

FORECASTING PRESENTATION

STAT8040 - 23F - Sec1 - Statistical Forecasting

Analysis by:

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AGENDA

- Introduction
- Overview of Data
- Visualization of Data
- Transformation of Data
- Forecasting and Analysis of Data
- Summary



INTRODUCTION



- The U.S. Industrial Production (IP) Index is an important measure that explains the actual output of various businesses in the United States, regardless of who owns them.
- In this presentation, we are going to analyze industrial production using some common statistical forecasting techniques.
- We are also going to answer the following questions:
 - how the industrial production has changed over time?
 - how the industrial production will continue?
 - which is the best model to produce forecasts?

DATA OVERVIEW

Dataset: Total Industrial production recorded from 1919 to 2023.

Variables: The dataset contains two variables: Date and INDPRO that explains the Industrial production over a period of around 104 years.

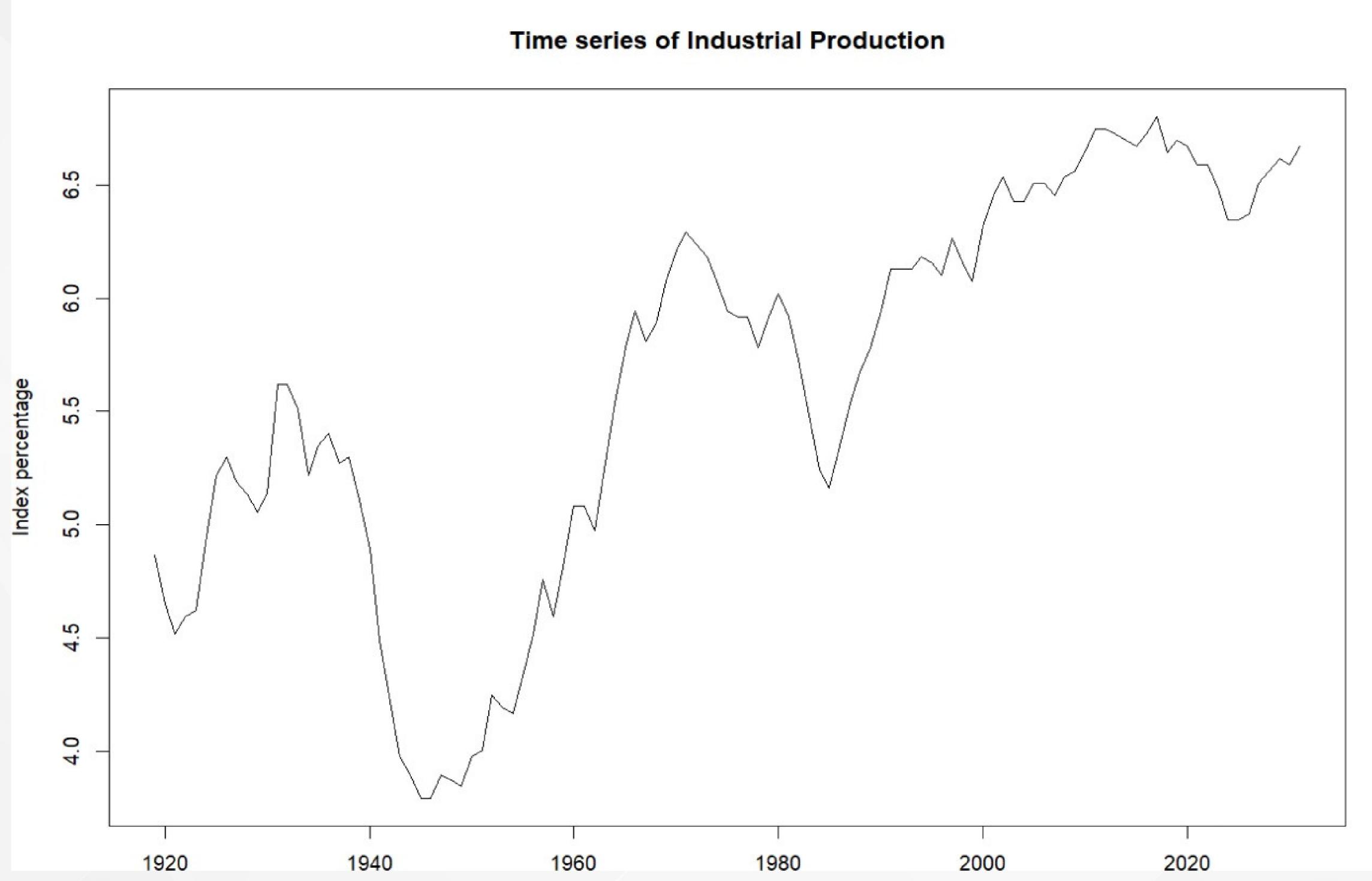
Total of 1257 rows, identifying the industrial production recorded each month.

Link: [FRED - INDPRO](#)

DATE	INDPRO
1919-01-01	4.8665
1919-02-01	4.6514
1919-03-01	4.517
1919-04-01	4.5976
1919-05-01	4.6245
1919-06-01	4.9203
1919-07-01	5.216
1919-08-01	5.2967
1919-09-01	5.1891
1919-10-01	5.1354



