

INTERNATIONAL UNIVERSITY OF JAPAN  
Public Management and Policy Analysis Program  
Graduate School of International Relations

ACC6512 (Winter 2012)

**Topics in Data Analysis: Panel Data Models**

Homework 4: Random Effect Model (100 points)

**Instructions:** Use the WHO health care attainment data that you prepared for homework assignment 1 through 3. First, finish writing your do file and print the log file. Don't add commands for calculation asked to the do file; **handwrite to report statistics or show your calculation!** Second, write down your answers on the print-out of your log file. You may add separate sheets, if needed. Use the .05 significance level in hypothesis test. Submit your answer to my office by Monday, March. 5<sup>th</sup>.

**Question 1 (5 points)** Comment the keep command in the do file: That is, “// keep if oecd==1” so that you have 700 observations in the data set. Fit your pooled OLS of regressing health care attainment on health expenditure and educational attainment only. Then fit **fixed group (country, NOT year) effect model** (within estimation using BOTH `.xtreg` and `.areg`).

**Question 2 (27 points).** Manual estimation of a random group effect model.

Question 2.1 (5 points) Fit the group mean regression model called “between estimation” using `.regress`. You need to transform data using group (country) means of dependent and independent. Use local or global macros as shown in the answer keys. Report SSE (Again do not use Stata commands. Copy SSE from the Stata output).

Question 2.2 (1 point) Fit the “between estimation” using `.xtreg`. You should get the same SSE you obtained in 2.1.

Question 2.3 (1 point) Report SSE of the within estimation you obtained in Question 1.

Question 2.4 (3 points) Calculate  $\hat{\sigma}_{between}^2$ . Include the relevant formula and show your computation clearly. Again, do not use Stata commands.

Question 2.5 (3 points) Calculate  $\hat{\sigma}_v^2$ . Include the relevant formula and show your computation clearly. Again, do not use Stata commands.

Question 2.6 (5 points) Calculate  $\hat{\sigma}_u^2$ . Include the relevant formula and show your computation clearly. Again, do not use Stata commands.

Question 2.7 (5 points) Calculate  $\hat{\theta}$ . Include the relevant formula and show your computation clearly. Again, do not use Stata commands.

Question 2.8 (3 points) Transform dependent and independent variables appropriately. Do not forget to create a variable for the intercept.

Question 2.9 (1 point) Fit a random group (country) effect model using `.regress`. Do not forget to suppress the intercept.

**Question 3 (18 points).** Estimation of a random group effect model using `.xtreg`

Question 3.1 (1 point) Fit a random group effect model using `.xtreg` with the `theta` option. In order to make quite sure that you are fitting the right model, add `i(country)` to the command as an option.

Question 3.2 (3 points) Report SSE and SEE using `e(rmse)`. You need to calculate SSE from SEE. Compare them with corresponding statistics you obtained in 2.9. How are they different?

Question 3.3 (2 points) Report coefficients and their standard errors of health expenditure and educational attainment. Compare them with those you obtained in 2.9? (Do not simply list statistics! Explain similarity and difference to your boss!)

Question 3.4 (3 points) Report  $\hat{\sigma}_v^2$  that Stata used in estimation. Read statistics below the parameter estimates. Notice that `sigma_e` is very similar to SEE in 2.9. Show your computation clearly. Again do not use Stata commands. Is this number the same as one you calculated in 2.5?

Question 3.5 (3 points) Report  $\hat{\sigma}_u^2$  that Stata used in estimation. Read statistics below the parameter estimates. Show your computation clearly. Again do not use Stata commands. Is this number the same as one you calculated in 2.6?

Question 3.6 (5 points) Report `rho` that Stata returned. Read statistics below the parameter estimates. Show how rho was calculated. Do not use Stata commands.

Question 3.7 (1 point) Report  $\hat{\theta}$  that Stata returned. You may see the left top of the Stata output or use `e(theta)`. Is this number the same as one you calculated in 2.7?

**Question 4 (20 points).** Assumptions of a random effect model

Question 4.1 (5 points) Interpret `rho` you calculated in 3.6 substantively. What does that number mean? Do you think your random group effect model makes sense?

Question 4.2 (10 points) In the left top of the Stata output, you can find an expression “`corr(u_i, X) = 0 (assumed)`” Explain what this sentence says to a random effect model and its significance.

Question 4.3 (5 points) In an old version of `.xtreg` would display “Random effects `u_i ~ Gaussian`” right above the expression in 4.3, as shown in the tutorial document (p.36-38). Explain what this sentence says to a random effect model. (Hint: a normal probability distribution is also called Gaussian probability distribution.)

**Question 5 (18 points).** Evaluation of a random effect model: LM test

Question 5.1 (3 points) Calculate SSE of the pooled OLS. Follow following steps: Fit the pooled OLS; Obtain residuals; Calculate squared residuals; Finally, calculate the sum of squared residuals. Is this number the same as SSE you obtained in Question 1?

Question 5.2 (3 points) Calculate the sum of squared group (country) means of residuals. Follow following steps: Get a data set with group means of residuals; Calculate squared group means of residuals; Finally, calculate the sum of squared group means of residuals.

Question 5.3 (1 point) Report n, T, and k (Not K).

Question 5.4 (3 points) Calculate the LM statistic. Include formula and show your computation clearly. Do not use Stata commands.

Question 5.5 (1 point) Fit a random group (country) effect using `.xtreg` and run `.xttest0` to get an LM statistic. Is this number the same as on you calculated in 5.4?

Question 5.6 (7 points) Conduct the hypothesis test to examine if there exists random group effect. Follow all five steps strictly and take the p-value approach. First, state the null hypothesis clearly.

**Question 6 (12 points).** Alternative ways of fitting a random effect model

Question 6.1 (1 point) Fit the random group effect model using `.xtmixed`. Keep in mind you should not omit the comma in the expression “`|| country: ,`” Notice that this command fits hierarchical (multilevel) linear models.

Question 6.2 (2 points) Compare parameter estimates and their standard errors you obtained in 6.1 and 3.1. How are they different?

Question 6.3 (1 point) In the Stata output, look for values equivalent to “`/sigma_u`” and “`/sigma_e`” and then report your finding.

Question 6.4 (1 point) Fit the random group effect model using `.xtreg` with the `mle` option. How do parameter estimates and their standard errors differ from counterparts of 3.1?

Question 6.5 (2 point) Fit the random group effect model using `.xtmixed` with the `mle` option. How do parameter estimates and their standard errors differ from counterparts of 6.4? Are they fitting the same model? What can you learn from this finding?

Question 6.6 (5 points) Conduct the Likelihood Ratio test for a random group (country) effect using Stata output in 6.5. Follow all five steps strictly and take the p-value approach.

End of homework assignment 4.