Time Series Labb 1

Time Series Analysis, Umeå University

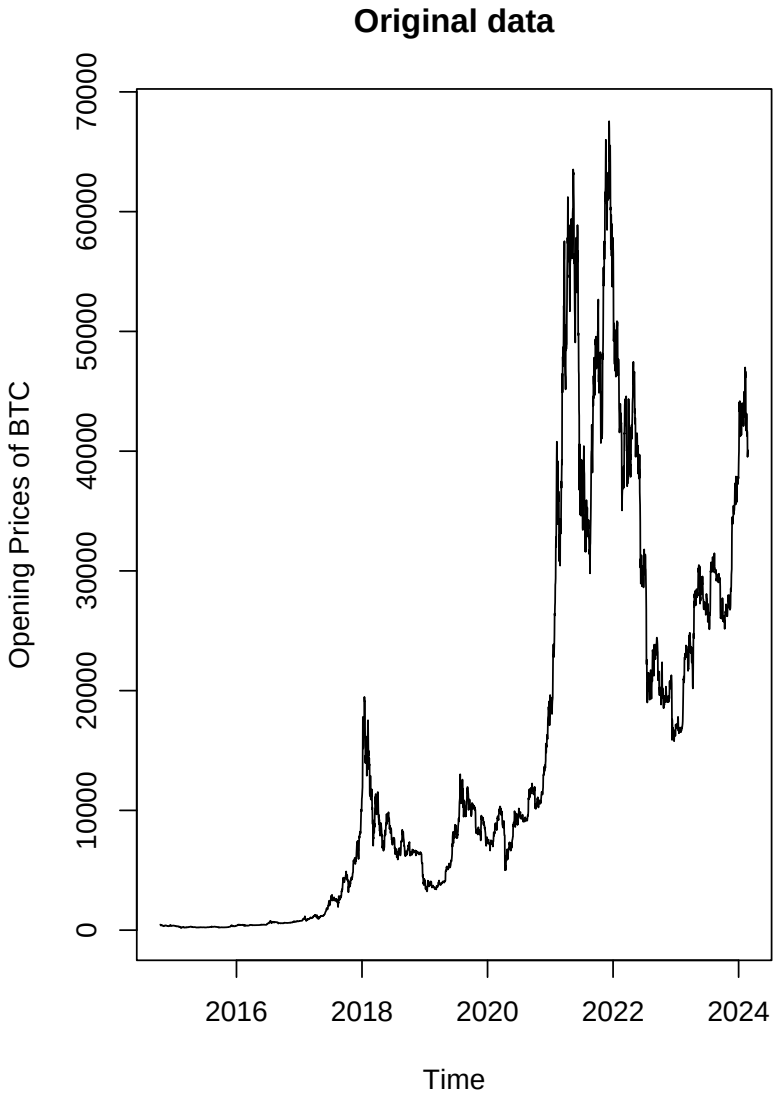
Artem Shiryaev Group 8

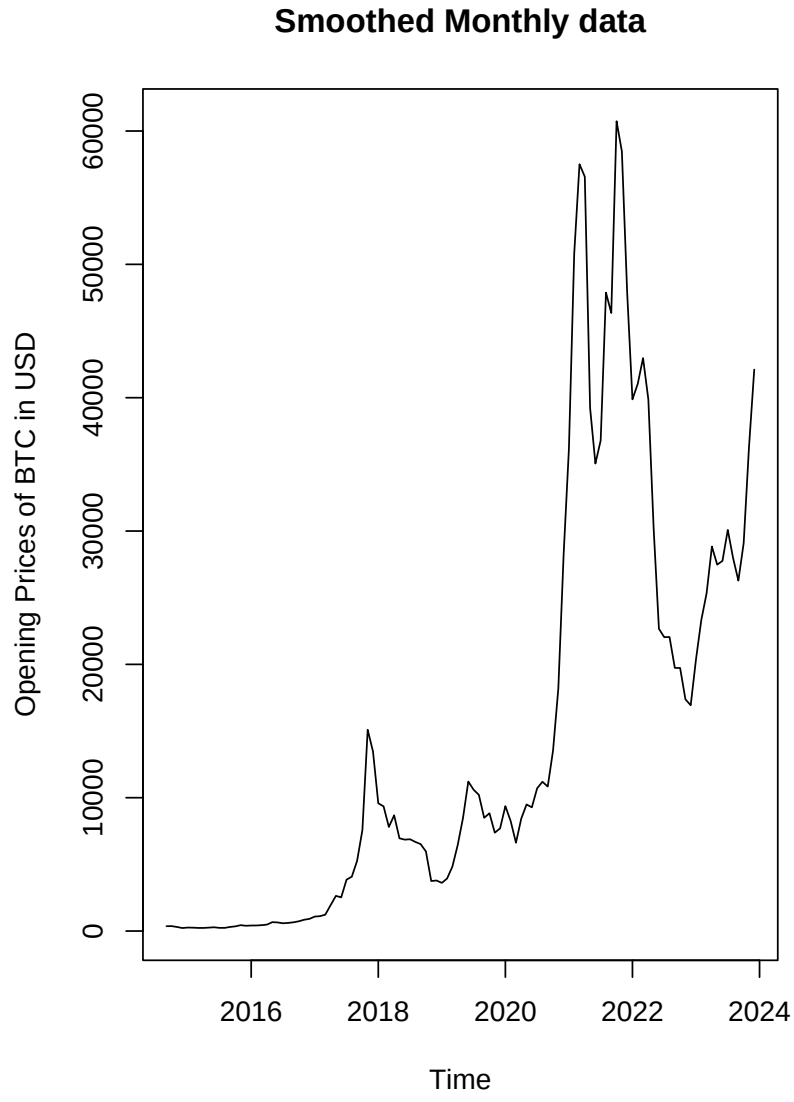
2024-03-15

Problem Forumlation

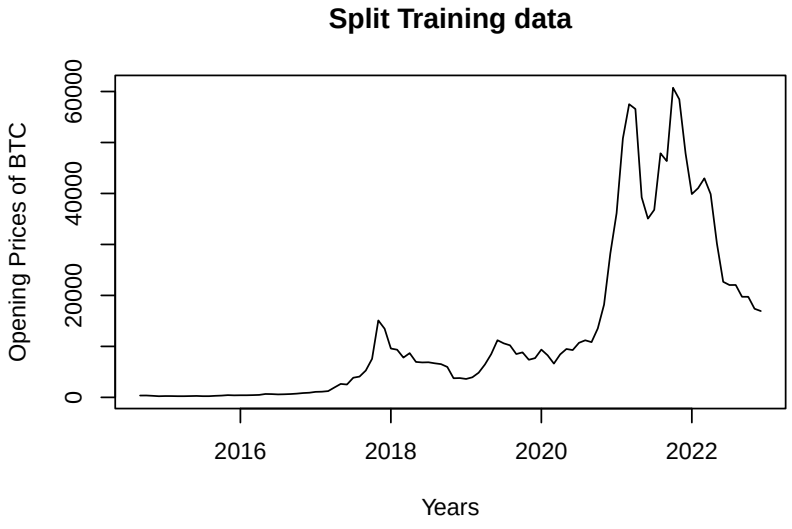
- Time Series Forecasting
- Investment Decision based on Accuracy of Models
- Exploration of data
- Model evaluation