DATA VISUALIZATIONS

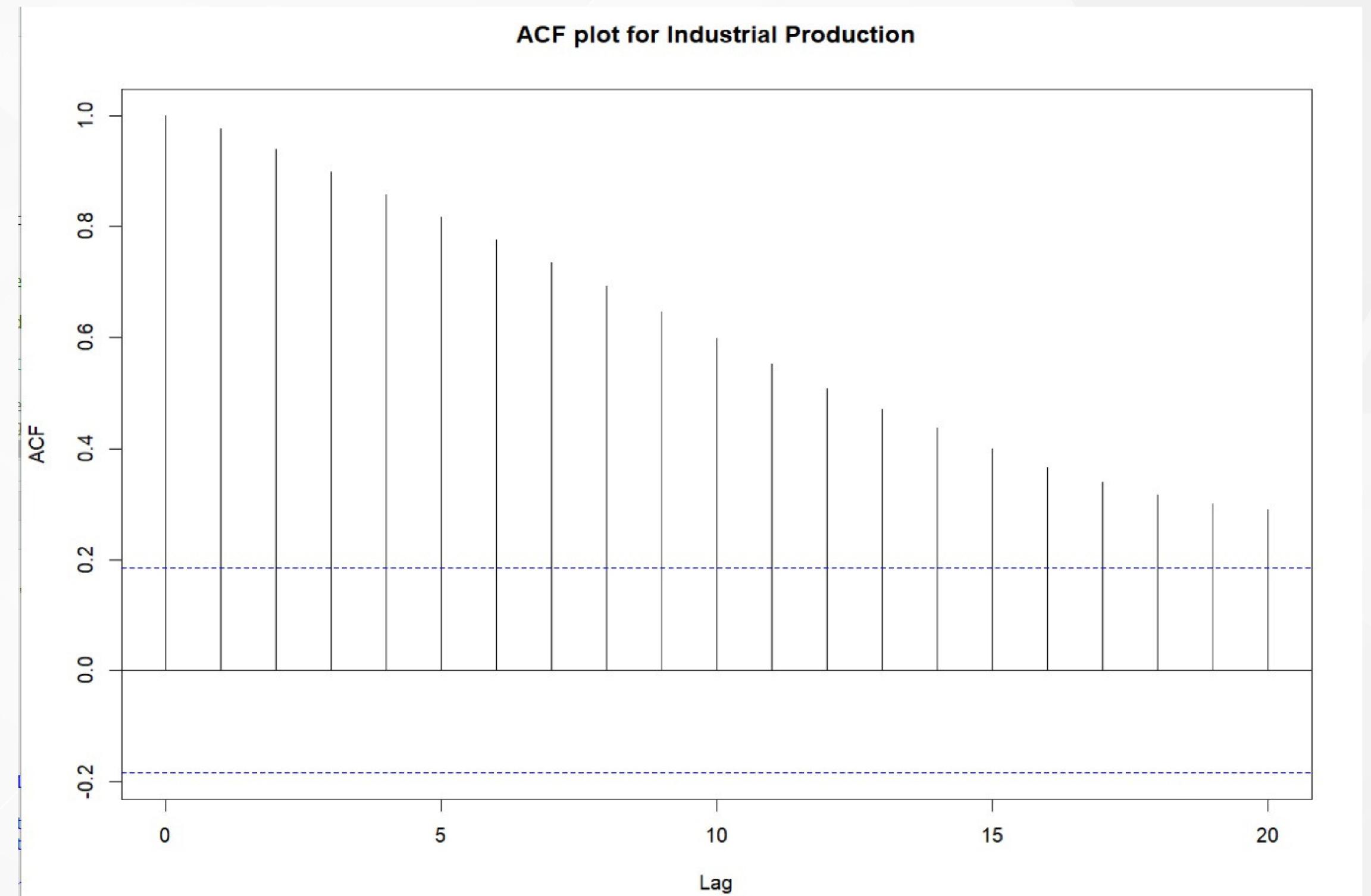


TIME SERIES GRAPH

- The Time series graph shows the trend of industrial production from the 1920s to the 2020s.
- Industrial production has increased steadily over time, with a few fluctuations in some periods.
- The most noticeable dips occurred in the 1940s and 1980s, due to the effects of World War II and the global recession, respectively.
- Industrial production reached its highest level in the 2020s

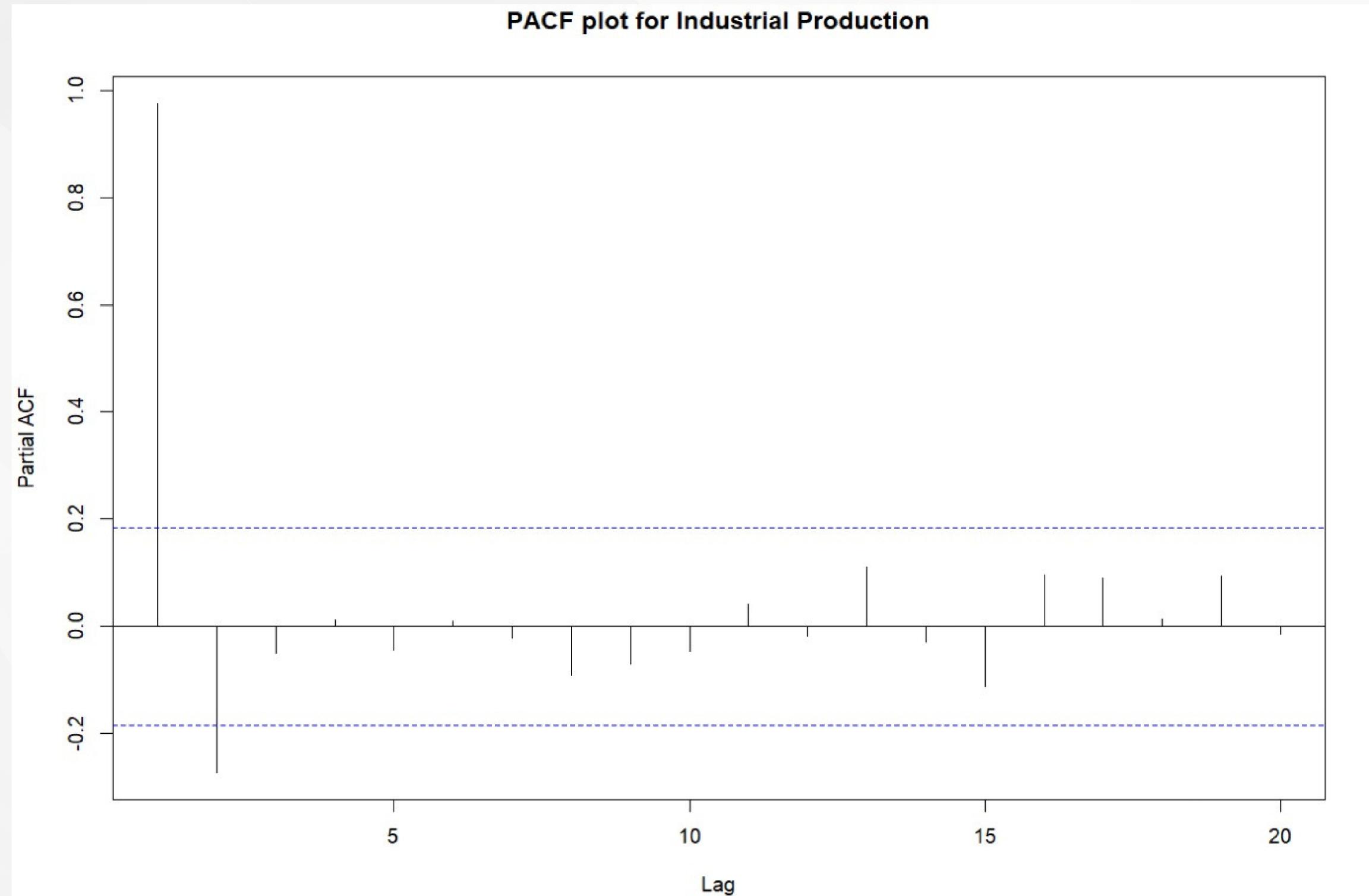
ACF PLOT

- The plot shows that the correlation decreases as the lag increases, which means that the industrial production is more influenced by its recent past than by its distant past.
- The plot also shows that the correlation is positive for all lags, which means that the industrial production tends to move in the same direction over time.

