PRESIDENT UNIVERSITY

APPLICATION OF ARIMA IN FORECASTING

CONSTRUCTION VALUE INDEX COMPLETED BY CONSTRUCTION COMPANIES IN JAMBI PROVINCE

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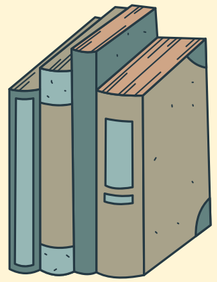
PRESENTATION OUTLINE

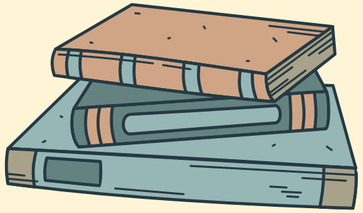


INTRODUCTION

Introduction to the data used

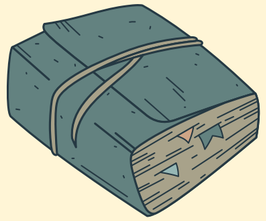
ANALYSIS & RESULT

Steps of analysis and the result



LITERATURE REVIEW

Short explanation about ARIMA model



CONCLUSION

Conclusion based on analysis and result using ARIMA model

INTRODUCTION

TO THE DATA

CONSTRUCTION SECTOR

- The construction sector is a sector that contributes quite a lot to the Indonesian economy
- According to a study conducted by the Central Statistics Agency, the construction sector is in the third position as the largest source of state revenue
- The construction industry has an indirect impact through a complex system of interaction relationships. In 2019, the growing construction sector caused the Indonesian economy to grow **5.01%** with Gross Domestic Product reaching 10.6%

