Homework 7

The codes are posted on blackboard, in a zip file. The program you should run on Matlab is the one named `HW7.m`. Note that for some exercises, you may have to change the length of simulation periods, in order to see the full dynamics revert; the variable for that is `Tsim`. All the parameters that you need to change are in the first 20 lines of code.

The Model

- The IS curve:

$$x_t = E_t(x_{t+1}) - \sigma[r_t^n - E_t(\pi_{t+1})] + g_t$$

- The Phillips Curve:

$$\pi_t = \kappa x_t + \pi_{t-1} + u_t$$

- Interest Rate Rule:

$$r_t^{n*} = r_t^* + \phi_\pi \pi_t + \phi_x x_t + \upsilon_t$$

- Where x_t is the output gap $(y_t - y_t^*)$, r_t^n is the nominal interest rate, and π_t the inflation rate. We will assume $y_t^* = 0$ and $r_t^{n*} = 0$.

- Processes for Shocks:

$$g_t = \rho_g g_{t-1} + \epsilon_{gt}, \quad \text{IS Shock}$$

$$u_t = \rho_u u_{t-1} + \epsilon_{ut}, \quad \text{Shock to Phillips Curve}$$

$$\upsilon_t = \rho_\upsilon \upsilon_{t-1} + \epsilon_{it}, \quad \text{Interest Rate Shock}$$

$$\epsilon_{jt} \sim N(0, \sigma_j) \qquad j = g, u, i$$

1. Run the code `HW7.m` with its original settings. Note that there are no shocks to the economy: $(g_t = u_t = \upsilon_t = 0)$ `shockg = 0; shocku = 0; shockeps = 0;` , but there is a positive level of inflation when the economy begins:

   ```
   pinit = 0.01;
   ```

   Look at the plots. How do you explain the fact that the variables are changing, even though all shocks are "shut down"?

2. Now, shut down the initial inflation: set `pinit = 0;`. Play with the three shocks: specifically, `shockg = 0.01;` (g_t), `shocku= 0.01;` (u_t) or `shockeps= 0.01;`(υ_t) either positive and negative valued shocks. Avoid putting more than one shock in at the same time, as that makes the responses harder to analyze. Discuss the effects of each shock - do this for either the positive or the negative value of it.

3. Repeat the previous question, but this time with a positive initial inflation level `pinit = 0.1;`. What is different in the economy's response to each shock, given a positive initial inflation rate? Intuitively, can you see where this effect is coming from?

4. This time, look at the parameter for the response to inflation in the interest rate rule, ϕ_π - this controls the strength of the response of nominal rates to inflation. What happens to your previous responses if this parameter is set to $\phi_\pi = 2$ (the original setting), versus $\phi_\pi = 1.01$? The parameter in the program is coded as the variable `phipi`. Describe overall patterns and discuss.

5. Finally, from the baseline, change the following parameters: set the `shocku= 0.1` ($u_t = 1$), `rhou = 0.9` ($\rho_u = 0.9$) and `phipi=1.001` ($\phi_\pi = 1.001$). Shut down the other two shocks and everything else remains unchanged. Basically, we will shock the economy with a very persistent shock to the Phillips Curve, and we will make the interest rate respond very weakly to inflation. What happens to the path of inflation? Does it revert back to steady state? How long does this take? You may have to change the length of simulation periods to see the full path (try in the 1000s). Discuss.

These are the baseline values for the parameters.

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%
% Parameters of Interest:
%%%%%%%%%%%%%%%%%%%%%%%%%%%

rhog        = 0.6;          % Persistence Parameter for IS shock
rhou        = 0.6;          % Persistence Parameter for Phillips Curve Shock
rhoeps      = 0.6;          % Persistence Parameter for Interest Rate Shock

pinit       = 0;            % Initial Inflation

phipi       = 2;             % Parameter for Response to Inflation

shockg      = 0;            % Value for IS Shock
shocku      = 0;            % Value for Phillips Curve Shock
shockeps    = 0;            % Value for Interest Rate Shock

Tsim          = 20;         % Simulation Periods
```