Macroeconomics A; EI056

Short problems

Cédric Tille

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1 Growth rate decomposition

1.1 The production function

Question: Consider the production function that we saw in class. Output Y_t is produced using capital K_t, labor L_t, and a general productivity A_t:

$$Y_t = A_t \left(K_t\right)^{1-\alpha} \left(L_t\right)^{\alpha}$$

Write an approximation of this relation around a point where $Y_t = \bar{Y}$, $K_t = \bar{K}$, $L_t = \bar{L}$, and $A_t = \bar{A}$. Specifically, show that:

$$\frac{dY_t}{\bar{Y}} = \frac{dA_t}{\bar{A}} + (1-\alpha)\frac{dK_t}{\bar{K}} + \alpha\frac{dL_t}{\bar{L}}$$

1.2 Expressing in growth rates

Question: Rearrange the expression to show that in terms of growth rates we get:

$$g\left(Y_t\right) = g\left(A_t\right) + (1-\alpha)\, g\left(K_t\right) + \alpha g\left(L_t\right)$$

where $g\left(Y_t\right)$ is the growth rate of Y between period $t-1$ and period t.

1.3 A more direct approach

Question: In this particular case, could we have done the computation more rapidly?
Hint: recall that the growth rate is also the difference between the logs:$g\left(Y_t\right) = \ln\left(Y_t\right) - \ln\left(Y_{t-1}\right)$

2 Evolution of the Phillips curve

2.1 Getting the data

Question: This question requires you to dowload some data and do some computations.
We use the Fred database: https://fred.stlouisfed.org/ Use the search field to look for

- Unemployment rate: you should pick from the list and get to https://fred.stlouisfed.org/series/UNRATE.
- Consumer price index: you should pick from the list and get to https://fred.stlouisfed.org/series/CPIAUCSL.

For both, use the tools to transform the data as you need. Specifically, use "edit graph" on the right to choose an annual frequency, and for the consumer price transform it into percentage change from a year ago.

Use the date ranges to pick data starting in 1950.

Then use the download option to get the data in an excel format (or one of the other formats).

2.2 Plotting the data

Question: In excel (or whatever software you prefer), do a scatter plot with inflation on the vertical axis, and the unemployment rate on the horizontal axis.

Distinguish between various periods by having them appears in dots of different colors. Specifically, consider a) 1950-1969, b) 1970-1989, c) 1990-2009, d) 2010-2022.

2.3 Simple econometrics

Question: We now look at how the sensitivity of inflation to the unemployment rate has evolved.

To do so, we regress the inflation on a constant and the unemployment rate. You can do that in an econometric software, but as we are at the beginning of the semester, you can also do it simply on excel with the function "intercept" and "slope".

How did the relation evolve over the periods a) 1950-1969, b) 1970-1989, c) 1990-2009, d) 2010-2022?