Section for Applied Statistics and Data Analysis

TA: Cong Mu

Office Hour: Wednesday 10:00AM - 12:00PM

October 11, 2019

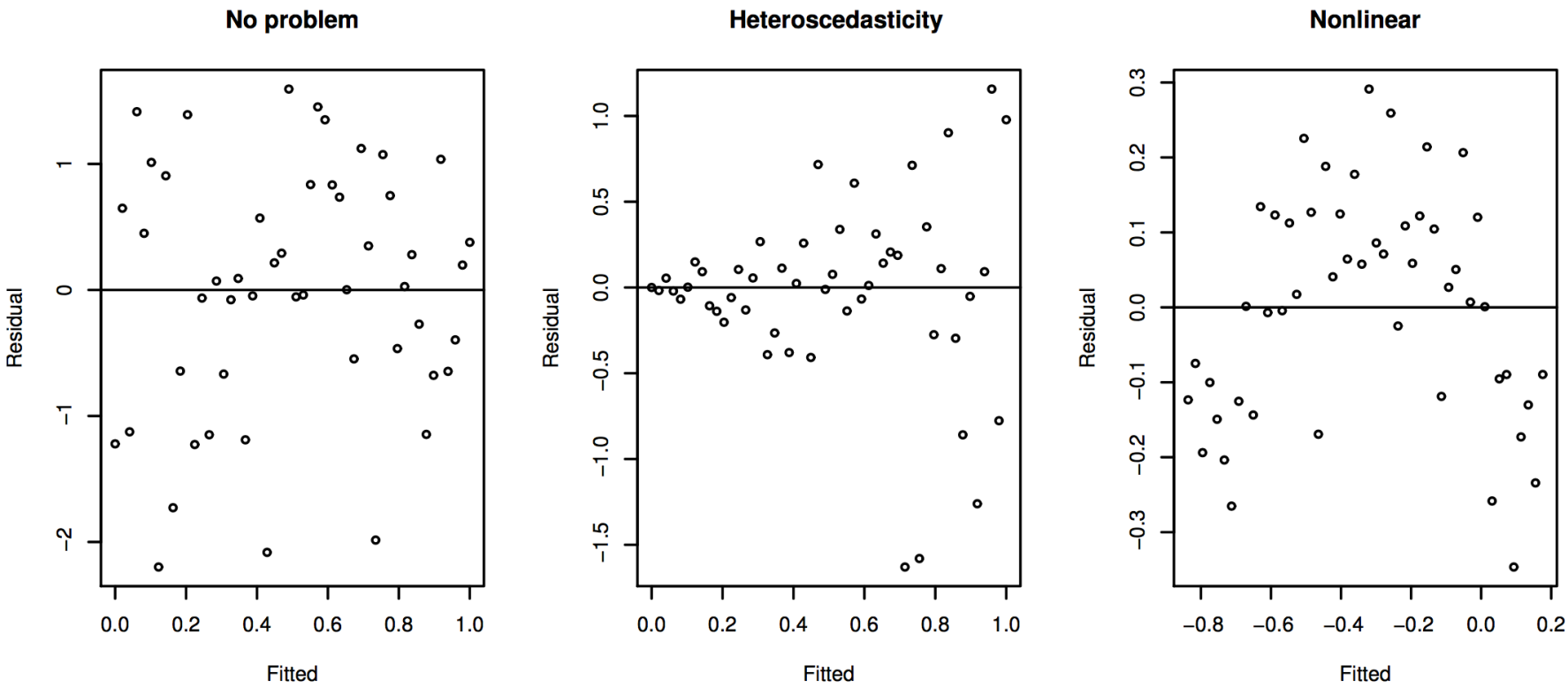
Overview

1. Some Statistics
   - Checking Error Assumptions
     - Constant Variance
     - Normality
     - Correlated Errors
2. Some Programming
   - Examples in Faraway

Diagnostics - Overview

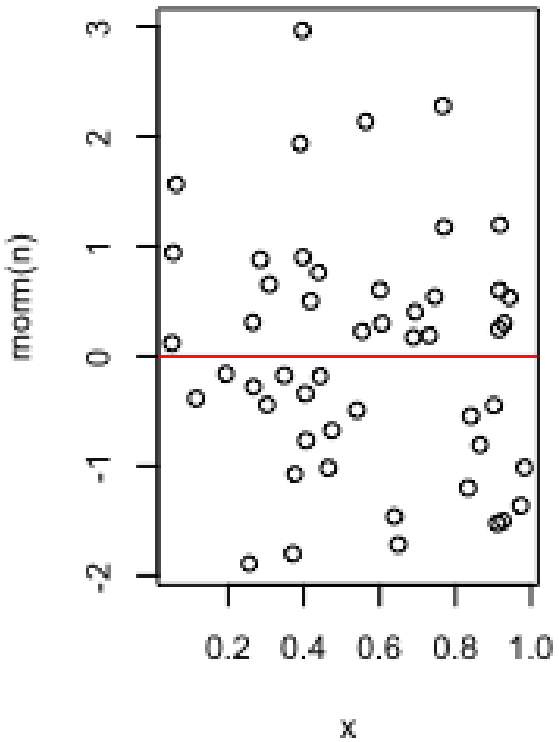
- Recall
$$\epsilon \sim \mathcal{N}\left(0, \sigma^2 \mathrm{I}\right).$$
- Checking Error Assumptions
  - Constant Variance
  - Normality
  - Correlated Errors
- Finding Unusual Observations
  - Leverage
  - Outliers
  - Influential Observations
- Checking the Structure of the Model

