Applied Econometric Time Series (Problem Set 1)

Dominik R. Wehr
Due: Jan 25th 1:15PM

January 18, 2024

1 Stochastic difference equations

Question Under what conditions (in terms of restrictions on a_2) is the below AR(2) process stationary in large samples?

$$y_t = a_0 + a_2 y_{t-2} + \varepsilon_t, \quad t = 1, 2, ..., T \tag{1.1}$$

Question Under the conditions derived in 1a, show that the process is not stationary in finite samples (y_0 and y_{-1} are some constants).

Question For large samples, derive the autocovariance and autocorrelation function γ_k ($k \geq 0$) and ρ_k ($k \geq 0$), respectively.

Question Why is stationarity such an important concept in time-series models?

Question Derive the long-run equilibrium of this model (assuming stationarity and large samples)

Question Quantify the long-run equilibrium (assuming large samples) when $a_0 = 2$ and $a_2 = 0.5$. Also, describe and quantify the adjustment mechanisms toward this equilibrium when (i) $y_{-1} = y_0 = 2$ and $\varepsilon_t = 0$ for all t, and (ii) $y_{-1} = 2$ and $y_0 = 1.5$ and $\varepsilon_t = 0$ for all t.

Question If you instead let $a_2 = 0.6$, show that the adjustment process towards an equilibrium takes longer time than if $a_2 = 0.5$.

2 Time Series Analysis of US Interest Rates

Question Go through the example of interest rate spreads Section 2.10 (pp. 88-96) and try to replicate the results (you download the data from the course web; sample size $T = 255$).

Question Conduct a Chow test for the spread series where you set the breakpoint at $t = 1981Q4$. What do you conclude? Will your conclusions change if you change the breakpoint?

Question Estimate an AR(1) process with intercept recursively for the sample sizes n, $n+1$,..., $T-1, T$ where $n = 10$. Plot the estimation results for the intercept and the AR(1) coefficient with ± 2 standard deviation band (see p. 108). What do you conclude?

Question For the same sample sizes as in 2c, calculate the CUSUM test accompanied with ± 2 standard deviation band. What do you conclude?