Macroeconomics

Tutorial 3

0.1 Dynare Simulation

In this exercise you are required to analyse a version of the baseline New Keynesian model in which there are three shocks: interest rate shocks, cost-push shocks and aggregate demand shocks. The basic structure of the model is a dynamic IS curve, a Phillips curve, and a simple rule for monetary policy.

$$y_t = E_t y_{t+1} - \frac{1}{\sigma}\left(i_t - E_t \pi_{t+1}\right) + g_t \tag{1}$$
$$\pi_t = \beta E_t \pi_{t+1} + \kappa y_t + u_t \tag{2}$$
$$i_t = \phi_\pi \pi_t + v_t \tag{3}$$

where

$$\kappa = \frac{(1-\omega)(1-\beta\omega)}{\alpha\omega}$$

The three shocks are assumed to be indipendent AR(1) processes, given by

$$\begin{pmatrix} \nu_{t+1} \\ u_{t+1} \\ g_{t+1} \end{pmatrix} = \begin{pmatrix} \rho_\nu & 0 & 0 \\ 0 & \rho_u & 0 \\ 0 & 0 & \rho_g \end{pmatrix} \begin{pmatrix} \nu_t \\ u_t \\ g_t \end{pmatrix} + \begin{pmatrix} \upsilon_\nu & 0 & 0 \\ 0 & \upsilon_u & 0 \\ 0 & 0 & \upsilon_g \end{pmatrix} \begin{pmatrix} \epsilon_t^\nu \\ \varepsilon_t^u \\ \epsilon_t^g \end{pmatrix}$$

Calibration

Parameter	Calibrated Value	Definition
β	0.99	Discount Rate
σ	1	Intertemporal Elasticity of Substitution
ω	0.5	% of Firms unable to change their price in each period
α	3	$(1/\alpha)$ elasticity of wages w.r. to output gap
ϕ_π	1.5	Coef. of Inflation in interest rate rule
ρ_ν	0.5	Persistence of Interest rate shock
ρ_u	0.8	Persistence of Supply shock (cost push)
ρ_g	0.3	Persistence of Demand shock
σ_ν	1	St. Dev of Interest rate shock
σ_u	0.5	St. Dev. of Supply shock (cost push)
σ_g	1	St.Dev. of Demand shock

1. Which are the backward looking varialbes in the model? Which are the forward looking variables?
2. Calculate, via simulation, the following stylised facts of this model economy: volatility, autocorrelation and correlations between output gap , inflation, and interest rate.
3. Show the responses of interest rates, output gap and inflation to the three different shocks. Explain, using the model, the intuition for the response of each variable to each type of shock.
4. Use the forecast error variance decomposition to verify which of the three shocks contributes most to fluctuations in interest rates, the output gap and inflation.

0.2 Welfare analysis

Assume that the welfare of agents in the economy can be measured by the following loss function:

$$\min \sum_{i=0}^{\infty} \beta^i \left[\pi^2 + y^2\right] \tag{4}$$

1. Which type of shock is most detrimental to welfare in this economy?
2. In the model, change the monetary policy rule as follow:

$$i_t = \phi_\pi \pi_t + \phi_y y_t + v_t$$

where $\phi_\pi = 1.5$, as before, and $\phi_y = 0.5$. Simulating the model again with this new policy rule, calculate the welfare function in (4) for this new specification. Which rule perform best? Should the central bank target income as well as inflation to improve the welfare of the consumers?