ECO 2403
TOPICS IN ECONOMETRICS

Department of Economics. University of Toronto
Winter 2017

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COURSE DESCRIPTION

This course deals with the following topics in advanced econometrics.

1. Nonparametric and Semiparametric Regression Models (2 weeks)
2. Mixture Models and Semiparametric Discrete Choice models (3 weeks)
3. Testing Identifying assumptions in causal inference models (2 weeks)
4. Empirical Analysis of Auction Models (3 weeks)
5. Bayesian Analysis and Markov Chain Monte Carlo (2 weeks)

PREREQUISITES

ECO2400 and ECO2401

MEETINGS

We will have one meeting per week.

1. Regular class time and location: **Fridays, Jan 6, 13, 20, 27, Feb 3, 10, 17, March 10, 24, and 31 from 2-4pm** in **WW Room 121**.
2. Rescheduled class time and location: **Thursdays, March 2 and 16 from 1-3pm in GE Room 106.**

EVALUATION

The evaluation will be based on an original research paper that each student will submit by the end of the course. The paper should be related to some of the topics covered in the course, and its main contribution can be either empirical or methodological.

Topic 1: Nonparametric and Semiparametric Regression Models

Instructor: Adonis Yatchew

Outline

1. Overview of nonparametric and semiparametric regression
2. Estimation of nonparametric, partial linear and index models
3. Treatment of endogenous variables
4. Testing procedures, constrained estimation and shape similarity
5. Models where data on derivatives are available
6. Applications and estimation in R

References:

- Yatchew, A., 2003, Semiparametric Regression for the Applied Econometrician, Themes in Modern Econometrics, Cambridge University Press
- Newey W., 2013, "Nonparametric Instrumental Variable Estimation, American Economic Review", 103:3, 550-556.
- Hall, Peter and A. Yatchew 2007: "Nonparametric Estimation When Data on Derivatives are Available", Annals of Statistics, 35:1, 300-323.
- Hall, Peter, and Joel L. Horowitz. 2005. "Nonparametric Methods for Inference in the Presence of Instrumental Variables." Annals of Statistics 33 (6): 2904–29.

Topic 2: Mixture Models and Semiparametric Discrete Choice models

Instructor: Victor Aguirregabiria and Jiaying Gu

Outline

1. Overview of Mixture models
   A. Discrete versus continuous
   B. Identification
   C. Finite Mixture versus Continuous Mixture

2. Estimation methods
   A. Characteristic function approach [plug-in estimator]
   B. Maximum Likelihood approach [convex optimization, algorithm]
   C. Moment based approach
   D. Minimum Distance approach
   E. Bayesian Approach
3. Inference
   A. Testing for homogeneity
   B. Testing for number of components
4. Applications
   A. Multiple Testing/classification
   B. Empirical Bayes and compound decision problems
   C. Count Data models
5. Applications: Discrete choice models with nonparametric distribution of the unobservables
   A. Methods for static models
   B. Methods for dynamic discrete choice structural models

References

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- Blevins, J. (2014): "Nonparametric identification of dynamic decision processes with discrete and continuous choices," Quantitative Economics, 5, 531–554.
- Buchholz, N., M. Shum, and H. Xu (2016): "Semiparametric estimation of dynamic discrete choice models," manuscript.
- Cosslett (1983): "Distribution-free maximum likelihood estimator of the binary choice model," Econometrica, 51, 765 – 782.
- Deely and Kruse (1968): "Construction of sequences estimating the mixing distribution," Annals of Mathematical Statistics, 39, 286 – 288.
- Efron (2010): "Large scale inference: Empirical Bayes methods for estimation, testing and prediction," IMS Monographs.
- Gautier and Kitamura (2013): "Nonparametric estimation in random coefficients binary choice models," Econometrica, 81, 581 – 607.
- Gu (2016): "Neyman's C(alpha) test for unobserved heterogeneity," Econometric Theory, forthcoming.
- Gu, Koenker and Volgushev (2016): "Testing for homogeneity in mixture models," preprint.
- Heckman and Singer (1984): "A method for minimizing the impact of distributional assumptions in economietric models for duration data," Econometrica, 52, 63 – 132.
- Ichimura, H. (1993): "Semiparametric least squares (SLS) and weighted SLS estimation of single-index models," Journal of Econometrics, 58(1), 71–120.
- Ichimura and Thompson (1998): "Maximum likelihood estimation of a binary choice model with random coefficients of unknown distribution," Journal of Econometrics, 86, 269 – 295.
- Klein and Spady (1993): "An efficient semiparametric estimator for binary response models," Econometrica, 61, 387 - 421.
- Kiefer and Wolfowitz (1956): "Consistency of the maximum likelihood estimator in the presence of infinitely many incidental parameters," Annals of Mathematical Statistics, 27, 887 – 906.
- Koenker and Mizera (2014): "Convex optimization, shape constraints, compound decisions and empirical Bayes rules," JASA, 109, 674 – 685.

