

## Assignment 2: Convergence, Accounting, & Development Due Tues, Jan 27

GLBL 5010 Economics for Global Affairs

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This assignment is designed to improve your understanding of total factor productivity (TFP) and why it is an important concept for thinking about economic development. You will need to use the following data ([stata](#), [csv](#)) for this assignment.

Submit a pdf file on gradescope with graphs and answers to the questions. Append your code at the end of the write-up (for Stata code, change the font to Courier New font size 9 to make it readable).

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### Question 1: Re-assessing convergence

Imagine that the national budget office of a country of your choice has asked you to provide a first draft of how to allocate expenditures across the country's line ministries (e.g., the Ministries of Education, Commerce, Health, etc.). Your objective is to allocate expenditures to the ministries to maximize economic development, as measured by per capita GDP (GDPPC). Let us leave aside the merits of whether this should be an appropriate objective to maximize.

From the discussion in class, we learned that TFP is an important concept for understanding the variation in the level of economic development across countries. Assume that GDP in all countries is determined by the following production function:

$$Y = AK^{\alpha}L^{1-\alpha}$$

where Y is GDP, L is population, K is capital, A is TFP. The dataset provides information on (Y, K, L) for each country. Focus on the years 1960 and 2018. Assume, as we did in class, that  $\alpha = 0.30$ .

Let us first revisit the finding that TFP is important in explaining the variation in GDPPC. To do so, let us go through an analysis step by step.

- A. First, convert the production function so that the left-hand side is expressed in GDPPC. Write out the expression. Use lowercase letters for variables that have been divided by L; for example,  $y = Y/L$ .
- B. Run the convergence regression from class and interpret the coefficient. Be brief; this should only be 2-3 sentences long.
- C. Take logs of the production function from 1A. For 1960 and 2018, construct the variables from the dataset:  $\ln y$ ,  $\ln k$ ,  $\ln A$ . Report the mean and standard deviation of  $\ln A$  in 1960.

- D. Plot the relationship between  $\ln y$  (y-axis) and  $\ln A$  (x-axis) for 1960. Report the correlation between the two variables and provide a brief summary (maximum of 3 sentences) of where your country stands relative to others.
- E. Imagine a hypothetical scenario where all countries in 2018 have the TFP of the United States. What would be the hypothetical  $\ln y$  for your country in 2018? What would be the corresponding GDPPC in dollar terms? What would be the hypothetical growth from 1960?
- F. Run the growth convergence regression again, this time using the hypothetical GDPPC for all countries constructed from 1E. Compare the results with the regression result in 1B. What do we learn from this exercise that is relevant to how you would allocate the national budget? Provide a brief explanation (maximum of 4 sentences).

## Question 2: A Model with Human Capital

Your policy recommendation from Q1 is based on a simple Cobb-Douglas production function. The national budget office wants you to examine a more realistic model of how a country's output is generated. This second problem guides you through a model of production that includes a role for human capital.

Assume that the production function includes human capital ( $H$ ):

$$Y = AK^{0.3}(HL)^{0.7}$$

The variable 'H' is an index based on average years of schooling and return to education. The dataset contains the human capital index variable.

Start from the original dataset and focus only on the year 2018.

- A. Briefly explain why it may be reasonable to include human capital in the production function.
- B. Using this production function, reconstruct the variables in the dataset:  $\ln y$ ,  $\ln k$ ,  $\ln A$ . Report the mean and standard deviation of  $\ln A$ .
- C. Plot the relationship between  $\ln y$  and  $\ln A$  that you've created in 2A. What is the correlation between the two variables? Briefly explain why this correlation differs from the correlation using the simplified production function in Question 1.
- D. Create a scatter plot using  $\ln A$  from question 1 against  $\ln A$  from 2A (again, do this for just the year 2018). What is the correlation between these two variables?
- E. Total factor productivity is sometimes referred to as a measure of our ignorance. Explain how augmenting the production function with human capital reduces our ignorance. How would you revise your recommendation in 1F based on this augmented production function? (Hint: It may be useful to think about changes in standard deviation.)