ECON 7010 - Macroeconomics I

Fall 2015

Notes for Lecture #12

Today:

- Models of economic fluctuations with money
- Models of economic fluctuations with asymmetric info

Azariadis, (1981):

- Assumes: $u(c) = c; g(n) = \frac{1}{2}n^2$
- Subbing in the BC, we get: $\max_{n_t} E_{p_{t+1},x_{t+1}|s_t} \frac{p_t n_t x_{t+1}}{p_{t+1}} - \frac{1}{2}n_t^2$
- The FOC is thus: $E_{p_{t+1},x_{t+1}|s_t} \frac{p_t x_{t+1}}{p_{t+1}} = n_t$
- Using our functional form assumptions, we get: $E_{z'|z} \frac{\phi(z)Mx'}{\phi(z')M'} = \psi(z)$
- Knowing that, in eq'm, $\phi(z) = \frac{z}{\psi(z)}$, we get: $E_{z'|z} \frac{\phi(z)Mx'}{\phi(z')M'} = E_{z'|z} \frac{\psi(z')zMx'}{\psi(z)z'M'} = \psi(z)$
  - Note that we get this from the market clearing conditions
- These functional form assumptions imply that the fundamental equation characterizing the SREE becomes: $E_{(\theta',x',\theta|z)}\{\frac{\theta'\psi(z')}{\theta}\} = (\psi(z))^2, \forall z$
  - Since iid, $\theta \coprod \theta', x'$
  - $\Rightarrow \underbrace{E_{(\theta',x')}(\theta'\psi(z'))}_{\equiv k^2\text{,a constant}} * \underbrace{E_{\theta|z}(\frac{1}{\theta})}_{\equiv (M(z))^2} = (\psi(z))^2, \forall z$
  - LHS is a constant b/c θ', x' iid so just calc their expectation from a known distribution
  - Note that k^2 is determined as part of the equilibrium and is not arbitrary (because $\psi(\cdot)$ is an equilibrium function)
  - k^2 is what is called the "natural rate of output" - this is the long run level of output the economy tends to
    * e.g. if $\theta = 1$, $\psi(z) = k$ =output
  - $\Rightarrow k^2 * (M(z))^2 = (\psi(z))^2, \forall z$
  - $\Rightarrow k * M(z) = \psi(z), \forall z \rightarrow$ an equilibrium condition
- Define some functions:
  - $(M(z))^2 = E_{\theta|z}(\frac{1}{\theta})$
  - $E_{\theta,x}[\theta\psi(z)] = k^2 \Rightarrow E_{\theta,x}[\theta * kM(z)] = k^2$ or $k = E_{\theta,x}[\theta * M(z)]$
  - Recall assumption (*) from previous lectures (that $Pr(\theta \leq \hat{\theta}|z)$ is increasing in $z, \forall\hat{\theta}$), this assumption $\Rightarrow M(z)$ is increasing in z (from $k * M(z) = \psi(z)$)
  - See this by: if $z \uparrow, \psi(z) \uparrow$, but k is a constant, so for equality to hold $M(z) \uparrow$
- Examples:
  1. x random, $\theta = 1$
     - If this, then we see that $\psi(z) = k$ (i.e., output constant and independent of nominal shocks, x)