- Laird (1978): "Nonparametric maximum likelihood estimation of a mixing distribution," JASA, 73, 805 – 811.
- Li and Chen (2010): "Testing the order of a finite mixture," JASA, 105, 1084 – 1092.
- Lindsay (1989): "Moment matrices: application in mixtures," Annals of Statistics, 17, 722 – 740.
- Lindsay (1995): "Mixture Models: Theory, Geometry and Applications," NSF-CBMS Regional Conference Series in Probability and Statistics
- Matzkin, R. (1992), "Nonparametric and Distribution-Free Estimation of the Binary Choice and the Threshold Crossing Models," Econometrica, 60, 239–270.
- Norets, A, & Tang, X (2014): "Semiparametric inference in dynamic binary choice models," Review of Economic Studies, 81(3), 1229–1262.
- Robbins (1951): "Asymptotically subminimax solutions of compound decision problems," Proceedings of the Berkeley Symposium on Mathematical Statistics and Probability, Vol I.
- Robbins (1956): "An empirical Bayes approach to statistics," Proceedings of the Third Berkeley Symposium on Mathematical Statistics and Probability, Vol I.
- Taber, C. (2000), "Semiparametric Identification and Heterogeneity in Discrete Choice Dynamic Programming Models," Journal of Econometrics, 96, 201–229.

Topic 3: Testing Identifying assumptions in causal inference models.

Instructor: Ismael Mourifié

Abstract: Estimating the causal effect of an endogenous variable on an outcome has always been a difficult task for economists and statisticians. Most of the existing results depend heavily on the so-called "identifying assumptions" such as the existence of (i) an instrumental variable (ii) an exclusion variable (iii) a discontinuity (RD design) etc.…Yet, those assumptions have long been claimed to be fundamentally non-testable, their validity is mostly established through economic intuition, creating a great deal of controversy among researchers. The goal of this lecture is to visit recent works showing that contrary to the general claim, many of the widely used identifying assumptions impose some restrictions on the data, and then their validity can be tested using the data.

Outline

1. Linear IV model: On the testability of the IV Zero-Covariance assumption.
2. Heterogeneous treatment effect: Testing the LATE assumptions.
3. On the testability of various IV independence assumptions.
4. Testing the Fuzzy Regression discontinuity assumptions.
5. (Partial) Identification when identifying assumptions fail to hold.
6. Discussion on the challenges and problems.

References:

- Andrews, D. W. K., and X. Shi (2013): "Inference Based on Conditional Moment Inequalities," Econometrica, 81, 609–666.
- Andrews, D. W. K., W. Kim, and X. Shi (2016): "Stata Commands for Testing Conditional

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- Chernozhukov, V., W. Kim, S. Lee, and A. M. Rosen (2015): "Implementing Intersection Bounds in Stata," Stata Journal, 15(1), 21–44.
- Arai, Y., Y-C. Hsu, T. Kitagawa, I. Mourifié, & Y. Wan (2016): Testing Identifying assumptions in Fuzzy Regression Discontinuity Design, Working Paper.
- Chenozhukov, V., S. Lee, and A. M. Rosen (2013): "Intersection Bounds: Estimation and Inference," Econometrica, 81(2), 667–737.
- Kitagawa, T: A test for instrumental Validity, Econometrica Vol. 83 (5), 2043--2063.
- Mourifié and Wan (2016): Testing Local Average Treatment effect assumptions, forthcoming at the Review of Economics and Statistics.
- Kédagni and Mourifié (2015): Generalized Instrumental Inequalities: Testing IV independence assumption, Unpublished manuscript.
- Kédagni and Mourifié (2016): Testing the IV Zero-Covariance assumption and Identification with an Invalid instrument, Working Paper.
- Nevo, A., and A. M. Rosen (2012): "Identification with Imperfect Instruments," The Review of The Review of Economics and Statistics, 94(3), 659--671.

Topic 4: Empirical Analysis of Auction Models

Instructors: Yuanyuan Wan and Yao Luo

Outline

1. Introduction: auction types, solution concepts, parameter of interest, revenue equivalence, early parametric approaches
2. Nonparametric identification and estimation of baseline models
    A. IPV (independent private value) paradigm with symmetric risk neutral bidders
        i. First price auction
        ii. Second price auction
    B. Extensions
        i. Risk averse bidders
        ii. Asymmetric bidders
        iii. Unobserved auction-level heterogeneity
        iv. Auction with endogenous entry
        v. Affiliated values
3. Further topics
    A. Common value auctions
    B. Testing in auction models
        i. Testing common value against private value
        ii. Testing Affiliation
        iii. Testing exogenous participation
        iv. Testing Monotone bidding strategy
        v. Testing Collusion
        vi. Testing entry model
    C. Partial identification in auction models
    D. Multi-unit and multi-object auctions