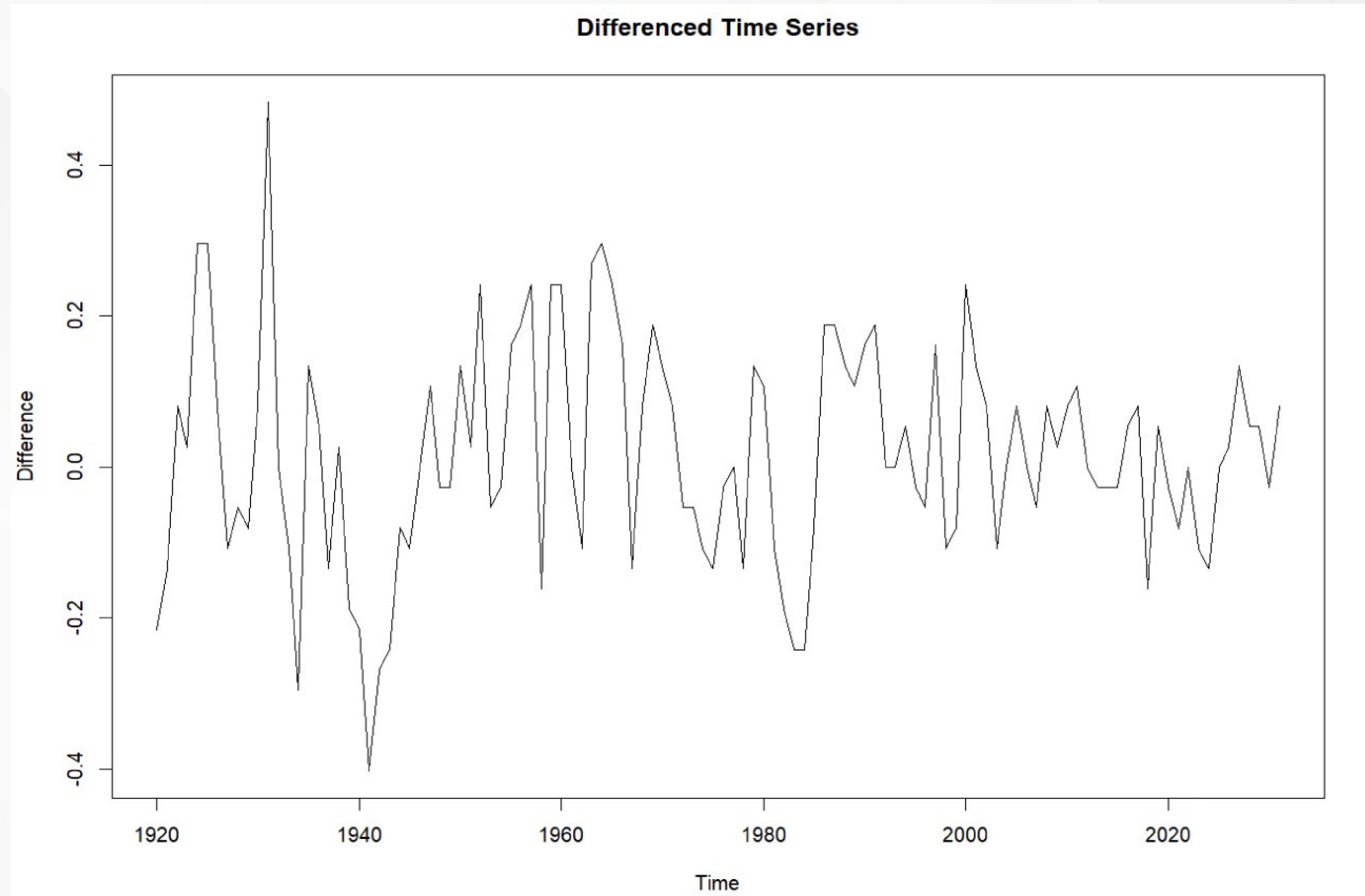


PACF PLOT

- The plot shows that the PACF has a significant positive value at lag 1, which means that the current value of industrial production is strongly correlated with its previous value.
- The plot also shows that the PACF drops to zero after lag 1, which means that the correlation between industrial production and its past values is not significant beyond lag 1.
- This suggests that industrial production follows a simple autoregressive model of order 1, or AR(1).

