UNIVERSITY OF STELLENBOSCH

Optional course in

Advanced Econometrics: Cross-section 872

2020

Convener: Rulof Burger (rulof@sun.ac.za)

Prerequisites: This course presumes some knowledge of basic statistics, mathematics and econometrics. Admission to the course is subject to obtaining certain sub-minima in graduate Econometrics and Mathematical Economics courses.

Lectures & tutorials: 2 sessions per week
Mondays: 9:00-11:00 (First lecture on 27 July in Schumann Annex 1027; Computer lab - TBC)
Wednesdays: 11:00-13:00 (Schumann Annex 2020)

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Aims and objectives

This course covers econometric methods for cross-section (and small T, large N panel data) models. The aim of the course is to provide graduate students with a firm understanding of the theoretical aspects behind techniques used in contemporary empirical research. The course also seeks to provide the knowledge and skills necessary to work as a professional economist in a research environment or to undertake empirical research in micro-economics, development economics, labour economics, health economics, industrial organisation or other fields that primarily use cross-sectional data.

The objectives of the course are to:

- equip students with the theoretical tools required to derive the properties and assess the merits of various estimators;
- study recent developments in econometric theory;
- develop students' ability to apply quantitative methods to the analysis of economic problems.

Course structure

The course consists of six lecture course components:

A. Regression theory (weeks 1 & 2)
B. Program evaluation (weeks 3 & 4)
C. Non-linear estimation methods (weeks 5, 6, 7 & 8)
D. High dimensional estimation methods (weeks 9, 10, 11 & 12)
E. TBD (week 13)

Examination and assessment

The course assessment consists of four parts: i) one mid-semester test on **14 October 2020**, ii) one examination at the end of the semester; iii) one oral presentation (group work); and iv) an essay that requires applying at least one of the techniques covered in the lectures towards answering an economic research question. The essay and presentation will contribute 40% and 10% to the final mark, with the exam and test combining for the remaining 50%.

The list of lectures below gives general guidance on the topics on which test and exam questions may be set. The semester test will cover topics A, B and C. The exam will cover topics D and E.

Essay

Students are expected to write an essay that applies at least one of the techniques covered in the lectures towards answering an economic research question of your choice. This essay has a 3000 word limit (please indicate the number of words at the end of the essay). References must be complete. The internet should be treated as any other source with full acknowledgement. The plagiarism declaration (available on the course website) has to be signed and attached to the front of your essay. In addition to a hard copy **every essay has to be submitted electronically on *turnitin.com*** on the same day as submission. No essay will be graded without an electronic submission. The submission date for the essay is **30 October 2020** for those who want to graduate in December 2020 and **29 January 2021** for those who want to graduate in March 2021. Hand the essays in at Ms. Smit's office in 506A. Students will also be expected to submit a short essay proposal indicating the research question, methodology and data on **2 October 2020**.

Textbooks

The course will use material from many different sources, but the best single text book to buy is:

Wooldridge, J.M., 2010. *Econometric Analysis of Cross Section and Panel Data*, 2nd Edition. MIT Press: Cambridge, MA.

Another very good text for much of the course material is:

Greene, W.H., 2011. *Econometric Analysis, 7th Edition.* Prentice Hall: Upper Saddle River, NJ.

A similarly useful (although less technical) coverage of many of the topics can be found in:

Angrist, J.D. and Pischke, J., 2009 *Mostly Harmless Econometrics*. Princeton University Press: Princeton, New Jersey.

Another very useful resource for the methods used in this course (and some other important techniques that we won't discuss) is the NBER's website for their "Whats New in Econometrics?" mini course, presented by Guido Imbens en Jeffrey Wooldridge in 2007 (http://www.nber.org/minicourse3.html). The website contains lecture notes, slides and videos of the lectures.

Lecture topics and potential readings lists

A. REGRESSION THEORY

1. Causality and econometric modelling

This lecture will cover conditional expectation functions, exogeneity assumptions, linear projections, stochastic explanatory variables, and causality.

- Wooldridge, J.M., 2001. Chapters 1 & 2 in *Econometric Analysis of Cross Section and Panel Data*, MIT Press: Cambridge, Massachusetts.
- Angrist, J.D. and Pischke, J., 2009. Chapter 1 in *Mostly Harmless Econometrics*. Princeton University Press: Princeton, New Jersey.
- Hoover, K.D., 2006. Causality in Economics and Econometrics. In The New Palgrave Dictionary of Economics. London: Palgrave Macmillan, 2008.
- Heckman, J.J., 2005. The Scientific Model of Causality. *Sociological Methodology* 35 (1): 1-97.
- Rubin, D.B., 1974. Estimating causal effects of treatments in randomized and nonrandomized studies. *Journal of Educational Psychology*, 66(5): 688-70.

2. Basic asymptotic theory & the single equation model

This lecture will cover convergence of stochastic sequences, limit theorems, asymptotic properties of OLS estimator, and the shortcomings of the OLS estimator.

- Wooldridge, J.M., 2001. Chapters 3 & 4 in *Econometric Analysis of Cross Section and Panel Data*, MIT Press: Cambridge, Massachusetts.
- Angrist, J.D. and Pischke, J., 2009. Chapter 3 in *Mostly Harmless Econometrics*. Princeton University Press: Princeton, New Jersey.

