14.462
Problem Set 3

Problem 1

Consider a variation on the search model presented in class. Specifically, suppose that the cost of creating a vacancy is equal to the cost of buying a machine of price $p(i/k)$ where i is the total number of machines being purchased and k is the total number of machines in the economy. Once the job is filled, the machine can be used by the same worker to produce y as long as the worker does not exogenously separate from the firm. As soon as the worker exogenously separates from the firm, the machine becomes obsolete. It therefore follows that

$$k = v + (1 - u),$$

so that there are as many machines as vacancies and jobs. Moreover,

$$\dot{k} = i - sk,$$

so that capital increases with investment but decreases with the death rate of the jobs s.

1. Free entry determines the value of a vacancy. What does this imply for the value of V in steady state?
2. Characterize the wage, the price of capital, and the level of capital in this economy.
3. Describe the effect of changes in productivity y, bargaining power of workers β, matching technology, and separation rate on the level of i and k.
4. What happens to unemployment and vacancies if investment becomes cheaper?

Problem 2

Consider a discrete time stochastic version of the first pass at the Beveridge curve described in the notes. Let

$$
\begin{aligned}
u_{t+1} &= u_t + s(1-u_t) - m_t\sqrt{u_t v_t} \\
v_{t+1} &= v_t \exp\left(\kappa\left(x_{t+1} - v_t/u_t\right)\right) \\
\ln m_{t+1} &= \alpha + \beta \ln m_t + \epsilon_{t+1},\ \epsilon_{t+1} \sim N\left(0, \sigma_\epsilon^2\right), \text{ i.i.d} \\
\ln x_{t+1} &= \gamma + \rho \ln x_t + \upsilon_{t+1},\ \upsilon_{t+1} \sim N\left(0, \sigma_\upsilon^2\right), \text{ i.i.d.}
\end{aligned}
$$

1. Consider the case in which $\sigma_\epsilon^2 = \sigma_\upsilon^2 = 0$. What are the steady state values of unemployment and vacancies, u_{ss} and v_{ss}, respectively?

2. Choose parameters so as to have reasonable values of u_{ss} and v_{ss}.

3. Perform a stochastic simulation under the assumption that $\sigma_\upsilon^2 = 0$. Plot u and v in Beveridge Curve space. Do the same under the alternative assumption that $\sigma_\epsilon^2 = 0$.

4. Compare the simulated paths of u and v to actual paths of u and v in the data. Which shocks appear to dominate?