Forecasting the Consumer Confidence Index for Economic Conditions Prediction in Ambon, Indonesia

Albertus Eka Putra Haryanto[1*], Destri Susilaningrum[1], Indra Nur Fauzi[2]

***Abstract*— The economic development in the Maluku Province indicates a generally positive growth. However, it is not accompanied by an increase in consumer confidence index. From July to September 2022, the Consumer Confidence Index recorded a decrease of approximately 7.6% to 8.2%. The value of the Consumer Confidence Index can be forecasted using time series analysis. Time series analysis is a method of analyzing data aimed at estimating or forecasting future periods. Several methods that can be used for forecasting in this study include naive, moving average, single exponential smoothing, double exponential smoothing, and time series regression. These methods can be used to forecast the value of the Consumer Confidence Index in Ambon City after the COVID-19 pandemic. After conducting the analysis, it was found that the best model for forecasting the consumer confidence index is the Double Exponential Smoothing method with a combination of α=0.4 and β=0.5. The forecasted results indicate a decrease in the consumer confidence index value, although the index still shows a relatively optimistic value.**

***Keywords*—Consumer confidence index, Double exponential smoothing, Forecasting, Time series regression**

I. INTRODUCTION[1]

The development of the global economy after the Covid-19 pandemic showed a positive trend in the third quarter of 2022. This is indicated by economic growth that reached 5.44% (yoy) in the Second Quarter of 2022 while recording economic growth above 5% for three quarters in 2022. The economy in Indonesia can continue to grow impressively and reliably [1]. This condition is also experienced by several provinces, one of which is Maluku Province. According to the results released by Bank Indonesia, in the Third Quarter of 2022, the economic growth of Maluku Province grew by 6.01 percent in the Third Quarter of 2022, when compared to last year, and grew by 4.84 percent when compared to the Second Quarter of 2022 [2]. The improvement in the economic condition after the Covid-19 pandemic has made people more enthusiastic about carrying out several economic track activities, such as household consumption levels and other needs. A belief in an economic condition in society can be measured using the Consumer Confidence Index (CCI). A study about the link between economic growth and consumer confidence showed that consumer confidence, stock exchange, and industrial production have a long-run association in emerging economies [3]. Consumer expenditures depend on the power to purchase and also willingness to purchase [4]. Objective factors determining the ability to buy are financial assets, access to credit, and willingness to purchase. Meanwhile, the subjective factors depend mainly on behavior and hopes about personal finances and the economy. So, positive changes in consumer confidence enhance the economic growth of the country [5]. CCI is an important indicator for economists and policymakers to understand the state of the economy, the direction it is heading, and to predict consumer spending habits. High consumer confidence is generally associated with higher levels of spending and investment, which can stimulate economic growth. Conversely, low consumer confidence can lead to lower levels of spending and investment, which can hinder economic growth. The Consumer Confidence Index (CCI) can be obtained from the results of the Consumer Survey conducted by Bank Indonesia. Bank Indonesia as a monetary bank in Indonesia requires a consumer survey with the basic objective of determining the development of consumer confidence levels and the condition of consumer financial stability. The consumer survey was conducted in 18 cities, one of which was in Ambon City which is the capital of Maluku Province [6]. Although there is an increase in economic growth in Ambon City, it is often not accompanied by a confidence index from consumers as economic actors. Recorded in July 2022 and September 2022, there was a decline in the Consumer Confidence Index of around 7.6% to 8.2% [2].

