

EconS 502: Macroeconomic Theory II

Professor: S. Choi

Due: In Class, Tuesday, 19th January, 2010

PROBLEM SET 1

1. Are the following statements TRUE or FALSE? Provide your theoretical and/or empirical reasonings based on our class discussions. The credits will be solely based on your reasonings.
 - (a) The current U.S. investment rate is 20% or lower, while China's level is as high as 40%. This implies that if the U.S. can raise the investment rate to 40%, then the U.S. GDP growth rate will converge to China's GDP growth rate.
2. Visit the Penn World Table website at http://pwt.econ.upenn.edu/php_site/pwt_index.php. Pick up your favorite country except the United States. Call this country A. Assume the model considered in class:

$$\begin{aligned}Y_t &= K_t^\alpha (A_t L_t)^{1-\alpha}, \\L_{t+1} &= L_t(1 + g_L), \\A_{t+1} &= A_t(1 + g_A), \\K_{t+1} &= s_t Y_t + (1 - \delta)K_t,\end{aligned}$$

for all year t , where $\alpha = 0.32$ and $\delta = 0.05$. All notations are the same as in class.

- (a) Obtain the data on $\{L_t\}$. (I suggest you to use "POP".) Suppose the starting year of the data is τ_1 (e.g., 1950) and the ending year is τ_2 (e.g., 2007). Obtain the average annual growth rate of $\{L_t\}$ between τ_1 and τ_2 . Use this as an estimate for g_L . What is your prediction on L_{2015} ?
- (b) Obtain the data on $\{Y_t/L_t\}$. (I suggest you to use "grdpl".) Compute $\{Y_t\}$ between τ_1 and τ_2 . Obtain the average annual growth rate of $\{Y_t\}$ between τ_1 and τ_2 .
- (c) Obtain the data on $\{s_t\}$. (I suggest you to use "ki".) Plot the evolution of $\{s_t\}$ between τ_1 and τ_2 . Is it stable? Is it growing or shrinking? (Feel free to add your own explanation on this evolution of $\{s_t\}$ in country A.) Obtain the average of $\{s_t\}$.

- (d) Now we want to measure $\{K_t\}$ (which is not in data). To begin with, assume a “balanced growth path” in which (i) all variables grow at constant rates and (ii) s_t is constant. Dividing both sides of the last equation by K_t , we have $K_{t+1}/K_t = s_t Y_t/K_t + (1 - \delta)$. What is a constant level of K_t/Y_t on this balanced growth path?
- (e) Now assume that the value of K/Y that you obtained holds for the middle year, $(\tau_1 + \tau_2)/2$ (or some year close to it, chosen at your discretion). Obtain $K_{(\tau_1+\tau_2)/2}$ for this year.
- (f) Now we obtain all remaining K_t 's. To deal (at least partly) with the problem that country A may not be on the balanced growth path, do not just apply your K/Y to all Y_t 's to find K_t 's. Rather, use the law of motion of K_t , the data on s_t and Y_t , and $\delta = 0.05$, to obtain all remaining K_t 's from τ_1 to τ_2 . (For example, you can obtain $K_{(\tau_1+\tau_2)/2-1}$ from $K_{(\tau_1+\tau_2)/2} = s_{(\tau_1+\tau_2)/2-1} Y_{(\tau_1+\tau_2)/2-1} + (1 - \delta) K_{(\tau_1+\tau_2)/2-1}$ where the only unknown is $K_{(\tau_1+\tau_2)/2-1}$.)
- (g) Measure $\{A_t\}$ for all years, from τ_1 to τ_2 . What is your prediction on A_{2015} ?
- (h) Now for the (long-run) entire time horizon τ_1 through τ_2 , discuss what fractions of per-capita output growth in country A are due to the accumulation in K_t/Y_t and to the growth of A_t , respectively. Was the physical capital accumulation important for this country's economic growth? Explain.
- (i) Assume that from year $\tau_2 + 1$ on, country A has the same growth rates and the same level of s_t as in averages of $\tau_2 - 9$ through τ_2 . What are your predictions on K_{2015} and Y_{2015} ? On K_{2050} and Y_{2050} ? What are the growth rates of K_t and Y_t between 2049 and 2050?
- (j) Suppose from the year $\tau_2 + 1$, the investment rate has risen to $1.5\bar{s}$ (by 50% from the previous average) and will stay at this new level forever. Assume the growth rate of A_t will be the same, forever, as the average growth of A_t from τ_1 to τ_2 . What is your prediction on the growth of Y_t/L_t for the next 100 years? (Show by figure or whatever you believe is the best so that country A's government officials without PhD's can understand.) If country A's investment rate permanently rises, how will it affect the short-run and long-run per-capita output growth? Explain.
- (k) Disregard (j) and consider (i). Now assume there is a one-time foreign direct investment of 100 billion dollars into country A in year $\tau_2 + 1$. What are your predictions on K_{2015} and Y_{2015} ? On K_{2050} and Y_{2050} ? What are the growth rates of K_t and Y_t between 2049 and 2050?