SUMMER TERM 2021

DEPARTMENTALLY ARRANGED 24-HOUR ONLINE EXAMINATION

ECON0019: QUANTITATIVE ECONOMICS AND ECONOMETRICS

Answer BOTH questions.

1. In *"Does Trade Cause Growth?"* (American Economic Review, 1999), Jeffrey Frankel and David Romer study the effect of trade on income. Their simple specification is

$$\log Y_i = \alpha + \beta T_i + \gamma W_i + \varepsilon_i,$$

where Y_i is per capita income of country i, T_i is international trade, W_i is within-country trade, and ε_i reflects other determinants of income. Since ε_i is likely to be correlated with the trade variables, Frankel and Romer decide to use instrumental variables to estimate the coefficients β and γ. As instruments, they use a measure of country's geographic position (its proximity to other countries) P_i and the country size S_i.

(a) Explain in detail (step by step) how one can construct the instrumental variable estimates $\hat{\beta}$ and $\hat{\gamma}$ when one has data on Y_i, T_i, W_i, P_i, and S_i for a random sample of countries.

(b) Provide formal conditions for these estimates to be consistent. Which of them can be tested?

(c) Explain the economic intuition why the conditions from Question 1(b) may be satisfied in this context. Also give at least one economic justification why at least one of them may be violated.

proxy

(d) Suppose that, unfortunately, data on within-country trade W_i are not available. In order to be able to estimate β, the researchers add another assumption (on top of those you proposed in item (b)): that W_i follows the model

$$W_i = \eta + \lambda S_i + \nu_i,$$

and P_i is uncorrelated with ν_i. Explain in detail (step by step) how one can estimate β from the data on Y_i, T_i, P_i, and S_i only and why that estimator will be consistent.

(e) Suppose now it is known that $\gamma = 0$. Further, the true effects of international trade on income are heterogeneous across countries, denoted β_i, such that the true model for per capita income is

$$\log Y_i = \alpha + \beta_i T_i + \varepsilon_i.$$

Suppose the researchers estimate the regression of $\log Y_i$ on T_i (and a constant), using P_i as the single instrument. Under what condition would they asymptotically recover the average causal effect $\mathbb{E}[\beta_i]$? Provide an economic justification for why this condition may be violated in this context. Explain how to interpret the estimand of this IV procedure in that case and the direction in which it may differ from the average causal effect.

2. The transmission of human capital across generations has drawn attention for many decades in Economics. Mikael Linhdahl, Marten Palme, Sofia Sadgren-Massih and Anna Sjogren ("A Test of the Becker-Tomes Model of Human Capital Transmission Using Microdata on Four Generations", Journal of Human Capital, 2014) use Swedish data to examine this question across several generations employing years of schooling as a measure for human capital.

(a) A simple version for the model entertained in their article, focussing on particular family, is:

$$S_t = \beta_0 + \beta_1 S_{t-1} + E_t$$

where S_t is years of schooling for generation t and E_t is "ability" for that generation. Assume that $|\beta_1| < 1$ so that stationarity and weak dependence hold. How would you test whether E_t is serially correlated in this particular context?

(b) Their model also postulates that ability is transmitted across generations according to:

$$E_t = \alpha_0 + \alpha_1 E_{t-1} + V_t.$$

Assume that V_t is iid across generations, with mean zero and variance given by $\sigma^2 > 0$. If $\alpha_1 \neq 0$ is contemporaneous exogeneity satisfied? Justify your answer. If one has data on T generations, suggest a consistent estimator for $\alpha_1 \times \beta_1$ and a test for the null hypothesis that $\alpha_1 \times \beta_1 = 0$. Explain your answer.

(c) Assume now that one has data on a cross-section with only two generations ("parent" and "child"). Suppose that the data on years of schooling for the child only provides the number of years when those are less than 12 years and, otherwise, one can only know that an individual had 12 or more years of schooling. The data on years of schooling for the parent is nonetheless complete, i.e., one observes the number of schooling years without the restriction above. Let HE^C be equal to 1 if the child has 12 or more years of education, and

S censored for child, min(c,12)

zero otherwise. Denote by S^P the years of schooling for the parent. Consider the following model:

$$HE^C = \mathbf{1}(\gamma_0 + \gamma_1 \ln S^P + U \geq 12).$$

Assume that $U \sim \mathcal{N}(0, 1)$ and notice that the regressor is the logarithm of S^P. Write down the log-likelihood function for the model above and a random sample of N families. How would you estimate

Average Partial Effect $$\mathbb{E}[\partial \mathbb{P}(HE^C = 1|S^P)/\partial S^P]?$$

(d) Under the data scenario above (i.e., years of schooling for the child is censored at 12 years), let S^C be the child's years of schooling. A friend is interested in the following regression:

$$S^C = \beta_0 + \beta_1 S^P + E$$

using this cross-sectional data. She suggests using only the uncensored observations (i.e., those for which $S^C < 12$) and estimate the regression above with OLS. Will the estimator consistently estimate β_0 and β_1? Explain your answer.

(e) Still on the regression from question 2(d), another friend instead suggests using a selection model to estimate β_0 and β_1. Explain how you would construct such an estimator in this particular setting.

Heckman correction