Econ720 - TA Session 3

Yanran Guo

UNC-Chapel Hill

2019. 9. 13

0. How to conduct economic research?

1. Observe some interesting facts in the real world.
2. Try to analyze it. Build my own story based on my observation.
3. Model my story using math and equations.

We Macro economists are story teller. But our stories are presented not by words but by equations.

1. Logic of "Equilibrium and Steady States"

1. **GOAL:** Want to analyze the aggregate economy
2. The evolvement of state variables (P5)
3. The evolution of state variable is captured by its difference equation (differential equation in a continuous time model)

$$k_{t+1} = \phi(k_t)$$

4. To derive this equation – saving function (P6,7,8,20)
5. The evolution of k is captured by $\frac{dk_{t+1}}{dk_t}$
   How to determine the sign of s_w and s_r? (P9-20)
   Since we do not know the specific functional form of $\phi(\cdot)$, even the simple model could generate complicated dynamics (P21-24, 27)
   In the figures of dynamics, there are some "points" that are quite interesting – Steady State (P25,27)

1. Logic of "Equilibrium and Steady States"

6. Steady state of the economy (P29)
7. Golden rule capital stock: maximize the S.S. consumption of each agent (P30)
   It is derived from the Resource Constraint

$$N_t c_t^y + N_{t-1} c_t^o = F(K_t, L_t) - K_{t+1} + (1-\delta)K_t$$

Divide both sides by $L_t \leftarrow$ Due to the S.S. definition!

$$c_t^y + c_t^o/(1+n) = f(k_t) - (1+n)k_{t+1} + (1-\delta)k_t$$

Since it is at S.S., $k_{t+1} = k_t = k$

And we define $c^* = c^y + c^o/(1+n)$

$$c^* = f(k) - (n+\delta)k$$

$$f'(k^{GR}) = n + \delta$$

1. Logic of "Equilibrium and Steady States"

8. The most optimal capital stock at steady state is $f'(k^{GR}) = n + \delta$. Is the capital stock in our model equal to k^{GR}? **We do not know...** Because we do not know the specific functional form of $\phi(\cdot)$, hence we can not solve for steady state k^{ss} in our model by using $k = \phi(k)$
9. Hence all the three cases are possible: $k^{ss} \overset{\leq}{\underset{>}{=}} k^{GR}$
   Nothing rule out a steady state that is dynamically inefficient, $k^{ss} > k^{GR}$, people are saving too much (P31)
   WHY??
   - Intuitively speaking (P33)
   - Mathematically speaking (P32)

1. Logic of "Equilibrium and Steady States"

10. Dyn. efficient: less likely to happen and relatively easier to solve
    Golden rule: great
    Dyn. inefficient: we care about this case

1. Logic of "Equilibrium and Steady States"

11. When we are in dynamic inefficient S.S., no matter what particular way we are going to use, can everyone better off if we somehow make each young give up 1 unit of consumption and give it to the old?
YES, when $n > f'(k) - \delta$ (P33)

$$\begin{aligned} dU_t(c) &= -u'(c_t^y) \times 1 + \beta u'(c_{t+1}^o) \times (1+n) \times 1 \\ &= -\beta(1+r_{t+1})u'(c_{t+1}^o) + \beta u'(c_{t+1}^o) \times (1+n) \\ &= \beta u'(c_{t+1}^o)(n - r_{t+1}) \\ &> 0 \text{ when } n > r_{t+1} = f'(k_{t+1}) - \delta \end{aligned}$$

Hence when $n > f'(k) - \delta$, the lifetime utility of each agent will increase, everyone is better off.

1. Logic of "Equilibrium and Steady States"

12. Taking 1 unit of consumption away from the young and transferring it to the old seems to be a promising way to solve dynamic inefficiency. But how can do that?
    Social security