LITERATURE REVIEW

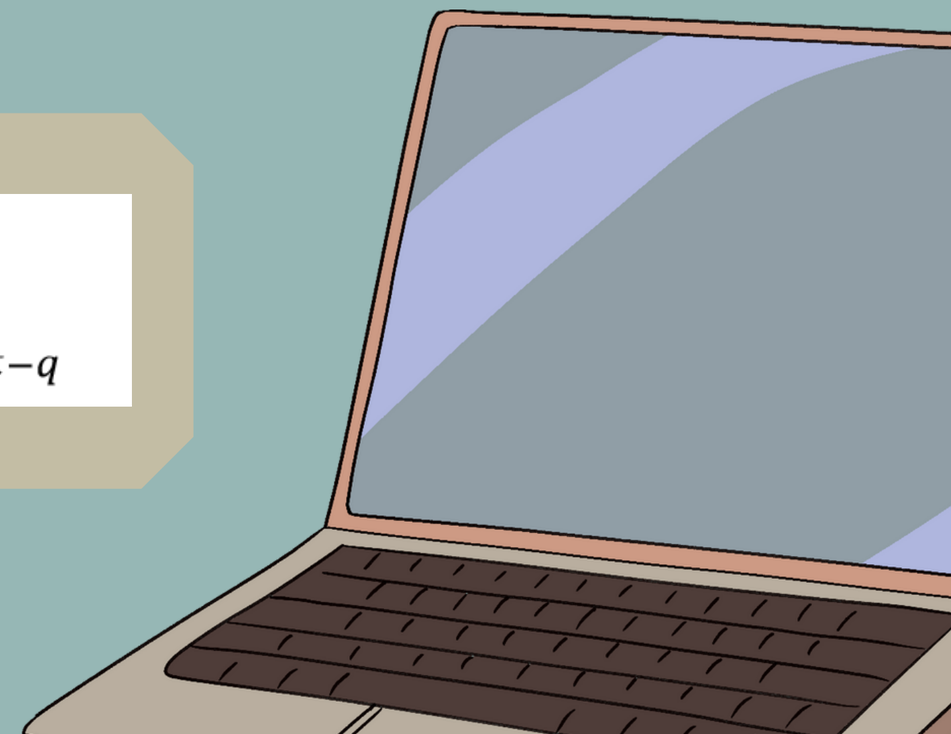
of ARIMA Model

LITERATURE REVIEW

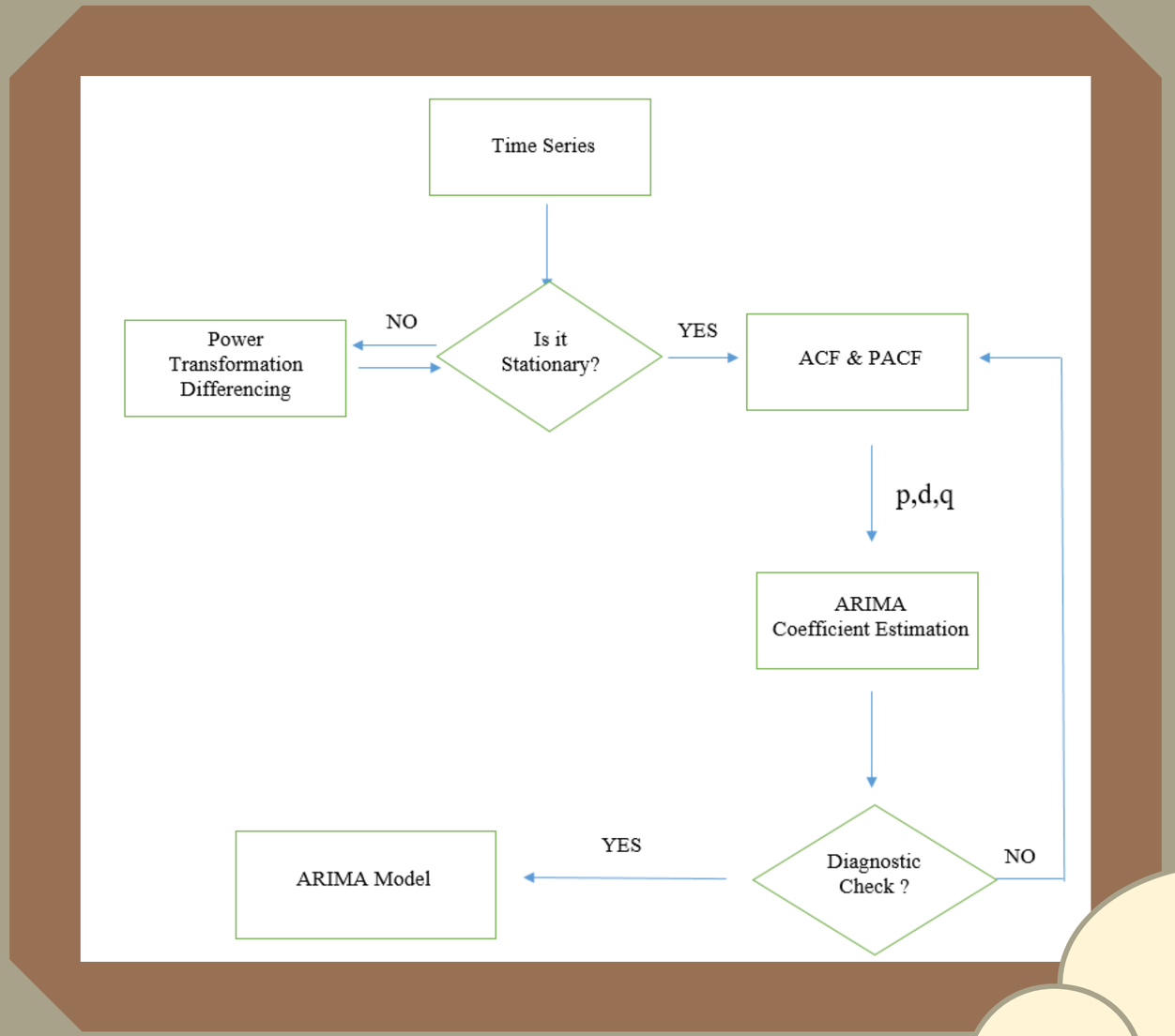
- ARIMA or widely known as Box-Jenkins method produces forecast based on synthesis patterns historical data. ARIMA uses values of dependent variable to produce accurate short-term forecast.
- ARIMA Mathematical Equation defined as

$$W_t = \Delta^d Y_t$$

$$Y_t = \phi_1 Y_{t-1} + \cdots + \phi_p Y_{t-p} + e_t - \theta_1 e_{t-1} - \cdots - \theta_q e_{t-q}$$

