



The autocorrelation function

PRACTICAL TIME SERIES ANALYSIS

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Objectives

- ▶ Define the autocorrelation function
- ▶ Obtain correlograms using `acf()` routine
- ▶ Estimate autocorrelation coefficients at different lags using `acf()` routine

The autocorrelation function (ACF)

- ▶ We assume weak stationarity
- ▶ The autocorrelation coefficient between X_t and X_{t+k} is defined to be

$$-1 \leq \rho_k = \frac{\gamma_k}{\gamma_0} \leq 1$$

- ▶ Estimation of autocorrelation coefficient at lag k

$$r_k = \frac{c_k}{c_0}$$

Another way to write r_k

$$r_k = \frac{\sum_{t=1}^{N-k} (x_t - \bar{x})(x_{t+k} - \bar{x})}{\sum_{t=1}^N (x_t - \bar{x})^2}$$

acf() routine

- ▶ We have already used it for autocovariance coefficients
- ▶ It plots autocorrelation coefficients at different lags: Correlogram
- ▶ It always starts at 1 since $r_0 = \frac{c_0}{c_0} = 1$

What We've Learned

- ▶ Definition of the autocorrelation function (ACF)
- ▶ How to produce correlograms using `acf()` routine
- ▶ How to estimate the autocorrelation coefficients at different lags using `acf()` routine.