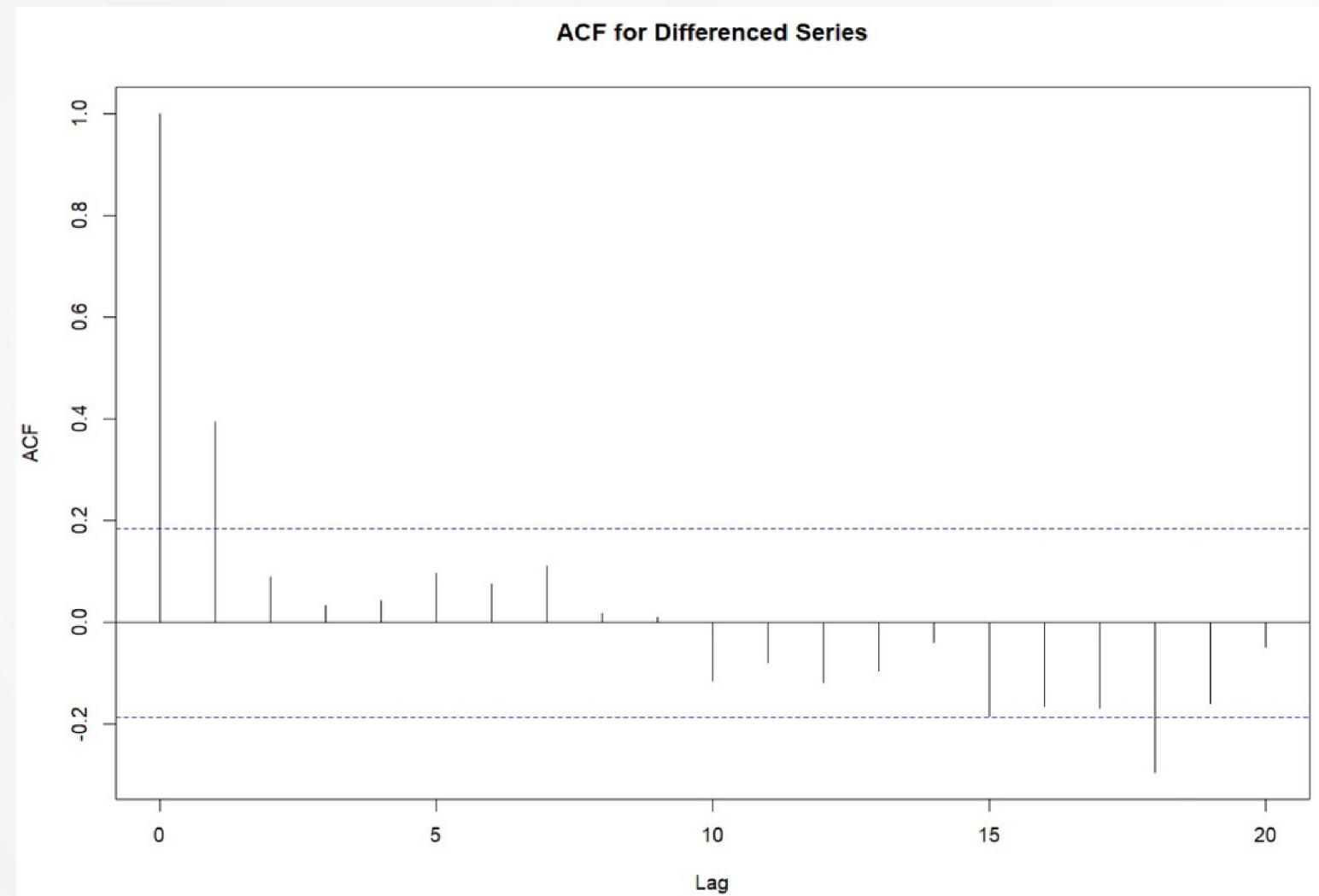


TRANSFORMATIONS

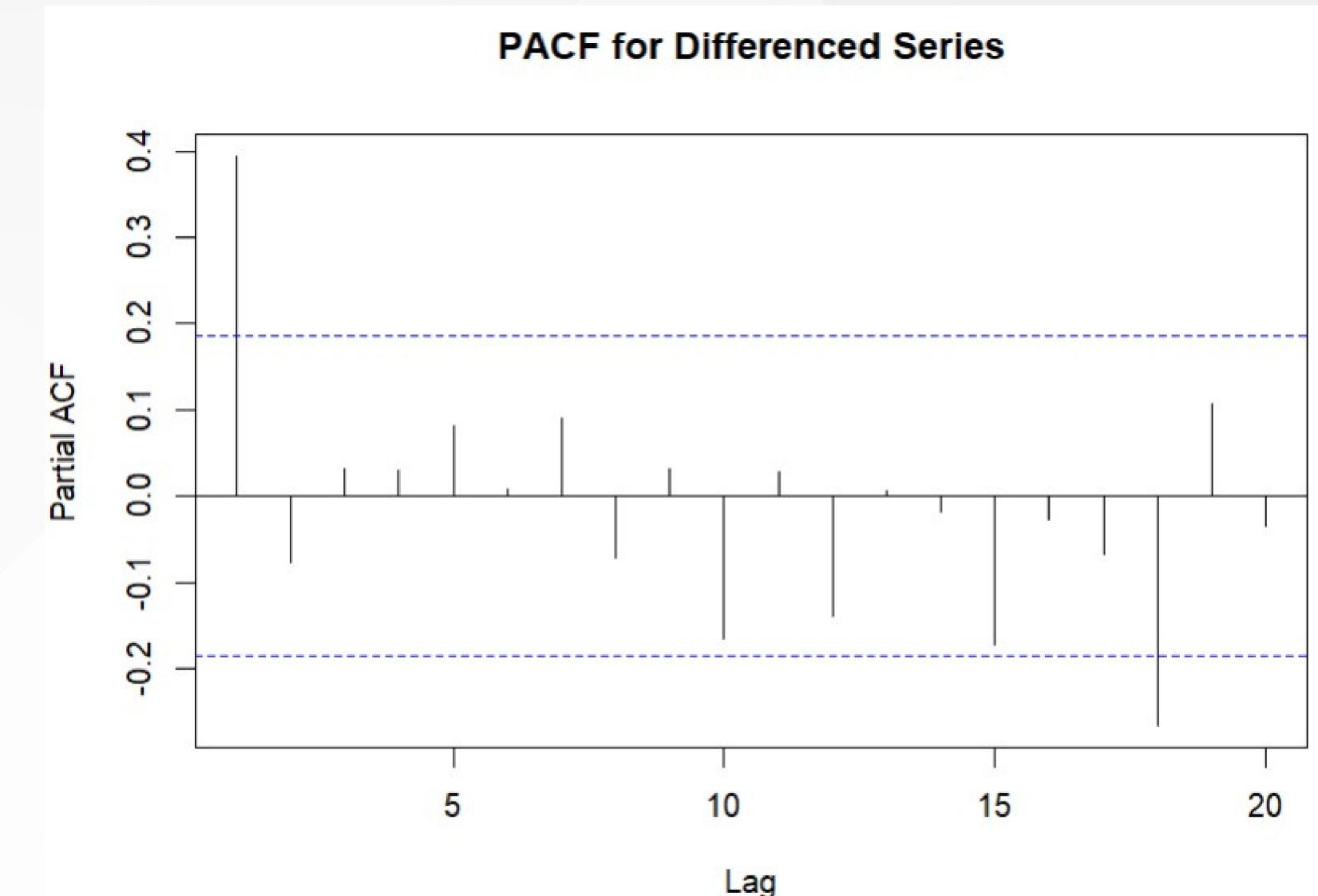


Differenced Time Series

DIFFERENCED TIME SERIES

