Princeton University **Spring 2019**
Department of Economics **ECO 518**

Econometric Theory II (Part 2)

Syllabus: Version 3b (April 24, 2019)

Instructor:	Mikkel Plagborg-Moller, mikkelpm@princeton.edu
Lectures:	Mon/Wed 9.00-10.30, JRR A97
Office hours:	Tue 1.30–2.30, JRR 282 Please sign up on http://wase.princeton.edu

Material. The course material is self-contained and there is no required textbook. Handouts covering most of the material will be available on the website. The handouts borrow heavily from material generously shared by Professor Alberto Abadie, although any errors are the sole responsibility of the instructor. Some students might find it useful to have a textbook as an additional reference. Good reference books are:

Cameron, A. C. and Trivedi, P. K. (2005), *Microeconometrics: Methods and Applications*, Cambridge University Press.

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

Wooldridge, J. M. (2010), *Econometric Analysis of Cross Section and Panel Data*, 2nd edition, MIT Press.

This syllabus also includes a list of additional readings that are useful for a deeper understanding of the material. Many of these are available electronically.

Homework. Problem sets will be posted on the course website every one or two weeks. The due date will typically be one week after the assignment is posted. Problem sets should be printed out and handed in to the preceptor on the due dates. *Late assignments will not be accepted.* Feel free to work in groups no larger than 3 students for the exercises, and you may turn in one exercise for the entire group. Moreover, you may discuss the exercises with any of your classmates. We reserve the right to subtract points for sloppy exposition, including unreadable code or poor document structure. If you find a grading error, please resubmit your problem set along with a one-paragraph explanation; the instructors reserve the right to re-grade the entire problem set.

Exams. The course will feature a final exam. No collaboration is allowed on the final.

Grading. Your final course grade will be an average of your grade in parts 1 and 2. The grade for part 2 will be a monotonic function of the weighted average of (i) the average problem set score (20% weight) and (ii) the final exam score (80% weight).

Code of conduct. All course activities, including class meetings and homework assignments, are subject to the university's academic code and code of conduct as detailed in the "Rights, Rules, Responsibilities" publication.

Accommodations for students with disabilities. Students must register with the Office of Disability Services (ODS) (ods@princeton.edu; 258-8840) for disability verification and determination of eligibility for reasonable academic accommodations. Requests for academic accommodations for this course need to be made at the beginning of the semester, or as soon as possible for newly approved students, and again at least two weeks in advance of any needed accommodations in order to make arrangements to implement the accommodations. Please make an appointment to meet with the instructor in order to maintain confidentiality in addressing your needs. No accommodations will be given without authorization from ODS, or without advance notice.

Important dates. These dates are preliminary. Changes will be announced via course email.

Mar 25 (Mon): First class with M. Plagborg-Moller

May 1 (Wed): Last class

May 16 (Thu): Final exam

Outline for Plagborg-Moller's part of the course. The following outline is preliminary and may change without warning.

1. Bootstrap
2. Nonparametric methods
    (a) Nonparametric density estimation

(b) Nonparametric regression

(c) Semiparametric methods (time permitting)

3. More on extremum estimators

   (a) Review of generalized methods of moments, maximum likelihood

   (b) Minimum distance

   (c) Testing

   (d) Weak identification

4. Discrete choice

   (a) Binary choice

   (b) Multinomial choice

5. Quantile regression

6. Estimation of treatment effects

   (a) Counterfactuals, potential outcomes

   (b) Randomized experiments

   (c) Selection on observables, matching, inverse probability weighting

   (d) Instrumental variables, local average treatment effects

   (e) Differences-in-differences

   (f) Regression discontinuity

1 Bootstrap

* Cameron and Trivedi: Chapter 11.

Efron, B. and Tibshirani, R. J. (1993), An Introduction to the Bootstrap. Chapman and Hall. Chapters 6 and 12–13.

Horowitz, J. L. (2001), "The Bootstrap," in *Handbook of Econometrics Vol. 5*, ed. by Heckman, J. J. and Leamer, E. E. Elsevier. Sections 1–3.

van der Vaart, A. W. (1998), Asymptotic Statistics. Cambridge University Press. Chapter 23.

2 Nonparametric methods

* Cameron and Trivedi: Chapter 9.

