EC502 Macroeconomics
Week 20 Seminar: Real Business Cycles

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1. (New) Keynesian BC theory: REFER LECTURE!

- What can explain the business cycles?
  Technology shocks - TFP shocks
- Propagation mechanism
  Productivity shocks $\rightarrow \uparrow$ MPL $\rightarrow \uparrow$ Ld $\rightarrow \uparrow$ w (W/P)
  consumption smooting $\rightarrow$ higher returns to capital and higher I or S.
  Higher wages $\rightarrow$
- Are changes in unemployment voluntary?
  Unemployment changes in RBC are efficient and voluntary. In NK: involuntary.
  Keynesian BC with fully flexible prices: Under flexible prices, there are no cycles - the main propagation mechanism is nominal rigidity.

2. Real Business Cycles (RBC) theory: REFER LECTURE

- Key difference with NK: NO RIGIDITIES, markets clear perfectly
  - Labour market: productivity shocks affect labour demand.
  - Because $MPL = w$, then $\uparrow A$ leads to $\uparrow w \longleftrightarrow$ PROCYCLICAL
  - Equilibrium will result from the intersection with labour supply
  - Elasticity of L^S will determine the size of the effect of the shock
  - The facts show that w/p is almost a-cyclical.

3. RBC theory and Aggregate Demand: REFER LECTURE!

RBC theory asserts that BCs are only due to supply shocks. Would the components of aggregate demand (C, I) change during the cycle?

- AD is also affected by supply shocks through MPL and MPK
- Consumption: (+) supply shocks will... =
  - Increase wages $\longleftrightarrow$ increase income $\longleftrightarrow$ increase consumption $\longleftrightarrow$ increase savings because temporary change $\longleftrightarrow$ increase investment
  - Increase interest rate $\longleftrightarrow$ affects both C and I.
- Investment: (+) supply shocks will increase MPK $\longleftrightarrow$ increase Tobin's Q $\longleftrightarrow$ increase investment
- These changes should be LAGGING or COINCIDENT with business cycles, NOT LEADING

4. Labour demand and supply

Production function: Utility function: HH budget constraint:

$$Y = A\bar{K}^{\alpha}L^{1-\alpha} \qquad U = \frac{C^{\gamma}}{\gamma} - \frac{L^{\theta}}{\theta} \qquad C = wL$$

a) Labour demand - **firm** maximizes profits

$$\max \quad \Pi = P \cdot A\bar{K}^{\alpha}L^{1-\alpha} - wL - R\bar{K}$$

$$\text{FOC:} \quad MPL \equiv A\bar{K}^{\alpha}(1-\alpha)L^{-\alpha} = w$$

Solve for L to get labour demand :

$$L^{D} = \left(\frac{(1-\alpha)A\bar{K}^{\alpha}}{w}\right)^{\frac{1}{\alpha}}$$

So labor demand falls as wages increase.

4. Labour demand and supply

Production

a) Labour supply - **workers** maximize utility. Make the indifference curve between C and L furthest from the origin tangent to the budget constraint. MRS between C and L:

$$MRS \equiv \frac{U'(L)}{U'(C)} = -w \quad \longleftrightarrow \quad \frac{-\frac{1}{\theta}\theta L^{\theta-1}}{\frac{1}{\gamma}\gamma C^{\gamma-1}} = -w \quad \longleftrightarrow \quad L^{\theta-1} = wC^{\gamma-1}$$

Use budget constraint to substitute for C above:

$$L^{\theta-1} = w(wL)^{\gamma-1} \quad \longleftrightarrow \quad L^{\theta-1} = w^{\gamma}L^{\gamma-1} \quad \longleftrightarrow \quad L^{\theta-\gamma} = w^{\gamma}$$

Solve for L as

$$L^S = w^{\frac{\gamma}{\theta-\gamma}}$$

So labour supply increases as wages increase... Changes in labour supply will depend on elasticity given by the exponent of w