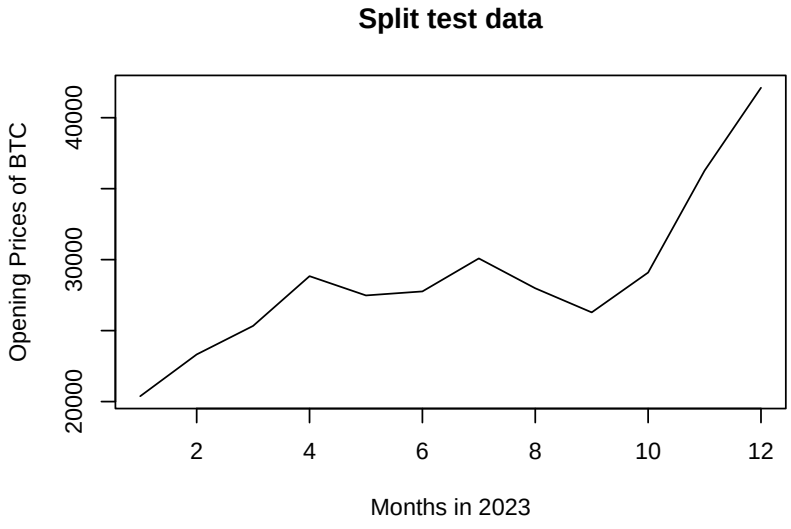
Data Presentation

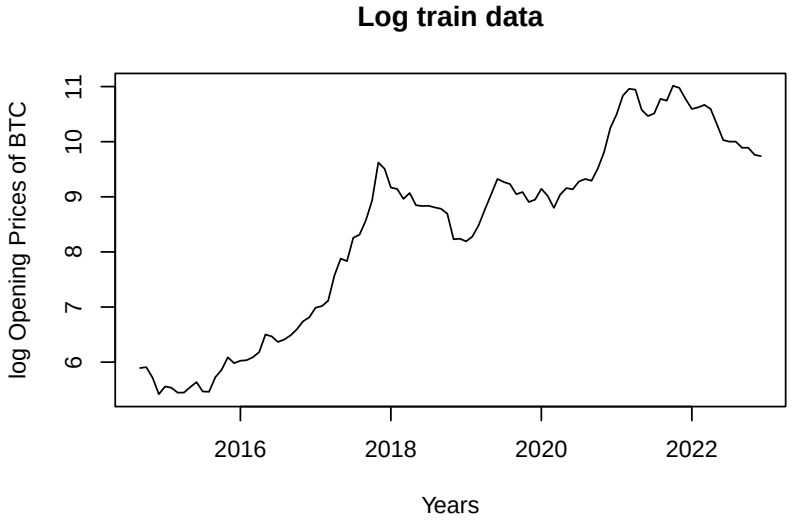


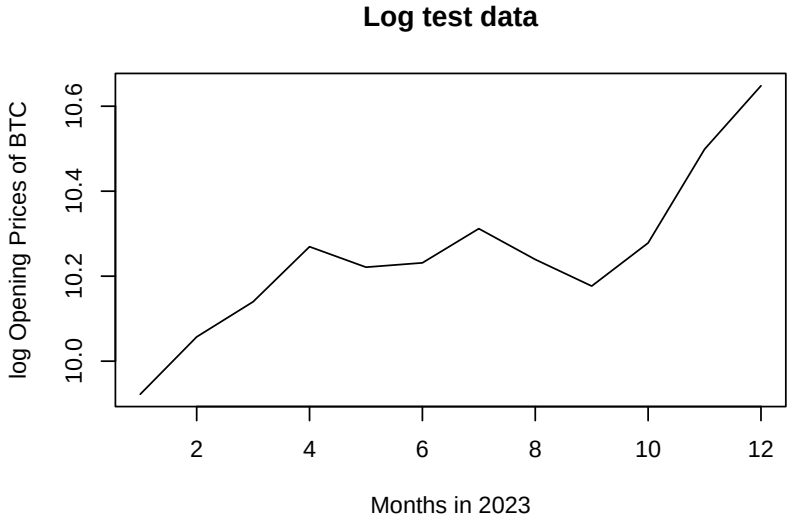


Data Presentation

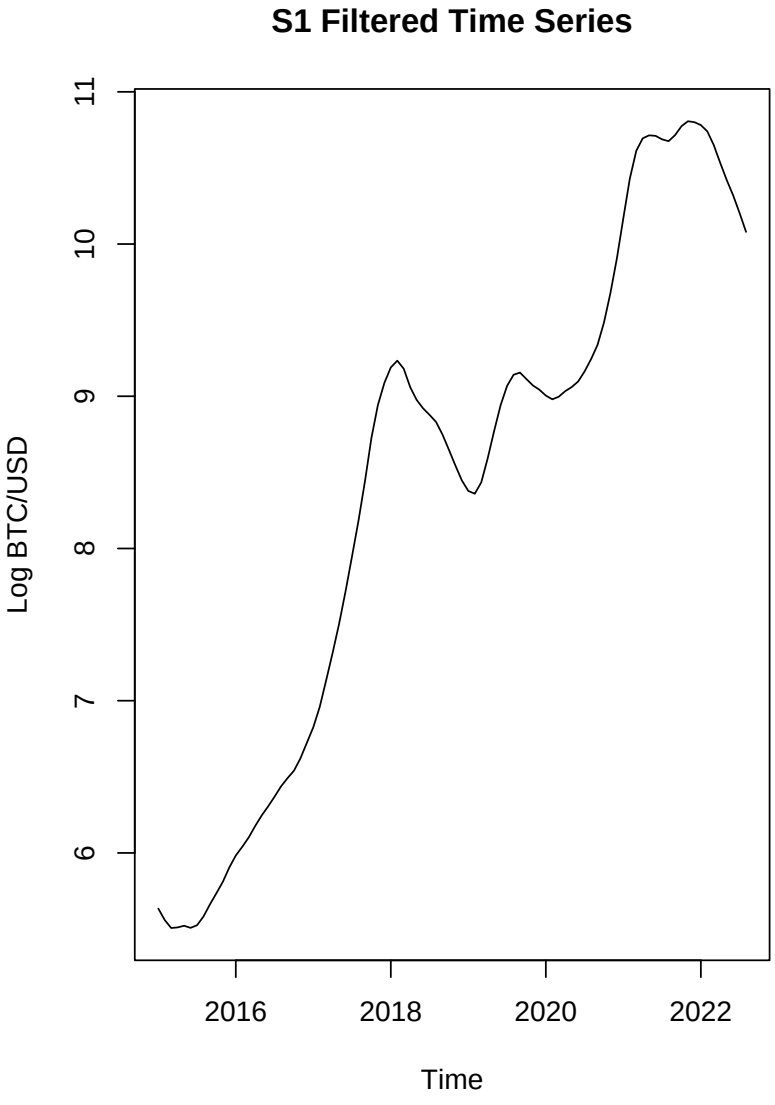


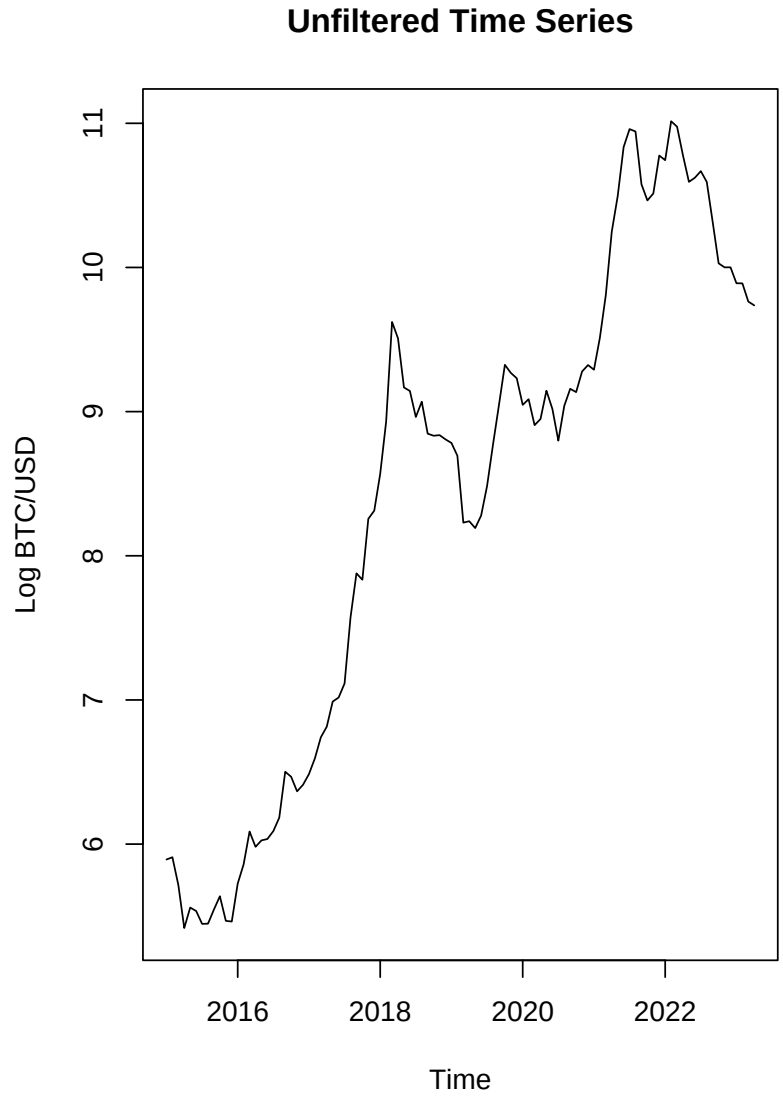




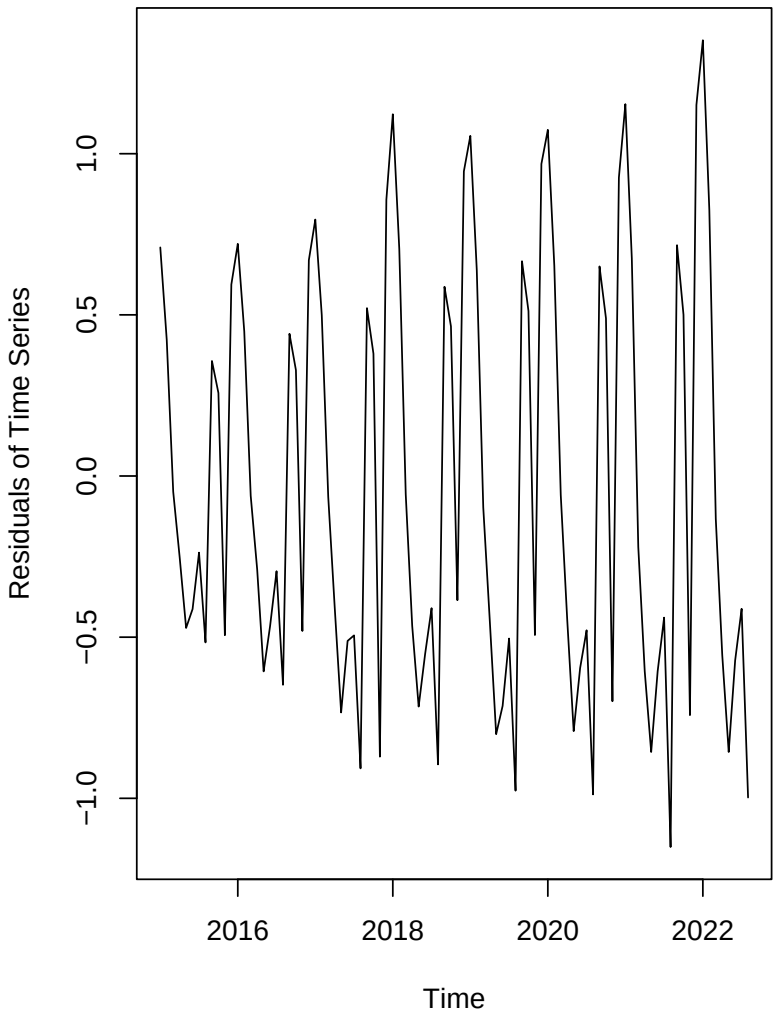


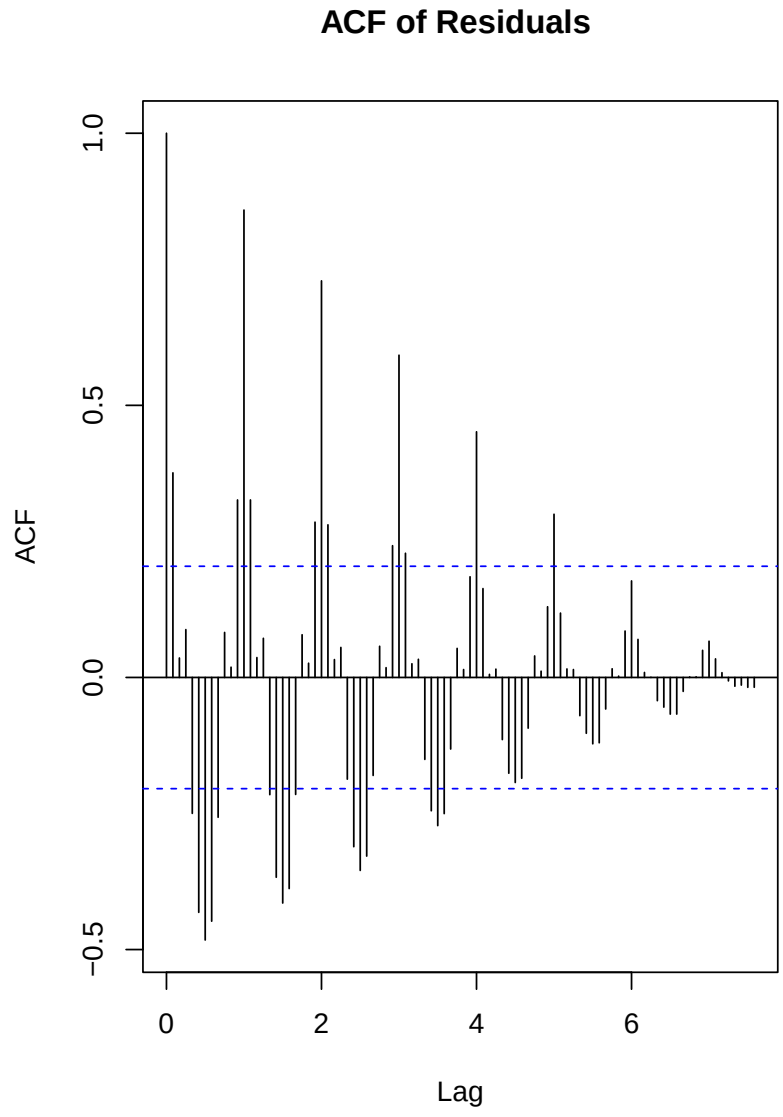
