The Forecasting Of Monthly Inflation In Yogyakarta City Uses An Exponential Smoothing-State Space Model

by Mohamad As'ad

THE FORECASTING OF MONTHLY INFLATION IN YOGYAKARTA CITY USES AN EXPONENTIAL SMOOTHING-STATE SPACE MODEL

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Abstract:

Yogyakarta is known as a student city, tourist city, and also a city of culture. Yogyakarta is an interesting tourist and cultural place with many beautiful tourist attractions in the city of Yogyakarta. Public transportation in the city of Yogyakarta is also varied, ranging from conventional and online-based. Access to the city of Yogyakarta varies, namely trains, buses, and planes. Thus, the economic growth in the city of Yogyakarta is getting better, this can be seen from the economic activity in the city of Yogyakarta which is getting busier. A good economy is usually always followed by stable inflation. This study aims to predict inflation in the future period using the Exponential Smoothing-State Space (ETS) model. Secondary monthly inflation data was obtained from BPS Yogyakarta City. From this research, the Exponential Smoothing-State Space Model / ETS (A, N, A) is obtained, which means that the monthly inflation data for the city of Yogyakarta does not contain trends, but contains additive seasonality and has additive errors. The results of this study indicate that inflation in the next three months is relatively stable, namely, the decline in inflation and the increase in inflation is still below 10%.

Keywords: BPS Yogyakarta City, Monthly Inflation Forecasting, Exponential Smoothing-State Space ETS

1. Introduction

According to the Central Bureau of Statistics (BPS), "inflation is a continuous upward trend in the prices of goods and services in general. If the price of goods and services in the country increases, then inflation will increase". The increase in the price of goods and services is the cause of the decline in the value of money. This means that inflation is a decrease in the value of goods and services (BPS, 2022). From the definition of inflation, the value of money can go up or down depending on the inflation rate. Activities in the economic sector in this case are highly dependent on the existing inflation rate, therefore indirectly inflation conditions should be taken into account in economic planning. Planning must be done so that future actions can be carried out properly and smoothly. In the economic field, it is also necessary to predict future economic conditions for the sake of good continuity of economic activity. According to Simanungkalit (2020), one of the good economic indicators is stable inflation conditions with small inflation fluctuations (< 10%). Inflation is very important as a parameter to determine good economic growth, for it is necessary to predict inflation so that economic activity can run well.

Inflation is a very important economic problem because it has a wide impact within the economic sector and outside the economic sector, within the country, and possibly abroad. Inflation needs to be kept stable, so the president issued his decree number 23 of 2017 concerning the "National Inflation Control Team" (Fitri, et al., 2018). The National Inflation Control Team (TPIN) is written in article 3 paragraph 2, chaired by the Coordinating Minister for the Economy, Deputy Chair I Governor of Bank Indonesia, Deputy Chair II from the Minister of Finance, and

Deputy Chair III the Minister of Home Affairs. The members of the TPIN are the Minister of Trade, the Minister of Agriculture, the Minister of Transportation, the Minister of Energy and Mineral Resources, the Minister of National Development Planning / Head of Bappenas, the Minister of Public Works and Perumnas, the Minister of SOEs, the Cabinet Secretary and finally the National Police Chief. The secretaries are Deputy for Macroeconomic Coordination and Finance, Coordinating Ministry for Economic Affairs. For the provincial level, a Provincial Inflation Control Team (TPIDP) is formed which is written in article 4. For the district/city level a Regional Inflation Control Team (TPID) is formed which is written in article 5 (Keppres no 23 of 2017).