B. PROGRAMME EVALUATION

3. Estimation of treatment effects under unconfoundedness

This lecture will cover the potential outcome approach, treatment effects, unconfoundedness, matching estimators, and propensity scores.

- Imbens, G., 2007. "Estimation of Average Treatment Effects Under Unconfoundedness." *Lecture notes from NBER's "What's New in Econometrics?" mini-course,* Cambridge, Massachusetts, July 30 2007.
- Wooldridge, J.M., 2001. Chapter 21 in *Econometric Analysis of Cross Section and Panel Data*, MIT Press: Cambridge, Massachusetts.
- Angrist, J.D. and Pischke, J., 2009. Chapter 3 in *Mostly Harmless Econometrics*. Princeton University Press: Princeton, New Jersey.
- Imbens, G.W. and Wooldridge, J.M., 2009. "Recent Developments in the Econometrics of Program Evaluation", *Journal of Economic Literature* 47(1): 5-86.

- Lalonde, R.J., 1986. "Evaluating the Econometric Evaluations of Training Programs with Experimental Data", *American Economic Review* 76(4): 604-620.

4. Estimation of treatment effects under confoundedness

This lecture will cover local average treatment effects, marginal treatment effects and control functions.

- Imbens, G., 2007. "Instrumental Variables with Treatment Effect Heterogeneity: Local Average Treatment Effects." *Lecture notes from NBER's "What's New in Econometrics?" mini-course,* Cambridge, Massachusetts, July 30 2007.
- Wooldridge, J.M., 2007. "Control Function and Related Methods." *Lecture notes from NBER's "What's New in Econometrics?" mini-course,* Cambridge, Massachusetts, July 30 2007.
- Wooldridge, J.M., 2001. Chapter 21 in *Econometric Analysis of Cross Section and Panel Data*, MIT Press: Cambridge, Massachusetts.
- Angrist, J.D. and Pischke, J., 2009. Chapter 3 in *Mostly Harmless Econometrics*. Princeton University Press: Princeton, New Jersey.
- Angrist, J.D. (1990) "Lifetime Earnings and the Vietnam Era Draft Lottery: Evidence from Social Security Administrative Records", *American Economic Review* 80(3): 313-336.
- Söderbom, M., Teal, F., Wambugu, A. & Kahyarara, G. (2006) "The Dynamics of Returns to Education in Kenyan and Tanzanian Manufacturing", *Oxford Bulletin of Economics and Statistics* 68(3): 261-288.

C. NON-LINEAR ESTIMATION METHODS

5. Introduction to common non-linear estimators

Readings to be determined

6. Models of polychotomous choice and sample selection models

This lecture will cover conditional logit, multinomial logit, nested logit, truncated regression, Tobits, Heckman's sample selection estimator.

- Wooldridge, J.M., 2001. Chapters 15, 16 & 17 in *Econometric Analysis of Cross Section and Panel Data*, MIT Press: Cambridge, Massachusetts.
- Heckman, J.J., 1979. "Sample Selection Bias as a Specification Error," *Econometrica* 47: 153-161.
- Tobin, J., 1958. "Estimation of Relationships for Limited Dependent Variable Models," *Econometrica* 26: 24-36.

7. Count data and duration analysis

Readings to be determined

8. Dynamic panel data models

This lecture will cover instrumental variables, generalised method of moments, AR(1) models.

- Wooldridge, J.M., 2001. Chapter 11 in *Econometric Analysis of Cross Section and Panel Data*, MIT Press: Cambridge, Massachusetts.

- Arellano, M. and Honore, B., 2001. "Panel data models: some recent developments" in J.J. Heckman and E.E. Leamer (eds), *Handbook of Econometrics, Vol. 5,* North Holland.
- Blundell, R.W., Bond, S.R. and Windmeijer, F., 2000. "Estimation in dynamic panel data models: improving on the performance of the standard GMM estimator" in B.H. Baltagi (ed), *Advances in Econometrics Vol. 15: Nonstationary Panels, Panel Cointegration and Dynamic Panels*, JAI Elsevier.
- Bond, S.R., 2002. "Dynamic panel data models: a guide to micro data methods and practice." *Portuguese Economic Journal*, 1: 141-162.

D. HIGH DIMENSIONAL METHODS

9. Nonparametric density estimation

This lecture will cover kernel density estimation, bandwidth selection, adaptive estimation, nearest-neighbour methods, and series estimators.

- DiNardo, J. and Tobias, J.L., 2001. "Nonparametric Density and Regression Estimation." *The Journal of Economic Perspectives* 15 (4): 11-28.
- Neumark, D., Schweitzer, M. and Wascher, W., 2005. "The Effects of Minimum Wages on the Distribution of Family Incomes: A Nonparametric Analysis." *The Journal of Human Resources* 40 (4): 867-894.
- Racine, J.S., 2008. "Nonparametric Econometrics: A Primer." *Foundations and Trends in Econometrics* 3(1): 1-88.

10. Nonparametric regression estimation

This lecture will cover moving average estimators, kernel regressions, local regressions, nearest neighbour methods, multivariate regression.

- DiNardo, J. and Tobias, J.L., 2001. "Nonparametric Density and Regression Estimation." *The Journal of Economic Perspectives* 15 (4): 11-28.
- Wittenberg, M., 2002. "Job search in South Africa: A non-parametric analysis." *The South African Journal of Economics* 70 (8): 1163-1196.

11. Machine learning models I

12. Machine learning models II

E. TBD