Statistical Methods Results: S1





Statistical Methods Results: S1





Statistical Methods Results: S2

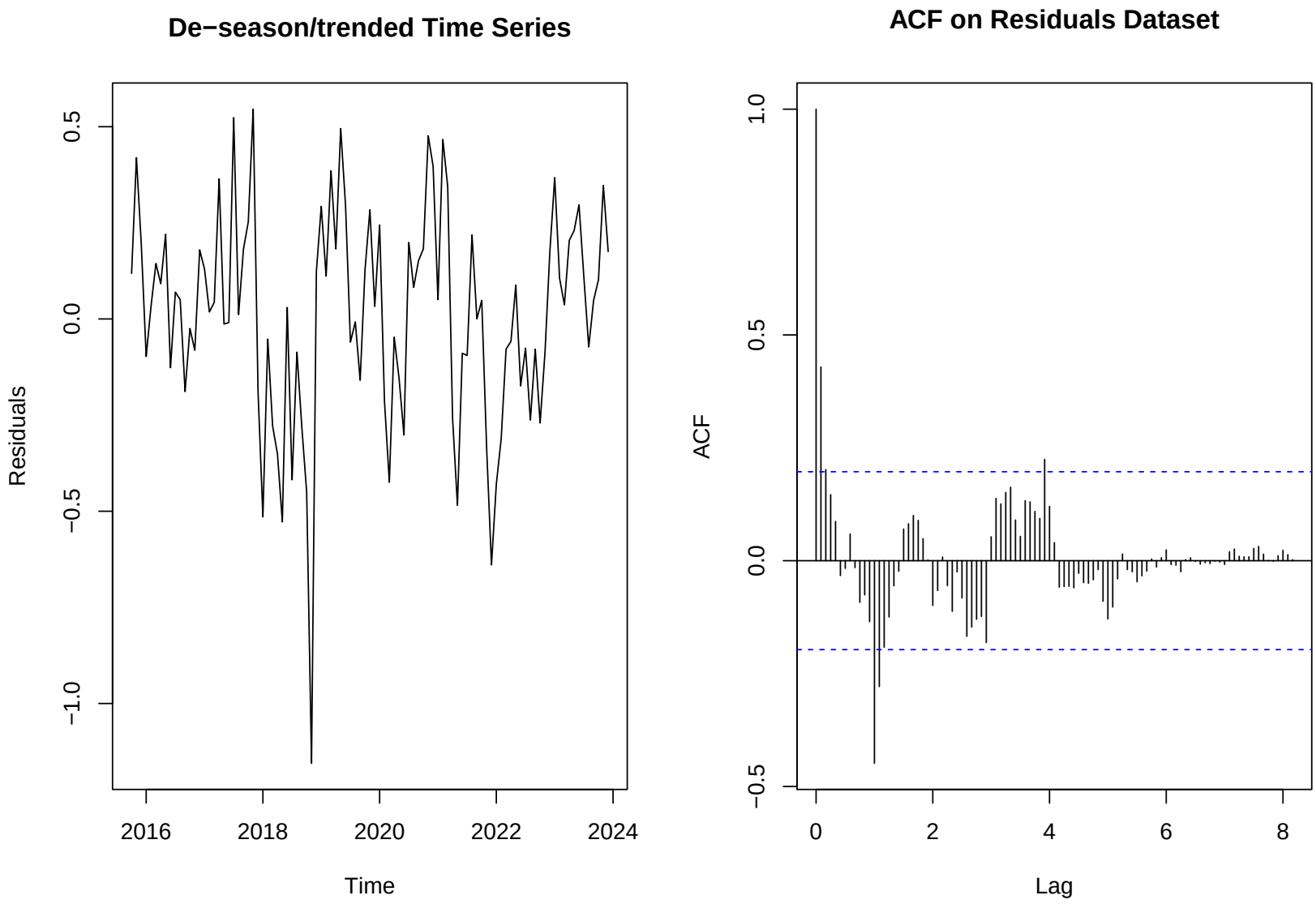


Figure 1: Differenced Method for de-seasonlized and de-trending Time

Checking Assumptions

- Visually checking the sample autocorrelation function

$$H_0 = \text{The Time Series is iid Noise}$$
$$H_1 = \text{The Time Series is NOT iid Noise}$$

- Protmanteau test
- Turning point test
- Difference-sign test
- Mann-Kendall Rank test
- Augmented Dicker-Fuller test
- Checking for normality
  - Histogram
  - qq plot
  - Normality test
    - Shapiro-Wilks test
    - Shapiro–Francia test