In general, there are two theories of inflation, namely the monetarist theory and the non-monetarist theory. The monetarist theory specifies that the general price level results from the relationship between the supply and demand for money, this theory is known as the quantity theory of money or classical theory. The non-monetarist theory believes that inflation occurs because of imbalances in the economy. The non-monetarist theory is also called the long-run theory because inflation is associated with structural factors of the economy that can gradually change over a long period. From the two theories, in general, inflation has a very important impact because it affects the value of money which is directly felt by the public, so this inflation needs to be controlled by the government through the National Inflation Control Team (TPIN). Inflation is measured from time to time by looking at the value of an index. The index number is calculated by the composition of the weight of the use of several goods and services, the greater the level of use of an item, the greater the weight in the calculation of inflation. The index numbers commonly used to calculate inflation include producer price index (PPI), wholesale price index (IHPB), consumer price index (CPI), gross domestic product deflator (GDP deflator), and asset price index (HA). Inflation is usually calculated on monthly, quarterly and annual basis (Utari et al., 2016).

This study aims to predict the value of inflation in the city of Yogyakarta, which is known as a student city, a tourism city, and also a cultural city with an easy and high-accuracy prediction method. This study chose Yogyakarta as a place to predict the value of inflation because the city of Yogyakarta as a student city, tourism city, or cultural city is very busy with economic activities because there are many schools, universities, tourist attractions and also cultural places which of course many students, domestic and foreign tourists who visit Yogyakarta. The number of students and tourist visits in the city of Yogyakarta will increase economic activities such as boarding houses, inns, or hotels and do not miss places to eat, shopping places, and so on. The inflation prediction method or results can be used by economic actors in the city of Yogyakarta or can be used in other cities with inflation data for that city. The following is a review of previous research on inflation prediction with a simple method that is easy to do and has high accuracy.

Previous research on inflation prediction at the country or city level has been done by many researchers with different methods. Research on inflation prediction and consumer price index in Zambia uses the ARIMA model and Holt's double exponential smoothing (DES) model. The results of the ARIMA model research are better than the DES model, but for software tools, it is easier to use the DES model from Holt (Jere and Sianga, 2016). Another study, namely Febriyanti et al., examined the consumer price index (CPI) in the city of Yogyakarta. The consumer price index (CPI) is a component or one of the factors in calculating the value of inflation. This study uses the double exponential smoothing (DES) method from Brown with forecasting accuracy using the mean absolute percentage error (MAPE) of 0.1308443%. Brown's DES method is considered

quite simple and accurate in this study (Febriyani et al., 2021). Inflation prediction research was conducted in Kenya by Lidiema (2017) using the seasonal autoregressive integrated moving average (SARIMA) and triple exponential smoothing (TES) methods. The results of this study obtained that the best model is SARIMA by looking at the smallest forecasting accuracy, namely the mean absolute square error (MASE), the mean absolute error (MAE), and the mean absolute percentage error (MAPE). Inflation prediction research in Bandung using the seasonal autoregressive integrated moving average (SARIMA) and single exponential smoothing (SES) methods was carried out by Fajruddin and Sumitra. The results of this study show that the SARIMA model is better than the SES mode with a mean absolute deviation (MAD) forecasting accuracy of 0.117, a mean square error (MSE) of 0.023, and a Mean absolute percentage error (MAPE) of 0.72% (Fajruddin and Sumitra, 2020). Research on forecasting inflation in the city of Samarinda uses the double exponential smoothing (DES) method from Brown with the best model results for the alpha parameter of 0.3 with a mean square error (MSE) of 0.485239 (Armi, et al., 2019). Research on inflation prediction in Indonesia using the moving average method, single exponential smoothing, and double exponential smoothing results in the conclusion that the best method is single exponential smoothing with an alpha value of 1.316, MAPE of 7.76202, MAD of 0.27343, and MSD of 0,14625(Sudibyo, et al., 2020). Monthly inflation forecasting in Malang using the ARIMA method resulted in the conclusion that the best model was ARIMA (2.0,3) with RMSE of 0.2645467, MAE of 0.2013898, and MASE of 0.6047399. The ARIMA method is not easy because statistical assumptions must be met and use special software (Farida and As'ad, 2021).

