Problem set # 4

Due date: March 27

Please show your work carefully in answer the following questions. As mentioned in class, you are encouraged to work in groups but must write your own answers. Note: this HW is long. Do not wait until we cover every topic in the lecture to attempt the problems.

1. **(Monopolistic Competition with taste shocks)** (this follows Dixit and Stiglitz, 1997) Suppose that the consumption index in equation $U_i = C_i - \frac{1}{\gamma}L_i^{\gamma}$ is $C_i = \left[\int_{j=0}^{1} Z_j^{\frac{1}{\eta}} C_{ij}^{(\eta-1)/\eta} dj\right]^{\frac{\eta}{\eta-1}}$, where C_{ij} is the individual's consumption of good j and Z_j is the taste shock for good j. Suppose the individual has amount Y_i to spend on goods. thus the budget constraint is $\int_{j=0}^{1} P_j C_{ij} dj = Y_i$.

   (a) Find the first-order condition for C_{ij} for the problem of maximizing C_i subject to the budget constraint. Solve for C_{ij} in terms of $Z_j,\ P_j$, and the Lagrange multiplier on the budget constraint.

   (b) Use the budget constraint to find C_{ij} in terms of $Z_j,\ P_j,\ Y_i$, and the Z's and P's.

   (c) Substitute your result in part (b) into the expression for C_i and show that $C_i = Y_i/P$, where $P = [\int_{j=0}^{1} Z_j P_j^{1-\eta} dj]^{\frac{1}{1-\eta}}$.

   (d) Use the results in part (b) and part (c) to show that $C_{ij} = Z_j(P_j/P)^{-\eta}(Y_i/P)$.

2. **(Calvo Handout)** Please go over the Calvo handout (on course website).

   (a) Derive equation (x), equation above $(*)$, equation $(*)$, equation $(+)$ and the Calvo Phillips curve. Be sure to show your work (most relevant steps).

   (b) Provide intuitions for equation (x) and the Calvo Phillips curve. Interpret the coefficients β and λ in the Calvo Phillips Curve.

3. Explain whether the following statement is *true, false or uncertain*:

   (a) **(Menu Costs)** If menu costs are the reason for monetary non-neutrality, then according to these models, a recession caused by a monetary contraction would not be very costly.

4. **(Policy question)** Pick one of the following two podcasts:

   (a) The Federal Debt and the COVID-19 Recession by Olivier Blanchard: https://econofact.org/podcast/the-federal-debt-and-the-covid-19-recession

   (b) Will the Biden Stimulus Lead to Inflation? A Conversation with Paul R. Krugman and Lawrence H. Summers: https://bcf.princeton.edu/events/a-conversation-with-paul-krugman-and-lawrence-h-summers/

Provide a 1/2 to 1 page summary with the main policy and macroeconomic ideas behind the talk, as well as the main mechanisms and insights that explain them. As possible, draw your conclusions in terms of the topics, tools and methods introduced in the lectures.

Remember to explain the talk **in your own words**. Please do not copy from the executive summary in the link.

5. **(Setting Dynare and Solving your first DSGE model.)** The objective of this question is to make sure you set up Dynare in your computer and start getting familiar with its basic use.

   (a) Install Dynare and add it to your Matlab path library (instructions for windows and mac here https://www.dynare.org/resources/quick_start/)

   (b) Code for a model: save the following code as a .mod file (mod goes for model) in your working folder[1]. Then run it with the instruction `dynare file_name.mod` (file_name is the name used for the file, change the command accordingly if you use another name).

```
// Simple_DSGE_Model.mod
// Simple closed economy model with productity shocks

// Note: (time notation in Dynare) x refers to x_t,
// x(-1) refers to x_{t-1}, and x(+1) refers to E_t[x_{t+1}]

// Variables block
var c, k, z;
varexo eps;

// Parameters block
parameters betta, rho, alphha, nu, deltta, sig;

alphha  = 0.33;
rho  = 0.95;
betta = 0.99;
nu = 1;
deltta  = 0.025;
sig  = 0.007;

// Model Equations block
model;

c^(-nu) = betta*c(+1)^(-nu)*(alphha*z(+1)*k^(alphha-1) + 1 - deltta) ;
c + k = z*k(-1)^alphha + (1 - deltta)*k(-1) ;
z = (1 - rho) + rho*z(-1) + eps;

end;

// Steady State block
initval;
k = (betta*alphha/(1-betta*(1-deltta)))^(1/(1-alphha));
c = k^alphha-deltta*k;
```

[1] for this just open Matlab, paste the code (in the editor) and save the file, replacing the ".m" part by ".mod"; alternatively feel free to use the file I posted on the course website.

```
z = 1;
end;

// Shocks block
shocks;
var eps; stderr sig;
end;

// Solution and simulation (of shock) command
stoch_simul(order=1,IRF=30) k z c;
```

(c) Report the plots the file generates (this will be the Impulse Response Functions of the endogenous variables after a shock in the model).