

## COURSE DESCRIPTION

*Lecture: 830-1000 Mondays and Wednesdays*

*Office Hours: Wednesdays 8-9pm (I will provide zoom link) or by appt at other dates/times either in person or over zoom*

Class materials (notes etc.) will be made available through a PIAZZA webpage for the course.

This course considers parametric, nonparametric and semiparametric estimation techniques that are used in microeconomics. Topics covered will include GMM, classical discrete choice (or qualitative response) modeling, choice-based sampling, simulation estimators, models with censoring and truncation (limited dependent variable models), sample selection models, nonparametric density and regression estimation methods, semiparametric models, panel data and treatment effects models.

The first part of the course considers the econometric problems introduced when the dependent variable is discrete. We discuss the development of classical discrete choice models and their link to utility maximization. We consider cases where the dependent variable is truncated or censored, and cases where the measurement process for the dependent variable is not independent of the behavioral process ('sample selection'). We will consider simulation methods for estimating these types of models. The second part of the course considers ways of relaxing parametric assumptions through nonparametric and semiparametric estimation, with a focus on local polynomial methods. We will first examine fully nonparametric methods and then a variety of semiparametric methods. The third part of the course examines techniques for estimating models that make use of panel data. The fourth part of the course considers program evaluation methods.

## COURSE REQUIREMENTS

There will be 3 problem sets and a final exam. Problem sets will include empirical assignments that require some programming. You can do the programming in a language of your choice. Matlab, R, FORTRAN or C are probably the most useful languages for the assignments. Group work (small groups of 2-4 students) is permitted and encouraged! on problem sets. The problem sets will count for 60% of the final grade and the final exam for 40%. The scheduled date for the final exam (assigned by the university, to be announced). Whether the exam is in person or take-home has not been yet decided and will be determined based on covid situation and university recommended practices in December.

## RECOMMENDED READINGS/REFERENCES

In addition to some course notes that will be made available on the PIAZZA website, I recommend the following textbooks and papers as outside readings.

### General Reference Texts:

The chapters from the Manski and McFadden book which can be downloaded from Berkeley's web site <http://emlab.berkeley.edu/users/mcfadden/discrete.html>.

- AMEMIYA, T., *Advanced Econometrics*, Harvard University Press, 1985. (selected chapters)
- PAGAN, ADRIAN AND AMAN ULLAH., *Nonparametric Econometrics*, Cambridge University Press, 1999.
- HOROWITZ, JOEL., *Semiparametric Methods in Econometrics*, Springer-Verlag, 1998
- GREENE, W. *Econometric Analysis*, MacMillan Publishing Company, 1990.
- MANSKI, C.F. AND D.L. MCFADDEN (EDS), *Structural Analysis of Discrete Data with Econometric Applications*, MIT Press, 1981. (selected chapters)
- ARELLANO, MANUEL, *Panel Data Econometrics*, Oxford University Press, 2003.
- HSIAO, C. *Analysis of Panel Data*, Cambridge University Press, 2014.
- HARDLE, W. *Applied Nonparametric Regression*, Cambridge University Press.
- LEE, MYOUNG-JAE *Methods of Moments and Semiparametric Econometrics for Limited Dependent Variable Models*, Springer-Verlag, New York, 1996.
- LANCASTER, T. *The Econometric Analysis of Transition Data*, Cambridge University Press.
- WOOLDRIDGE, JEFFREY *Econometric Analysis of Cross Section and Panel Data*, MIT Press, 2010.

### Recommended Readings by Topic

#### (A) CLASSICAL DISCRETE CHOICE MODELS

General references:

AMEMIYA (CHAPTER 9)

GREENE (CHAPTER 20)

MANSKI, C.F. AND D.L. MCFADDEN (EDS), *Structural Analysis of Discrete Data with Econometric Applications*, MIT Press, 1981. (Chapters 1 and 5)

MCFADDEN, D.L. (1984): "Econometric Analysis of Qualitative Response Models" in *Handbook of Econometrics*, Volume II, Chapter 24.

Some related papers:

BUNCH, DAVID S. "Estimability in the Multinomial Probit Model" in *Transportation Research B*.

HAUSMAN, J. AND WISE, D. "A Conditional Probit Model for Qualitative Choice: Discrete Decisions Recognizing Interdependence and Heterogeneous Preferences," in *Econometrica*, Mar. 1978, 46(2), pp.403-26.