References:

- Krishna, V. (2009): "Auction theory", Academic press.
- Paarsch, H. J., & Hong, H. (2006): "An introduction to the structural econometrics of auction data", MIT Press Books
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- Hendricks, K., Pinkse, J., & Porter, R. H. (2003): "Empirical implications of equilibrium bidding in first-price, symmetric, common value auctions", *The Review of Economic Studies*, 70(1), 115-145.
- Li, T., & Zhang, B. (2010): "Testing for affiliation in first price auctions using entry behavior", *International Economic Review*, 51(3), 837-850.
- Haile, P. A., & Tamer, E. (2003): "Inference with an incomplete model of English auctions", *Journal of Political Economy*, 111(1), 1-51.
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- Liu, N., & Luo, Y. (2016): "A Nonparametric Test for Comparing Valuation Distributions in First-Price Auctions".
- Luo, Y., & Wan, Y. (2016): "Integrated-quantile-based estimation for first price auction models".
- Marmer, V., Shneyerov, A., & Xu, P. (2013): "What model for entry in first-price auctions? A nonparametric approach", *Journal of Econometrics*, 176(1), 46-58.
- Marmer, V., & Shneyerov, A. (2012): "Quantile-based nonparametric inference for first-price auctions", *Journal of Econometrics*, 167(2), 345-357.
- Aryal, G., & Gabrielli, M. F. (2013): "Testing for collusion in asymmetric first-price auctions", *International Journal of Industrial Organization*, 31(1), 26-35.
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- An, Y., Hu, Y., & Shum, M. (2010): "Estimating first-price auctions with an unknown number of bidders: A misclassification approach", *Journal of Econometrics*, 157(2), 328-341.
- Hu, Y., McAdams, D., & Shum, M. (2013): "Identification of first-price auctions with non-separable unobserved heterogeneity", *Journal of Econometrics*, 174(2), 186-193.
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- Hortaçsu, A., & Kastl, J. (2012): "Valuing dealers' informational advantage: a study of Canadian Treasury auctions", *Econometrica*, 80(6), 2511.
- Hickman, B. R., Hubbard, T. P., & Sağlam, Y. (2012): "Structural econometric methods in auctions: A guide to the literature", *Journal of Econometric Methods*, 1(1), 67-106.

Topic 5: Bayesian Analysis and Markov Chain Monte Carlo

Instructor: Martin Burda

Outline

1. Fundamentals of Probability and Bayesian Analysis
2. Hierarchical Modeling
3. Nonparametric Infinite Mixture Models
4. Posterior Asymptotics and Bernstein von Mises Theorem
5. Model Diagnostics
6. Markov Chain Monte Carlo
7. Hamiltonian Monte Carlo
8. Sequential Monte Carlo and Particle Filtering

References:

- Berger, J. O. (1993): "Statistical Decision Theory and Bayesian Analysis", Springer.
- Brooks, S., Gelman, A., Jones, G. L., and Meng, X.-L. (2011): "Handbook of Markov Chain Monte Carlo", Chapman & Hall/CRC.
- Geweke J. (2005): "Contemporary Bayesian Econometrics and Statistics", Wiley.
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- Norets, A., and Pelenis, J. (2014): "Posterior Consistency in Conditional Density Estimation by
- Covariate Dependent Mixtures," *Econometric Theory*, 30(3), 606-646.

SCHEDULE OF LECTURES

WEEK	DATE	TOPIC
Week 1:	Fri. Jan. 6	Topic 1: Nonparametric & Semiparametric Regression
Week 2:	Fri. Jan. 13	Topic 1: Nonparametric & Semiparametric Regression
Week 3:	Fri. Jan. 20	Topic 2: Mixture and Semiparametric Discrete Choice models
Week 4:	Fri. Jan. 27	Topic 2: Mixture and Semiparametric Discrete Choice models
Week 5:	Fri. Feb. 3	Topic 2: Mixture and Semiparametric Discrete Choice models
Week 6:	Fri. Feb. 10	Topic 3: Testing in Casual Inference Models
Week 7:	Fri. Feb. 17	Topic 3: Testing in Casual Inference Models
Week 8:	Fri. Feb. 24	Reading Week
Week 9:	Thur. Mar. 2	Topic 4: Empirical Analysis of Auction Models
Week 10:	Fri. Mar. 10	Topic 4: Empirical Analysis of Auction Models
Week 11:	Thur. Mar. 16	Topic 4: Empirical Analysis of Auction Models
Week 12:	Fri. Mar. 24	Topic 5: Bayesian Analysis and MCMC
Week 13:	Fri. Mar. 31	Topic 5: Bayesian Analysis and MCMC