Tutorial 2: Dynamic Econometric Models

Empirical Exercises

1. Simulation of the AR models. Use Matlab
   (a) Write a procedure that simulates an AR(1) process: $y_t = \alpha y_{t-1} + u_t$. The disturbances are drawn from a standard normal distribution. The initial observation is set to zero.

   (b) Now write a program that 1000 times calls the simulation procedure, estimate the AR(1) coefficient by OLS using the simulated data, and stores the result. Plot the empirical distribution of these 1000 estimates together with the theoretical asymptotic distribution for the following choices: α=0,0.05,0.9,0.99 and T=20,40,80. Discuss your results.

2. In this exercise you will replicate the paper of Romer and Romer 2010 that studies the effect of tax changes on real economic activity in the US. In this paper, they used novel approach of narrative analysis to construct the exogenous tax changes, i.e. tax changes that are not systematically correlated with other factors affecting the current state of the output growth. In the data file RRdata.xlsx you will find the dataset used in this paper.
   - $PGDP$: price index of real GDP
   - $PCGDPl$: changes in the logarithm of real GDP, $PCGDPl = log(PGDP_t) - log(PGDPt - 1)$.
   - $EXOGENRRATIO$: a ratio of the exogenous tax changes to nominal GDP at time t.

   (a) Denote $\Delta Y_t = PCGDPl$ and $\Delta T_t = EXOGENRRATIO$. Regress real output growth ΔY_t on a constant, the current and first 12 lags of exogenous tax changes ΔT_t

   $$\Delta Y_t = a + \sum_{i=0}^{M=12} b_i \Delta T_{t-i} + e_t \tag{1}$$

      i. Calculate the responses of real GDP to tax shock over 12 horizons. Replicate figure 4 in the paper.

ii. Plot the autocorrelogram of the residuals. By visual examination, do the residuals exhibit serial correlation?

iii. By using the Newey-West t-statistic, is the effect of tax shock on real GDP at horizon 10 statistically significant? Compare with the results reported by using conventional t-statistic

(b) Romer and Romer 2010 checked their result robustness by control the lagged GDP growth in the model. In specific, they estimate

$$\Delta Y_t = a + \sum_{i=0}^{M=12} b_i \Delta T_{t-i} + \sum_{j=1}^{N=11} c_j \Delta Y_{t-j} + e_t \tag{2}$$

i. Again, check whether the residuals are serially correlated?

ii. Replicate figure (5) in the paper. Compare with the results obtained in part (a)i.

iii. Use the information criteria, i.e. AIC, BIC and HQ, to select the appropriate lag order for ΔT and ΔY in the model .