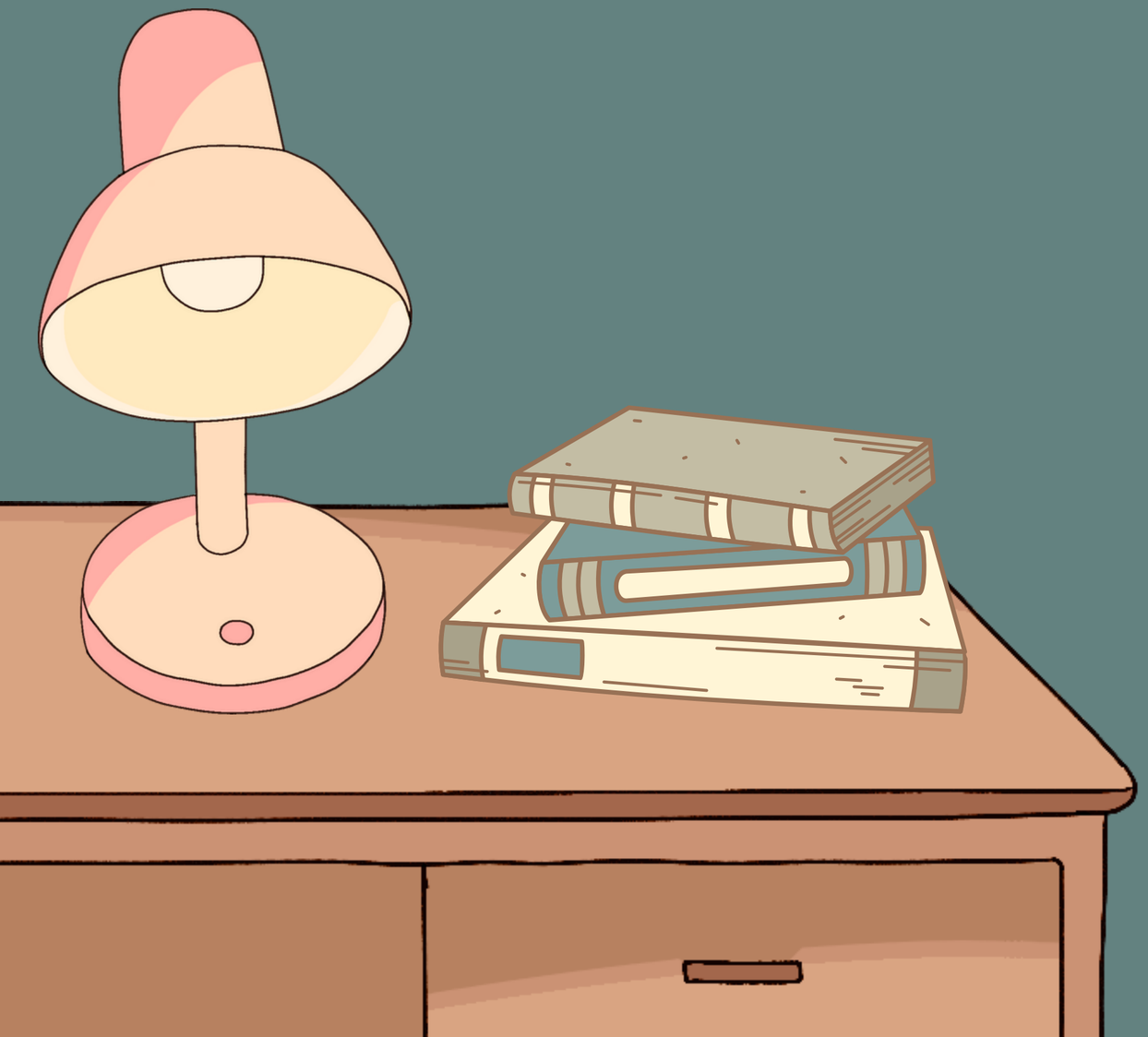


BOX-JENKINS METHOD



ANALYSIS & RESULT

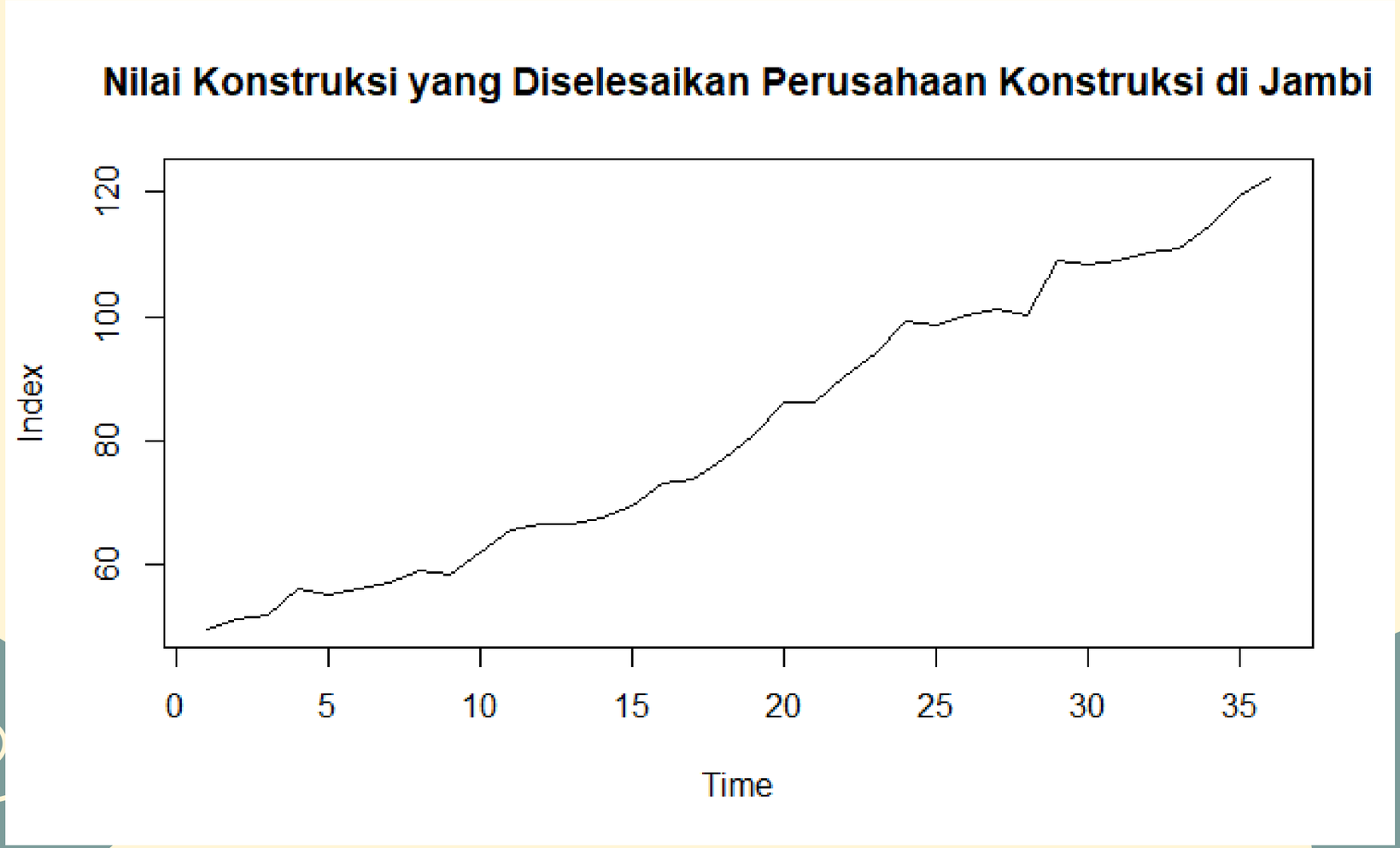
DATA PREPARATION



Year	Month	Data
2010	Januari-Maret	49.59
	April-Juni	51.02
	Juli-September	51.86
	Oktober-Desember	56.04
2011	Januari-Maret	54.93
	April-Juni	56.11
	Juli-September	57.07
	Oktober-Desember	58.9
2012	Januari-Maret	58.45
	April-Juni	61.77
	Juli-September	65.4
	Oktober-Desember	66.5
2013	Januari-Maret	66.37
	April-Juni	67.37
	Juli-September	69.5
	Oktober-Desember	73.17
2014	Januari-Maret	73.73
	April-Juni	76.82
	Juli-September	80.9
	Oktober-Desember	86.1
2015	Januari-Maret	86.16
	April-Juni	90.37
	Juli-September	94.04
	Oktober-Desember	99.36
2016	Januari-Maret	98.63
	April-Juni	100.21
	Juli-September	101.02
	Oktober-Desember	100.15
2017	Januari-Maret	108.96
	April-Juni	108.44
	Juli-September	108.96
	Oktober-Desember	110.37
2018	Januari-Maret	110.9
	April-Juni	114.67
	Juli-September	119.45
	Oktober-Desember	122.38

DATA PREPARATION

Time Series plot from the data:



STATIONARY CHECK

Stationary check using Augmented-Dickey-Fuller (ADF) test.

```
> adf.test(data_konstruksi$Data)

        Augmented Dickey-Fuller Test

data:  data_konstruksi$Data
Dickey-Fuller = -2.5601, Lag order = 3, p-value = 0.3552
alternative hypothesis: stationary
```