The value of the Consumer Confidence Index can be forecasted using time series analysis. Time series analysis is a data analysis method aimed at making estimates and forecasts in the future. In the time series analysis, it will be known that the process of an estimate and forecasting results can be obtained properly and efficiently [7]. The classic methods used in this study are naive, moving average, single exponential smoothing, double exponential smoothing, and time series regression. Previous research related to research methods has been carried out and has resulted in the double exponential smoothing method tending to be better at forecasting the Consumer Price Index in Indonesia in 2015 – 2018 when compared to the Moving Average [8]. The use of this method is also based on the data used, namely CCI data after the Covid-19 pandemic in 2020, starting from April 2020. From the method used, one of the best forecasting models will be selected using the RMSE and MAPE value criteria in the out-sample data used as predictions of economic conditions, especially in Ambon City in the future. Forecasting the CCI helps to predict future spending patterns and can inform economic policy decisions, such as interest rates, taxes, and government spending. Thus, the government can implement or formulate policies to

[1]Department of Business Statistics, Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia. E-mail: albertputr4@gmail.com
[2] Regional Economic Development Institute.

improve the consumer confidence index whether the economic growth in Ambon City is slowing down or strengthening.

A. Time Series Analysis

Time series analysis is a series of observations of a variable that is taken over time and recorded sequentially according to the time sequence of events with a fixed time interval. This analysis is also applied to forecast the probabilistic structure of circumstances that occur in the future in order to make decisions for particular planning [7].

1. Naive Method

Naive method is a simple method, the calculation of this method uses past data to forecast the future. The naïve method considers that a system tends to maintain momentum on past data in the future [4].The mathematical equation for obtaining the forecasting value in the later period using the naïve method is shown in equation (1).

and $$\hat{Y}_{t+1} = Y_t \quad (1)$$

$\hat{Y}_{t+1}$: Forecasting value for the time period t+1

Y_t : Actual value of time period t

Y_{t-1} : Actual value of time period t-1

2. Moving Average

The Moving Average method is a method of forecasting future observations by calculating the average number of observations determined from the beginning of the number of periods to be used. The working principle of this method is to discard the oldest observations and enter the latest observation values so that forecasting values for the future are obtained [7]. The mathematical model for obtaining forecasting values by using moving averages is shown in equation (2).

$$M_t = Y_{t+1} = \frac{(Y_t + Y_{t-1} + \ldots + Y_{t-n+1})}{n} \quad (2)$$

3. Single Exponential Smoothing

Single Exponential Smoothing is a method that works by correcting errors that occur in previous data using α parameters. The α value closer to 1 will be more adjustable than the previous error, conversely, if the α value is closer to 0, it can include smaller error adjustments [7]. The mathematical model for obtaining forecasting values in later periods using single exponential smoothing is shown in equation (3).

$$Y_{t+1} = \alpha Y_t + (1-\alpha) Y_{t-1} \quad (3)$$

4. Double Exponential Smoothing (Holt)

The double exponential smoothing (Holt) method has the same main idea as Brown, which is to overcome the lagging of the forecast with actual data when there is an element of trend. The difference between these two methods is that Holt does not use direct smoothing like Brown, but instead will use different parameters from the original to smooth out the trend pattern [7]. The mathematical model for obtaining forecasting values in later periods using double exponential smoothing (holt) is shown in equation (4).

$$\hat{Y}_{t+p} = A_t + T_t p \quad (4)$$

Where

$$A_t = \alpha Y_t + (1-\alpha)(A_{t-1} + T_{t-1}) \quad (5)$$

$$T_t = \gamma (A_t - A_{t-1}) + (1-\gamma) T_{t-1} \quad (6)$$

5. Time Series Regression

The basic idea of time series regression is to use data on predictor (quantitative) variables to forecast or explain the diversity of response variables (quantitative). The shape of the regression model in the context of a time series is the same as that of a typical linear regression [7]. The general form of linear trend time series regression involving t (time period) as a predictor can be written with equation (7).

$$Y_t = \alpha + bt + e_t \quad (7)$$

The basic assumptions of time series regression are similar to the basic assumptions of linear regression, where the residuals of the model must meet the Identical, Independent, and Normal Distributed residual assumptions.

1) Identical Residual Testing

The Glejser test is used for identical residual testing. The first stage of residual testing is identical i.e. regressing Y against X and obtaining the residual value of e. Furthermore, the second stage is to reconstruct the value of $|\text{it}|$ to X. Hypothesis of the Glejser test is as follows [9].