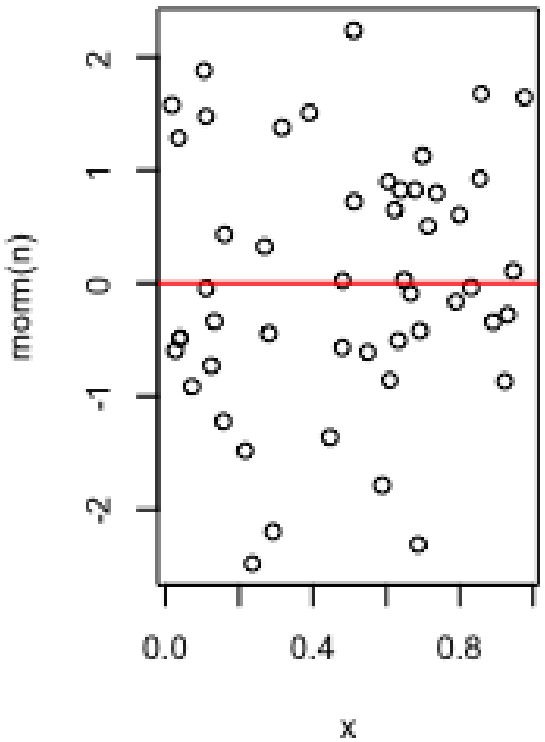
Constant Variance - Overview

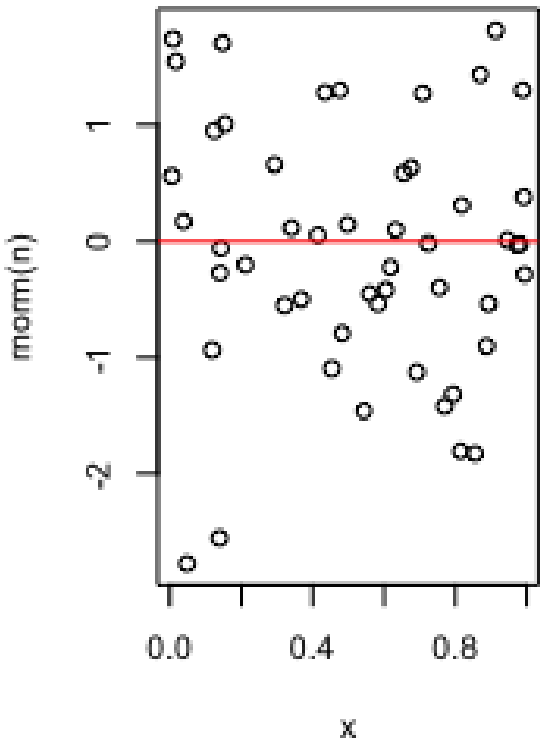


(Figure from Linear Models with R)