2. $x = 1, \theta$ random
   - Try this as an exercise (PS 6, #1)
3. Noisy price signals
   - $\theta \in \{\theta_1, \theta_2\}, \theta_1 < \theta_2, Pr(\theta = \theta_1) = Pr(\theta = \theta_2) = \frac{1}{2}$
   - $x \in \{\theta_1, \theta_2\}$
   - $z \in \{\frac{\theta_1}{\theta_2}, 1, \frac{\theta_2}{\theta_1}\} = \{z_1, z_2, z_3\}$
   - $M(z_1)^2 = E_{\theta|z_1}(\frac{1}{\theta}) = \frac{1}{\theta_2} <$
   - $M(z_2)^2 = E_{\theta|z_2}(\frac{1}{\theta}) = \frac{1}{2}(\frac{1}{\theta_1} + \frac{1}{\theta_2}) <$
   - $M(z_3)^2 = E_{\theta|z_3}(\frac{1}{\theta}) = \frac{1}{\theta_1}$
   - Note with the above that assumption (*) is satisfied b/c $M(z) \uparrow$ as $z \uparrow$
   - $k^2 = \frac{1}{4}[\theta_1\psi(\frac{\theta_1}{\theta_1}) + \theta_1\psi(\frac{\theta_2}{\theta_1}) + \theta_2\psi(\frac{\theta_1}{\theta_2}) + \theta_2\psi(\frac{\theta_2}{\theta_2})] = \frac{1}{4}[\theta_1\psi(z_2) + \theta_1\psi(z_3) + \theta_2\psi(z_1) + \theta_2\psi(z_2)]$
   - $\psi(z_1) = k * (\frac{1}{\theta_2})^{\frac{1}{2}},\ \psi(z_2) = k * (\frac{1}{2}(\frac{1}{\theta_1} + \frac{1}{\theta_2}))^{\frac{1}{2}}$
   - $\psi(z_3) = k * (\frac{1}{\theta_1})^{\frac{1}{2}}$
   - The 4 equations above will be used to solve for the equilibrium functions and constant: $\psi(z_1), \psi(z_2), \psi(z_3), k$

Monetary Policy (Natural Rate Theory)

- Is anticipated monetary policy neutral? (Azariadis Section 3) (Note: Monetary policy = distrib of x, $f(x)$)
  - Natural rate theory says yes (these are the neoclassical guys who believe in the classical dichotomy -that nominal variables have no long run effect on real variables)
  - Azariadis says no
    * Take example 3 above with noisy prices and add a constant, ω, to x
    * $\Rightarrow x \in \{\theta_1 + \omega, \theta_2 + \omega\}$
    * $\Rightarrow z \in \{\frac{\theta_1+\omega}{\theta_1}, \frac{\theta_1+\omega}{\theta_2}, \frac{\theta_2+\omega}{\theta_1}, \frac{\theta_2+\omega}{\theta_2}\}$
    * $\Rightarrow E(\frac{1}{\theta}|z)$ will change - in this case z reveals x and θ
      · $\Rightarrow E(\frac{1}{\theta}|z) = (M(z))^2$, so $M(z)$ changes $\Rightarrow \psi(z)$ changes
  - "If I change $f(x)$, does $\psi(z)$ change?" – Yes, according to Azariadis, monetary policy matters
- To see that the above only works is add a constant, do the following exercise for the noisy price example:
  - Replace x w/ $\tilde{x} = \lambda x$ ($\lambda > 0$, constant), then $\psi(z)$ is independent of λ
  - This is PS 6, #2
- What $f(x)$ is optimal?
  - Objective - what are you trying to do?
    * price stability
    * stabilize output
    * utility of representative agent (welfare)
      · lifetime utility $= E_{\theta',x',\theta,z}\left[u\left(\frac{\theta'\psi(z')}{\theta}\right) - g(\psi(z))\right] \equiv \bar{W}$, where $\psi(z)$ is determined in equilibrium
      · pick $f(x)$ to maximize this... (i.e., $\max_{f(x)} \bar{W}$)
  - Should we set $x = \bar{x}$ w/ prob = 1?
    * This is what the natural rate guys (e.g. Lucas) thought

* Azariadis says no!
  - If you get rid of risk w x, you still have risk of θ
  - Getting rid of noise in x may not lessen uncertainty about z, so it is not welfare improving (b/c of incomplete markets - no way for agents to insure against population shock)
  - i.e., If x is a random variable, decreasing its variance may not help
  - May be ok with proper labor contracts (e.g., wage is promise to so many good next period, not today)