Problem Set 2 – Empirics
Estimation of convergence rate on cross-sectional and panel data.

Convergence rate λ, similarly to other issues of economic growth, can be estimated on cross-sectional data, however, some information might be lost. For example, country specific factors might cause dynamics that could result into misleading interpretations. In this problem set, convergence rate over the period 1965-1995 is estimated using both, cross-sectional and panel data.

1. Cross sectional data

Estimate a convergence rate λ using the model from the seminar:

$$g = c + (1-e^{-\lambda t})\frac{\alpha}{1-\alpha-\beta}\log s_k + (1-e^{-\lambda t})\frac{\beta}{1-\alpha-\beta}\log s_h$$
$$-(1-e^{-\lambda t})\frac{\alpha}{1-\alpha}\log(n+g+\delta) - (1-e^{-\lambda t})\log y(0)$$

where c is a constant encompassing several deterministic terms.
In your problem set, start with estimation output and then calculate the convergence rate from the estimated coefficient at initial output.

2. Panel data Sheet "panel"

Note: When importing dataset into gretl, use following steps:
(i) Using the "Data"=>"Dataset Structure" tell gretl, that your dataset contains panel data. Set "Panel Data" => "Stacked cross sections" (=vertical blocks are cross-sectional) => number of time periods = 4.
(ii) Open the dataset in gretl (mark all variables – right-click – display values) and it should look like this:

```
Obs      year  y0       gpop        inv      lfshl
Angola 1965 7,96357
Angola 1975 7,64297 -2,707180 2,186882 -4,457285
Angola 1985 7,52848 -2,566532 2,102728 -3,591076
Angola 1995 7,13299 -2,506809 1,720181 -3,668691
```

From the Solow model augmented for human capital it can be shown that around steady state the dynamics of convergence can be estimated using following equation:

$$\log(y_{i,t}) = \gamma_i + \mu_t + \gamma_1 \log(y_{i,t-1}) + \gamma_2 \log(s^k_{i,t}) + \gamma_3 \log(s^h_{i,t}) + \gamma_4 \log(n_{i,t}+g+\delta) + \varepsilon_{i,t}$$

Here γ_i is a country specific intercept, μ_t is a time trend. Coefficient γ_1 is equal to $e^{-\lambda\tau}$ with λ being the convergence rate and τ the time length between observations (in this case 10 years).

i. Estimate the pooled model and present the results (OLS estimated on panel dataset).
ii. Get the results of the fixed effects model. Is the fixed effects model distinct from the pooled model?
iii. Compare implied values of speed of convergence (calculated from estimated coefficient γ_1) from pooled model with random and fixed effects.

Hint: Start with generating the time trend variable, in Gretl go to "Add" => "Time trend". All variables in dataset are in logs already so no further transformations are needed.