Checking Assumptions

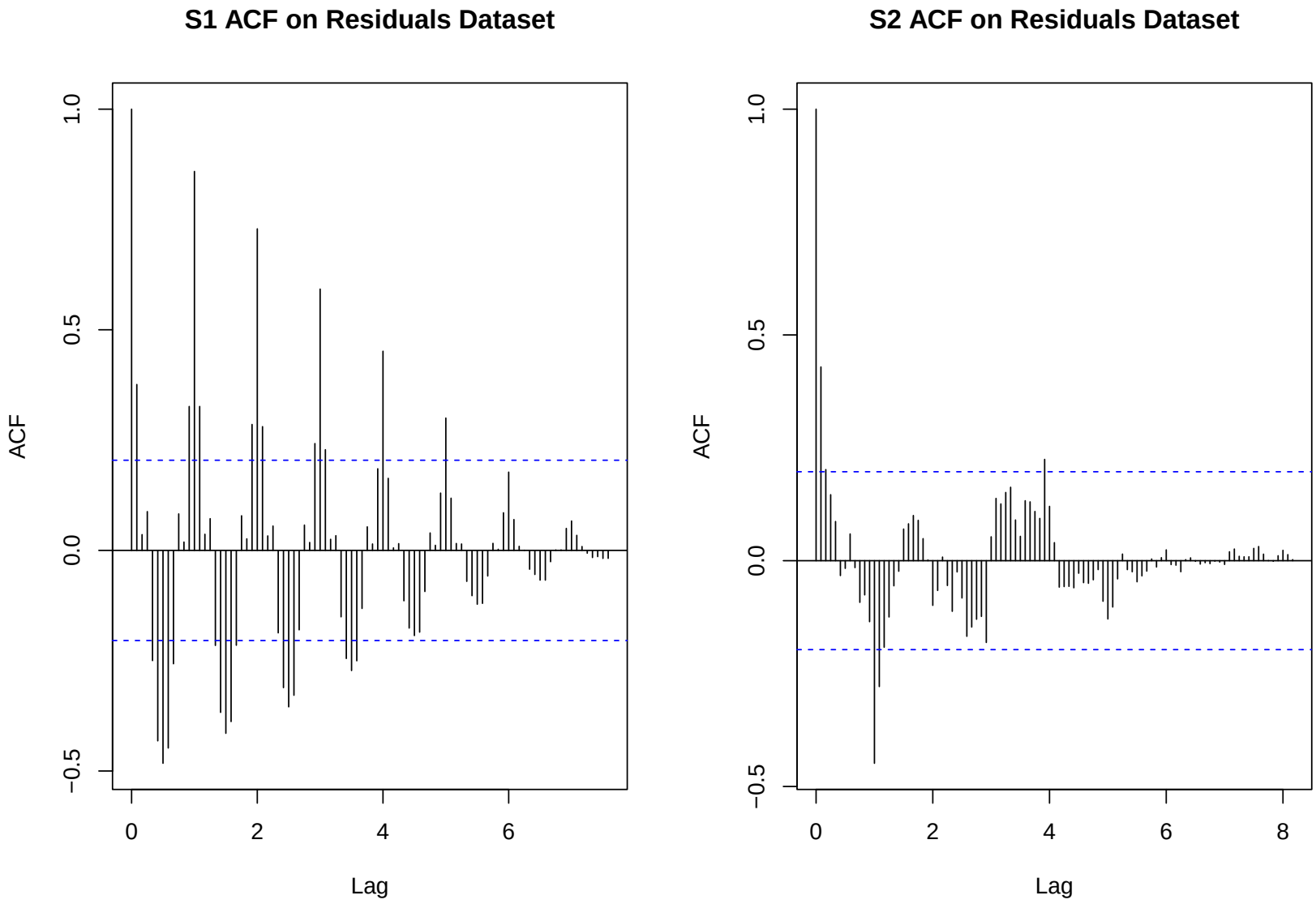


Figure 2: ACF for S1 and S2 methods on time series

Checking Assumptions

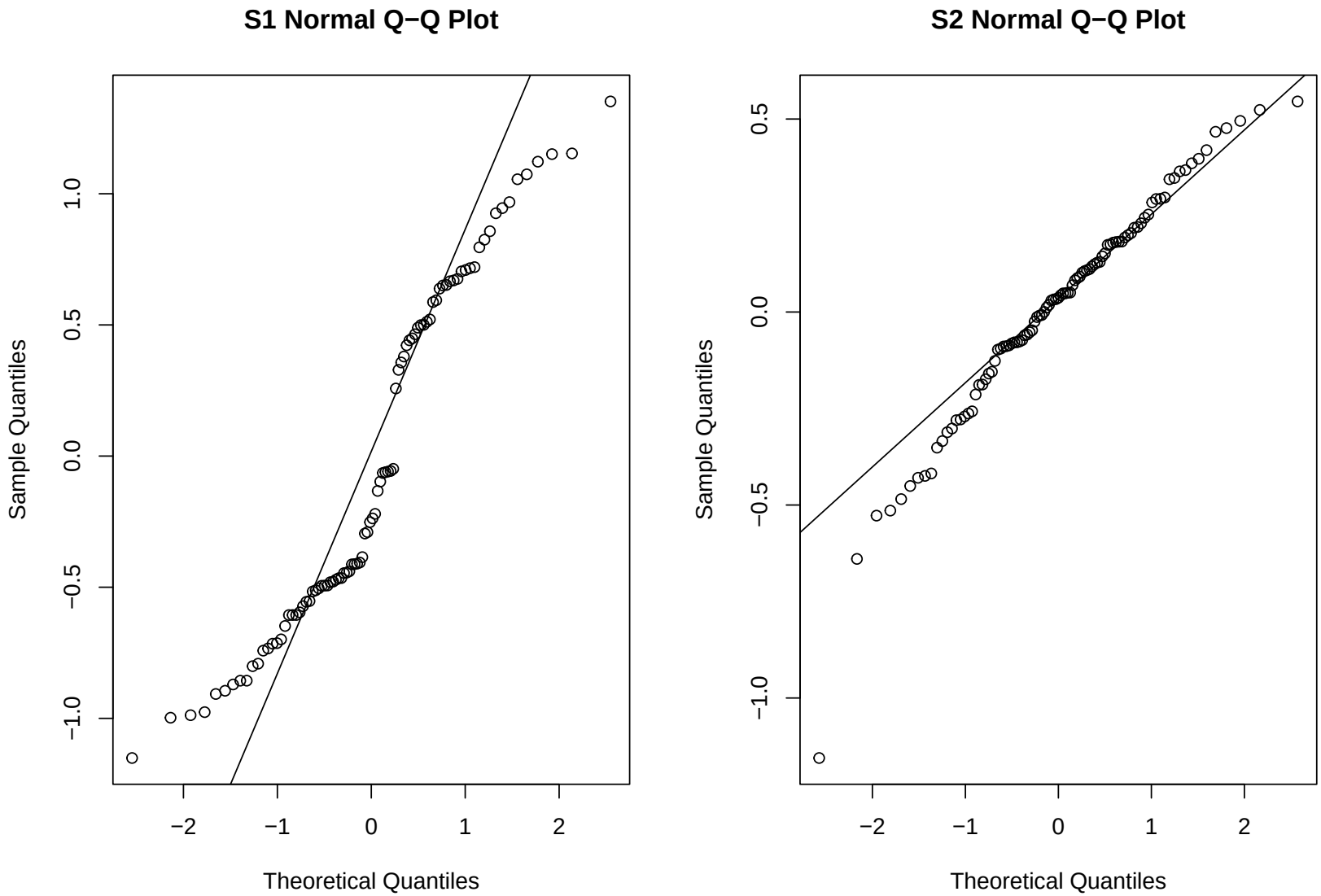