- If $\theta > \gamma$, as $\uparrow w$, also $\uparrow L^S$
- If $\theta < \gamma$, as $\uparrow w$, then $\downarrow L^S$

4. Labour demand and supply

Labour demand:

$$L^D = \left(\frac{(1-\alpha)A\bar{K}^{\alpha}}{w} \right)^{\frac{1}{\alpha}}$$

Labour supply:

$$L^S = w^{\frac{\gamma}{\theta-\gamma}}$$

a) Equilibrium - where $L^D = L^S$

$$\left(\frac{(1-\alpha)A\bar{K}^{\alpha}}{w} \right)^{\frac{1}{\alpha}} = w^{\frac{\gamma}{\theta-\gamma}}$$

[Solve for w]
So equilibrium wage w^* is

$$w^* = \left[((1-\alpha)^{1/\alpha} A^{1/\alpha})\bar{K} \right]^{\frac{(\theta-\gamma)\alpha}{\gamma(\alpha-1)+\theta}} \tag{1}$$

And equilibrium employment L^* can be denoted as

$$L^* = w^{*\frac{\gamma}{\theta-\gamma}} \tag{2}$$

4. Labour demand and supply

b) Find the values for equilibrium

$$\gamma = 0.5 \qquad \theta = 2 \qquad \alpha = 0.3 \qquad A = 2 \qquad \bar{K} = 5$$

Equilibrium wage w^* is

$$w^* = \left[((1-\alpha)^{1/\alpha} A^{1/\alpha})\bar{K}\right]^{\frac{(\theta-\gamma)\alpha}{\gamma(\alpha-1)+\theta}} = \left[((1-0.3)^{1/0.3} \cdot 2^{1/0.3}) \cdot 5\right]^{\frac{(2-0.5)0.3}{0.5(0.3-1)+2}}$$

$=2.1$

And equilibrium employment L^* can be denoted as

$$L^* = w^{*\frac{\gamma}{\theta-\gamma}} = 2.1^{\frac{0.5}{2-0.5}} = 1.28$$

Elasticity of labour supply:

$$\frac{\partial L^*}{\partial w^*}\frac{w^*}{L^*} = \frac{\gamma}{\theta-\gamma} w^{*\frac{\gamma}{\theta-\gamma}-1}\frac{w^*}{L^*} = \frac{\gamma}{\theta-\gamma} = \frac{0.5}{2-0.5} = 0.33$$

A 1% increase in wage leads to a 0.33% increase in employment

4. Labour demand and supply

c) What happens to employment if TFP (A) increases by 10%?

- $\uparrow MPL$ which will increase labour demand

$$\uparrow L^D = \left(\frac{((1-\alpha)\uparrow A)\bar{K}^{\alpha}}{w} \right)^{\frac{1}{\alpha}}$$

- Labour demand $>$ labour supply, so equilibrium wage should change to increase L^S

$$\uparrow L^D > L^S = w^{\frac{\gamma}{\theta-\gamma}} \qquad \uparrow\downarrow w?$$

- That will depend on the wage elasticity of labour. If $\theta > \gamma$, then $\uparrow w$
- $\uparrow w$ will reduce previous $\uparrow L^D$ as marginal cost increases
- Use equilibrium equations with $A' = 2.2$

$$L^D = 1.78$$

4. Labour demand and supply

What happens to employment if TFP (A) increases by 10%?
From a previous equilibrium value of $L^* = 1.28$
Equilibrium wage is

$$w^* = \left[((1-\alpha)^{1/\alpha} {A'}^{1/\alpha})\bar{K}\right]^{\frac{(\theta-\gamma)\alpha}{\gamma(\mathbf{1}-\alpha)+\theta}} = 2.3$$

And equilibrium employment L^*

$$L^* = {w^*}^{\frac{\gamma}{\theta-\gamma}} = 2.3^{\frac{\mathbf{0.5}}{\mathbf{2-0.5}}} = 1.32$$

- TFP increased a lot, but employment only increased slightly
- Labour supply is not very elastic