From a review of previous research, information is obtained that to predict monthly inflation, the relatively easy and simple exponential smoothing (ES) model can be used. The latest development of the exponential smoothing (ES) model, there is the development of a model by looking at the state-space known as the exponential smoothing-state space model written by Hyndman and Athanasopaulos (2018). The exponential smoothing-state space method is a decomposition model of the ES model so that it can explore data in more detail and can improve forecasting accuracy. The exponential smoothing-state space method uses research entitled "selection for the best ETS (error, trend, seasonal) model to forecast weather in the Aceh Besar District". The results of this study were to predict air temperature and sea surface temperature using the ETS (M, N, A) model, to predict the dew point, sea level pressure, and station pressure, the ETS (A, N, A) model was used to predict visibility. ETS (A, A, N) model, to predict wind speed the ETS (A, N, N) model is used (Jopifasi, et al., 2017). In this study, the exponential smoothing-state space / ETS model is used to predict monthly inflation in the city of Yogyakarta.

2. Research Method

This study uses secondary monthly inflation data from January 2015 to December 2021 as many as 84 data obtained from the Yogyakarta City BPS website (https://jogjakota.bps.go.id/indicator/3/1/1/inflation.html). Calculation of inflation with the consumer price index (CPI) can be calculated using the following formula (Utari et al., 2016):

$$Inflation_t = \left(\frac{IHK_t}{IHK_{t-1}} - 1\right) x\ 100\%$$

where, t is the month/quarter/year inflation to t
CPI_t is CPI month / quarter / year t
CPI_{t-1} is CPI month/quarter/year t-1

The model used to predict monthly inflation is the exponential smoothing-state space or known as ETS (E=error, T=trand, S = seasonal). This ETS method is a decomposition of the exponential smoothing (ES) model with three models, namely: a single exponential smoothing (SES) model, a double exponential smoothing (DES) model, and a triple exponential smoothing (TES) model (Hyndman and Athanasopaulos, 2018). The SES model can be calculated as follows (Makridakis, 1998):

$$F_t = F_{t-1} + \alpha(A_{t-1} - F_{t-1})$$

where: Ft = new forecast
F_{t-1} = Forecasting
α = Smoothing constant (0 1)
A_{t-1} = Last period's actual demand

The DES model used is Holt (two parameters). Holt's model can be calculated as follows (Makridakis, 1998):

$$A_t = \alpha Y_t + (1-\alpha)(A_{t-1} + T_{t-1})$$
$$T_t = \beta(A_t - A_{t-1}) + (1-\beta)T_{t-1}$$
$$\hat{Y}_{t+p} = A_t + T_t p$$

Y_t is the actual data for the t period, A_t is the exponential smoothing value, α is the smoothing constant no the trend, β is the smoothing constant for the trend estimate, T_t is the trend estimate, $\hat{Y}$ the forecast value for the future period and p is the number of periods being forecasted.
The additive TES model can be calculated as follows (Hyndman and Athanasopoulos, 2018):

$$\hat{y}_{T+p}(T) = \lambda_T + pb_T + sn_{T+p-L} \qquad (p = 1, 2, 3, ...)$$
$$\lambda_T = \alpha(y_T - sn_{T-L}) + (1-\alpha)(\lambda_{T-1} + b_{T-1})$$
$$b_T = \gamma(\lambda_T - \lambda_{T-1}) + (1-\gamma)b_{T-1}$$
$$sn_T = \delta(y_T - \lambda_T) + (1-\delta)sn_{T-L}$$

where α, γ, and δ are smoothing constants between 0 and 1,
L = number of seasons

The multiplicative TES model can be calculated as follows (Hyndman and Athanasopoulos, 2018):

