

EconS 502: Macroeconomic Theory II
Professor: S. Choi
Due: In Class, Wednesday, 21st January

PROBLEM SET 1

1. 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. Suppose that the government of country A considers to encourage private investment to enhance economic growth. The government wants your advice on how the change in investment rate will affect the economic growth. Write a report for the government, incorporating all of the following questions.

Assume the model considered in the class:

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

Notations are the same. Assume $\delta = 0.05$ and $\alpha = 0.32$ hold for country A. (We obtained them in class in the calibration of the U.S. economy. We assume that those two parameter values are the same across all countries in the world.)

- (a) For country A, obtain the data on Y_t and L_t . Suppose the starting year of the data is τ_1 (e.g., 1960) and the ending year is τ_2 (e.g., 2003). Report the growth rates of Y_t and Y_t/L_t , respectively, on averages of τ_1 through τ_2 . What is the ratio of country A's Y_t/L_t to the United State's Y_t/L_t , in τ_1 ? What is this ratio in τ_2 ? Is country A "catching up" the United States?

(Hint: "Real GDP Chain per Worker" is the best for Y_t/L_t if available. If not available, just use "Real GDP per capita". If you use "Real GDP Chain per Worker", then L_t should be the number of workers which is not reported in the data. To recover this, divide the product of "Real GDP per capita (Constant Prices: Chain series)" and "population," which is the real gross GDP, by "Real GDP Chain per Worker." If you believe that you found a better way, follow your own way and justify it.)

- (b) For country A, obtain the data on s_t . See how s_t fluctuates over time. Is s_t stable? Or is s_t growing or shrinking? (Feel free to add your explanation on why this might be happening in country A.)

(Hint: Use "Investment share of CGDP." If you believe that you found a better way, follow your own way and justify it.)

- (c) Now we measure K_t . Whether s_t is stable or not, assume the economy is on the balanced growth path. (This may be crazy but let's do it in this simple way. You can improve this calibration later in your second year.) That is, suppose that all variables grow at constant rates and s_t is constant over time. Obtain \bar{s} (constant) by averaging s_t 's in τ_1 through τ_2 . Obtain K/Y for country A.
(If you find K/Y negative for country A, this model doesn't work for your country. Please pick up another country.)
- (d) 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, given the value of K/Y and the observation on $Y_{(\tau_1+\tau_2)/2}$.
- (e) We have just obtained $K_{(\tau_1+\tau_2)/2}$. 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 as we did in the previous question. 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 $K_{(\tau_1+\tau_2)/2-1}$.)
- (f) Now for the 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.
(Hint: Obtain the growth rate of K_t/Y_t using K_t 's and Y_t 's.)
- (g) 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.

This is an open-ended question – There is no given answer. Don't ask me what you should do, but make any reasonable assumptions, do whatever you think is necessary, and provide the best report for country A's government. 10 points maximum. Very excellent reports receive 10 points. One of very excellent reports will be posted as a suggested solution. (If you don't want your answer to be posted, please indicate it.) Fairly good reports receive 8 points. Average reports receive 6.