H_0: Identical Residuals

H_1: Non-Identical Residuals

Significance level : α

H_0 will be rejected if $F > F_{(\alpha,\ dbr,\ dbg)}$, where *dbr* is the degree of freedom of the regression between $|e_t|$ and X. While, *dbg* is the degree of freedom of the residuals obtained from the regression between $|e_t|$ and X.

2) Independent Residual Testing

Independent residual testing can use the Durbin-Watson test with the following hypothesis [10].

I. First Hypothesis

H_0: There is no positive correlation between each residual

H_1: There is a positive correlation between each residual

Rejection Area:

$d < d_L$: Reject H_0

$d > d_u$: Do not reject H_0

$d_L \leq d \leq d_u$: Inconclusive

II. Second Hypothesis

H_0: There is no negative correlation between each residual

H_1: There is a negative correlation between each residual

Rejection Area :

$d > 4\text{-}d_L$: Reject H_0

$d < 4\text{-}d_u$: Do not reject H_0

$4\text{-}d_u \leq d \leq 4\text{-}d_L$: Inconclusive

III. Third Hypothesis

H_0: There is neither a positive nor negative correlation between each residual

H_1: There is either a positive or negative correlation between each residual

Rejection Area:

$d < d_L$: Reject H_0

$d > 4\text{-}d_L$: Reject H_0

$d_u < d < 4\text{-}d_u$: Do not reject H_0

$d_L \leq d \leq d_u$ atau 4-du ≤ d ≤ 4-d_L : Inconclusive

Statistics test:

$$d = \frac{\sum_{t=1}^{T}(e_t - e_{t-1})^2}{\sum_{t=1}^{T} {e_t}^2} \quad (8)$$

Notes that:

d = Durbin Watson value

d_L = lower limit

d_U = upper limit

6. Time Series Regression

3) Normally Distributed Residual Testing

The Kolmogorov-Smirnov test can be used to test whether the residuals are normally distributed with the following hypothesis [11].

H_0: F_n (X) = F_0 (X) or H_0: Residuals are normally distributed

H_1: F_n (X) ≠ F_0 (X) or H_1: Residuals are not normally distributed

H_0 will be rejected if $D > D_{\alpha, n}$

Statistics test :

$$D = Sup|F_n(x) - F_0(x)| \quad (9)$$

Where:

$F_n(x)$: The cumulative distribution value of the sample

$F_0(x)$: The applied cumulative distribution value, or below H_0 P(Z<Z_i) for the Normal distribution.

B. Best Model Selection

In forecasting, of course, a method that is in accordance with the data and predicted information is needed in order to achieve the desired goal. A good forecasting model generates predicted values that are relatively close to the actual data. There are several criteria to measure the proximity between the actual value and its forecast. For the purposes of forecasting evaluation, time series data is often divided into two parts [7].

a. Data used for modeling purposes, this data is often referred to as data in-sample or training data.
b. Data used for forecasting evaluation purposes, this data is also called out-sample data or testing data.

It is necessary to select the best model if more than one forecasting method is used. The selection of the best model will be based on various criteria of the goodness of the model. Some of the model criteria that can be used are Root Mean Square Error (RMSE) and Mean Absolute Percentage Error (MAPE) for out-sample data. The equation for determining the RMSE value in forecasting data is shown in equation (10), RMSE is a commonly used metric to assess how well a model's predictions match the actual observed values [7].

$$\text{RMSE} = \sqrt{\frac{1}{T}\sum_{t=1}^{T} {e_t}^2} \quad (10)$$

Meanwhile, the equation for determining the MAPE value in forecasting data is shown in equation (11) as follows.

$$MAPE = \frac{1}{T}\sum_{t=1}^{T}\left|\frac{Y_t - \hat{Y}_t}{Y_t}\right| x100\% \quad (11)$$

The smaller the RMSE and MAPE percentage values, the better the model's ability to predict [7].

