ECON 355: Homework 5
Spring 2021
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This homework is due April 29 at noon. Please upload a single pdf file with your answers to our shared folder on Google Drive. You should also upload your MATLAB and Dynare code files separately. Be sure to show your work.

1. [15 points] For this question you will replicate Figure 2 (your image will look slightly different due to rounding) from "Without Looking Closer, it May Seem Cheap: Low Interest Rates and Government Borrowing" by Garín et al. (2019). Let's suppose you have already approximated and you get the following results:

When $\beta = 0.99$ and $z = 0.005$ (baseline calibration):

$$\ln \bar{k} = 1.66$$

$$\overline{SUS} = 0.5$$

When $\beta = 0.9928$ and $z = 0.005$ (high β calibration):

$$\ln \bar{k} = 1.78$$

$$\overline{SUS} = 0.7$$

$$\tilde{k}_t = 0.95\tilde{k}_{t-1}$$

$$SUS_t = 0.7 + 0.19\tilde{k}_{t-1}$$

Note: SUS is the level of SUS and not the log deviation from the steady state like $\tilde{k}$ is.

When $\beta = 0.99$ and $z = 0.0021$ (low z calibration):

$$\ln \bar{k} = 1.77$$

$$\overline{SUS} = 0.5$$

$$\tilde{k}_t = 0.95\tilde{k}_{t-1}$$

$$SUS_t = 0.5 + 0.14\tilde{k}_{t-1}$$

For each calibration (low z and low β) start with $\ln k_{t-1}$ at the steady state from the original calibration. For the first period of your simulation, the calibration of the model unexpectedly changes. This means that model follows the approximation from the new calibration and the steady state will change. This means that you need to calculated $\tilde{k}_{t-1}$ with k at the old steady state value but you will subtract $\bar{k}$ at the new steady state. From there you can calculate how $\tilde{k}$ will evolve using the equations above. Using that information you can calculate SUS_t.

You will create a two panel plot using MATLAB. You should use the command subplot(1,2,1) and subplot(1,2,2) before you plot each series. You will also want to add a title and label using the title and ylabel commands. You should also use the legend command to add a legend (information for all of these can be found on MATLAB's website). To write β you can enter in $\backslash beta$. To plot a red dashed line you can use a command like plot(x,y,'- -r').

2. [15 points] A common feature of New Keynesian models is to include price markup shocks. These markup shocks lead to firms setting prices at higher or lower values above the marginal cost of production. For this problem, assume there are no other shocks in the model and there is log utility of consumption. The labor market is perfectly competitive.

Intermediate good producer j has a production function $Y_t(j) = H_t(j)$ and faces price adjustement costs

$$PAC = \frac{\phi}{2}\left(\frac{P_t(j)}{\pi P_{t-1}(j)} - 1\right)^2 Y_t$$

where π is the steady state of the gross inflation rate, $\pi_t = \frac{P_t}{P_{t-1}}$. The demand for the j$^{\text{th}}$ firms good is given by

$$Y_t(j) = \left(\frac{P_t(j)}{P_t}\right)^{-e\epsilon_t} Y_t$$

where the price markup shock follows the process $\ln \epsilon_t = \rho \ln \epsilon_{t-1} + \sigma u_t$ where u is an i.i.d. standard normal shock.

Intermediate firms want to maximize the expected discounted present value of dividends in real terms by solving the following:

$$\max_{P_t(j)} E_0 \sum_{t=0}^{\infty} \beta^t \frac{1}{C_t}\left(Y_t(j)\frac{P_t(j)}{P_t} - w_t H_t(j) - PAC_t\right).$$

a. Find the first order condition for the firm.

b. Assume a symmetric equilibrium. From the household's FOC you found $w_t = \psi H_t^{\eta} C_t$. Use this along with the production function to plug in for w_t with a function of Y_t and C_t. Set up the equation so you will be able to replace all of the price level terms with terms for gross inflation. After doing this, log linearize the FOC from part a.