The University of Hong Kong
Econ 6069 Computational Methods in Economics
Final Exam

Form a group of 2-3 people. Write a computer program to solve one of the two problems. Present the results on December 5th, 9:30 am – 12:20 pm. Hand in the final codes and report by 5:00 pm, December 20th.

1. Read “The Career Decisions of Young Men” (Keane and Wolpin, 1997) and lecture note ”Dynamic Labor Supply”.

   Consider the life-cycle labor supply decisions for young men starting at age 20 ($t = 0$). Suppose now the agent’s objective function is

   $$E\{\sum_{t=0}^{T-1} \beta^t u(A_t, h_t, t) + \beta^T W(A_T)\}$$

   where t represents age. Individuals make two decisions: 1) the saving decision A_{t+1}, and 2) the labor supply decision h_t. h_t is hours of work and $h_t \in [0, 1]$. The terminal stage is at age 60 ($T = 40$) and the terminal valuation satisfies

   $$W(A_T) = \frac{1}{r} u(rA_T)$$

   The utility function is defined as

   $$u(A_t, h_t, t) = \log(c_t) - 1/\delta * h_t^{1.5}$$

   The budget constraint is

   $$A_{t+1} = (1 + r)(A_t + w_t h_t - c_t)$$

   and the wage rate w_t is defined by

   $$\ln w_t = a_0 + a_1 t + a_2 t^2 + \epsilon_t$$

   ϵ_t follows a normal distribution $N(0, \sigma^2)$.
   Assume that wage function parameters are $a_0 = 5, a_1 = 0.1, a_2 = -0.002, \sigma = 1.0$. We also set $\beta = 0.95, r = 0.05, \delta = 1.5$. Assume that individuals have zero wealth at age 20.

   (a) Solve the value function and policy function using value function iteration. (Hint: to integrate wage shock ϵ, use Tauchen’s method.)

   (b) Simulate 1000 individuals’ life cycle labor supply decisions and plot the average hours of work and average wage of working individuals by age. Search for a δ that matches the average labor supply at 70%.

(c) Suppose log wages now depend on cumulated experience E_t rather than age t, $\ln w_t = a_0 + a_1 E_t + a_2 E_t^2 + \epsilon_t$, where experience follows $E_t = E_{t-1} + h_t$. Redo parts (a) and (b). Explain the differences between parts (c) and (b).

2. Read "The cyclical behavior of equilibrium unemployment and vacancies" (Shimer, 2005).

Individuals and firms are matched through a matching function. For an unemployed worker, the arrival rates of jobs is

$$f(\theta) = \mu\theta^{\eta}$$

where θ is the market tightness (number of vacancies divided by number of unemployed workers). For a firm who is looking for workers, the recruiting rates is

$$q(\theta) = \mu\theta^{\eta-1}$$

An unemployed worker receives z (value of leisure) in each period. The value function of an unemployed worker is

$$U_p = z + \delta\{f(\theta_p)E_p W_{p'} + (1 - f(\theta_p))E_p U_{p'}\}$$

where δ is the discount rate (equals $1/(1+r)$ in Shimer's paper). The output of a firm-worker pair is productivity p. The output is shared between workers and firms, where workers get w and firms get $p-w$. There is no on-the-job search for workers. The chance that a worker becomes unemployed is s. The value function of an employed worker is

$$W_p = w_p + \delta\{(1-s)E_p W_{p'} + sE_p U_{p'}\}$$

The value function of a firm hiring a worker in sector i is

$$J_p = p - w_p + \delta(1-s)E_p J_{p'}$$

For firms, the cost of posting a vacancy is c and it satisfies the following condition

$$V_p = -c + \delta q(\theta_p)E_p J_{p'}$$

In the equilibrium, there is free entry condition such that $V_p = 0$.

The bargaining process between workers and firms is:

$$W_p = U_p + \beta(W_p - U_p + J_p)$$

which pins down the equilibrium wage w.

In the equilibrium, workers' inflow equals outflow. So unemployment u follows

$$uf(\theta_p) = s(1-u)$$

(a) Following the parameters in Shimer (2005), we calibrate the model by assuming that $s = 0.1, r = 0.012, z = 0.4, q(\theta) = 1.355\theta^{-0.72}, \beta = 0.72, c = 0.213$. Different from Shimer, we simplify the productivity process by assuming that log productivity follows an AR(1) process: $\log p' = 0.8 \log p + \epsilon$, where $\log p$ follows a normal distribution $N(1, 0.05^2)$ and ϵ also follows a normal distribution $N(0, 0.03^2)$. Solve the value functions using two approaches: 1) discretization method (discretize p) and 2) approximation method.

(b) Calculate the wage, unemployment rate, and job finding rate, when $\log p$ equals 0.4, 0.7, 1, 1.3, and 1.6.

(c) Calculate the standard deviation of productivity, unemployment rate, and job finding rate. Compared them with data in Table 1 of Shimer (2005). Do you have any idea how to improve the model fit by changing the calibrated parameters?