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FORECASTING
PRINCIPLES AND PRACTICE

A comprehensive introduction to the latest forecasting methods using R. Learn to improve your forecast accuracy using dozens of real data examples.

3RD EDITION

OTexts

7. Time series regression models

7.1 Evaluating the regression model

OTexts.org/fpp3/

Regression residuals

Residuals are defined as:

$$e_t = y_t - \hat{y}_t$$
$$= y_t - \hat{\beta}_0 - \hat{\beta}_1 x_{1,t} - \hat{\beta}_2 x_{2,t} - \cdots - \hat{\beta}_k x_{k,t}$$

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Useful properties

$$\sum_{t=1}^{T} e_t = 0 \quad \text{and} \quad \sum_{t=1}^{T} x_{k,t} e_t = 0 \qquad \text{for all } k.$$

# Checking assumptions

- ε_t have mean zero and are uncorrelated, NID($0,\sigma^2$).

- ε_t are uncorrelated with each $x_{j,t}$.
  - Timeplot, ACF, Histogram (`gg_tsresiduals()`)
  - Against predictors (non-linearity)
  - Against fitted values (heteroscedasticity)
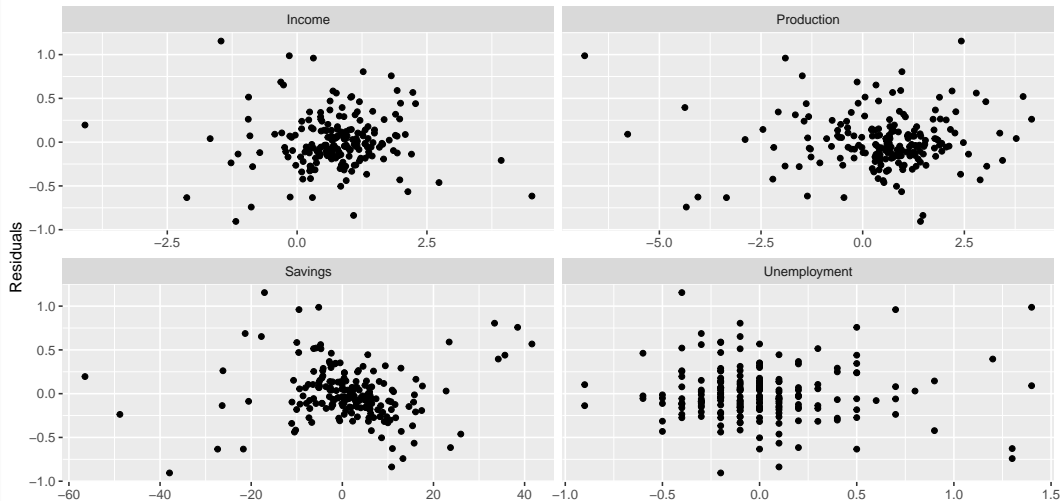 - Against predictors not in the model (include predictor in the model)

Expect to see scatterplots resembling a horizontal band with no values too far from the band and no patterns such as curvature or increasing spread.

Example: US consumption expenditure

```
fit_consMR |> gg_tsresiduals()
```
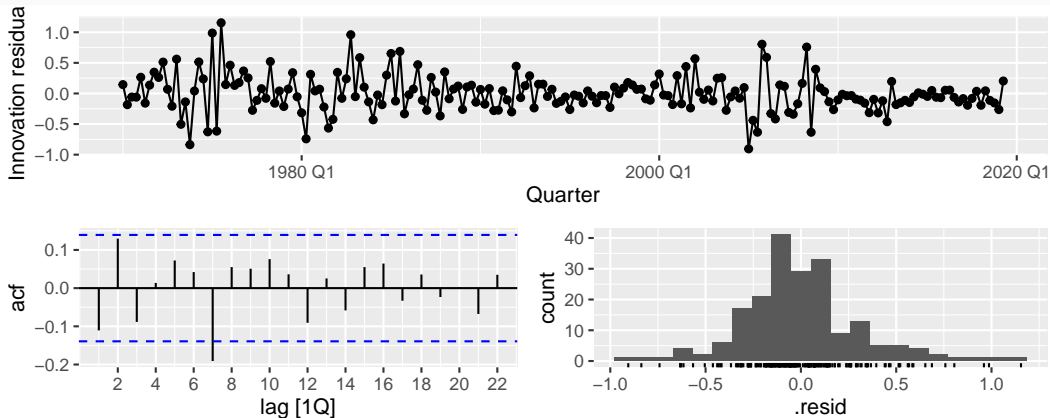
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