C. Consumer Confidence Index

The Consumer Confidence Index (CCI) is a simple average of the Current Economic Conditions Index and the Consumer Expectations Index. The Current Economic Condition Index includes durable goods purchase confidence and job availability, comparing current conditions with six months ago. Meanwhile, the Consumer Expectation Index includes consumer confidence regarding consumer expectations of economic conditions in the next six months compared to today, including income expectations, the condition of the Indonesian business economy in general, and the availability of employment. If the index value is above 100, it shows that the optimistic response is more when compared to the pessimistic response. Meanwhile, if the index value is below 100, it shows more pessimistic responses compared to optimistic responses [6].

II. METHOD

The data used in this study is secondary data obtained from the Bank Indonesia website. The research variable used is Consumer Confidence Index data from April to October 2022. Data from April 2020 to May 2022 is used as data in-sample, meanwhile, data from June 2022 to October 2022 is used as *out-sample* data. The following Table 1 is the data structure used in the study. Data analysis steps can be written as follows:

1. The in-sample data is modeled using the following methods:
   a. Naive method
   b. Moving Average with trial Length between 2 to 10
   c. Single exponential smoothing with trial values of α between 0.1 to 1
   d. Double exponential smoothing with trial values of α between 0.1 to 0.9 and γ between 0.1 to 1
   e. Linear time series regression
2. The model obtained from the in-sample data in point 1 produced RMSE value. The model is used to forecast CCI, which will then be compared with the out-sample data to calculate MAPE.
3. The best model is determined from the model that produces the smallest RMSE and MAPE.

TABLE 1.
RESEARCH DATA STRUCTURE

Time Periods	CCI	Notes
April 2020	CCI_1	
May 2020	CCI_2	
June 2020	CCI_3	*In Sample*
…		
May 2022	CCI_{27}	
June 2022	CCI_{28}	
July 2022	CCI_{29}	
August 2022	CCI_{30}	*Out Sample*
September 2022	CCI_{31}	
October 2022	CCI_{32}	

III. RESULT AND DISCUSSION

A. The Characteristics of the Consumer Confidence Index

The dynamics and development of the CCI from April 2020 to October 2022 after the COVID-19 pandemic that hit Indonesia, especially Ambon City can be shown in Figure 1 as follows.

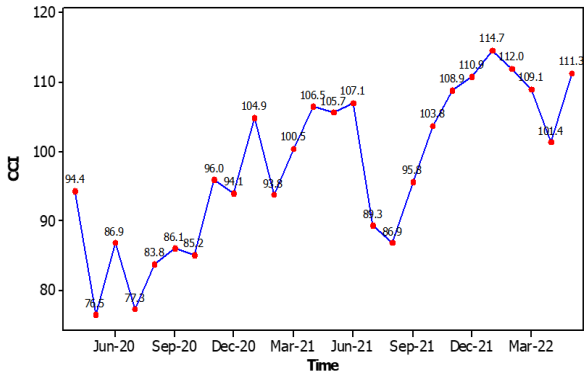

Figure 1. Time series plot of CCI

Figure 1 shows that the Consumer Confidence Index after the Covid-19 pandemic shows fluctuating developments and tends to increase over several time periods. The most significant decline in the Consumer Confidence Index occurred in July 2021. The decline in the Consumer Confidence Index in an economy is closely related to an increase in covid-19 cases. In July 2021, there was a variant of the omicron virus that had just entered Indonesian territory, where there was a significant spike in covid-19 cases, especially in Ambon City. It was recorded that in July 2021, the CCI experienced a significant decline to an index value of 89.3%. In that month, people tended to be pessimistic about the economic conditions in Ambon City. The pessimistic condition felt by the community after the COVID-19 pandemic lasted until September 2021. The consumer confidence index is a key indicator of consumer confidence, this index can provide a relatively comprehensive picture of consumers' comprehensive judgment of the current and future economic situation and development [12]. After entering October 2021, the Consumer Confidence Index is in the optimistic category, where the covid-19 pandemic conditions in Ambon City also tend to decline. Figure 2 shows the trend of the development of confirmed cases of COVID-19 in Ambon City from June 2021 to March 2022. An increase in the consumer confidence index can be obtained by controlling the covid-19 cases in Ambon City.

