Session 10: Review Exercises

AY2025/26 Term 1

Question 1: Given a panel data structure, explain how the following are related to each other. Use words only (absolutely no math!).

a. Pooled OLS

b. Clustered standard errors

c. Random effects estimator

d. Fixed effects estimator

Be as concise as you can. Your answer should be a half-page paragraph.

Question 2: Write the time series regression $y_t = \beta_0 + \beta_1 X_t + u_t$ where $u_t = \rho u_{t-1} + \epsilon$, $|\rho| < 1$, $\epsilon \overset{iid}{\sim} (0, \sigma^2)$, $t = 1, \ldots, T$ as

$$y = X\beta + u\,,\; u \sim (0, \Omega)\,.$$

The form of Ω and the appropriate transformation matrix P was given in Session 10 slides. Show in detail what the transformations Py and PX are, and show that the variance-covariance matrix of Pu is $\sigma^2 I_n$.

(*Hint: For the last question above, don't multiply out* $P\Omega P^{\mathrm{T}}$. *Just expand the transformation* Pu *in terms of the* ϵ_t *and explain why the variance-covariance matrix of* Pu *must be* $\sigma^2 I_n$.)

Question 3: In the context of slide #32 of Session 10 slides, show that

$$(M_0 + \psi(I_T - M_0)) \left(M_0 - \frac{1}{\psi^2}(I - M_0) \right) (M_0 + \psi(I_T - M_0))^{\mathrm{T}} = I_T\,.$$