

Homework 9: Growth, Debt, and Time

36-350

Due at 11:59 pm on Monday, 17 November 2014

We continue to work with the data set on economic growth and government debt from lab 10.

1. Load the data and make a scatter-plot of GDP growth (vertical axis) against the debt ratio (horizontal axis). (You did this in lab.)
2. Fit a linear model of growth on the debt ratio. Report the intercept and slope to reasonable precision. (Explain why the precision you give is reasonable.) Add a line to your scatterplot from problem (1) showing the fitted regression line. Visually, is it a reasonable match to the data?
3. Some economists claim that high levels of government debt cause slower growth. Other economists claim that low economic growth leads to higher levels of government debt. The data file, as given, lets us relate this year's debt to this year's growth rate; to check these claims, we need to relate current debt to future growth.
 - a. Create a new dataframe which just contains the rows of `debt` for France, but contains all those rows. It should have 54 rows and 4 columns. Note that some years are missing from the middle of this data set.
 - b. Create a new column in your dataframe for France, `next.growth`, which gives next year's growth *if* the next year is in the data frame, or NA if the next year is missing. (`next.growth` for 1971 should be (rounded) 5.886, but for 1972 it should be NA.)
4. Add a `next.growth` column, as in (3), to the *whole* of the `debt` data frame. Make sure that you do not accidentally put the first growth value for one country as the `next.growth` value for another. (The `next.growth` for France in 2009 should be NA, not 9.167.)
Hints: Write a function to encapsulate what you did in (4), and call it in `ddply()`.
5. Make a scatter-plot of next year's GDP growth against this year's debt ratio. Linearly regress next year's growth rate on the current year's debt ratio, and add the line to the plot. Report the intercept and slope to reasonable precision. How do they compare to the regression of the current year's growth on the current year's debt ratio?
6. Make a scatter-plot of next year's GDP growth against the current year's GDP growth. Linearly regress next year's growth on this year's growth, and add the line to the plot. Report the coefficients (to reasonable precision). Can you tell, from comparing these two simple regressions, whether current growth or current debt is a better predictor of future growth?
7. Add a column, `delta.growth`, to the `debt` dataframe, giving the difference between next year's GDP growth rate and this year's GDP growth rate.
8. Regress the change in GDP growth on the current GDP growth and the current debt level. Report the coefficients.
9. Some economists have claimed that there is a "tipping point", or even a "point of no return" when the ratio of government debt to GDP crosses 90%, above which growth slows dramatically or even becomes negative. Add a column to the dataframe indicating whether the debt ratio is over 90%. Repeat the last linear regression, allowing the slopes to depend on whether the debt ratio has "passed the point of no return". Do the coefficients support the claim?

Behind the scenes: It'd be a spoiler to say where the problems came from, or even the data. If you think you've figured it out, write Prof. Shalizi; the first three correct answers will get prizes from Gaby et Jules Patisserie.