Figure 3: Q-Q plots for Normality of Residuals of S1 and S2 Method

Spectral Analysis

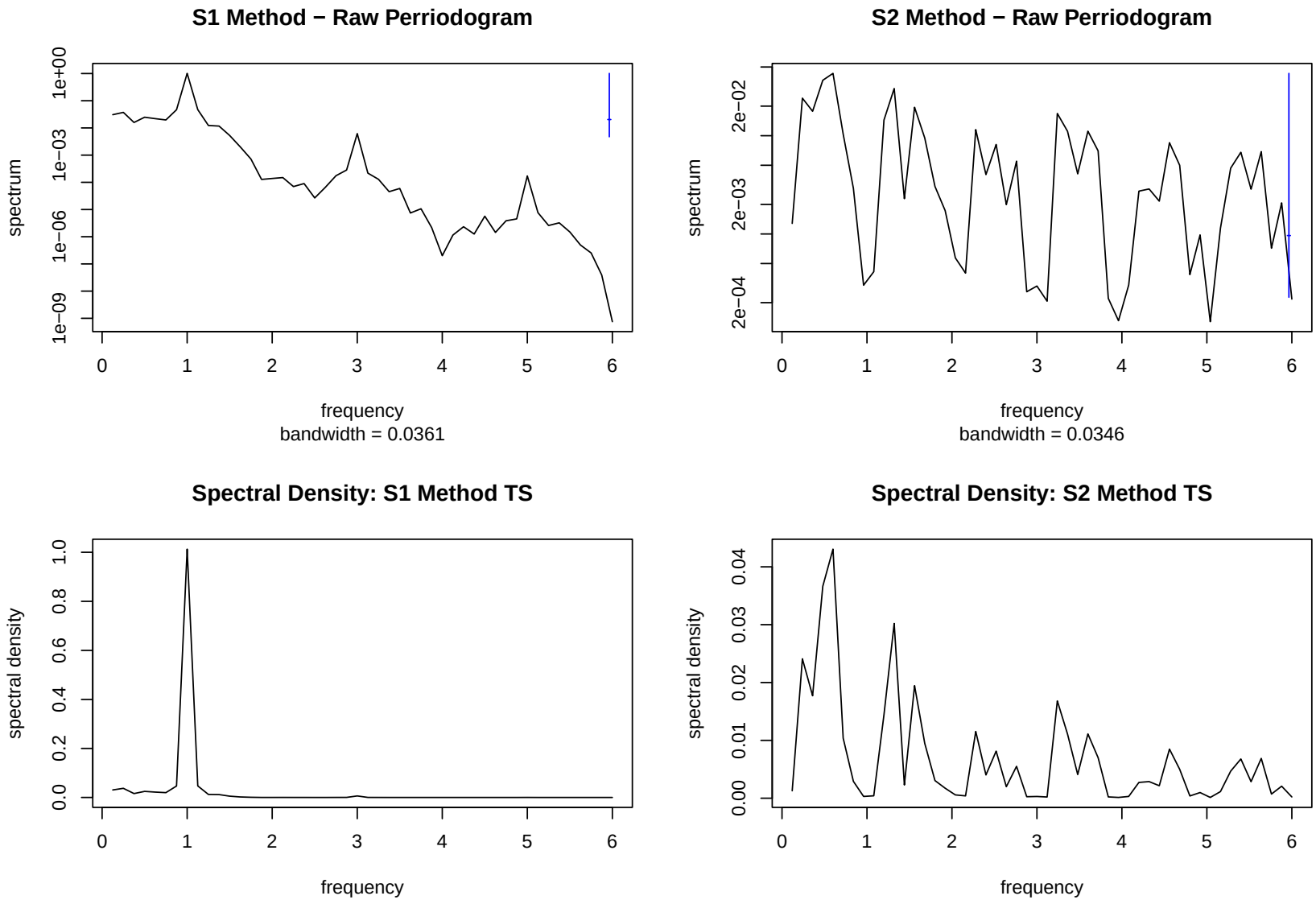
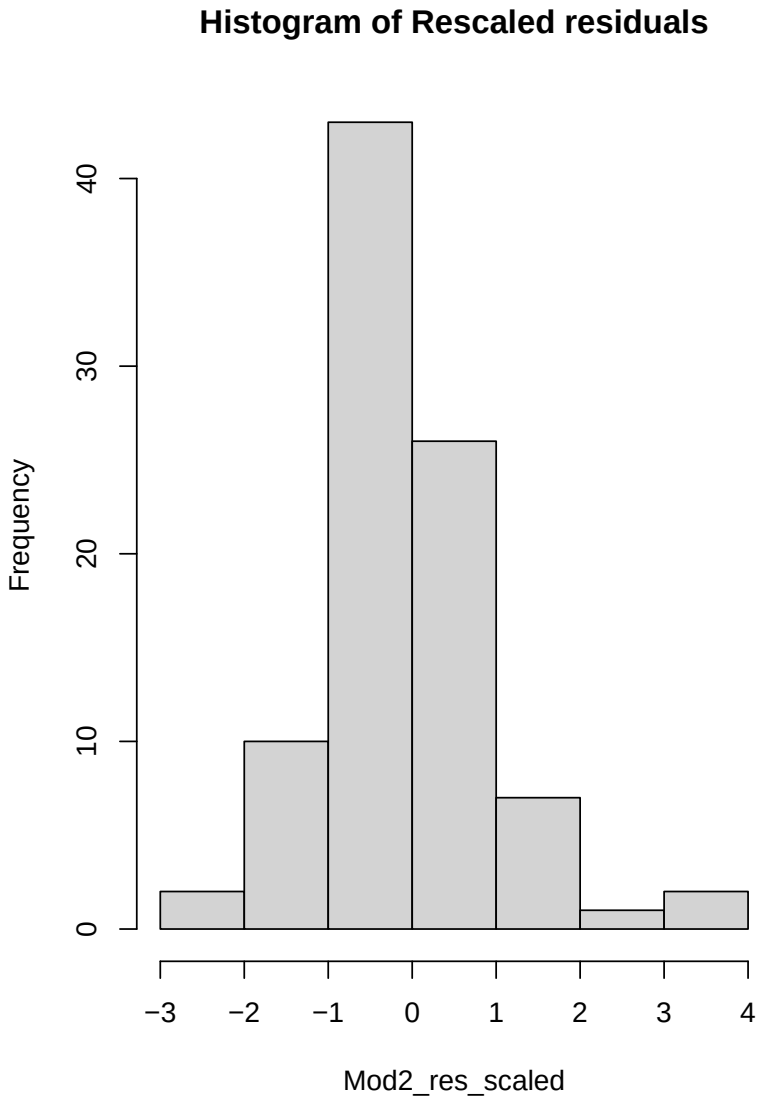


