPE Values

MAPE Value	Interpretation
≤ 10	The forecasting results are very accurate
10 – 20	Accurate forecasting results
20 - 50	Decent forecasting results (fairly good)
> 50	Innacurate forecasting results

The MAPE evaluation calculation formula is described as follows:

$$\text{MAPE} = \frac{1}{n}\sum_{i=1}^{n}\left|\frac{A_i - F_i}{A_i}\right| \times 100\% \qquad (2)$$

Where,
n : sample size
Ai : actual data value
Fi : forecasting data value
Based on this formula, the difference between the actual data and the forecast is divided by the actual data, then the value is absolute, so MAPE will always be positive.

IV. RESULT AND FINDINGS

A. Forecasting Result

Forecasting is an estimated process of the amount or amount of something in the future based on data in the past that is analyzed scientifically, especially using the statistical method. Forecasting is a form of effort to see something in the future and past, but this cannot be sure to occur or not.

Table *2.* Forecasting Result

Year	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**
Forecasting Result	3,40	3,48	3,55	3,61	3,66	3,71	3,74

Based on the forecasting results, the Open Unemployment Rate in Indonesia continues to increase every year, until 2028 it is predicted that the open unemployment rate will increase by 3,74% in Central Sulawesi Province.

B. Forecasting Accuracy

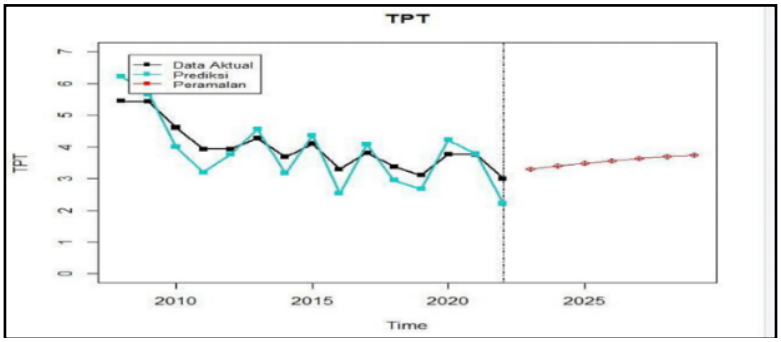
Table 3. MAPE Accuracy Value

MAPE Value
11,82%

Based on the results of forecasting accuracy, a MAPE value of 11,82% is obtained. It can be concluded that this time series data has good forecasting model capabilities because the MAPE value is in the range of 10%-20%. Where the smaller the MAPE value, the more accurate and better the forecast. This data has a small MAPE percentage value so it is good for use in the ARIMA method in predicting data for the future period.

C. Actual Data Plot, Prediction, and Forecasting

The form of plot visualization of actual data, predictions and forecasting of the Open Unemployment Rate in Indonesia from 2022-2028 is as follows:



Graph 1. Visualization Of Actual Data and Forecasting Result

Visually it can be seen between predictive data almost stuck or has a data plot that is almost the same as actual data. So, it must have a low accuracy value (MAPE) and the forecasting results obtained are quite good. Where, the smaller the value of the MAPE, the more accurate and the better a forecasting model.

V. CONCLUSIONS

Based on the results of the forecasting analysis, it can be concluded that the time series analysis process using ARIMA provides good trend results because the actual data values and forecasting results are almost the same. The prediction results regarding the Open Unemployment Rate for the next 5 years, starting from 2023 to 2028 show an upward trend which indicates that the Open Unemployment Rate has experienced a significant increase with a forecast accuracy level of 11,82%. Therefore, this model is accurate, so it can predict the Open Unemployment Rate in Central Sulawesi Province. For further research, it is recommended to use monthly datasets to produce a better level of forecasting and have relatively smaller error values.

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Universiti Teknologi MARA Cawangan Melaka
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