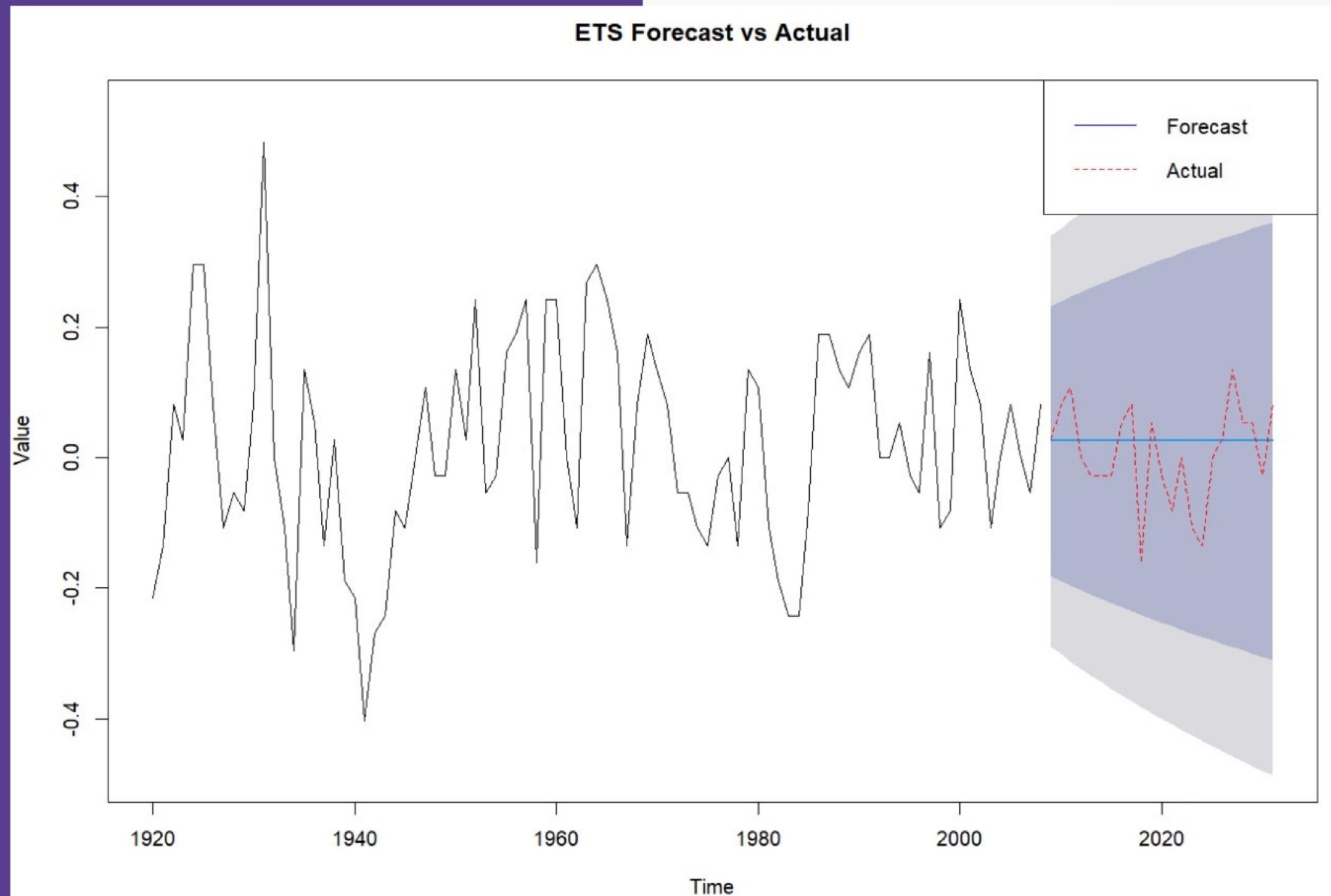


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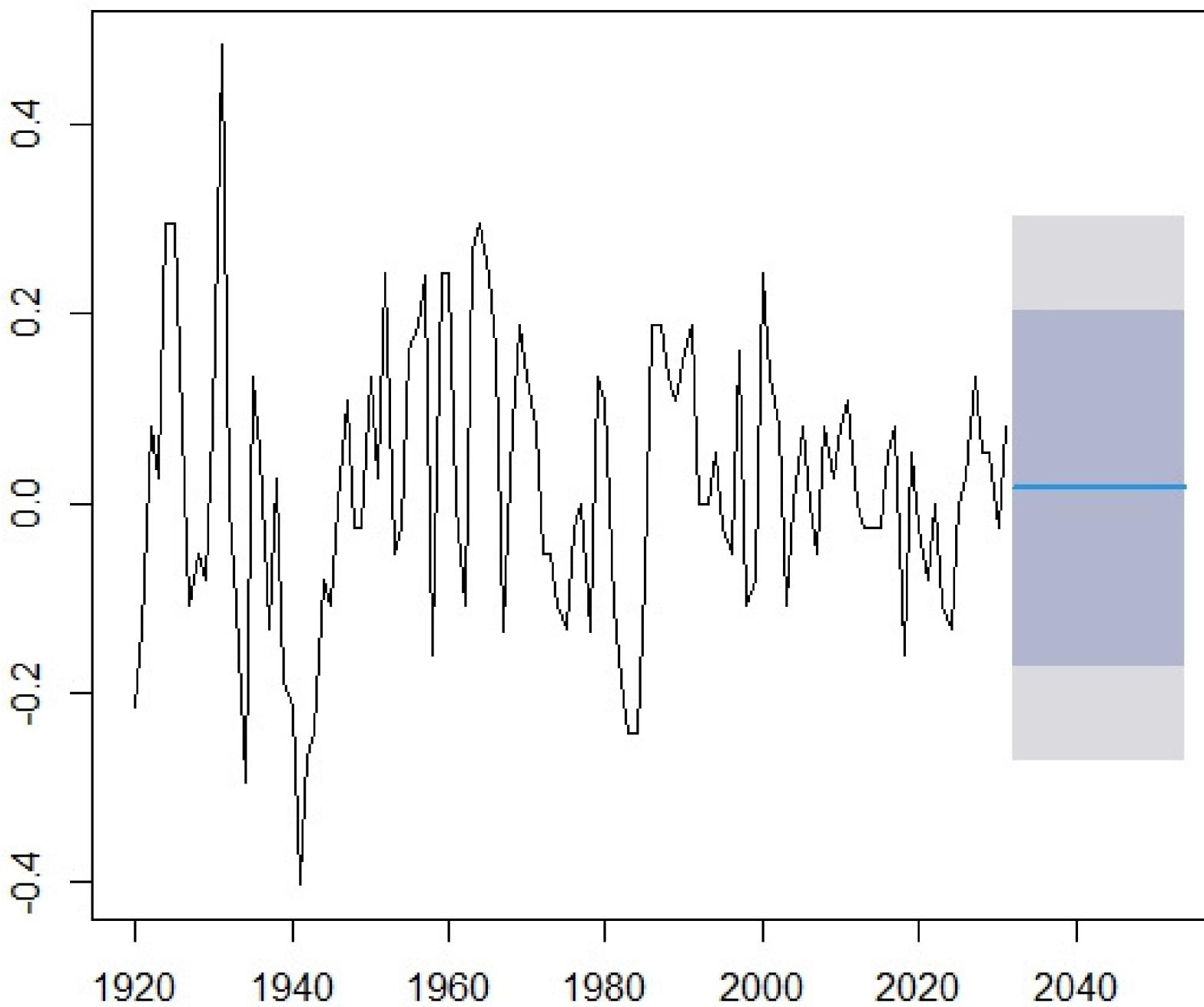
FORECASTING AND ANALYSIS

