Macroeconomics II: Dynare Tutorial Exercise

Erik Öberg

Consider the vanilla RBC model discussed in Lecture 1. Its equilibrium and log-linear equilibrium are characterized by

$$\frac{1}{C_t}W_t = \theta N_t^{\varphi} \quad \Rightarrow \quad \hat{w}_t = \hat{c}_t + \varphi n_t$$

$$\frac{1}{C_t} = \beta E_t\left[(R_{t+1}^r + (1-\delta))\frac{1}{C_{t+1}}\right] \quad \Rightarrow \quad \hat{c}_t = -\beta R^r E_t \hat{r}_{t+1}^r + E_t\hat{c}_{t+1}$$

$$C_t + I_t = Y_t \quad \Rightarrow \quad \frac{C}{Y}\hat{c}_t + \frac{I}{Y}\hat{i}_t = \hat{y}_t$$

$$Y_t = A_t K_t^{\alpha} N_t^{1-\alpha} \quad \Rightarrow \quad \hat{y}_t = \hat{a}_t + \alpha\hat{k}_t + (1-\alpha)\hat{n}_t$$

$$K_{t+1} = (1-\delta)K_t + I_t \quad \Rightarrow \quad \hat{k}_{t+1} = (1-\delta)\hat{k}_t + \delta\hat{i}_t$$

$$R_t^r = \alpha A_t \left(\frac{K_t}{N_t}\right)^{\alpha-1} \quad \Rightarrow \quad \hat{r}_t^r = \hat{a}_t - (1-\alpha)(\hat{k}_t - \hat{n}_t)$$

$$W_t = (1-\alpha)A_t \left(\frac{K_t}{N_t}\right)^{\alpha} \quad \Rightarrow \quad \hat{w}_t = \hat{a}_t + \alpha(\hat{k}_t - \hat{n}_t)$$

$$A_t = A_{t-1}^{\rho_a} exp(\epsilon_t) \quad \Rightarrow \quad \hat{a}_t = \rho_a\hat{a}_{t-1} + \epsilon_t$$

and its steady state is given by

$$R^r = \frac{1}{\beta} - (1-\delta)$$

$$W = (1-\alpha)\left(\frac{R^r}{\alpha}\right)^{-\frac{\alpha}{1-\alpha}}$$

$$N = \left[\frac{1}{\theta}\frac{W}{\frac{R^r}{\alpha} - \delta}\left(\frac{R^r}{\alpha}\right)^{\frac{1}{1-\alpha}}\right]^{\frac{1}{1+\varphi}}$$

$$K = \left(\frac{R^r}{\alpha}\right)^{-\frac{1}{1-\alpha}}N$$

$$Y = \frac{R^r K}{\alpha}$$

$$I = \delta K$$

$$C = (\frac{R^r}{\alpha} - \delta)K$$

Exercise 1: Calibration

Calibrate the model on a *quarterly frequency*. Set $\varphi = 1$, and

- Pick δ to match NIPA estimates of average *yearly* capital depreciation rate $\sim 10\%$

- Pick β to match a *yearly* real return on capital of 4 percent, net of depreciation

- Pick α to match long-run labor share $\sim 2/3$

- Pick θ to match average hours worked ~ 0.7

With these parameter values, what are the values of $\frac{C}{Y}$ and $\frac{I}{Y}$?

Exercise 2: Simulation using Dynare

Going forward to analyze dynamics, let's set $\rho_a = 0.973$ and $\sigma_\epsilon = 0.009$.

1. Plug in the log-linear system into Dynare and simulate a first-order pertubation

2. Compare your estimated IRFs with those we retreived in class, are they the same?

3. Look at the simulation moments, are they the same as those we looked at in class?

4. Set the HP-filter parameter to 1600 (standard for quarterly data), do the moments change? Are they the same as in class?

Exercise 3: Making you own graphs using the IRFs

1. Construct a figure of the IRFs of output and TFP in the same graph

2. Construct a figure of the IRFs of Investment and consumption in the same graph

Exercise 4: From IRFs to simulation plots

1. Generate a sequence of $T = 200$ random draws of the shocks

2. Produce a time series of output, consumption and investment based on these draws and your estimated IRFs, similar to the graph in Lecture 1