Result:
p-value = 0.3552

because p-value>0.05, it means the data is not stationer

STASIONARY CHECK

-DIFFERENCING-

1

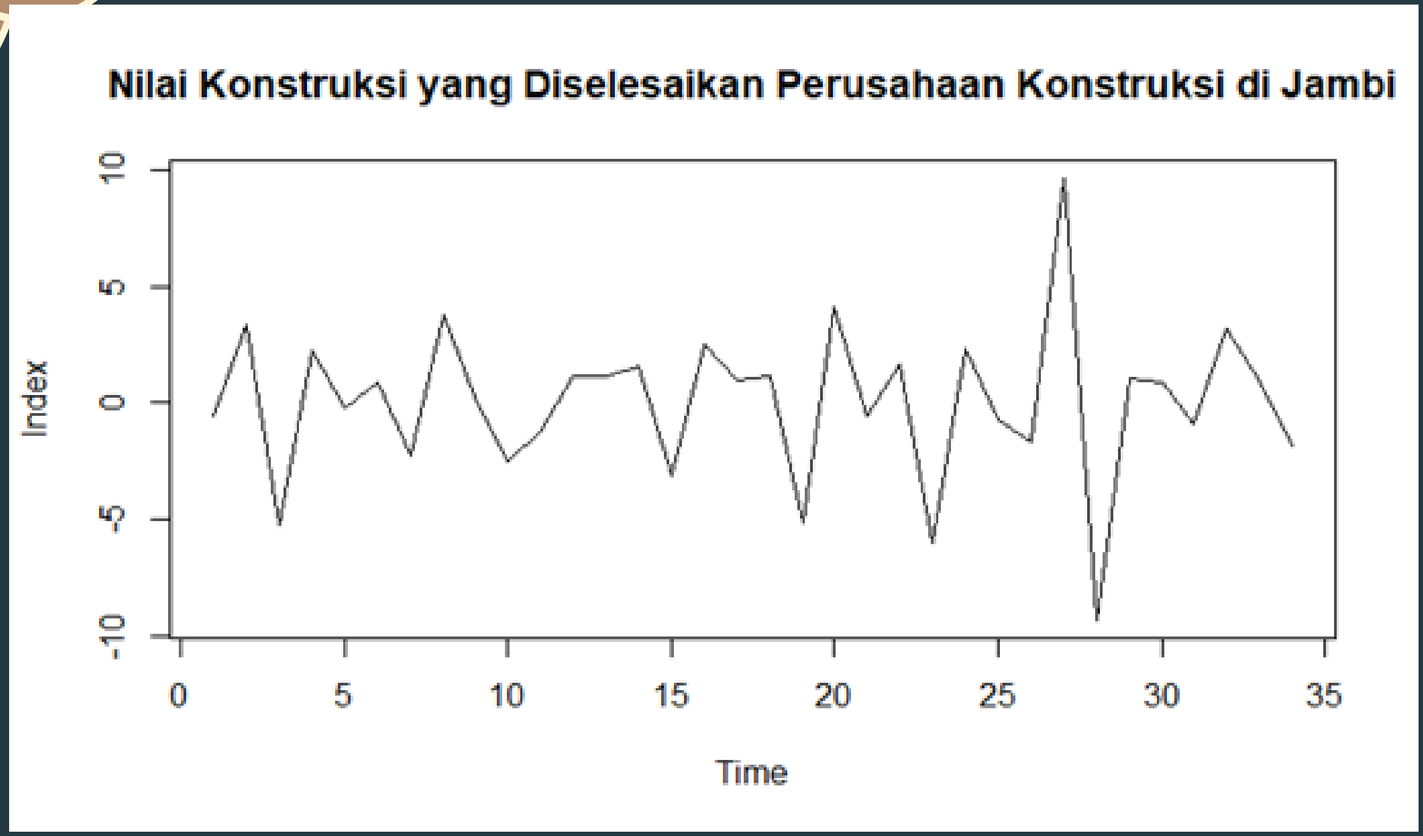
```
> diff1=diff(data_konstruksi$Data)
> adf.test(diff1)

        Augmented Dickey-Fuller Test

data:  diff1
Dickey-Fuller = -3.2147, Lag order = 3, p-value = 0.1014
alternative hypothesis: stationary
```

not stationary

2

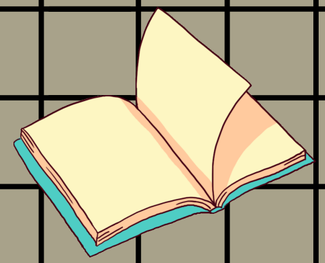
```
> diff2=diff(diff1)
> adf.test(diff2)

        Augmented Dickey-Fuller Test

data:  diff2
Dickey-Fuller = -5.074, Lag order = 3, p-value = 0.01
alternative hypothesis: stationary

Warning message:
In adf.test(diff2) : p-value smaller than printed p-value
```