ETS MODEL

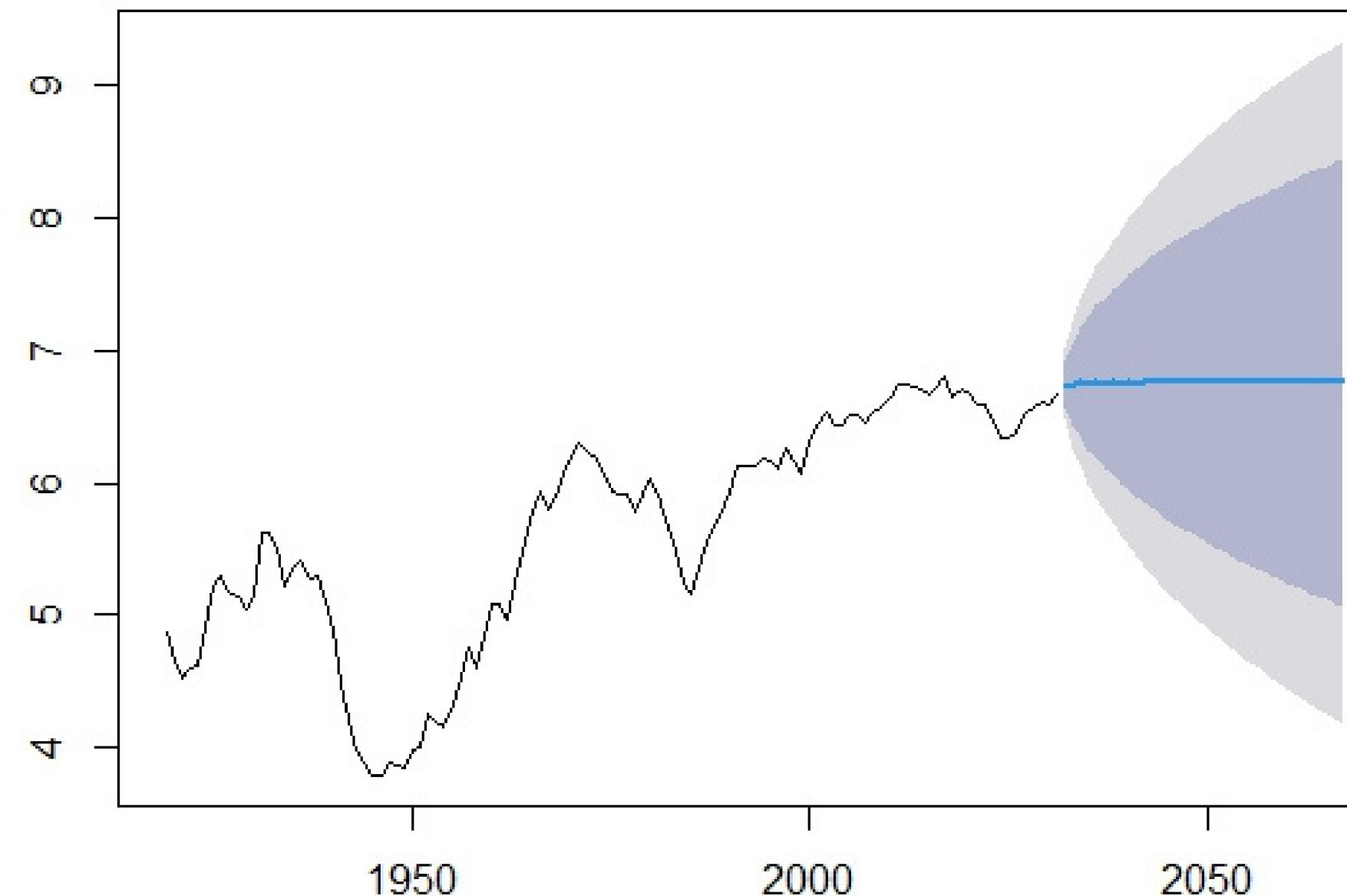


ARIMA MODEL 1

Forecasts from ARIMA(0,0,0) with non-zero mean



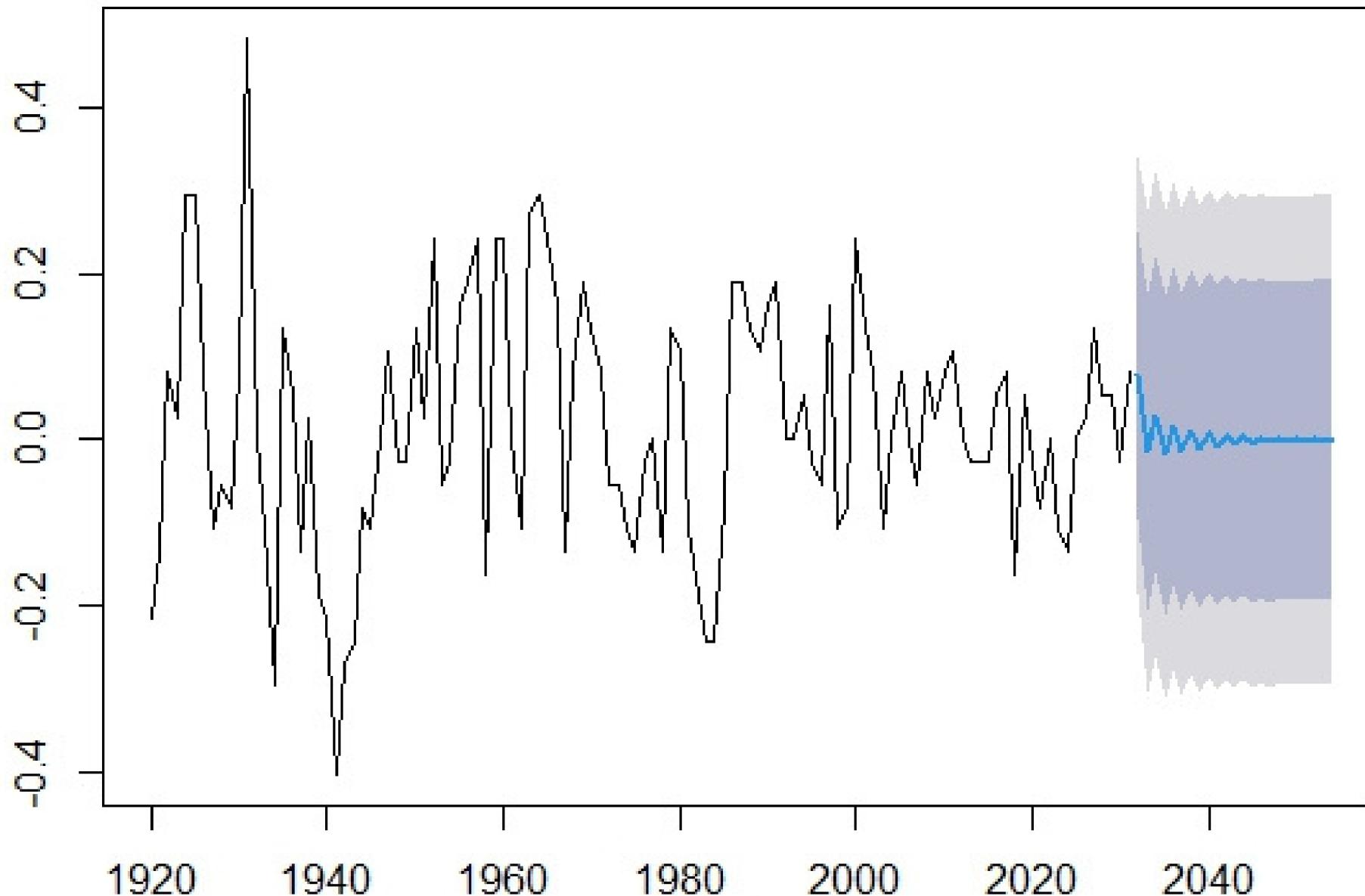
Forecasts from ARIMA(2,1,1)



