Syllabus: Econometrics II

Instructor

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Summary

The first part of this course covers core principles of estimation and inference, moving up in (mathematical) generality from OLS to IV to GMM to m- and extremum estimation, and down again to Maximum Likelihood. We will also get introduced to principles of non- and semiparametric estimation and to bootstrap inference.

Assessment

There will be about eight homework exercises (30%), a prelim (April 7th in class; 30%), and a final (TBA, between May 9th and May 16th; 40%). The final will emphasize material from later in the semester, but the material is inherently extremely cumulative.

The homework will mix theoretical and practical exercises. You may use any software that does the job, e.g. Stata, R, Julia, Python, or MATLAB. I can advise on how to access these. Teamwork is encouraged but homework write-ups must be handed in separately. Your weakest homework will be dropped from consideration.

Canvas

Will be used extensively. Please let me know if there are any issues.

Course Outline

Part 1: Ordinary Least Squares

1. OLS: definition and finite sample properties.
(Hayashi ch. 1)

2. OLS: Large sample properties in rather general setting. Robust test statistics.
(Hayashi ch. 2)

Part 2: Generalized Method of Moments

3. GMM: overview, linear single-equation GMM. OLS and IV as special cases.
(Hayashi ch. 3)

4. GMM: linear single equation. Hypothesis and specification tests, 2SLS as special case.
(Hayashi ch. 3, Wooldridge article)

5. GMM: multiple-equation GMM. SUR, FIVE, and RE as special cases.
(Hayashi ch. 4)

6. Panel data: a GMM perspective. FE, RE, first-difference as special cases.
(Hayashi ch. 5, Wooldridge ch. 10-11. Our treatment is very abbreviated.)

Part 3: Extremum Estimators

7. Identification: A more formal approach.
(Matzkin)

8. Extremum estimators. Overview, consistency, asymptotic normality.
(Hayashi ch. 7; Newey/McFadden)

9. Hypothesis testing: the trinity.
(Hayashi ch. 7; Newey/McFadden)

10. Maximum likelihood: some applications. (Linear regression, binary response, Tobit type II/Heckit.)
(Hayashi ch. 8; lecture notes)

Part 4: Non- and Semiparametrics

11. Kernel density regression, Nadaraya-Watson, and local polynomial regression in considerable detail.
(lecture notes)

12. Semiparametrics.

13. Quantile Regression.

Part 5: The Bootstrap

12. What is the bootstrap? When does it work? When does it improve on asymptotic approximation? Bootstrap inference, bootstrap bias correction.
(Horowitz handbook chapter, Politis/Romano/Wolf book chapter.)

Readings

In addition to the readings, I will provide detailed lecture notes. All papers listed below will be made available on Blackboard.

Main textbook

Hayashi, F. (2000): *Econometrics.* Princeton University Press.

Other recommended textbooks for this lecture

Hansen, B. (2019): *Econometrics*. Bruce's lecture notes are available on his webpage and are very good.

Wooldridge, J. (2002): *Econometric Analysis of Cross Section and Panel Data*. MIT Press. (A highly regarded textbook, good for panel data.)

Other useful readings

Matzkin, R.L. (2007): Nonparametric identification, in J.J. Heckman & E.E. Leamer (eds.) *Handbook of Econometrics (Volume VI)*. Elsevier.

Newey, W. and D. McFadden (1994): Large sample estimation and hypothesis testing, in R. Engle and D. McFadden (eds.) *Handbook of Econometrics (Volume IV)*. Elsevier. (The definitive source, similar to Hayashi ch. 7, more rigorous but very clear.)

For part 5 (bootstrap)

Horowitz, J. (2001): The bootstrap, in J.J. Heckman & E.E. Leamer (eds.) *Handbook of Econometrics (Volume V).* Elsevier. (The canonical citation. There is also a 2018 update on arXiv.)

Horowitz, J.L. (2003): The bootstrap in econometrics, *Statistical Science* 18: 211-218. (An introduction with practical examples.)

Politis, D.N., J.P. Romano, and M. Wolf (1999): *Subsampling*. Springer. (Chapter 1 is a nice review of the bootstrap.)