1 Assignment IV

Course on Estimation of DGSE models
Juan F Rubio-Ramírez
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Exercise 1. Let

$$y_t = F y_{t-1} + v_t$$

where F is $r \times r$ matrix with all eigenvalues inside the unit circle and $E v_t = 0$ and $E v_t v_t' = Q$. Calculate is $E y_t y_t'$.

Exercise 2. Assume we want to explain the joint behavior the measured total stock of beef, the number of slaughtered beef, and the price of slaughtered beef for 1900-1990 (Bureau of the Census (1975), and (1989)) using the following model. (You can find the data under "Data for Exercise 2 in Assignment IV "). Let $y_t = (y_{1,t}, y_{2,t}, y_{3,t})'$ where $y_{1,t}$ is the measured total stock of beef, $y_{2,t}$ is the number slaughtered beef and $y_{3,t}$ is the price index of the price of slaughtered beef, and evolve as

$$y_t = X_t' \theta_t + \varepsilon_t$$

$$X_t' = I_{3\times 3} \otimes \begin{pmatrix} 1 & y_{t-1}' \end{pmatrix}$$

where θ_t is an unobservable state that follows as a random walk

$$\theta_{t+1} = \theta_t + v_{t+1}$$

where

$$E \begin{bmatrix} \varepsilon_t \\ v_t \end{bmatrix} \begin{bmatrix} \varepsilon_t' & v_t' \end{bmatrix} = \begin{pmatrix} R & 0 \\ 0 & Q \end{pmatrix}$$

Let $\overline{\theta}_{t|t-1} \equiv E\left(\theta_t | y^{t-1}\right)$, $P_{t|t-1} \equiv E\left(\left(\theta_t - \overline{\theta}_{t|t-1}\right)\left(\theta_t - \overline{\theta}_{t|t-1}\right)' | y^{t-1}\right)$, $\overline{\theta}_{1|1} = \begin{pmatrix} 0 & 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}'$, $P_{1|1} = 1000 * I_{12\times 12}$, $R = 10 * I_{3\times 3}$ and $Q = (0.01)^2 * P_{1|1}$.