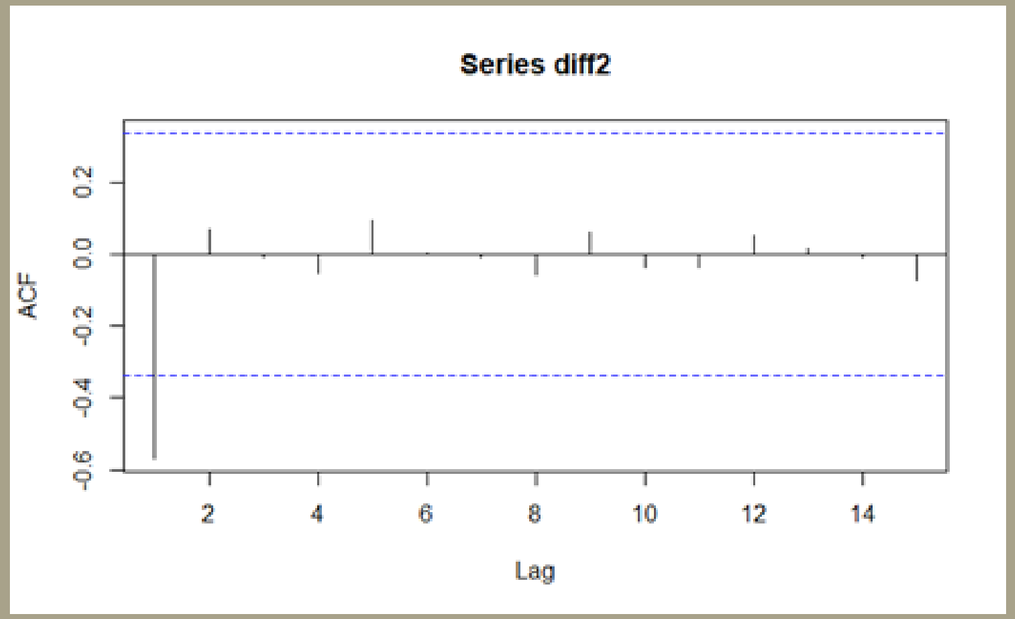
Stationer



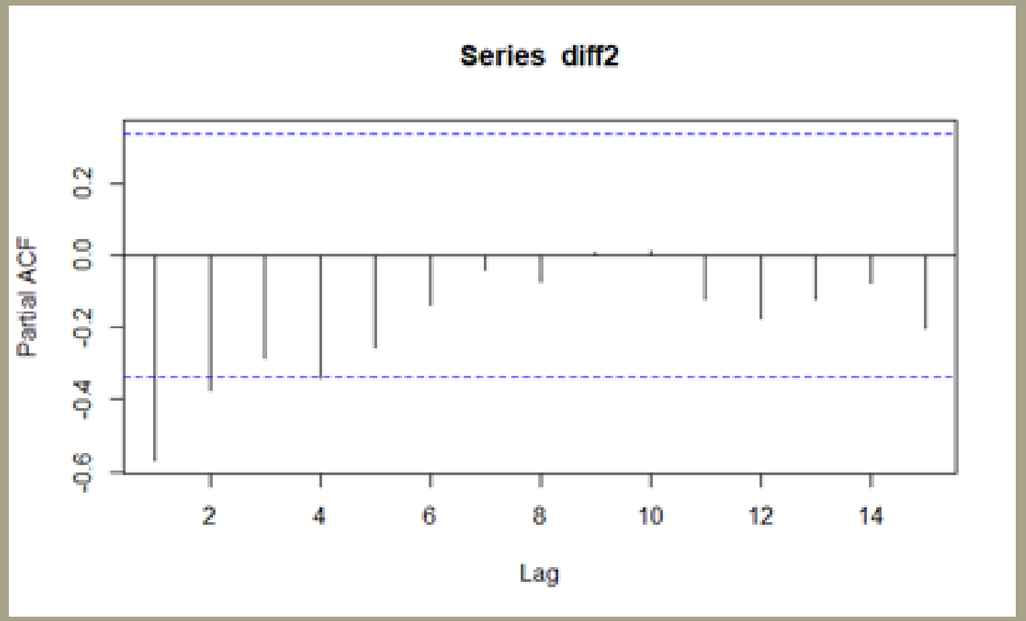
PLOT AFTER DIFFERENCING

MODEL SPESIFICATION





q = 1



p = 2

MODEL SPESIFICATION

Model ARIMA	p	d	q
ARIMA(2,2,1)	2	2	1
ARIMA(1,2,1)	1	2	1
ARIMA(0,2,1)	0	2	1
ARIMA(2,2,0)	2	2	0
ARIMA(1,2,0)	1	2	0
ARIMA(0,2,0)	0	2	0

PARAMETER ESTIMATION

Model ARIMA	Coefficient Estimation Result					
	AR1	AR2	MA1	MSE	Log Likelihood	AIC
ARIMA(2,2,1)	-0.1897	-0.0702	-0.9351	4.823	-76.26	158.52
ARIMA(1,2,1)	-0.1658		-0.9520	4.826	-76.33	156.66
ARIMA(0,2,1)			-1.0000	4.822	-76.76	155.23
ARIMA(2,2,0)	-0.7675	-0.3647		6.584	-80.61	165.23
ARIMA(1,2,0)	-0.5565			7.68	-83.09	168.17
ARIMA(0,2,0)				11.37	-89.57	179.14

- DIAGNOSTIC TEST -

Saphiro & Ljung-Box Test

Model ARIMA	Saphiro Test	Ljung Test	AIC
ARIMA(2,2,1)	0.2074	0.7006	158.52
ARIMA(1,2,1)	0.1881	0.667	156.66
ARIMA(0,2,1)	0.09197	0.1864	155.23
ARIMA(2,2,0)	0.1929	0.4627	165.23
ARIMA(1,2,0)	0.07487	0.1608	168.17
ARIMA(0,2,0)	0.06348	0.0003891	179.14