$$\hat{y}_{T+p}(T) = (1_T + pb_T)sn_{T+p-L} \qquad (p = 1,2,3,...)$$
$$1_T = \alpha(y_T / sn_{T-L}) + (1-\alpha)(1_{T-1} + b_{T-1})$$
$$b_T = \gamma(1_T - 1_{T-1}) + (1-\gamma)b_{T-1}$$
$$sn_T = \delta(y_T / 1_T) + (1-\delta)sn_{T-L}$$

where α, γ, and δ are smoothing constants between 0 and 1,
L = number of seasons

There are two forms of error in the ETS model, namely additive and multiplicative. There are three trends in the ETS model, namely none, additive, and additive dumped. There are three seasonal ETS models: none, additive and multiplicative. From E there are two, T there are three, and S there are three, then there are 18 possible models. This study uses one of the best models of 18 ETS models. The selected model has the smallest Akaike information criteria (AIC) value and has the highest accuracy (the smallest root mean square error / RMSE value and the mean absolute percentage error / MAPE value). The AIC value can be calculated as follows (Jopifasi, et al., 2017):

$$AIC = -2\left(\frac{LL}{T}\right) + \frac{2t_p}{T}$$

where, LL = log likelihood, t_p = Total Parameters, T = Number of observations

The RMSE and MAPE values can be calculated as follows (As'ad et al., 2020):

$$RMSE = \sqrt{\frac{\sum_{i=1}^{n} e_i^2}{n}}$$

$$MAPE = \frac{1}{n}\sum_{i=1}^{n}\left|\frac{e_i}{y_i}\right|$$

where, n = total data, e_i = error for i

This study uses the R package statistics as a software tool in the analysis. R package statistics can be downloaded for free because it is an open-source program and can be installed on Linux, macOS, and Windows operating systems. To download the R package statistics, you can do it at the following link: https://cran.r-project.org/
The following are the steps of analysis in this study are as follows:
1. Plot of monthly inflation data for the city of Yogyakarta
2. Do the stationarity test with the Dicky Fuller test (DF-test)

Dicky Fuller test has H_o and H_1 as follows (As'ad and Eni, 2019):
$H_0 : \phi = 0$ (there is a unit root, the data is not stationary)
$H_1 : \phi \neq 0$ (no unit root, data is stationary)

The test statistics are as follows:

$$ADF_t = \frac{\hat{\phi} - 1}{SE(\phi)}$$

3. From number 2 conclude whether the data require trend and seasonal models
4. Do a possible model from conclusion number 3

5. Calculate AIC
6. Calculate RMSE and MAPE
7. From numbers 5 and 6 find the smallest value and get the best ETS model
8. From number 7, use the model to forecast monthly inflation for the next several periods.

3. Results and Discussion

3.1. Results

The first step in this research is to plot inflation data to view the graph results and identify trends and seasonality. The following is a graph of monthly inflation in the city of Yogyakarta from January 2015 to December 2021.
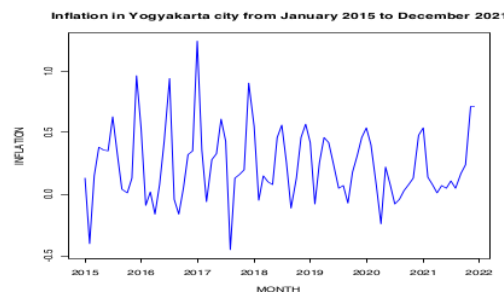

Figure 1.
The graphic of monthly inflation data for the Yogyakarta city

From Figure 1, it can be seen that the data does not contain a trend. The Dicky Fuller Test (ADF-test) needs to be carried out to provide certainty that the data does not contain a trend. The following are the results of the ADF-test:

Tabel 1.
Augmented Dickey-Fuller (ADF) Test

data: inflasiy
Dickey-Fuller = -5.1723, Lag order = 4, p-value = 0.01
alternative hypothesis: stationary
Warning message:
In adf.test(inflasiy) : p-value smaller than printed p-value

The DFT-test value is -5.1723 with a p-value of 0.01. If the p-value (0.01) < 0.05, then H1 is accepted, which means the data is stationary. It is now certain that the data is stationary. The ETS model that is suitable for this is T or trend side of none (N) because it is stationary / there is no trend.