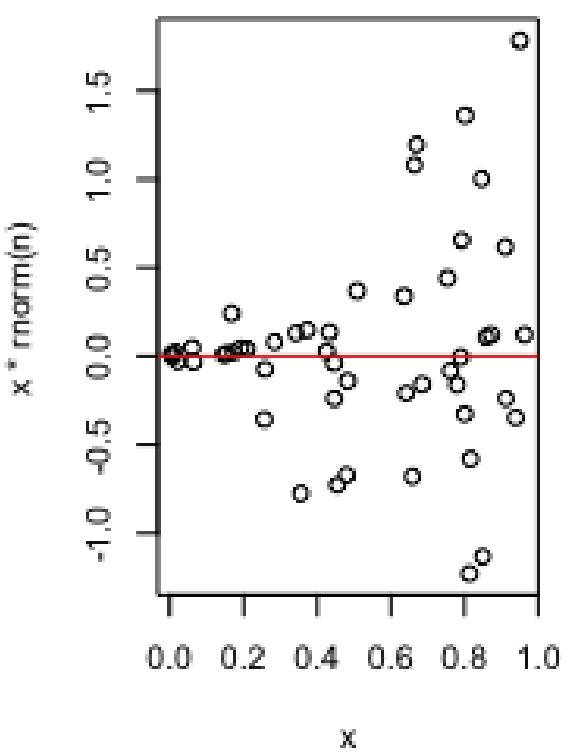
Example - Constant Variance

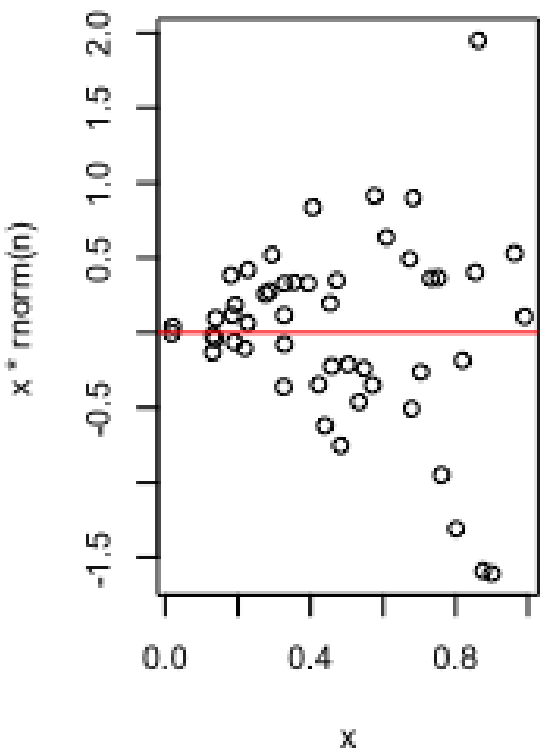


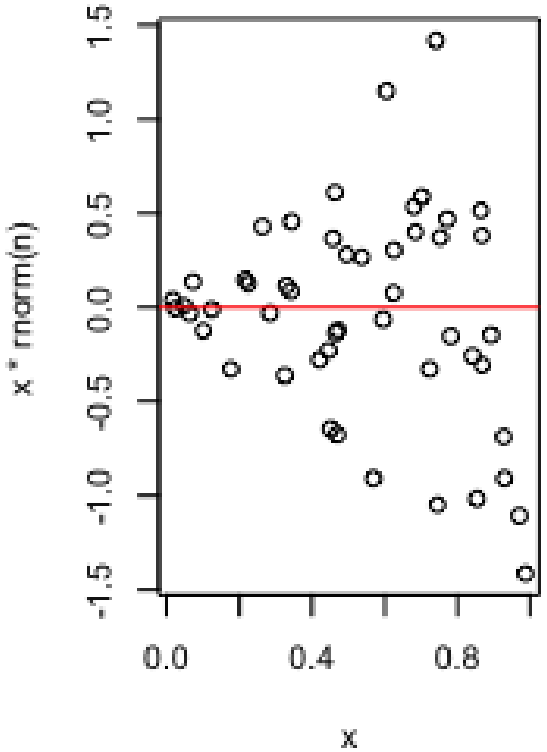




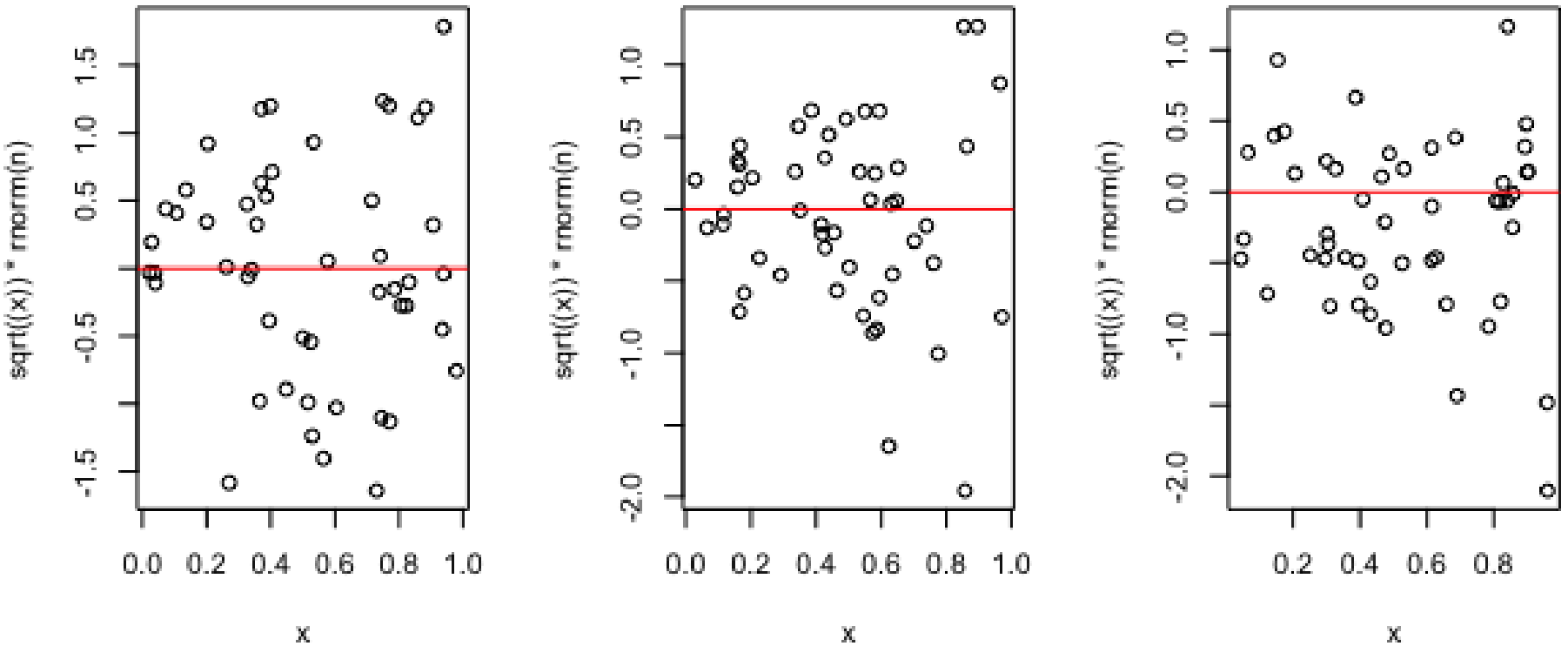
Example - Strong Nonconstant Variance