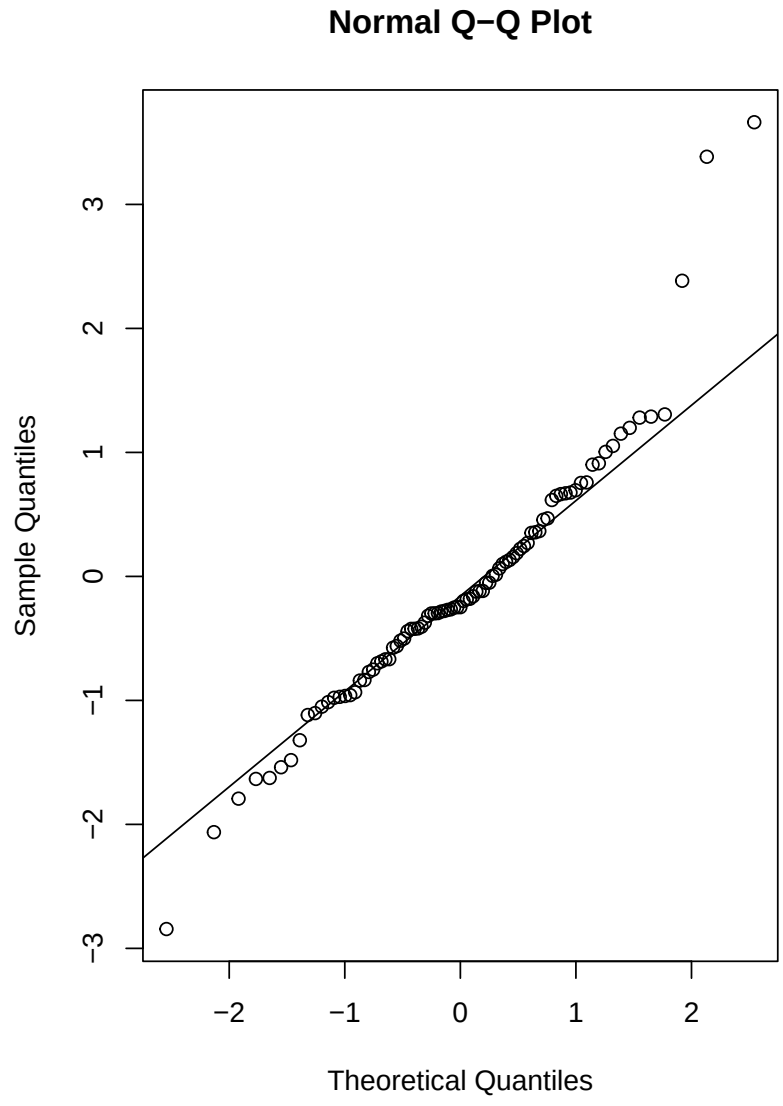
Figure 4: Spectral Analysis on S1 and S2 data

Fitting ARMA models

- Check ACF for AR(p), PACF for MA(q)
- Evaluate using AIC
- Fit model
- Residual Diagnostics

