

Problem set 2

October 2015

Each student picks 1 of the following problems. Each student must hand in

- A 2-page document describing the economic question, methodology and results. I expect *economic comments*. Only typed up documents will be accepted.
- A Matlab file and all necessary files (data) to replicate the results. I must be able to run the code on my computer

You should email the solutions to me by **December 1st, midnight**. I expect students to pick different problem sets. I let the coordination up to you. If you have other ideas for problem sets, feel free to tell me about it. I am open to discussion.

1 Habit consumption in a standard RBC model

purpose : introduce habit formation in consumption and look at the impact of this mechanism on macroeconomic dynamics. Rewrite the RBC model with habit in consumption. The utility flow is now

$$\log(C_t - \phi_c C_{t-1}) - \phi_L L_t$$

where ϕ_c measures the degree of internal habit persistence.

1. Derive the new FOCs
2. Derive the new steady state with a benchmark calibration of $\phi_c = 0.6$
3. Write the mod file
4. compare the IRFs and simulated moments with $\phi_c = 0.6$ versus $\phi_c = 0.3$

what do we learn?

2 Ricardian equivalence

Consider the baseline RBC model. Add government spending G_t as a shock. The government budget constraint is balanced through lump-sum transfers to households. This will alter the baseline RBC model along 2 dimensions :

- i) Add another endogenous variable G_t (hence add an equation in the dynamic system, G_t , that is $\log(G_t) = (1 - \rho_g)\log(\omega Y) + \rho_g \log(G_{t-1}) + \varepsilon_g t$, with $\omega = 0.2$ the steady state value of government spending as a fraction of output. Take ω to be an exogenous parameter.

- ii) G_t is a component of the demand for goods in the good market equilibrium: $Y_t = C_t + I_t + G_t$
1. Look at the steady state. How does G affect the steady state of the economy, with respect to the baseline economy?
 2. Write the Dynare mod file. Calibration is the same as in the baseline RBC model. In addition, $\omega = 0.2$, $\rho_g = 0.95$, $\sigma_{\varepsilon_g} = 0.01$.
 3. plot the IRFs of output, consumption, investment, employment after a government spending shock. Comment the IRFs.
 4. Plot the IRFs of output, consumption, investment, employment after a government spending shock for $\rho_g = 0.70$, $\rho_g = 0.95$, $\rho_g = 0.99$ (For instance, for output, you shall have 3 IRFs of output on the same graph, each IRF for a specific value of ρ). Comment the IRFs.

3 Exploring the effect of changes in income tax

Take the baseline RBC model. Add income taxation τ_n in household's budget constraint, such that labor income becomes $(1 - \tau_n)w_t$. Consider this tax rate as a shock. The government budget constraint is balanced through lump-sum transfers to households. This will alter the baseline RBC model along 2 dimensions :

- FOC on consumption-leisure
- add an endogenous variable τ_n and add an dynamic equation governing the evolution of τ_n : $\log(\tau_{n,t}) = (1 - \rho_\tau)\log(\tau_n) + \rho_\tau\log(\tau_{n,t-1}) + \varepsilon_{\tau,t}$

The steady state labor income tax τ_n is 0.2; $\rho_\tau = 0.9$ and $\sigma_{\varepsilon_\tau} = 0.01$

1. Look at the steady state. How does τ_n affect the steady state of the economy, with respect to the baseline economy?
2. Write the Dynare mod file.
3. plot the IRFs of output, consumption, investment, employment after a tax shock. Comment the IRFs.
4. Plot the IRFs of output, consumption, investment, employment after a tax shock for $\eta = 0.5$, $\eta = 1$, $\eta = 2$. Recall that η enters the utility function, on the leisure term. (For instance, for output, you shall have 3 IRFs of output on the same graph, each IRF for a specific value of η). Comment the IRFs.