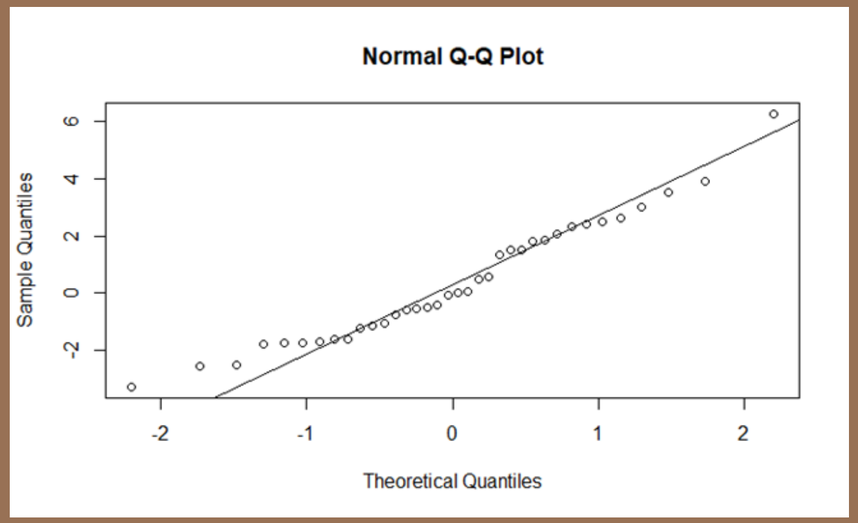
p-value must be greater than 0.05

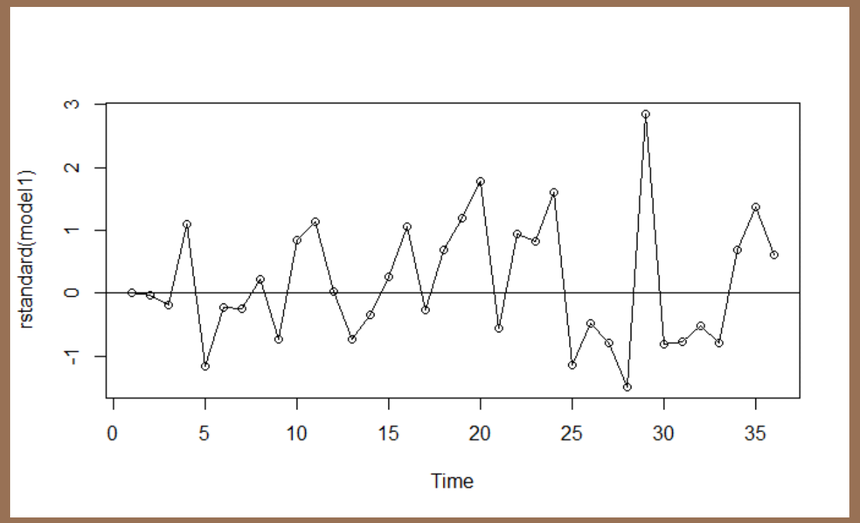
ARIMA(2,2,1)

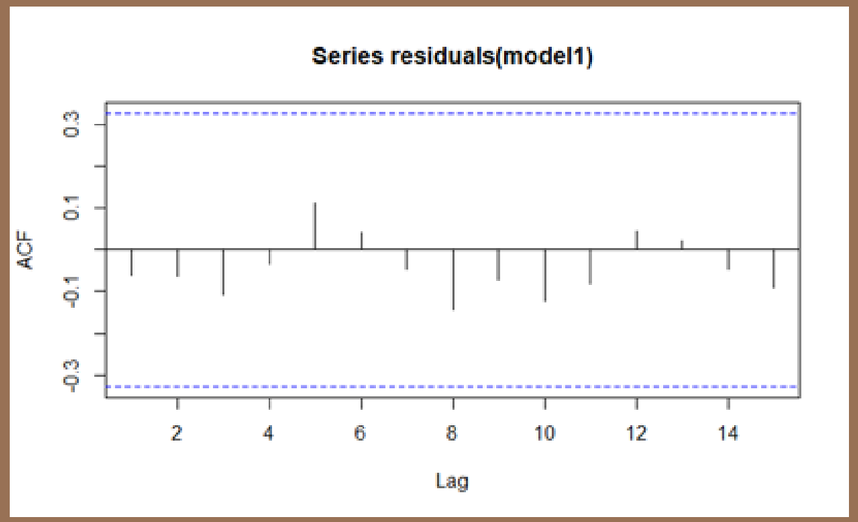
$$Y_t = -0.1897Y_{t-1} - 0.0702Y_{t-2} + e_t + 0.9351e_{t-1}$$