For the error model, there are two, namely additive (A) and multiplicative (M), while for seasonal there are three possibilities, namely None (N), additive (A), and multiplicative (M). From

Figure 1, monthly inflation data shows that fluctuations from the initial period to the final period do not show an increase in fluctuations that are getting bigger, so it can be said that the seasonality is likely to be additive and there is no seasonality or none(N). From the analysis of Figure 1, the possible ETS models are ETS (A, N, A) or ETS (A, N, N).

The ETS (A, N, A) model can be written as follows:

$$y_t = l_{t-1} + s_{t-m} + \varepsilon_t$$
$$l_t = l_{t-1} + \alpha \varepsilon_t$$
$$s_t = s_{t-m} + \gamma \varepsilon_t$$

The ETS (A, N, N) model can be written as follows:

$$y_t = l_{t-1} + \varepsilon_t$$
$$l_t = l_{t-1} + \alpha \varepsilon_t$$

The following is the output of the ETS (A, N, A) and ETS (A, N, N) models.

Tabel 2.
ETS (A, N, A) model output results

ETS(A,N,A)
Call:
ets(y = inflasiy, model = "ANA")
Smoothing parameters:
alpha = 2e-04
gamma = 1e-04
sigma: 0.2373

The results of the ETS (A, N, A) model in table 2, obtained an alpha value of 2e-04, gamma of 1e-04, and sigma of 0.2373. The following is the result of ETS (A, N, N):

Tabel 3.
ETS (A, N, N) model output results

ETS(A,N,N)
Call:
ets(y = inflasiy, model = "ANN")
Smoothing parameters:
alpha = 1e-04
sigma: 0.2984

The results of the ETS (A, N, N) model in table 3, obtained an alpha value of 1e-04, and a sigma of 0.2984. The gamma value does not exist because the seasonal status is none (N).

To find out a good ETS model, a comparison of the AIC values of the ETS (A, N, A) model and the following ETS (A, N, N) model will be carried out:

Tabel 4.
The AIC value of the ETS (A, N, A) model and the ETS (A, N, N) model

Model	ETS (A, N, A)	ETS (A, N, N)
AIC Value	145.1996	172.9755

From table 4, the AIC value for the ETS (A, N, A) model is 145.1996 and the AIC value for the ETS (A, N, N) model is 172.9755. The smallest AIC value is the ETS model (A, N, A), this means that the model is good while the ETS model is (A, N, A).
Furthermore, the value of the forecasting accuracy will be compared, namely the root mean square error (RMSE) and the mean absolute percentage error (MAPE) in table 5 below:

Tabel 5.
RMSE and MAPE values for the ETS (A, N, A) model and the ETS (A, N, N) model

Model	ETS (A, N, A)	ETS (A, N, N)
RMSE Value	0.2166014	0.2947857
MAPE Value	127.1662	214.899

From table 5 the smallest RMSE value is the ETS (A, N, A) model with a value of 0.2166014, while the smallest value for MAPE is the ETS (A, N, A) model with a value of 127.1662. A good model between the ETS (A, N, A) and ETS (A, N, N) models is ETS (A, N, A).

