Time Series Analysis

Lecture 3

Autoregressive Models and Moving Average Models

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Moving Average Models,

Modeling (i.e., Estimation, Model Diagnosis, Model Performance Evaluation, and Statistical Inference) Using Real-World Data

Estimation

- We estimate a moving average model of order 4 (MA(4)).
- Each of the estimate parameters is highly significant and so is the intercept.

ARIMA(p,d,q)

```
> summary(ma4.nzfit)
Series: nz
ARIMA(0,0,4) with non-zero mean

Coefficients:
         ma1    ma2    ma3    ma4  intercept
       1.928  2.080  1.662  0.699      0.755
s.e.   0.045  0.060  0.046  0.037      0.014

sigma^2 estimated as 0.00187:  log likelihood=913
AIC=-1814   AICc=-1814   BIC=-1788

Training set error measures:
                     ME  RMSE   MAE  MPE MAPE MASE ACF1
Training set -0.00024 0.043 0.032 -1.3  4.4  2.3  0.4
```

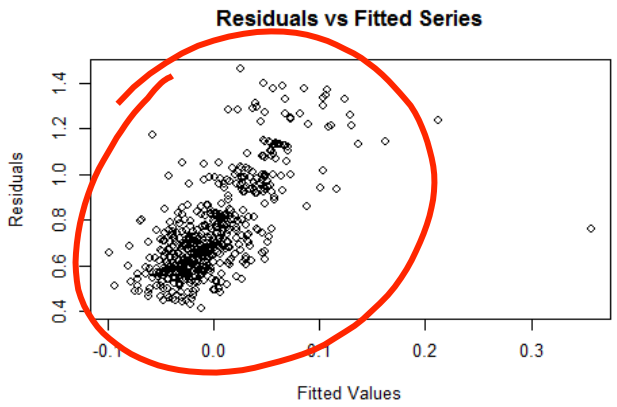
Model Diagnostic Using Residuals

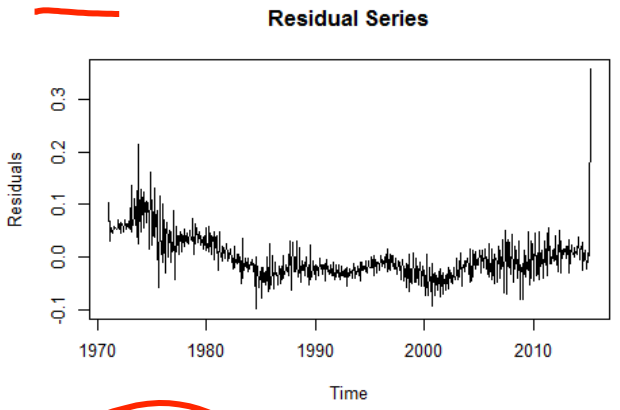
- The residual series confirms that the MA4 model does not capture the NZD series' dynamic well.
- Both the ACF and PACF show evidence of autocorrelation in the residuals.
- Ljung-Box statistic rejects the null hypothesis that the series is uncorrelated.

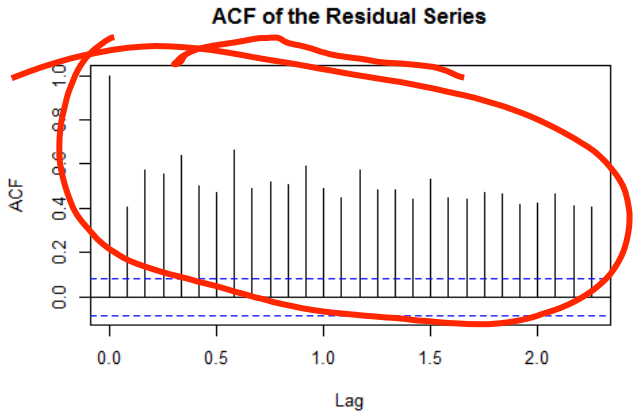
```
> head(ma4.nzfit$resid, 10)
 [1] 0.104 0.032 0.069 0.047 0.049 0.046 0.059 0.055 0.056 0.053
> summary(ma4.nzfit$resid)
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
-0.10000 -0.03000 -0.01000  0.00000  0.02000  0.36000
```

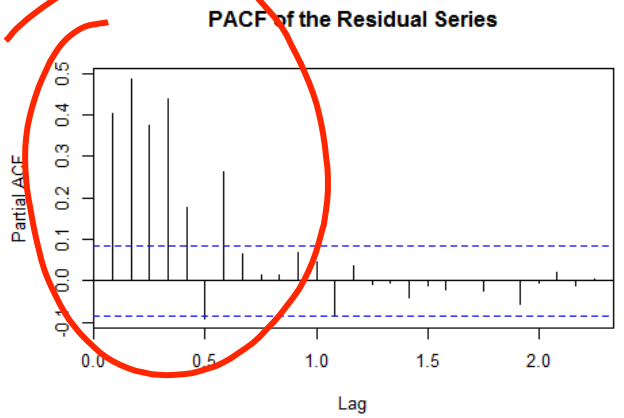
```
 Box-Ljung test

data:  ma4.nzfit$resid
X-squared = 87, df = 1, p-value < 2.2e-16
```









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