Chen, X. (2007), "Large Sample Sieve Estimation of Semi-Nonparametric Models," in *Handbook of Econometrics Vol. 6B*, ed. by Heckman, J. J. and Leamer, E. E. Elsevier. Sections 1–2.

DiNardo, J. and Tobias, J. L. (2001), "Nonparametric Density and Regression Estimation," *Journal of Economic Perspectives*, vol. 15, 11–28.

Green, P. J. and Silverman, B. W. (1993), Nonparametric Regression and Generalized Linear Models: A roughness penalty approach. CRC Press.

Härdle, W. and Linton, O. (1994), "Applied Nonparametric Methods," in *Handbook of Econometrics Vol. 4*, ed. by Engle, R. F. and McFadden, D. L. Elsevier.

Ichimura, H. and Todd, P. E. (2007), "Implementing Nonparametric and Semiparametric Estimators," in *Handbook of Econometrics Vol. 6B*, ed. by Heckman, J. J. and Leamer, E. E. Elsevier. Sections 1–6.

Newey, W. K. (1990), "Semiparametric efficiency bounds," *Journal of Applied Econometrics*, vol. 5(2), 99–135.

Pagan, A. and Ullah, A. (1999), Nonparametric Econometrics. Cambridge University Press. Chapters 1–3.

Powell, J. L. (1994), "Estimation of Semiparametric Models," in *Handbook of Econometrics Vol. 4*, ed. by Engle, R. F. and McFadden, D. L. Elsevier.

Wasserman, L. (2006), All of Nonparametric Statistics. Springer. Chapters 4–6.

3 Extremum estimators

* Hayashi: Chapter 7.

Cameron and Trivedi: Chapters 5–6 and 10.

Wooldridge: Chapters 13–14.

Andrews, I., Stock, J. H., and Sun, L. (2019), "Weak Instruments in IV Regression: Theory and Practice," *Annual Review of Economics*, forthcoming. Available online at: `https://scholar.harvard.edu/files/wirev_092218-_corrected_0.pdf`

Newey, W. K., and McFadden, D. (1994), "Large Sample Estimation and Hypothesis Testing," in *Handbook of Econometrics Vol. 4*, ed. by Engle, R. F. and McFadden, D. L. Elsevier. Sections 1–6 and 9.

4 Discrete choice

* Cameron and Trivedi: Chapters 14–15.

* Hayashi: Chapter 8.1.

Wooldridge: Chapters 15–16.

Train, K. E. (2009), Discrete Choice Methods with Simulation, 2nd edition. Cambridge University Press. Chapters 1–6. Available online at: `http://elsa.berkeley.edu/books/choice2.html`

5 Quantile regression

* Cameron and Trivedi: Chapter 4.6.

* Buchinsky, M. (1998), "Recent Advances in Quantile Regression Models: A Practical Guideline for Empirical Research," *Journal of Human Resources*, vol. 33, 88–126.

Buchinsky, M. (1994), "Changes in the U.S. Wage Structure 1963-1987: Application of Quantile Regression," *Econometrica*, vol. 62, 405–458.

Chernozhukov, V. and Hansen, C. (2008), "Instrumental variable quantile regression: A robust inference approach," *Journal of Econometrics*, vol. 142(1), 379–398.

Koenker, R. (2005), Quantile Regression. Cambridge University Press.

Koenker, R. and Hallock, K. F. (2001), "Quantile Regression," *Journal of Economic Perspectives*, vol. 15(4), 143–156.

6 Estimation of treatment effects

The following four readings are overviews of the material that we will cover in this section.

* Abadie, A. and Cattaneo, M. D. (2018), "Econometric Methods for Program Evaluation," *Annual Review of Economics*, vol. 10, 465–503.

Angrist, J. D. and Pischke, J. S. (2009), Mostly Harmless Econometrics: An Empiricist's Companion. Princeton University Press.

Imbens, G. W. and Rubin, D. B. (2015), Causal Inference for Statistics, Social, and Biomedical Sciences: An Introduction. Cambridge University Press.

Imbens, G. W. and Wooldridge, J. M. (2009), "Recent Developments in the Econometrics of Program Evaluation," *Journal of Economic Literature*, vol. 47(1), 5–86.