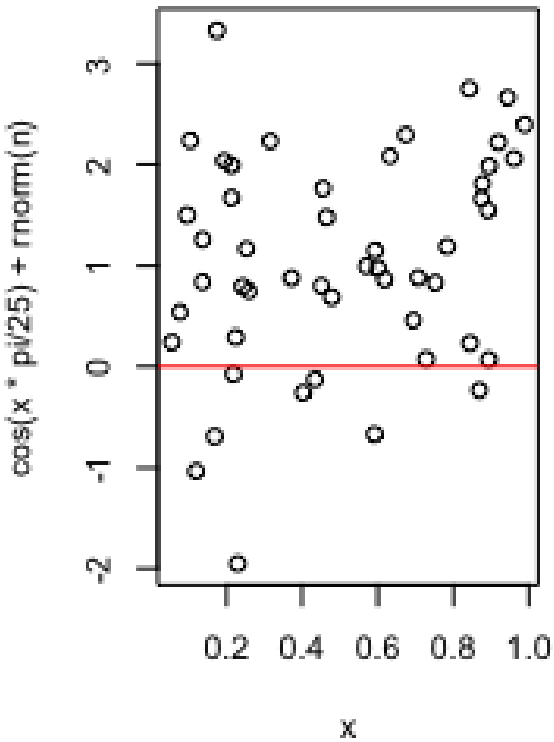


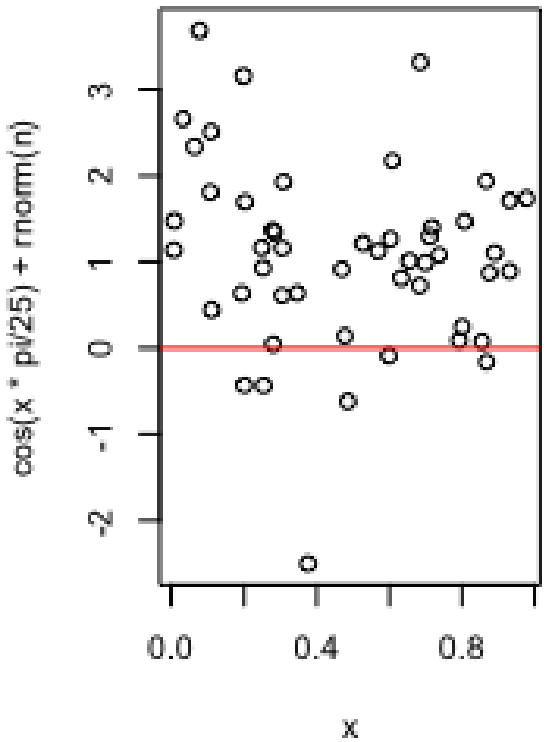


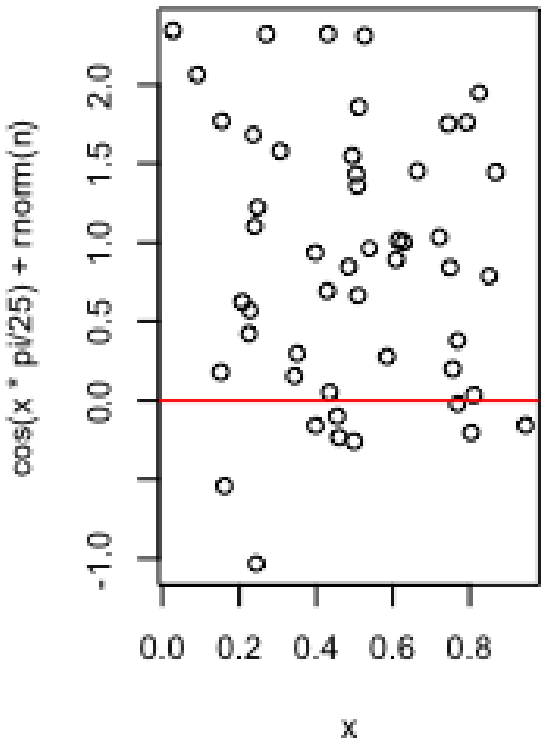
Example - Mild Nonconstant Variance



Example - Nonlinearity



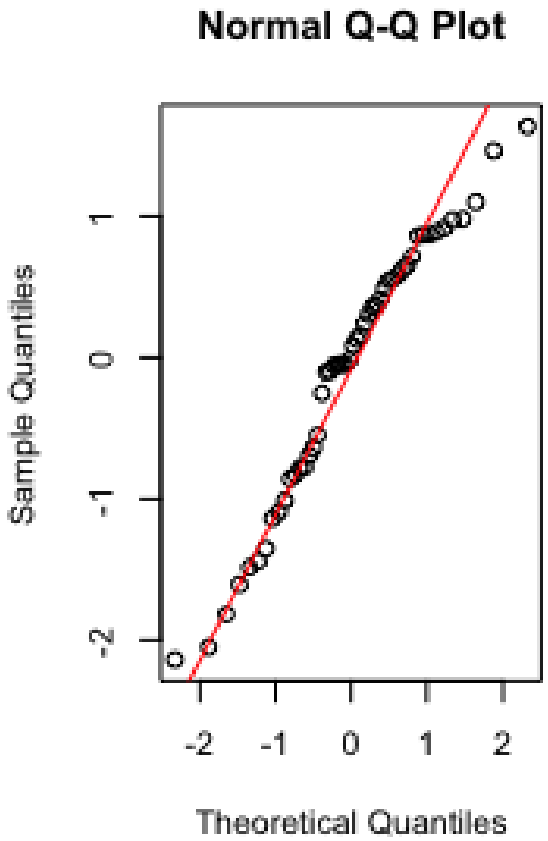