B. *Forecasting Consumer Confidence Index in Ambon*

The application of the forecasting method to predict the value of the CCI is carried out using several classical methods. The following methods will produce different CCI prediction models. The best model is selected based on the smallest values of RMSE and MAPE.

a. *Naive Method*

The following are the results of the Naive method evaluation on the CCI data in Table 2.

TABLE 2.
FORECASTING CCI WITH THE NAÏVE METHOD EVALUATION

Evaluation Indicators	Values
RMSE	5.85%
MAPE	5.12%

Table 2 reveals that using the Naive method, the RMSE value generated using in-sample data is 5.85%. Meanwhile, the MAPE value generated using out-sample data is 5.12%. Figure 2 shows the plot of the divination results using the Naive method.

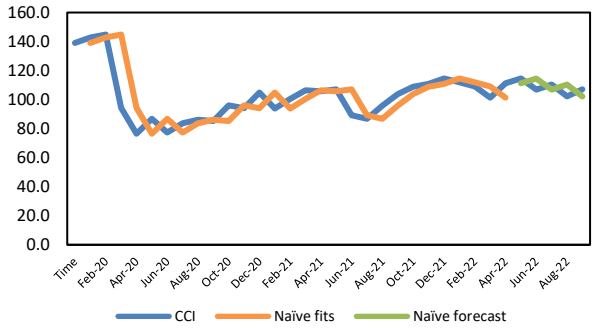

Figure 2. Time series plot and forecasted CCI value of naive method

b. *Moving Average Method*

Table 3 gives the evaluation results of the Moving Average method by stimulating the *M* value. The *M* value indicates the moving average length, *M* value for forecasting the Consumer Confidence Index is simulated between 2 to 10.

TABLE 3.
FORECASTING CCI WITH THE MOVING AVERAGE METHOD EVALUATION

M	RMSE	MAPE
2	4.48%	3.21%
3	4.19%	**2.90%**
4	**4.09%**	3.16%
5	4.34%	3.42%
6	4.42%	3.46%
7	4.37%	3.43%
8	4.16%	3.28%
9	4.14%	2.96%
10	4.91%	3.69%

Table 3 reveals that the least RMSE value from the CCI forecast is obtained when the moving average length M = 4, while, the minimum MAPE value is obtained from M = 3. Based on the evaluation results in Table 3, it can be concluded that the optimum M value for CCI prediction using the Moving Average Method is MA(3) since the RMSE and MAPE values tend to be minimum when compared to other models. Figure 3 shows a plot of the forecast results using the Moving Average method with the MA(3) model.

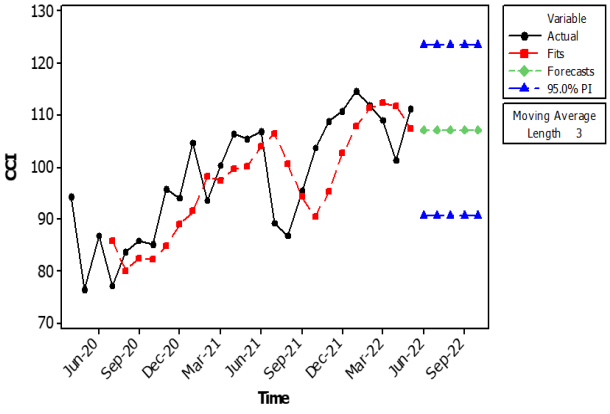

Figure 3. Time series plot and forecasted CCI value of MA(3)

c. *Single Exponential Smoothing Method*

Table 4 presents the result of evaluating the Single Exponential Smoothing method by trying α values from 0.1 to 1 to forecast the CCI values.

