

UNIVERSITY OF STELLENBOSCH

Advanced Cross-section Econometrics 872

2022

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
Tuesdays: 14:00-16:00 (CGW Schumann Building, Room 221)
Thursdays: 11:00-13:00 (Computer lab, Van der Sterr 3054)

Lecturers: Rulof Burger (rulof@sun.ac.za)
Weeks 1-3, 10-13
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Dieter von Fintel (dieter2@sun.ac.za)
Weeks 4-9
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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 and 3)
- B. Program evaluation (weeks 4 & 5)
- C. Non-linear estimation methods (weeks 5, 6, 7 & 8)
- D. High dimensional estimation methods (weeks 9, 10, 11 & 12)

Examination and assessment

The course assessment consists of four parts: i) one mid-semester test on **23 September 2022**, 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 topics assessed in the test and exam will be confirmed in class.

To pass this module, a mark of at least 40 percent is required for the examination and a final mark of at least 50 percent must be obtained. To obtain a distinction in a module, a minimum final mark of 75 percent is required. No sub-minima are required for the different subsections of the module.

A student fails a module (with no access to a supplementary examination opportunity) if they obtain less than 40 percent in the examination. A student that obtains at least 40 percent in the examination, but a final mark of less than 50 percent qualifies for a supplementary examination opportunity, which can increase the student's final mark to a maximum of 50 percent.

Sick test and medical certificates

Students are required to write the mid-semester test on the scheduled date. If a student is sick on the day of the mid-semester test, they need to submit a valid medical certificate to the course coordinator within 48 hours of missing the assessment. If a valid medical certificate is not received by this deadline, the student will not gain entrance to the sick test opportunity and the module will be deemed incomplete on their academic record. No exceptions will be made.

If a student has to write a sick test in a module, they write this sick test on the same date as the module's examination (in one sitting) with a 30 minute break between the two papers. The sick test is the second and final assessment opportunity for material covered in a mid-semester test. As such, no medical certificates will be accepted as an excuse for missing the sick test. A student that must write the sick test is also not allowed to submit a medical certificate to miss the examination, since the sick test and examination is written in one sitting.

In the second semester, examinations are written in October and November. Students are required to make use of the first examination opportunity in each module, unless they submit a valid medical certificate. (Valid) medical certificates for missed examination opportunities must be submitted to Carina Smit (carina@sun.ac.za) within 48 hours of missing the assessment to gain access to the supplementary examination opportunity. The supplementary examination is in all circumstances the final examination

opportunity. If a supplementary examination opportunity is scheduled, all these examinations will be scheduled in one calendar week (in the first semester: at the end of June or early in July for the first semester modules and in December for the second semester modules).

For a medical certificate to be valid, it must meet the following requirements:

- Name of the patient (student);
- Date and time of medical examination;
- An indication that the certificate has been issued after a personal observation (this excludes telephonic consultation or communication) of the student by a suitably registered medical practitioner;
- Confirmation that the student will not be able to or was not able to attend class or take the class test(s) or carry out the class work, due to illness, and
- Any other information which, in the judgement of the practitioner would be required or relevant.

Please refer to the University Calendar, Part 1, for further information.

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) must be signed and attached to the front of your essay. **Every essay must 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 **21 October 2022** for those who want to graduate in December 2022 and **28 January 2023** for those who want to graduate in March/April 2023. Students will also be expected to submit a short essay proposal indicating the research question, methodology and data on **16 September 2022**.

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 and 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.

3. Endogeneity and instrumental variable estimation

This lecture will cover endogeneity, measurement error, omitted variable bias, reverse causality, instrumental variables, and weak instruments.

- Wooldridge, J.M., 2001. Chapters 4.4, 5 & 6.2 in *Econometric Analysis of Cross Section and Panel Data*, MIT Press: Cambridge, Massachusetts.
- Angrist, J.D. and Pischke, J., 2009. Chapters 2 & 4 in *Mostly Harmless Econometrics*. Princeton University Press: Princeton, New Jersey.
- Angrist, J.D. and Krueger, A.B., 2001. "Instrumental Variables and the Search for Identification: From Supply and Demand to Natural Experiments." *The Journal of Economic Perspectives* 15(4): 69-85.
- Card, D., 1995. "Using Geographic Variation in College Proximity to Estimate the Return to Schooling", in Louis N. Christofides, E. Kenneth Grant and Robert Swidinsky, (eds.) *Aspects of labour market behaviour: essays in honour of John Vanderkamp*. University of Toronto Press: Toronto.

B. PROGRAMME EVALUATION

4. 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.

5. 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

6. Introduction to common non-linear estimators

- Wooldridge, J.M., 2001. Chapter 13 and 14 in "Econometric Analysis of Cross Section and Panel Data", MIT Press: Cambridge, Massachusetts.
- Imbens, G., 2007. "Generalized Method of Moments and Empirical Likelihood." Lecture Notes from "What's new in Econometrics?" mini-course, Cambridge, MA, July 30, 2007.
- Hayashi, F., 2000, Chapter 3 in "Econometrics", Princeton University Press
- Hendry, D.F. and Nielsen, B. 2007. Chapters 1-4 in "Econometric Modeling: A Likelihood Approach." Princeton University Press: Princeton

7. 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.

8. Count data and duration analysis

- Wooldridge, J.M., 2001. Chapter 19 and 20 in "Econometric Analysis of Cross Section and Panel Data", MIT Press: Cambridge, Massachusetts.
- Greene, W.H., 2008. Chapter 25 in "Econometric Analysis", Pearson Prentice Hall
- Cameron, A.C. & Trevedi, P.K., 2005. Chapter 17 and 18 in "Microeconometrics: Methods and Applications", Cambridge University Press

9. 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

10. 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.

11. 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.

12. Machine learning in econometrics I

- Mullainathan, S., & Spiess, J., 2017. "Machine Learning: An Applied Econometric Approach." *Journal of Economic Perspectives*, 31 (2), 87-106.
- James, G., Witten, D., Hastie, T. and Tibshirani, R., 2013. "An Introduction to Statistical Learning with Applications to R." New York: Springer.

13. Machine learning in econometrics II

- Mullainathan, S., & Spiess, J., 2017. "Machine Learning: An Applied Econometric Approach." *Journal of Economic Perspectives*, 31 (2): 87-106.
- Belloni, A., Chernozhukov, V & Hansen, C., 2014. "High-Dimensional Methods and Inference on Structural and Treatment Effects." *Journal of Economic Perspectives*, 28 (2): 29-50.
- James, G., Witten, D., Hastie, T. and Tibshirani, R., 2013. *An Introduction to Statistical Learning with Applications to R*. New York: Springer.