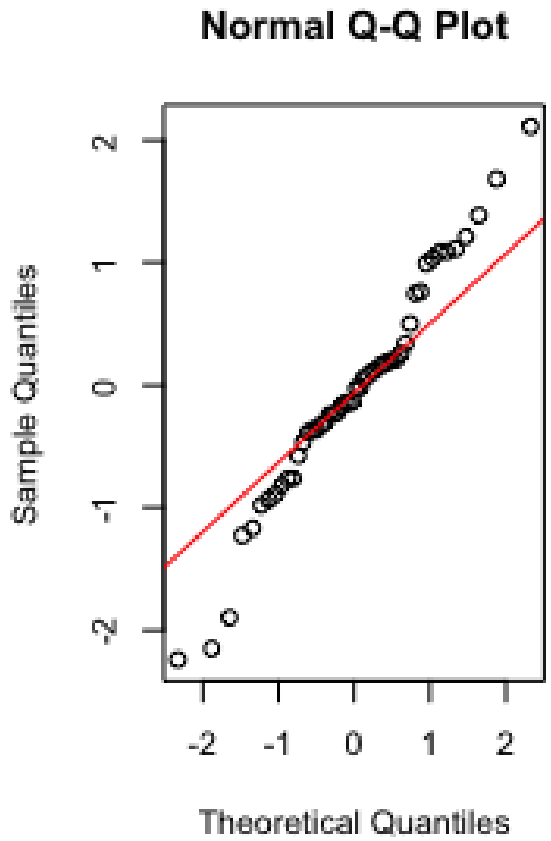


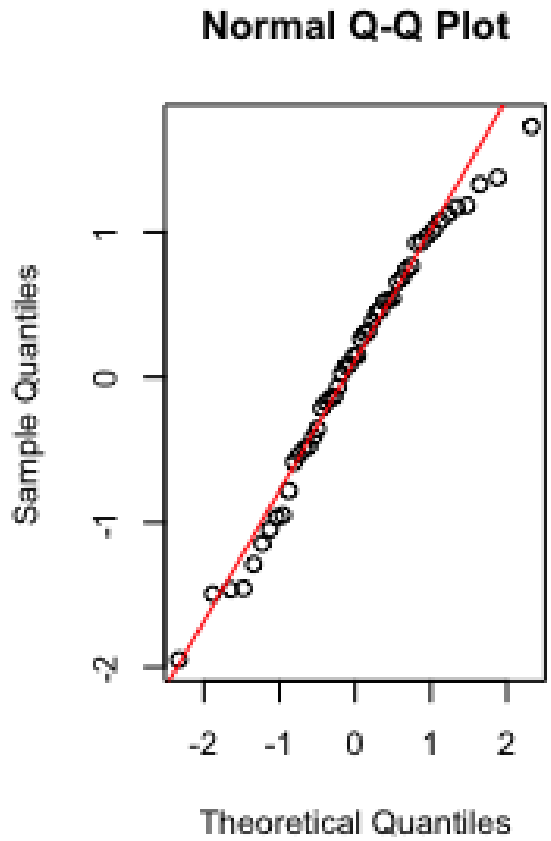
Normality - Overview

- Q-Q Plot
- Tests
  - Shapiro-Wilk test
  - Anderson-Darling test
  - etc
- Some R Packages
  - `nortest`
  - `normtest`
  - etc

