1 Readings

1. Read DLS ch 6,9, Barro ch 7,8, Wickens ch 2,4

2. Read Chapters 1,2 of Ebrahimian and Madanizadeh (RBC Calibration for Iran’s Economy).

3. Read "Are Micro and Macro Labor Supply Elasticities Consistent?" by Chetty and summarize it in 500 words (max).

4. Real business cycles: A simple introduction (on the folder list)

5. RBC Models - A Toy Example by Ozdagli 2006

6. "Theory ahead of business cycle measurement" by Prescott 1986

2 RBC model (1)

1. Setup an RBC model with inelastic labor (no labor supply decision: \( l = 1 \)) where household per period utility function is \( u(c) = \frac{c^{1-\eta}}{1-\eta} \) and the production function is \( y = f(k, l) = Ak^{\alpha}l^{1-\alpha} \) and a persistent productivity shock \( z_t = \log A_t = \rho \log A_{t-1} + \varepsilon_t \). (the social planner problem)

2. Write down the FOCs and find the Euler equation.

3. Solve for the steady state.

4. Log linearize the model, simplify to get an equation which has only capital and the productivity shock.
5. Solve for the Recursive Law of Motion to find $\gamma_1, \gamma_2$ such that $k_{t+1} = \gamma_1 k_t + \gamma_2 z_t$.

6. Explain how do $\gamma_1, \gamma_2$ depend on the exogenous parameters. Can you come up with some intuitions?

7. Now solve for $c_t, i_t, y_t, v_t, w_t$ in terms of $k_t, z_t$.

8. Calibrate your model using typical numbers we use in class.

9. Use the parameters you found in the previous part and plot all of the endogenous responses (listed above) to a 1% productivity shock at time 0. Explain the intuitions behind these responses. How large are the spot effects and how large are the persistency? In one paragraph, explain how does a productivity shock is affecting different variables over time.

10. (optional- with credit) Simulate your model using the calibrated model and estimate the standard deviations of important variables and their correlations with GDP using Monte-Carlo simulation (draw 10000 samples for the shock $\varepsilon_t$ and run your model. Ignore the first 100 points and calculate the variance of your variable. Redo this 1000 times and take an average)

11. (optional- with credit) Analytically, solve for the conditional and unconditional mean and variance of $z_t, k_{t+1}$ and $c_t$. Now compare it with the simulated ones in the previous part.

12. (optional- with credit) Analytically, solve for the unconditional correlation of consumption and investment with output. How does it compare with the simulated ones?

3 RBC model (2)

1. Setup an RBC model (like the one in class) with capital and labor and a persistent productivity shock in a competitive equilibrium environment (do not setup the social planner problem). Household per period utility function is $u(c) = \log(c) - \gamma(1+\phi)$ and the production function is $y = f(k, h) = Ak^\alpha h^{1-\alpha}$

2. Find the Euler equation, the labor supply and the labor and capital demand functions.
3. Define the equilibrium and then simplify the equation by clearing the markets.

4. Solve for the steady state.

5. Log linearize the model (you should have at most three equations: one for labor, one for capital and one for consumption)

6. Calibrate your model to US data using Cooley Prescott paper (Read the paper carefully). How do you treat government purchases? How about government investment? How do you treat the change in the inventory data?

7. Use Dynare to solve and simulate your model. Explain your finding on how the model match with the data (compare the moments of the data and your model like the variances of variables and their correlations with GDP). What fraction of output volatility can your model explain? What is the ratio of the output volatility to Solow residual volatility in the data and in your model.

8. Plot the impulse responses using Dynare. How do consumption, output, labor and capital respond to a 1% shock to productivity. Explain how the amplification process (spot effect) and the transmission mechanism (persistency) is working? Specifically, pay attention on how a productivity shock is affecting employment and investment. Write a story for how a productivity shock is affecting the economy and then propagates over time.

9. How does your impulse responses change when you change $\rho$ the persistence parameter of the productivity?

10. How does your impulse responses change when you change $\sigma^2_e$ the variance the productivity innovation $\varepsilon_t$?

11. (Optional) How does your responses change if the utility function is $u(c, h) = (1 - \gamma) \log c + \gamma \log (1 - h)$? How about $u(c, h) = \frac{(c^{1-\gamma}(1-h)^\gamma)^{1-\eta}}{1-\eta}$?

12. Now, use the calibrated model in Ebrahimian and Madanizadeh (chapters 1 and 2) and calibrate your model for the Iran’s Economy.

13. Redo parts 7 and 8 and compare your results. How much difference do you observe?