Christiano
Assignment 8

Tutorial on Optimal Monetary Policy in the Rotemberg Sticky Price Model, in Dynare 4

Consider the Rotemberg model in the lecture notes on optimal monetary policy. For questions 1-3, work with the Dynare mod file, model.mod. This program is incomplete, and requires that you type in the model equations from the lecture handout (a model file that will produce the answers to questions 1-3 is modelans123.mod; a model file that addresses question 4 is modelans4.mod).

1. Enter the equilibrium conditions of the Rotemberg model into Dynare, including the following monetary policy rule:

$$R_t = \frac{\pi^{t\arg et}}{\beta} - 1 + \alpha\left(\pi_{t+1} - \pi^{t\arg et}\right),$$

where $\pi^{t\arg et}$ is a parameter set by the monetary authorities. Set the parameters as follows:

$$\begin{aligned} \beta &= 0.99,\ \varepsilon = 5,\ \varphi = 100,\ \rho = 0.9,\ \alpha = 1.5, \\ 1+\nu &= \varepsilon/(\varepsilon - 1),\ \chi = 1,\ \pi^{t\arg et} = 1. \end{aligned}$$

Do a linear approximation on the model, instead of a log linear approximation. Compute the impulse response to a one standard deviation technology shock, when that standard deviation is 0.01 (i.e., 1 percent). In computing the impulse response functions, display the percent deviation of consumption and hours worked from their steady state, display the actual net inflation rate in annual terms (i.e., multiply by four), the actual net nominal rate of interest in annual terms, and the actual net real rate of interest.

2. In this model, the 'natural' allocations have the property that hours worked do not respond to a technology shock. In the equilibrium, hours worked do respond. What is the intuition? Consider an alternative formulation of the model for technology:

$$\log(A_t) = 1.85\log(A_{t-1}) - 0.855\log(A_{t-2}) + \varepsilon_t.$$

Note how with this model, an innovation in $logA_t$ creates the expectation of an even larger jump in $\log A_{t+1}$. Note how different the response of hours worked to a technology shock is relative to question 1.

3. Compute the natural rate of interest for this model, as defined in example 5 of the notes on solving models. Plot that along with the real equilibrium interest rate. Do the results allow you to see why it is that in question 2 hours worked rises too much in response to a technology shock?

4. Compute the optimal policy for this model. For this, you must tell Dynare what utility function you want to optimize, and what discount rate you would like to use. Simply replace the stoch_simul command with ramsey_policy. In general, the ramsey_policy command has the same parameters as stoch_simul. However, one additional command is planner_discount, which must be set to the planner's discount rate. You can simply make that the same as the discount rate of the representative household in the model. The name of the utility function is declared before the ramsey_policy command in the Dynare command, planner_objective Util; . Of course, one of the equations of the model actually has to define the utility function!

    a. Solve the model with the parameters in question 1 and:

        - verify that the multipliers on the intertemporal Euler equation and the pricing equation are zero, as established in the lecture notes. (The multiplier on the i^{th} equation of the model is labeled mult_i.)
        - verify that inflation and employment are constant at their first-best values as established in the lecture notes.
        - explain that we have time consistency of the optimal plan.
        - replace the AR(1) time series representation for log-technology in question 1 with the AR(2) process in question 2. What happens to the sign of the coefficient on ε_t in the equation for the nominal rate of interest? Provide intuition.
        - graph the response of inflation, hours worked, the nominal rate of interest, consumption, technology, and the real rate of interest to an innovation in technology under the equilibrium and the Ramsey equilibrium. In the graph for the real interest rate include also the natural rate of interest computed in question 3. Do the Ramsey allocations look like the 'natural allocations'? (For this, you will first have to run the code that computes the equilibrium, and then save the output, as in PlotQ1.m. Then run the code that computes the Ramsey equilibrium and plot it's output along with the saved output from the equilibrium, as in PlotQ2.m.)

b. Now, set the tax subsidy to zero and re-solve the model.

- What happens to the multipliers? Explain that now the Ramsey plan is not time consistent.
- Do the Ramsey allocations look like the 'natural' allocations?