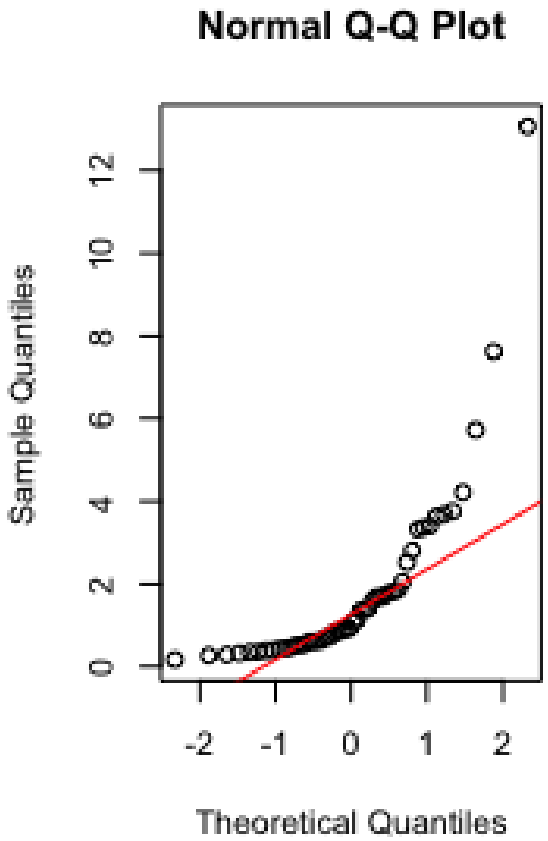
Example - Normal

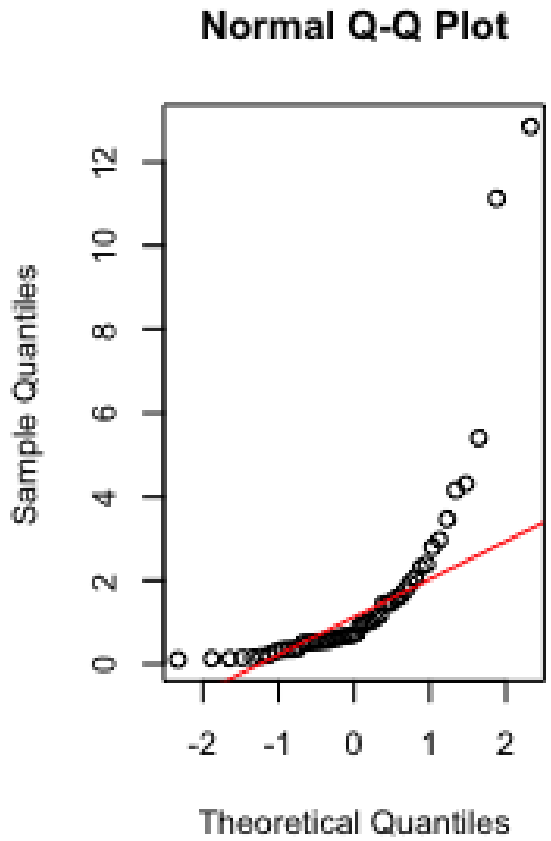


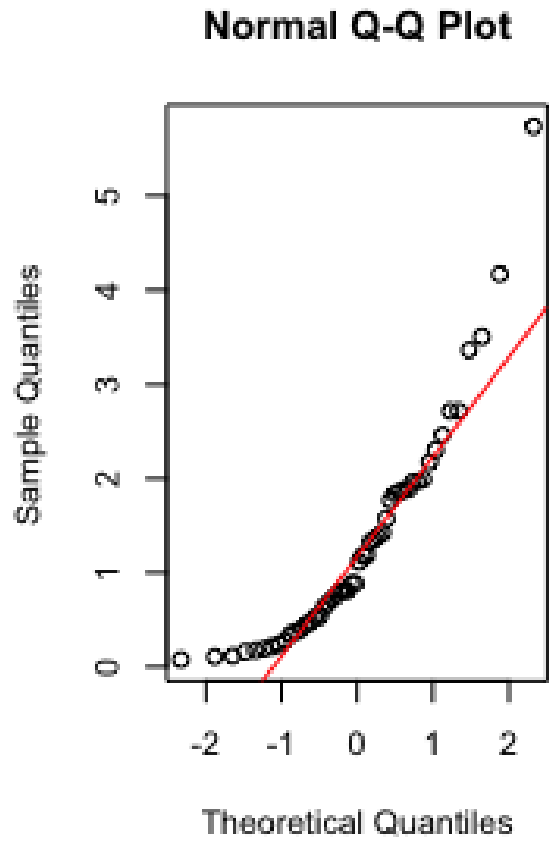




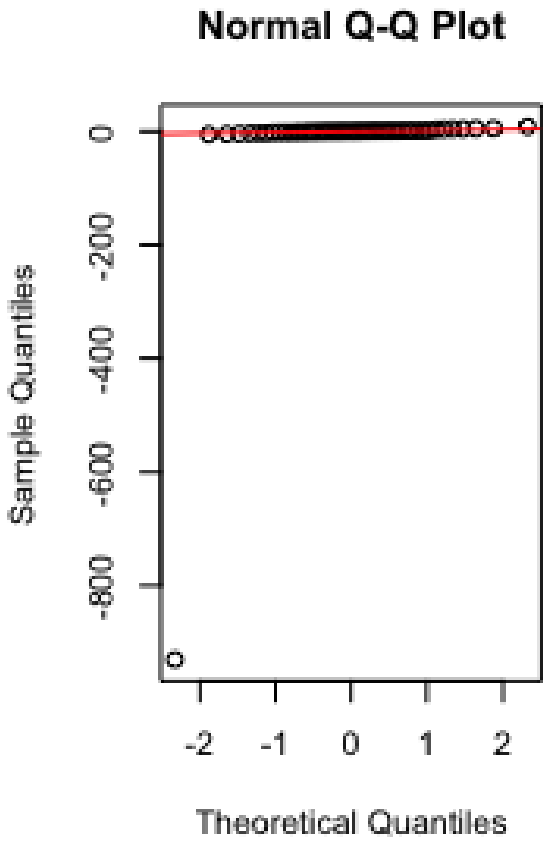
Example - Lognormal (a skewed distribution)