TABLE 4.
FORECASTING CCI WITH THE SINGLE EXPONENTIAL SMOOTHING METHOD EVALUATION

α	RMSE	MAPE
0.1	7.19%	5.38%
0.2	4.36%	**1.12%**
0.3	**4.09%**	2.35%
0.4	**4.09%**	2.73%
0.5	4.10%	2.88%
0.6	4.12%	3.06%
0.7	4.19%	3.38%
0.8	4.34%	3.89%
0.9	4.64%	4.57%
1	5.14%	5.41%

Table 4 shows that the smallest RMSE value is obtained from the Single Exponential Smoothing Method with α = 0.3 and 0.4, both α result same RMSE values (4.09%), meanwhile, the smallest MAPE value is generated from the Single Exponential Smoothing Method with α = 0.2. Based on the overall evaluation in Table 3, it was found that α = 0.2 is the optimum α to forecast the CCI using Single Exponential Smoothing because the RMSE and MAPE values tend to be minimum when compared to other models. Figure 4 shows the plot of forecasting results using the Single Exponential Smoothing method with a model of α = 0.2.

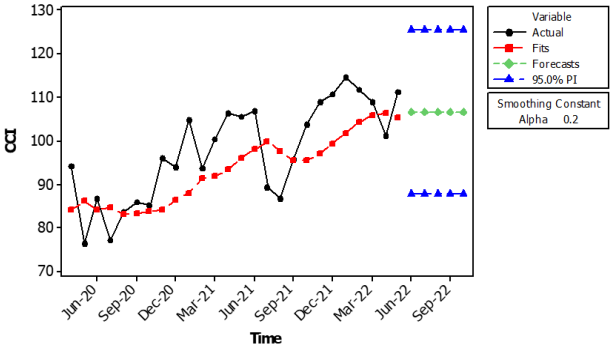

Figure 4. Time series plot and forecasted CCI value of single exponential smoothing method with α = 0.2

d. Double Exponential Smoothing Method

Table 5 provides the evaluation results of the Double Exponential Smoothing method to forecast the CCI value by trying the combination of α and gamma value in order to obtain the optimum model, each value is simulated from 0.1 to 1. It can be inferred from Table 5 that the least RMSE and MAPE value is obtained from the combination of α = 0.4 and γ = 0.5, therefore the combination of those values provides the best model. Figure 5 shows the plot of forecasting results using the Double Exponential Smoothing method.

TABLE 5.
FORECASTING CCI WITH THE DOUBLE EXPONENTIAL SMOOTHING METHOD EVALUATION

α	γ	RMSE	MAPE
0.1	0.1	8.73%	7.16%
0.1	0.2	8.60%	7.05%
0.2	0.3	7.01%	5.81%
0.3	0.4	7.23%	5.96%
0.4	0.5	**3.47%**	**2.72%**
0.5	0.6	6.46%	5.19%
0.6	0.7	5.04%	3.91%
0.7	0.8	7.26%	5.94%
0.8	0.9	16.58%	13.41%
0.9	1	28.51%	23.33%

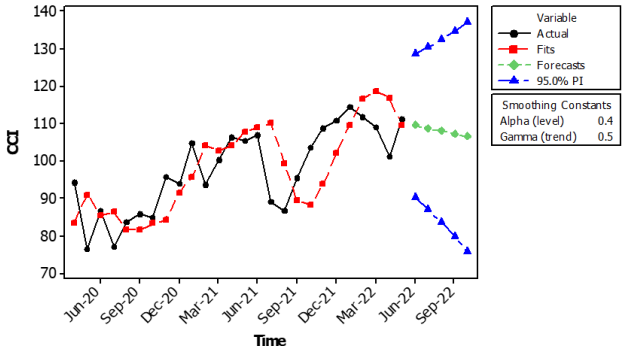

Figure 5. Time series plot and forecasted CCI value of single exponential smoothing method with α = 0.4 and γ = 0.5

e. Time Series Regression

Before evaluating the RMSE and MAPE criteria, residual assumptions will first be tested to see the feasibility of the *time series* regression model formed. The Glejser test is used for testing the residual identical assumption, the Glejser analysis result concludes that the residuals obtained from the time series regression already meet the identical assumption. The Durbin-Watson statistics value obtained from the residuals is 1.31, this value is able to test the independent assumption and shows that there is neither a positive nor negative correlation for each residual. Residuals also have to meet the normally distributed assumption, one of the methods to test whether the residuals are normally distributed is the Kolmogorov-Smirnov test. A D value (0.19) was obtained in a Kolmogorov-Smirnov test, it was decided that the residuals produced by the forecasting model using the time series regression method have also met the assumption of normal distribution. The following in Table 6 are the results of the forecasting model evaluation using RMSE and MAPE values based on *time series* regression.