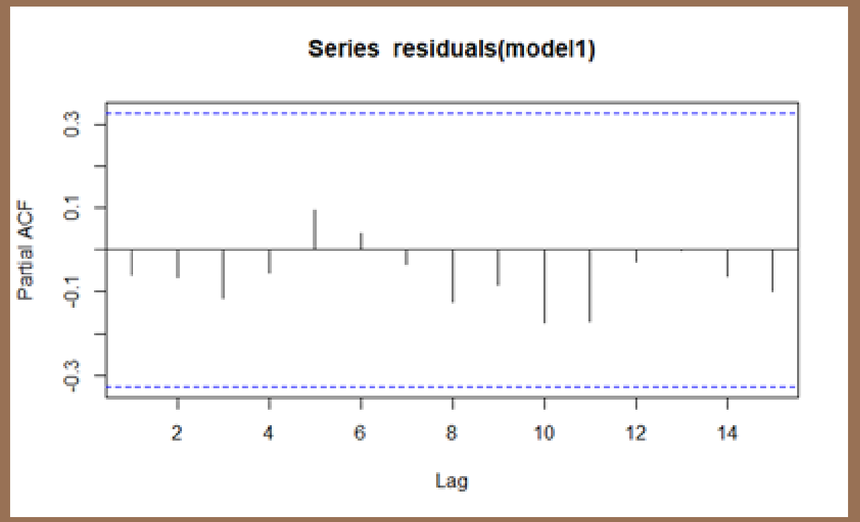
- DIAGNOSTIC TEST -

Plot of ARIMA (2,2,1)

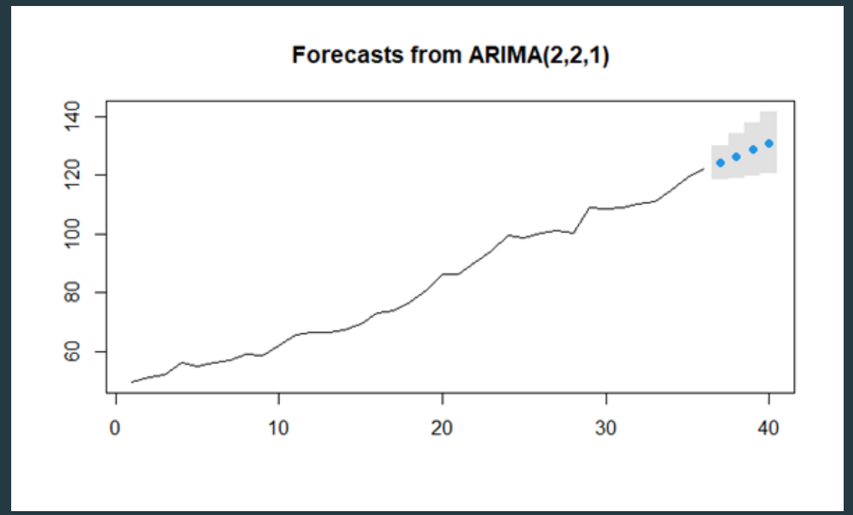








- FORECASTING -



Point Forecast	Lo 99	Hi 99
124.3147	118.6544	129.9751
126.5682	119.0422	134.0942
128.8311	119.7577	137.9045
131.0698	120.4756	141.6641

Forecasting values are for the next 4 Quarters from January 2019 to December 2019 with 99% confident levels

- COMPARISON -

Year	Month	Point Forecast	Actual Data	Lower Bound	Upper Bound
2019	Januari-Maret	124.3174	119.90	118.6544	129.9751
	April-Juni	126.5682	123.26	119.0422	134.0942
	Juli-September	128.8311	126.35	119.7577	137.9045
	Oktober-Desember	131.0698	129.37	120.4756	141.6641

- ERROR CALCULATION -

ARIMA(2,2,1)				
Predicted Data	**Actual Data**	**(y'-y)^2**	**|y'-y|**	**|y'-y|/yi*100%**
124,3174	119,9	19,5134	4,4174	3,68%
126,5682	123,26	10,9442	3,3082	2,68%
128,8311	126,35	6,1559	2,4811	1,96%
131,0698	129,37	2,8893	1,6998	1,31%
Total		**39,5028**	**11,9065**	
	MSE	**9,8757**		
Error	**RMSE**	**3,1426**		
	MAE	**6,8991**		
	MAPE	**9,65%**		

CONCLUSION

- The results of the analysis for the construction value index forecasting completed by construction companies in Jambi province from 2010 to 2018 using the ARIMA(2,2,1) model ranged from 124 to 131 with a 99% confidence interval.

- Forecasting using ARIMA model is quite accurate for the short term. This can be seen from the comparison of the predicted data with the actual data which is not much different and is still in the interval.

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