From table 4 and table 5, the best model is ETS (A, N, A) because it has the smallest AIC, RMSE, and MAPE. Monthly inflation data and forecast results for the city of Yogyakarta are presented in Figure 2 below:
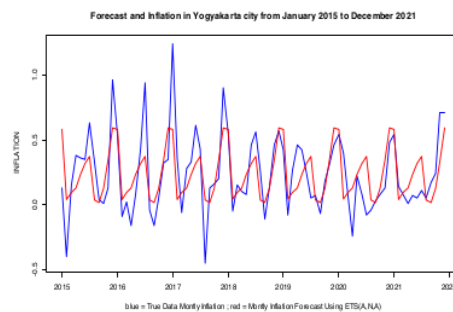

Figure 2.
The graphic of monthly inflation data and forecast for the Yogyakarta city

The ETS (A, N, A) model is then used for forecasting the next three months, namely January-March 2022, as follows:

Tabel 6.
ETS (A, N, A) Model Forecast Results for January-March 2022

Month	January	February	March
Forecasting	0.57823712	0.04173216	0.09439960

The results of the monthly inflation forecast for the city of Yogyakarta from January 2022 to February 2022 there will be a decline or deflation and will then increase again in March 2022. According to the literature above, inflation is quite a under control because it is less than 10%.

3.2. Discussion

The results of this study obtained the ETS (A, N, A) model which means the model does not contain trends and contains additive seasonality, and also has additive errors. This ETS (A, N, A) model, if equated with the ARIMA model, includes a model containing seasonality so that it becomes a SARIMA model like previous studies (Lidiema, 2017; Fajruddin and Sumitra, 2020). ARIMA inflation research model that does not contain seasonality in previous studies (Jere and Sianga, 2016; Farida and As'ad, 2021). Research on monthly inflation prediction using the ARIMA or SARIMA method is quite difficult and not simple because the model must meet the statistical assumptions in the model which are sometimes difficult to fulfill. Unlike the ARIMA or SARIMA models, the ETS model which is a decomposition of the single exponential smoothing (SES), double exponential smoothing (DES) and triple exponential smoothing (TES) models do not have statistical assumptions that must be met, so the model obtained is easier and faster obtained which only chooses a model with a small AIC value and forecasting accuracy.

4. Conclusion

Research on monthly inflation forecasting in the city of Yogyakarta using the ETS (A, N, A) model has an AIC value of 145.1996, an RMSE of 0.2166014, and a MAPE of 127.1662. The ETS (A, N, A) model means that the data does not contain trends but contains additive seasonality with additive errors as well. Additive seasonality means that there is a stable seasonality in 12 months of the year that repeats every year. From an economic point of view, inflation is stable, sometimes a bit high in certain months, such as the long Eid holiday, New Year's Christmas, or other holidays that are rather long and will fall again if there are no holidays. Due to the long holiday, tourist visits to the city of Yogyakarta have increased and economic activity has also increased, which automatically increases the demand for goods and services with a steady supply causing the value of money to be high (inflation occurs). Inflation forecast in January 2022 rose, this may be due to the long Christmas and New Year holidays in December 2021, where the demand for goods and services increased with a fixed supply which automatically increased inflation for a moment and fell again in February 2022. Inflation forecast for March 2022 will increase slightly, it can be said to be safe or stable because the previous months did not rise continuously and were still below 10%.

References

Armi, A.E., Kridalaksana, A.H. dan Arifin, Z, (2019), Peramalan Angka Inflasi Kota Samarinda Menggunakan Metode Double Exponential Smoothing (Studi Kasus : Badan Pusat Statistik Kota Samarinda), Informatika Mulawarman : Jurnal Ilmiah Ilmu Komputer, vol 14. No.1 p.21-26. http://dx.doi.org/10.30872/jim.v14i1.1252

As'ad, M. and Farida, E., (2019), Implementasi Jaringan Syaraf Tiruan untuk Memprediksi Inflasi Bulanan di Kota Malang, Jurnal Ilmiah KOMPUTASI vol. 18 no. 2 p. 101-106. http://dx.doi.org/10.32409/jikstik.18.2.2570

As'ad, M., Sujito, Setyowibowo, S., (2020), Prediction of Daily Gold Prices Using an Autoregressive Neural Network, Inform: Jurnal Ilmiah Bidang Teknologi Informasi dan Komunikasi, vol.5 no. 2 p.69-73. DOI: http://dx.doi.org/10.25139/inform.v0i1.2715