TABLE 6.
FORECASTING CCI WITH TIME SERIES REGRESSION EVALUATION

Evaluation Indicators	Value
RMSE	8.90%
MAPE	7.28%

Figure 6 shows the plot of forecasting results using the time series regression method.

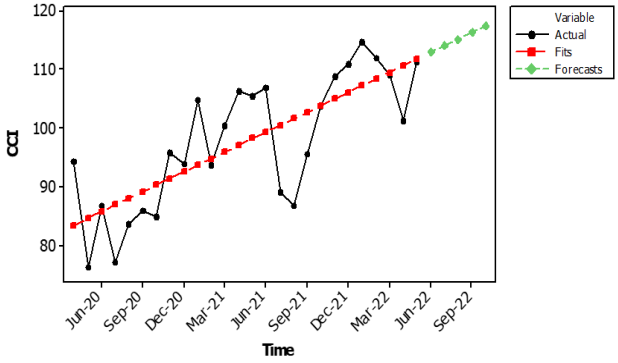

Figure 6. Time series plot and forecasted CCI value of time series regression

Linear time series regression model can be written as follows:

$$\hat{Y}_t = 82.59 + 1.13t \qquad (12)$$

The resulting model shows that the Consumer Confidence Index in Ambon has a positive trend, which means that its value will continue to increase.

f. Best Model Selection

The forecasting models have been obtained and described in the previous subsection, it is necessary to select the best model based on the criteria of MAPE and RMSE values. The selection of the best forecasting results on each forecasting method is shown in Table 7 as follows.

TABLE 7.
BEST FORECASTING MODEL SELECTION

Forecasting Methods	RMSE	MAPE
Naive	5.85%	5.12%
Moving Average (MA(3))	4.19%	2.90%
Single Exponential Smoothing (α=0.2)	4.36%	1.12%
Double Exponential Smoothing (α=0.4; γ=0.5)	**3.47%**	**2.72%**
Time Series Regression	8.90%	7.28%

Table 7 shows that the best forecasting model to predict the Consumer Confidence Index in Ambon, Indonesia is the Double Exponential Smoothing model with a combination of α = 0.4; γ = 0.5 because the MAPE and RMSE values tend to be more minimal when compared to other forecasting models. As for the mathematical model of forecasting, it can be explained as follows

$$\hat{Y}_{t+p} = 0{,}3Y_t + 0{,}7A_{t-1} + 0{,}7T_{t-1} + p(0{,}4A_t - 0{,}4A_{t-1} + 0{,}6T_{t-1}) \quad (13)$$

Based on the mathematical model above, the prediction value of the consumer confidence index in Ambon City for the next five periods is carried out using the *double exponential smoothing* forecasting method with a combination of α = 0.4; γ = 0.5 in Table 8 as follows.

TABLE 8.
CONSUMER CONFIDENCE INDEX FORECASTING RESULTS

Time Periods	Forecasted CCI
November 2022	105.98
December 2022	105.24
January 2023	104.51
February 2023	103.77
March 2023	103.03

Table 8 shows that the forecasting values for the next five periods (November 2022 to March 2023) tend to decrease from month to month, although the CCI value obtained is still relatively optimistic because the value is still more than 100. If the consumer confidence index continues to decline even though it is still above 100, this indicates that although consumers still feel confident, their confidence in the economy has decreased from the previous period. This can be caused by various factors, such as rising living costs, declining economic growth, or political and economic uncertainty. A special strategy is needed to increase consumer confidence so that economic stability, especially in Ambon City, can be controlled and improved.