ARIMA MODEL 2

ARIMA MODEL 3

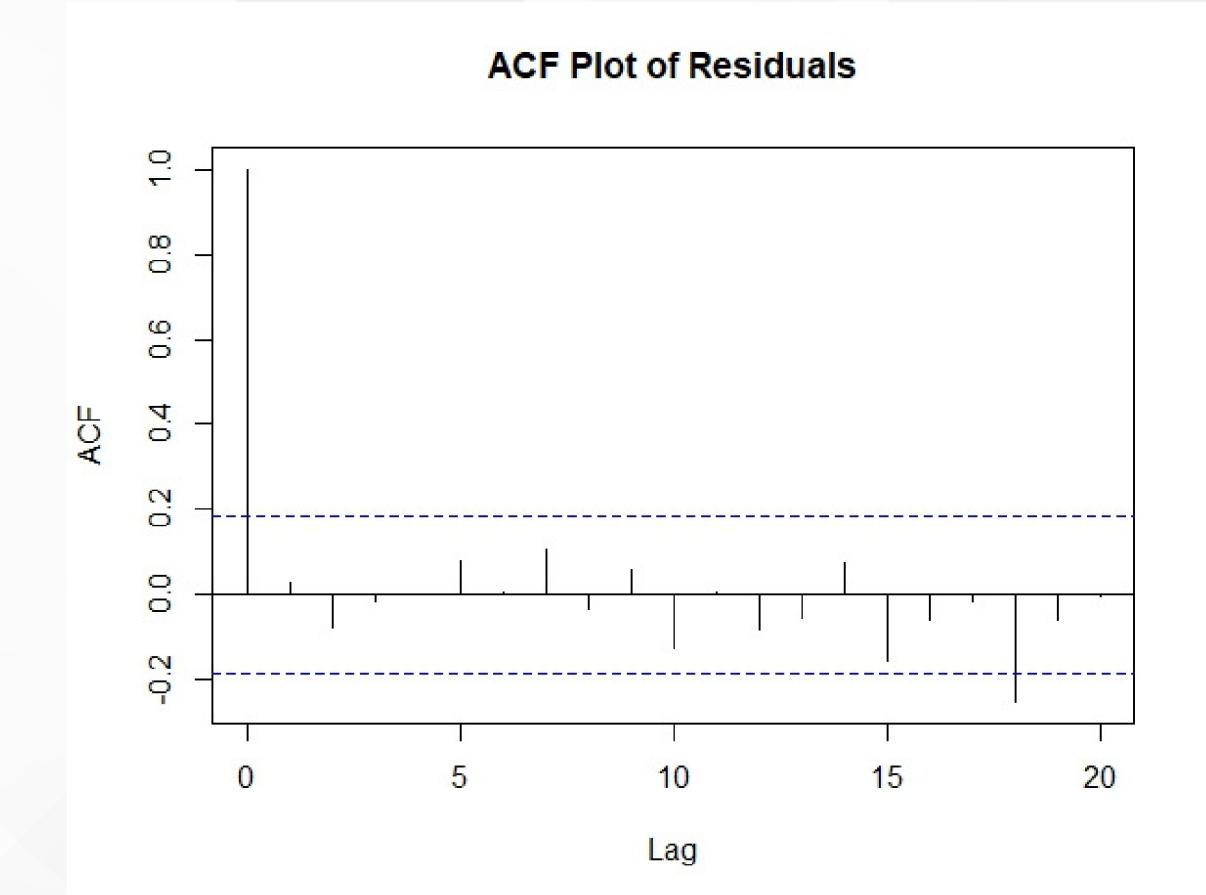
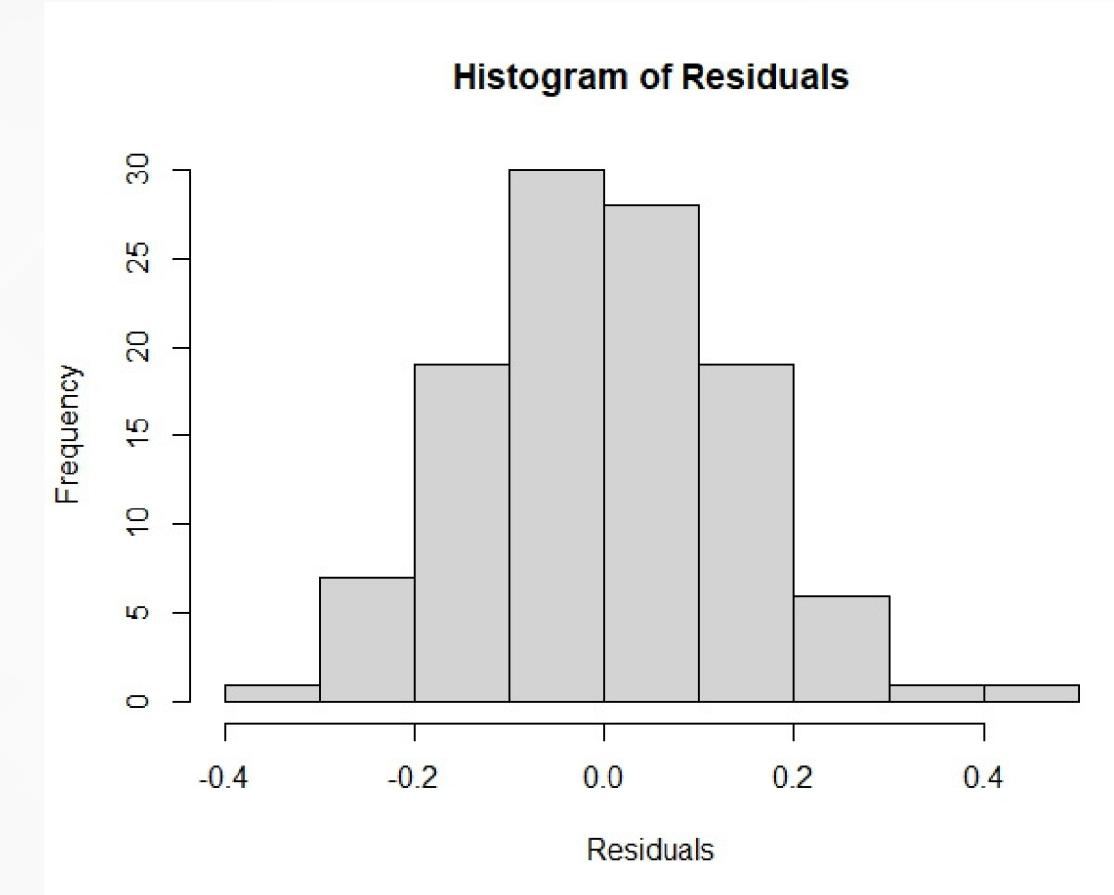
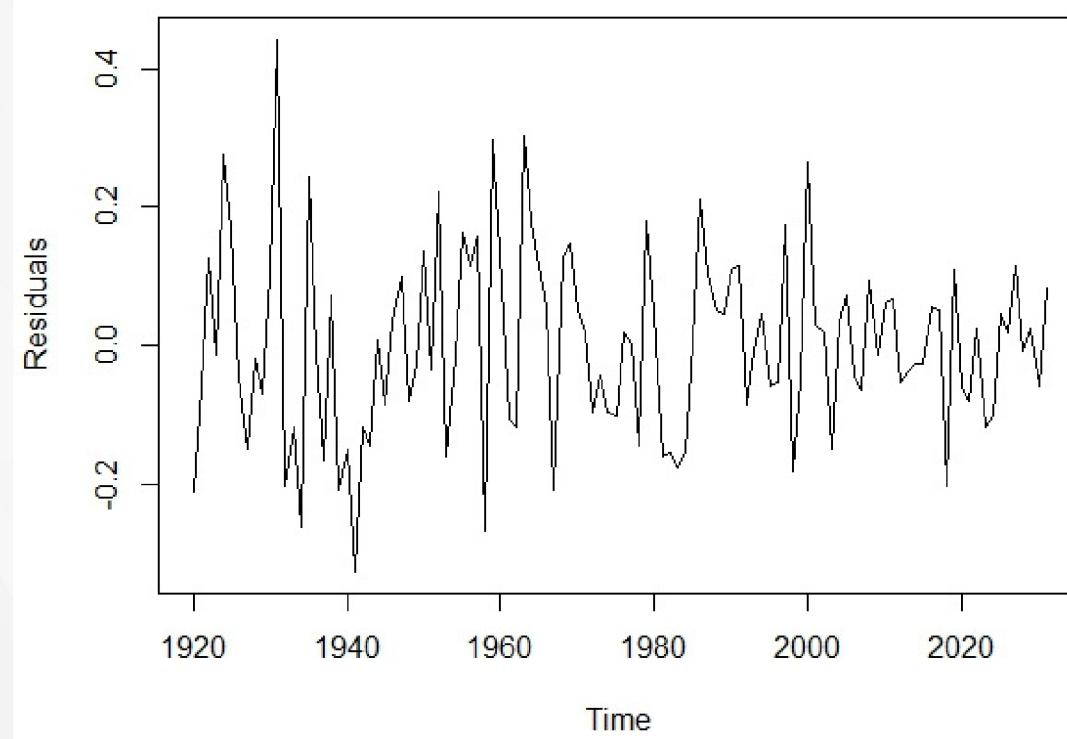
Forecasts from ARIMA(2,0,1) with zero mean



MODEL RESULTS

Model	ME	RMSE	MAE
ETS	-0.0195	0.0769	0.0607
ARIMA(0,0,0)	-0.0102	0.0751	0.0603
ARIMA(1,0,0)	-0.0112	0.0744	0.0599
ARIMA Non-Seasonal	0.0021	0.0739	0.0612
SARIMA	-6.7477	6.7481	6.7477

DIAGNOSTIC PLOTS



SUMMARY

- Industrial Production showcased a significant upward trend, except for two dips that might be influenced by World War II and Economic crisis.
- Converted data from non-stationary to stationary using Differencing.
- We applied ETS and different ARIMA models on the data to forecast industrial production.
- Best forecast turned out to be ARIMA(1,0,0). Diagnostic plots satisfied the assumptions

REFERENCES

- FRED. (2023, November 16). Industrial Production: Total Index. [Data set].
<https://fred.stlouisfed.org/series/CANPRINTO01MLM>



THANK YOU

GOOD LUCK TO THE NEXT GROUP