Econometrics III (module 5, 2023–2024)

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Assignment 4

Problem 1 "Cost function continued", 35 points

Do Exercise 23.10(a,c,d) from Hansen's textbook. Be very careful when computing standard errors! Then continue:

(b) Now, instead of using the concentration method, use general smooth optimization in Python. Perform both point NLLS estimation and computation of NLLS standard errors. Try several starting parameter combinations. Did the two methods yield identical results? Which method turned out more reliable and/or convenient?

(e) Compute the average (over observations) marginal influence of the variable $\log Q$ on the conditional mean of $\log TC$, and the marginal influence of the variable $\log Q$ on the conditional mean of $\log TC$ evaluated at the sample means of the regressors. How much different are the two measures?

(f) Suppose you want, in the framework of the ST model, to test a hypothesis that $\log Q$ does not influence the conditional mean of $\log TC$. Outline briefly how one should proceed.

Problem 2 "Publish or perish", 15 points

Suppose we want to model the publishing activity of economists. Since the number of papers published in a year is an integer, the first choice for the model may be the Poisson distribution. Suppose we have a random sample of economists with data on a number of papers published in the year 2023 M and the number of years x since obtaining PhD. We assume that

$$\Pr\{M = m|x\} = \frac{\exp(-\lambda(x|\alpha,\beta))\lambda(x|\alpha,\beta)^m}{m!},$$

where the conditional mean is $\lambda(x|\alpha,\beta) = \exp(\alpha + \beta x)$, and α and β are unknown parameters.

1. Show how to estimate the model using conditional MLE. In particular, write down the log-likelihood function, derive the first order conditions, check if there is a closed form solution, and derive the asymptotic variance of the ML estimator.

2. How would you test the hypothesis that publishing a paper is pure luck? Write down the test statistic, its asymptotic distribution, and the decision rule.