IV. CONCLUSION

Based on the results of forecasting with the best model (Double Exponential Smoothing), the trend of the CCI value in Ambon City in November 2022 to March 2023 is declining, but it is still in the optimistic category. When the consumer confidence index is declining, the government can take several actions to improve the economic situation and increase consumer confidence. One of the most effective ways to increase consumer confidence is to strengthen the overall economy. This can be achieved through job creation, reducing unemployment, and increasing economic growth. In addition, consumers are more likely to be confident in the economy and their financial situation if they trust that they are protected from fraud and scams. Governments and regulators can improve consumer protection laws and enforcement to build consumer confidence. High inflation can also affect consumer confidence because it can reduce the purchasing power of money and increase economic uncertainty. Therefore, controlling inflation can help improve the consumer confidence index. The government should further enhance the inflation control program that has been implemented, namely through the 4K program, which focuses on affordability of prices, availability of supply, smooth distribution, and effective communication [13]. With the improvement of these programs, it is expected that the consumer confidence index can increase even further in the upcoming period.

REFERENCES

[1] Kemenkeu, "Perekonomian Indonesia Tumbuh Optimis pada Kuartal II 2022," 2022. [Online]. Retrieved from Kementerian Keuangan Republik Indonesia: https://www.kemenkeu.go.id/informasipublik/publikasi/berita-utama/Perekonomian-Indonesia-Tumbuh-Optimis (accessed Sep. 23, 2022).

[2] B. Indonesia, "Laporan Survei Konsumen Oktober 2022", 2022. [Online]. Retrieved from Bank Indonesia: https://www.bi.go.id/id/publikasi/laporan/Documents/SK-Oktober-2022.pdf (accessed Nov. 08, 2022).

[3] S. Celik, E. Aslanoglu, and S. Uzun, "Determinants of Consumer Confidence in Emerging Economies: A Panel Cointegration Analysis", Top. Middle East. North African Econ., vol. 12, pp. 1-19, 2010.30

[4] G. Katona, "A Communication: Consumer Durable Spending", Brookings Papers on Economic Activity, pp. 234-239, 1971.

[5] T. U. Islam and M. N. Mumtaz, "Consumer Confidence Index and Economic Growth: An Empirical Analysis of EU Countries", EuroEconomica, vol. 35, no. 2, 2016.

[6] B. Indonesia, "Metadata Indeks Keyakinan Konsumen (Survei Konsumen)", 2016. [Online]. Retrieved from Bank Indonesia: https://www.bi.go.id/id/statistik/Metadata/Survei/Documents/1-Metadata-SK-2016.pdf (accessed Nov. 08, 2022).

[7] S. Makridakis, S. Wheelwright, and V. McGee,"Metode dan Aplikasi Peramalan Jilid 1 Edisi Kedua", Jakarta: Penerbit Erlangga, 1999.

[8] N. A. Sudibyo, A. Iswardani, A. W. Septyanto, and T. G. Wicaksono,"Prediksi Inflasi di Indonesia Menggunakan Metode Moving Average, Single Exponential Smoothing dan Double Exponential Smoothing". Lebesgue : Jurnal Ilmiah Pendidikan Matematika, Matematika dan Statistika, 1, pp. 123-129. doi:10.46306/lb.v1i2, 2020.

[9] Setiawan and D. E. Kusrini, "Ekonometrika", Yogyakarta: Andi Offset, 2010.

[10] D. C. Montgomery, "Introduction to Linear", Arizona: John Wiley & Sons, 2016.

[11] Ghozali, "Aplikasi Analisis Multivariate dengan Program SPSS", Semarang: Badan Penerbit Universitas Diponegoro, 2006.

[12] H. Huijian, L. Zhiming, and L. Zongwei,"Using Machine Learning Methods to Predict Consumer Confidence from Search Engine Data", Sustainability, 15, 3100, https://doi.org/10.3390/su15043100, 2003.

[13] B. Indonesia, "Laporan Perekonomian Provinsi Maluku Mei 2022". [Online]. Retrieved from Bank Indonesia: https://www.bi.go.id/id/publikasi/laporan/lpp/Pages/Laporan-Perekonomian-Provinsi-Maluku-Mei-2022.aspx. (accessed Nov. 08, 2022).