4 Exploring the effect of changes in capital taxation

Take the baseline RBC model. Add capital taxation τ_k in household's budget constraint, such that capital income becomes $(1 - \tau_k)(r_t + 1 - \delta)k_{t-1}$. Consider this tax rate as a shock. The government budget constraint is balanced through lump-sum transfers to households. This will alter the baseline RBC model along 2 dimensions :

- Euler equation

- add an endogenous variable τ_k and add a dynamic equation governing the evolution of τ_k :

$$\log(\tau_{k,t}) = (1 - \rho_\tau)\log(\tau_k) + \rho_\tau\log(\tau_{k,t-1}) + \varepsilon_{\tau,t}$$

The steady state capital income tax τ_k is 0.1; $\rho_\tau = 0.9$ and $\sigma_{\varepsilon_\tau} = 0.01$

1. Look at the steady state. How does τ_k affect the steady state of the economy, with respect to the baseline economy?
2. Write the Dynare mod file.
3. plot the IRFs of output, consumption, investment, employment after a tax shock. Comment the IRFs.
4. Plot the IRFs of output, consumption, investment, employment after a tax shock for $\rho_\tau = 0.70$, $\rho_\tau = 0.9$, $\rho_\tau = 0.99$ (For instance, for output, you shall have 3 IRFs of output on the same graph, each IRF for a specific value of ρ_τ). Comment the IRFs.

5 Income tax in a deterministic model

Consider question 3 in a deterministic framework.

1. Look at the steady state. How does τ_n affect the steady state of the economy, with respect to the baseline economy?
2. Write the Dynare mod file in a deterministic framework.
3. plot the transitional dynamics of output, consumption, investment, employment after a permanent tax increase from 0.2 to 0.3
4. Plot the transitional dynamics of output, consumption, investment, employment after a permanent tax increase from 0.2 to 0.3 for $\eta = 0.5$, $\eta = 1$, $\eta = 2$. Recall that η enters the utility function, on the leisure term. (For instance, for output, you shall have 3 IRFs of output on the same graph, each transitional path for a specific value of η). Comment the transitional dynamics.

6 Capital tax in a deterministic model

Consider question 4 in a deterministic framework.

1. Look at the steady state. How does τ_k affect the steady state of the economy, with respect to the baseline economy?
2. Write the Dynare mod file in a deterministic framework.
3. plot the transitional dynamics of output, consumption, investment, employment after a permanent tax increase from 0.2 to 0.3
4. Plot the transitional dynamics of output, consumption, investment, employment after a permanent tax increase from 0.2 to 0.3 for $\rho_\tau = 0.70$, $\rho_\tau = 0.9$, $\rho_\tau = 0.99$ (For instance, for output, you shall have 3 lines for output on the same graph, each line for a specific value of ρ_τ). Comment the transitional dynamics.

7 Why do Americans Work so Much More than Europeans?

This problem set is a bit more complicated than the others. Download Prescott's paper (<https://www.minneapolisfed.org/research/qr/qr2811.pdf>). This is a baseline DSGE model with government expenditure and distortive taxation. Consider this model in a deterministic setting.

1. Write the Dynare file of Prescott's model, with his calibration and specifications for utility. Recover the results in table 2.
2. What would happen in a European country (of your choice, a country with heavy labor taxation) if they face the same tax rate as in the US?
3. Make dynare compute the transitional dynamics between the current tax rate and the hypothetical economy with US tax rates. What do we learn?

8 Heterogeneous households

This problem set is a bit more complicated than the others. Take the baseline RBC model. Add another household in the economy. Let us call it household 2. This household does not save, and is more impatient than the other household (let us call it household 1) (i.e. β^2 is lower than β^1). Both households have the same productivity, hence the same wage. Both households have the same utility function. The new productivity function is $y_t = a_t k_t^\alpha (l_t^1 + l_t^2)^{1-\alpha}$.

1. Write the Dynare file
2. Comment the IRFs
3. Compare the IRFs of the baseline RBC and the RBC with heterogeneous households