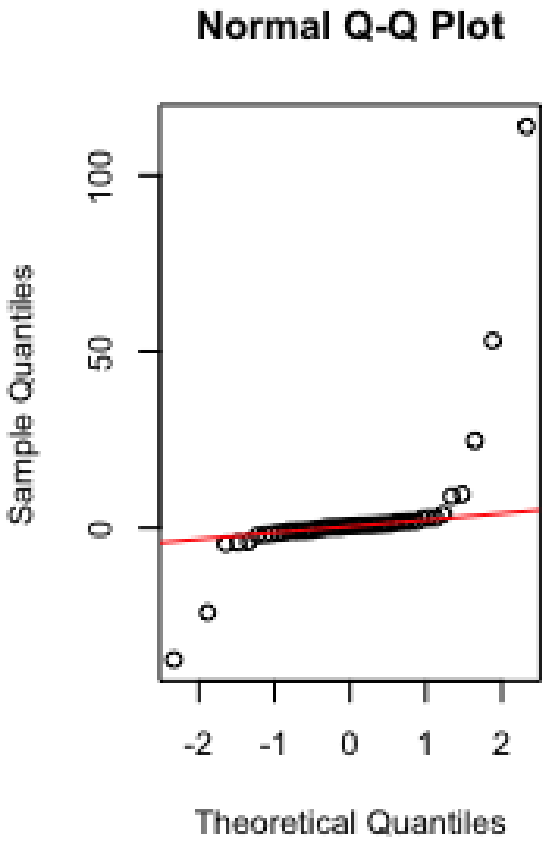


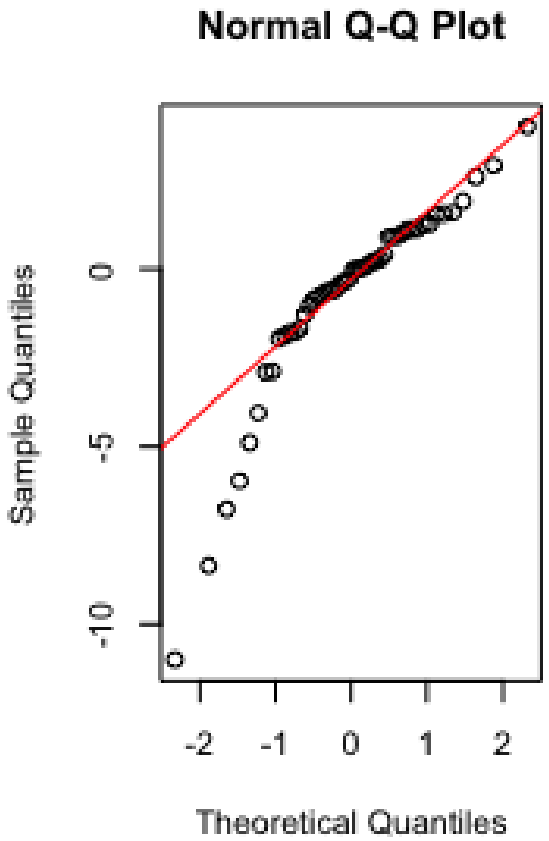




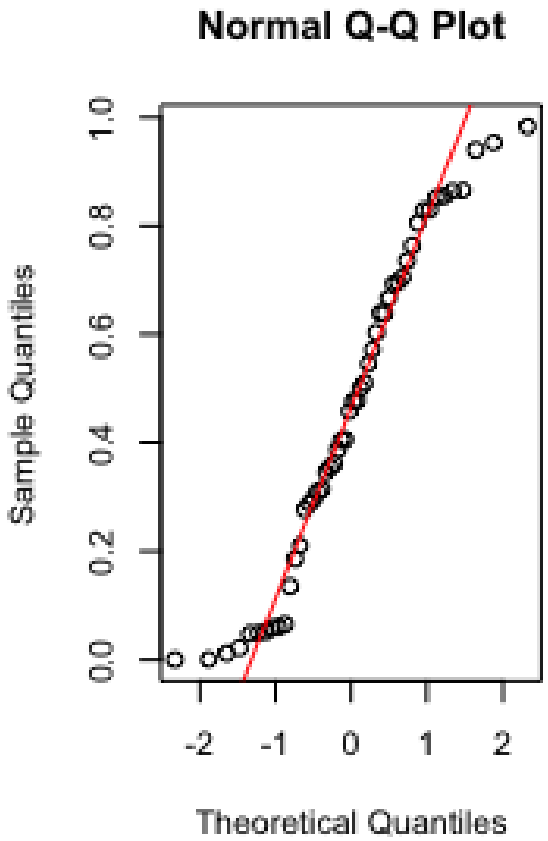
Example - Cauchy (a long-tailed distribution)

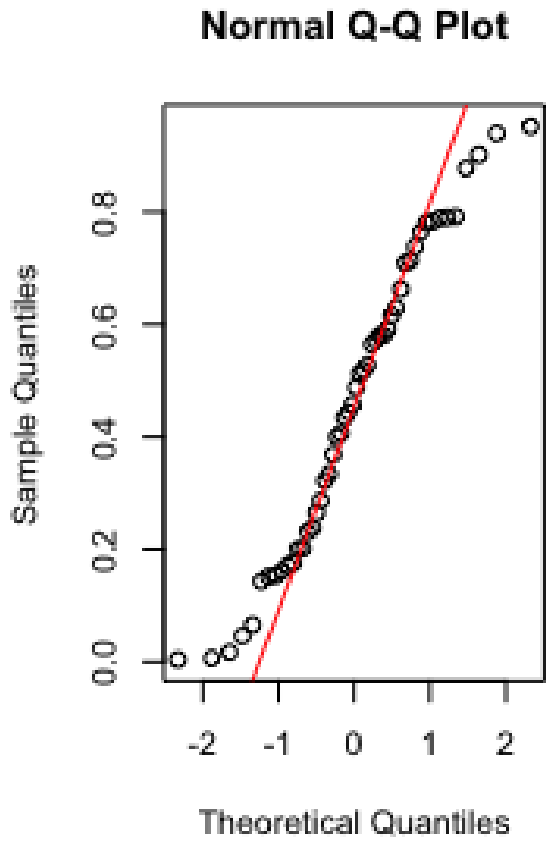


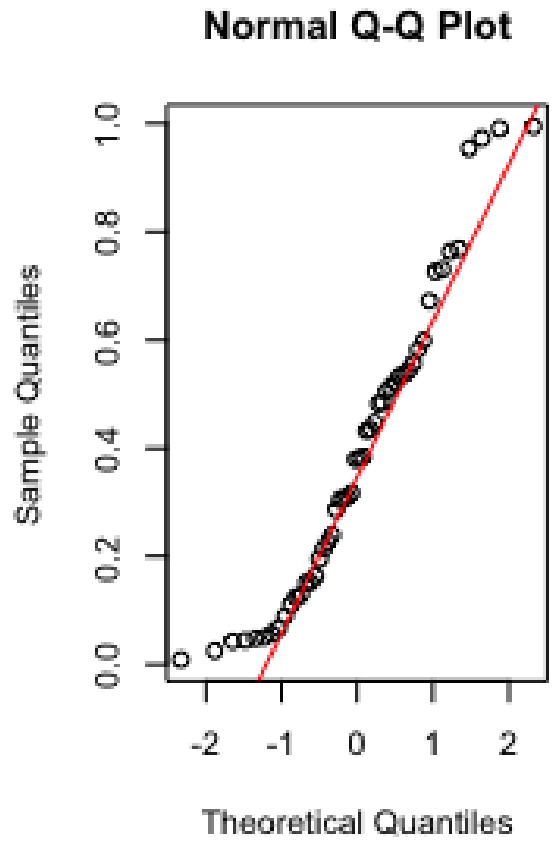




Example - Uniform (a short-tailed distribution)







Correlated Errors - Overview

- Plot Successive Pairs of Residuals
- Tests
  - Durbin-Watson test
  - etc
- Some R Packages
  - `lmtest`
  - etc

Examples in Faraway Chapter 6

- **Example:** `savings` dataset
- **Example:** `gala` dataset
- **Example:** `globwarm` dataset

Thanks for listening!