For a thorough discussion with many opposing viewpoints on causal empirical methodology, see the symposium "Con Out of Econometrics" in the *Journal of Economic Perspectives*, 2010, vol. 24(2), pages 3–94. Available online at: `https://www.aeaweb.org/issues/126`

Randomized experiments

Abadie, A., Athey, S., Imbens, G. W., and Wooldridge, J. M. (2017), "Sampling-based vs. Design-based Uncertainty in Regression Analysis," working paper. Available online at: `https://arxiv.org/abs/1706.01778`

Duflo, E., Glennerster, R., and Kremer, M. (2008), "Using Randomization in Development Economics Research: A Toolkit," in *Handbook of Development Economics Vol. 4*, ed. by Schultz, T. P. and Strauss, J. A. Elsevier.

Selection on observables, matching, inverse probability weighting

* Imbens, G. W. (2004), "Nonparametric Estimation of Average Treatment Effects under Exogeneity: A Review," *Review of Economics and Statistics*, vol. 86(1), 4–29.

Abadie, A. and Imbens, G. W. (2006), "Large Sample Properties of Matching Estimators for Average Treatment Effects," *Econometrica*, vol. 74, 235–267.

Abadie, A. and Imbens, G. W. (2008), "On the Failure of the Bootstrap for Matching Estimators," *Econometrica*, vol. 76, 1537–1557.

Dehejia, R. H. and Wahba, S. (1999), "Causal Effects in Non-Experimental Studies: Re-Evaluating the Evaluation of Training Programs," *Journal of the American Statistical Association*, vol. 94, 1053–1062.

Heckman, J. J., Ichimura, H., and Todd, P. E. (1997), "Matching as an Econometric Evaluation Estimator: Evidence from Evaluating a Job Training Programme," *Review of Economic Studies*, vol. 64, 605–654.

Instrumental variables, local average treatment effects

* Angrist, J. D., Imbens, G. W., and Rubin, D. B. (1996), "Identification of Causal Effects Using Instrumental Variables," *Journal of the American Statistical Association*, vol. 91, 444–472.

Abadie, A. (2003), "Semiparametric Instrumental Variable Estimation of Treatment Response Models," *Journal of Econometrics*, vol. 113, 231–263.

Heckman, J. J. and Vytlacil, E. J. (1999), "Local instrumental variables and latent variable models for identifying and bounding treatment effects," *Proceedings of the National Academy of Sciences*, vol. 96(8), 4730–4734.

Imbens, G. W and Angrist, J. D. (1994), "Identification and Estimation of Local Average Treatment Effects," *Econometrica*, vol. 62, 467–475.

Differences-in-differences

Abadie, A. and Gardeazabal, J. (2003), "The Economic Costs of Conflict: A Case Study of the Basque Country," *American Economic Review*, vol. 93(1), 113–132.

Athey, S. and Imbens, G. W. (2006), "Identification and Inference in Nonlinear Difference-in-Differences Models," *Econometrica*, vol. 74, 431–497.

Card, D. (1990), "The Impact of the Mariel Boatlift on the Miami Labor Market," *Industrial and Labor Relations Review*, vol. 44, 245–257.

Card, D. and Krueger, A. B. (1994), "Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania," *American Economic Review*, vol. 84, 772–793.

Regression discontinuity

* Lee, D. S., and Lemieux, T. (2010), "Regression Discontinuity Designs in Economics," *Journal of Economic Literature*, vol. 48, 281–355.

Armstrong, T. and Kolesár, M. (2018), "Simple and Honest Confidence Intervals in Nonparametric Regression," working paper. Section 6. Available online at: `https://arxiv.org/abs/1606.01200`

Calonico, S., Cattaneo, M. D., and Titiunik, R. (2014), "Robust Nonparametric Confidence Intervals for Regression Discontinuity Designs," *Econometrica*, vol. 86(2), 2295–2326.

Hahn, J., Todd, P., and Van der Klaauw, W. (2001), "Identification and Estimation of Treatment Effects with a Regression-Discontinuity Design," *Econometrica*, vol. 69(1), 201–209.

Imbens, G. W. and Kalyanaraman, K. (2012), "Optimal Bandwidth Choice for the Regression Discontinuity Estimator," *Review of Economic Studies*, vol. 79, 933–959.

Imbens, G. W. and Lemieux, T. (2008), "Regression Discontinuity Designs: A Guide to Practice," *Journal of Econometrics*, vol. 142, 615–635.

Kolesár, M. and Rothe, C. (2018), "Inference in Regression Discontinuity Designs with a Discrete Running Variable," *American Economic Review*, vol. 108(8), 2277–2304.