Fahruddin, R. dan Sumitro I.D., (2020), Peramalan Inflasi Menggunakan Metode SARIMA Dan Single Exponential Smoothing (Studi Kasus: Kota Bandung), Majalah Ilmiah UNIKOM, Vol.17 no.2 https://doi.org/10.34010/miu.v17i2.3180

Farida, E., As'ad, M., (2021), The Forecasting of Monthly Inflation in Malang City Using An Autoregressive Integrated Moving Average, International Journal of Economics, Business and Accounting Research (IJEBAR), vol. 5 no. 2. p. 73-83. http://dx.doi.org/10.29040/ijebar.v5i2.2328

Febriyanti, S., Pradana, W. A., Saputra, M. J., & Widodo, E. (2021). Forecasting the Consumer Price Index in Yogyakarta by Using the Double Exponential Smoothing Method. Parameter: Journal of Statistics, 2(1), 1-7. DOI: https://doi.org/10.22487/27765660.2021.v2.i1.15641

Fitri, A., Anwar, S., Zohra, A.S. dan Nasution, M.H., (2018), Peramalan Laju Inflasi Bulanan Kota Padang Menggunakan Metode Triple Exponential Smoothing, Jurnal Ilmiah Sosio Ekonomika Bisnis : JISEB, vol.21 no. 2, p.1-10.

https://jogjakota.bps.go.id/indicator/3/1/1/inflasi.html. Accessed on 11 January 2022

https://peraturan.bpk.go.id/Home/Download/46875/Keppres%20No%2023%20Tahun%202017.pdf, Keppres no 23 tahun 2017, Accessed on 31 January 2022.

https://www.bps.go.id/subject/3/inflasi.html. Accessed on 11 January 2022

Hyndman, R.J. and Athanasopoulos, G., (2018), "Forecasting: principles and practice", 2nd edition, OTexts: Melbourne, Australia.

Jere, S. and Siyanga, M. (2016) Forecasting Inflation Rate of Zambia Using Holt's Exponential Smoothing. "Open Journal of Statistics", 6, 363-372. http://dx.doi.org/10.4236/ojs.2016.62031

Jofipasi, C.A., Mitahuddin and Hizir, (2017), Selection for the best ETS (error, trend, seasonal) model to forecast weather in the Aceh Besar District, IOP Conf. Series: Materials Science and Enginering, 7th, IO Publising. doi:10.1088/1757-899X/352/1/012055

Makridakis, S., Wheelwright, S.C, & R.J. Hyndman, R.J., (1998), *Forecasting: Methods and Applications*, John Wiley & Sons, Inc.

Simunangkalit, E.F.B., (2020), Pengaruh Inflasi Terhadap Pertumbuhan Ekonomi Di Indonesia, / Journal of Management (SME's), vol. 13 no.3 p.327-340. https://doi.org/10.35508/jom.v13i3.3311

Sudibyo, N.A., Iswardani, A., Septianto, A. W. dan Wicaksono, T.G., (2020), Lebesgue: Jurnal Ilmiah Pendidikan Matematika, Matematika dan Statistika, vol. 1 no. 2. https://doi.org/10.46306/lb.v1i2.25

Utari, G.A.D., Cristina, R.S. dan Pambudi S, (2016), Inflasi di Indonesia: Karakteristik dan Pengendaliannya, BI Institute, Jakarta

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the Geographical Information System", IOP Conference Series: Materials Science and Engineering, 2018
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20 Rob Hyndman, Anne Koehler, Keith Ord, Ralph Snyder. "Forecasting with Exponential Smoothing", Springer Science and Business Media LLC, 2008
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34 "Reduced Forms and Relationships with ARIMA Models", Springer Series in Statistics, 2008
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Negotiation Interview in the emergency department to reduce high‑risk alcohol use among older adults: A randomized trial", Journal of the American College of Emergency Physicians Open, 2022
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