Fitting ARMA models





Fitting ARMA models

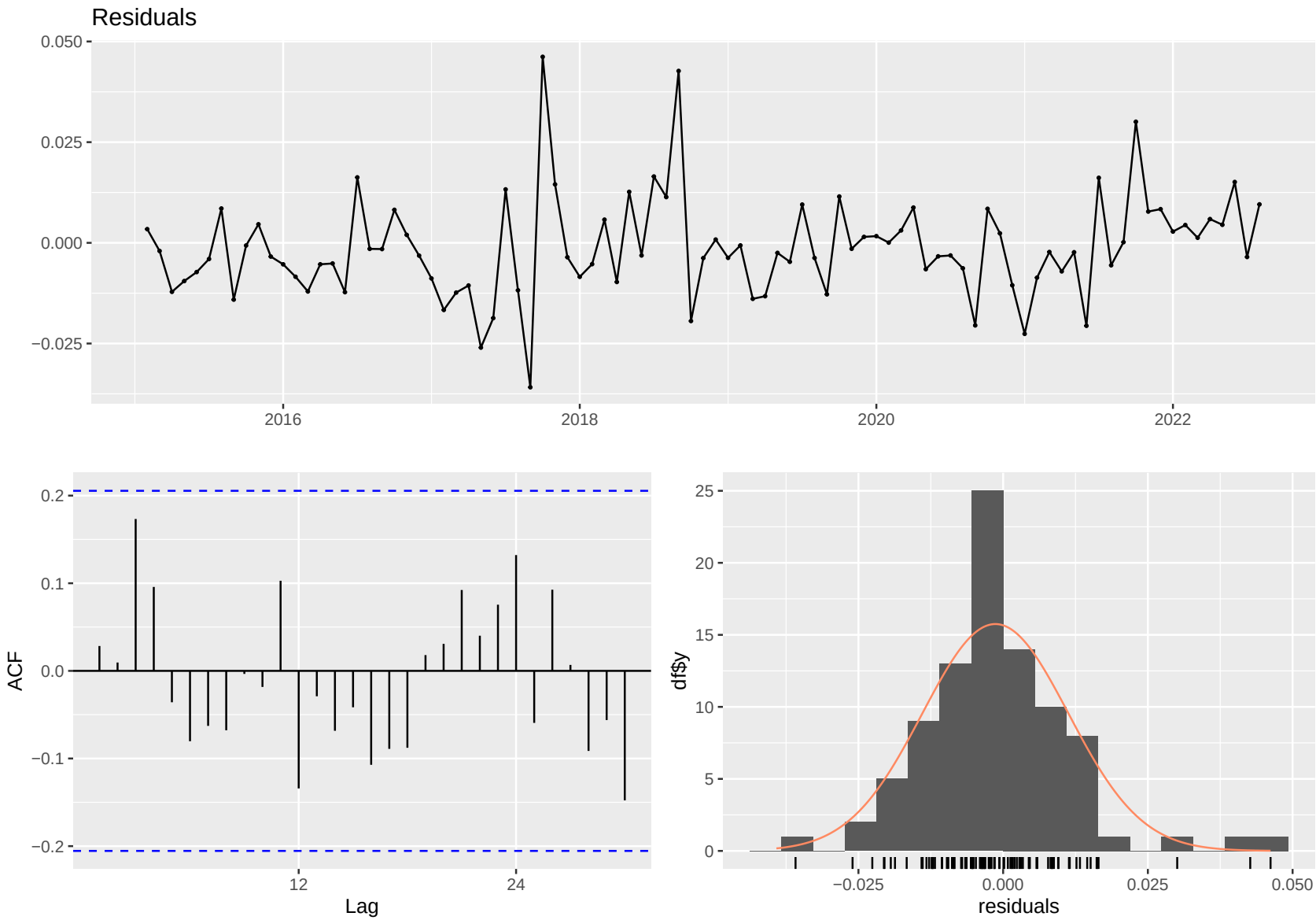


Figure 5: Residual checks

Forecast of 2023

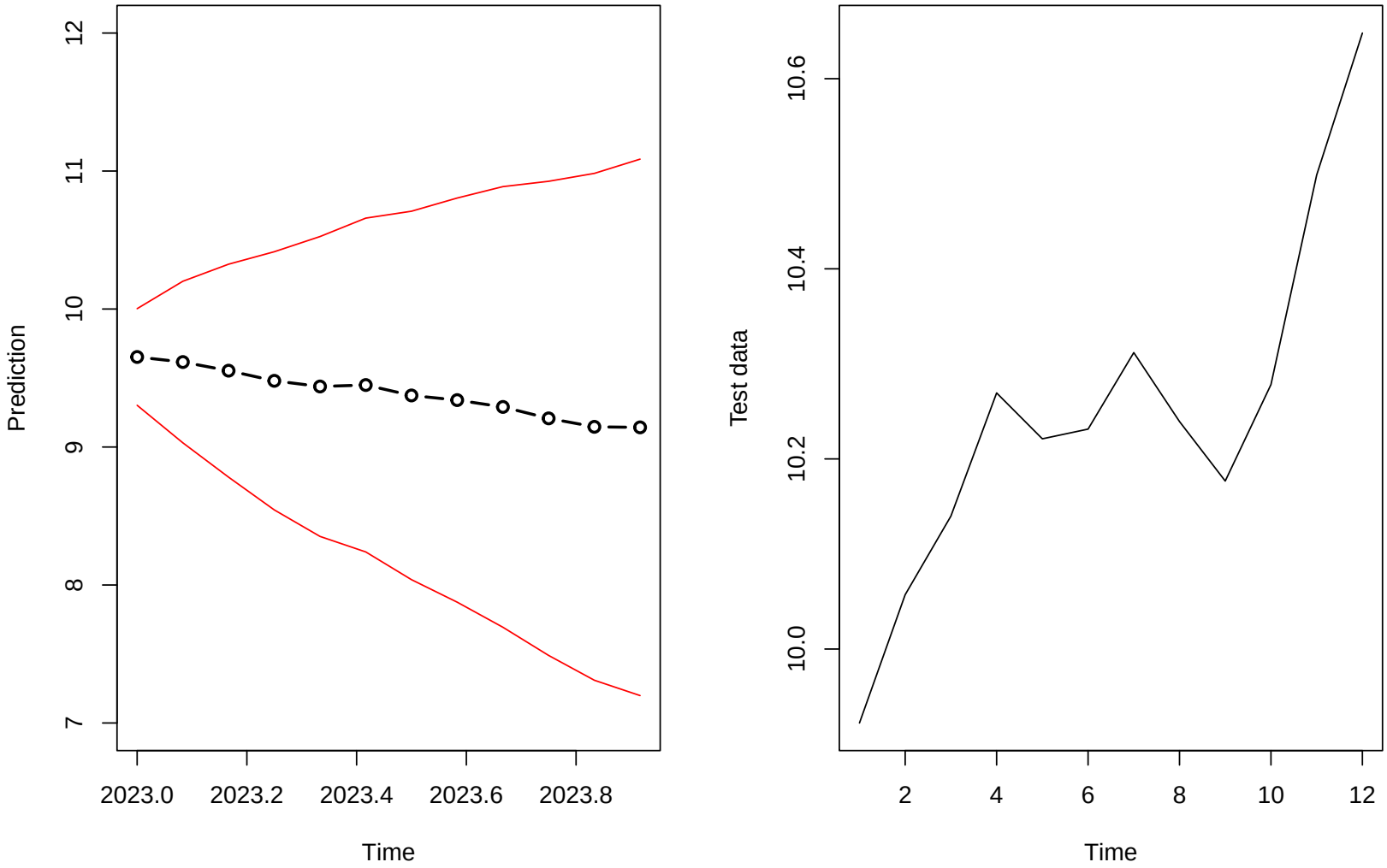


Figure 6: Forecast with SARIMA(9,0,1) Model with 95 CI

Forecast of 2023

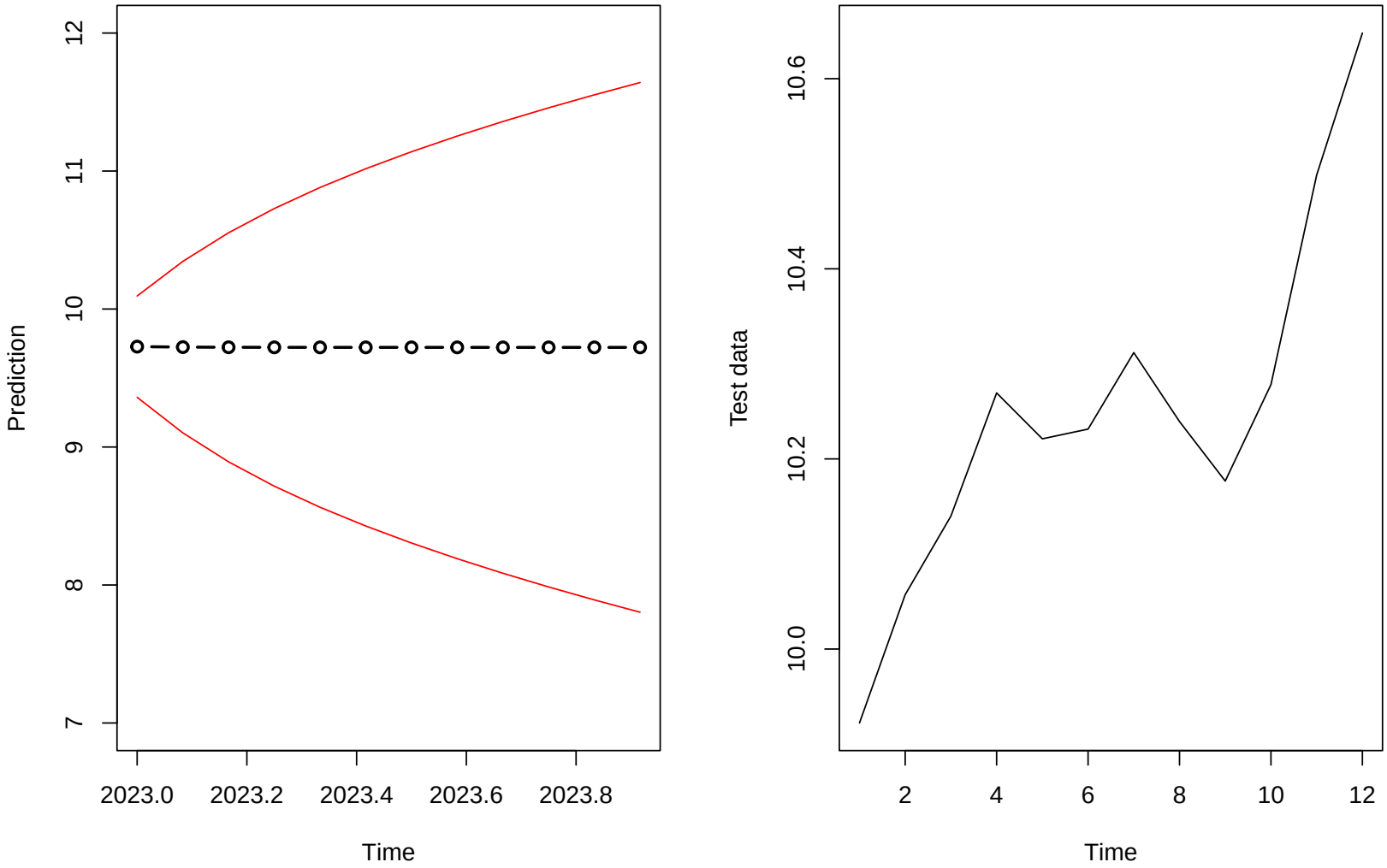


Figure 7: Forecast with auto.arima AR(1) Model with 95 CI

Summary

Model	ARMA(1,1)	ARMA(9,1)	SARMA(9,0,1) $\times$ (1,0,1)	AR(1)
MSE	1261	1258	10.1	3.72

Conclusion

- Poor performance, linear time series model is insufficient or poorly specified for using on this kind of data set
- Stationary assumption and normality assumption violated
- Intuitively the assumption of the model that $s_t = s_{t+d}$ may be too strong
- Poor data handling and processing from my side
- Challenging to fit a suitable model

Questions?

Thank you for listening.