BERRY, S.; LEVENSOHN, J. AND PAKES, A. "Automobile Prices in Market Equilibrium" in *Econometrica*, July 1995, 63(4), pp. 841-890

HAIJIVASSILIOU, V. AND RUUD, P. (1994) "Classical Estimation Methods for LDV Models using Simulation" in *Handbook of Econometrics*, Volume 4, pp. 2384-2441.

(B) CHOICE-BASED SAMPLING

MANSKI, C.F. AND D.L. MCFADDEN (EDS), *Structural Analysis of Discrete Data with Econometric Applications*, MIT Press, 1981. (Chapter 1, Chapter 2)

MANSKI, C. F. AND S. R. LERMAN "The estimation of choice probabilities from choice based samples " in *Econometrica*, Vol. 45, No. 8, Nov. 1977.

(C) SIMULATION ESTIMATORS

MANSKI, C.F. AND D.L. MCFADDEN (EDS), *Structural Analysis of Discrete Data with Econometric Applications*, MIT Press, 1981. (Chapter 7)

STERN, STEVEN "Simulation-Based Estimation" in *Journal of Economic Literature*, Vol. 35, No. 4 (Dec., 1997), pp. 2006-2039

GOURIEROUX, CHRISTIN AND ALAIN MONFORT *Simulation-Based Econometric Methods*, Oxford University Press, 2002.

GEWEKE, JOHN AND MICHAEL KEANE (2001): "Computationally intensive methods for integration in econometrics," *Handbook of Econometrics*, Vol. 5.

MCFADDEN, DANIEL "A method of simulated moments for estimation of discrete response models without numerical integration " in *Econometrica*, Vol. 57, No. 5, Sep, 1989, 995-1026.

(D) MODELS WITH CENSORING, TRUNCATION

McFADDEN, D.L., "Econometric Analysis of Qualitative Response Models", in *Handbook of Econometrics* (Z. Griliches and M. Intriligator, eds), Vol. II, 1984.

AMEMIYA, T., Chapter 10.

(F) SAMPLE SELECTION

HECKMAN, J., "Sample Selection Bias as a Specification Error", *Econometrica*, 47, 1979: 153-62.

HECKMAN, J., "Varieties of Selection Bias", *AER*, Papers and Proceedings, 1990.

J. HAUSMAN, "Taxes and Labor Supply," in A. Auerback and M. Feldstein, eds, *Handbook of Public Finance*, North Holland, 1987.

R. D. ROY, "Some Thoughts on the Distribution of Earnings," *Oxford Economics Papers*, 3(2), 1951.

HECKMAN, J., AND B. HONORE, "Empirical Content of the Roy Model," in *Econometrica*, Sept., 1990.

EISENHOWER, PHILIP, HECKMAN, J. AND E. VYTLAVIL "The Generalized Roy Model and the Cost-Benefit Analysis of Social Programs," in *Journal of Political Economy*, Apr, 2015.

(F) NONPARAMETRIC ESTIMATION METHODS

General references:

HARDLE, W. *Applied Nonparametric Regression*, Cambridge University Press.

HARDLE, W. AND LINTON, O. "Applied Nonparametric Methods" in *Handbook of Econometrics*, (R. Engle and D. McFadden, eds.), Vol. IV, 1994, p.2295.

PAGAN, A. AND A. ULLAH *Nonparametric Econometrics*

ICHIMURA, HIDEHIKO AND TODD, PETRA (2006) "Implementing Nonparametric and Semiparametric Estimators," in *Handbook of Econometrics*, Volume 6b.

Additional papers:

FAN, J. "Design Adaptive Nonparametric Regression," in *JASA*, 87, 998-1004.

FAN, J. "Local Linear Regression Smoothers and their Minimax Efficiencies," *The Annals of Statistics*, 21, 196-216.

HAUSMAN, J. "Specification Tests in Econometrics," in *Econometrica*, 46, 6, 1251-1271.

JONES, M. C., MARRON, J. S. AND SHEATHER, S. J. (1996): "A Brief Survey of Bandwidth Selection for Density Estimation" in *Journal of the American Statistical Association*, Vol. 91, No. 433, 401-407.

STOKER, T. M. (1989) "Consistent Estimation of Scaled Coefficients" in *Econometrica*, 54, pp.1461-1481.

POWELL, J., STOCK, J.H. AND T. STOKER (1989) "Semiparametric Estimation of Weighted Average Derivatives" in *Econometrica*, 57, pp.1403-1430.

#### (G) SEMIPARAMETRIC MODELS

ICHIMURA, HIDEHIKO AND TODD, PETRA (2000) "Implementing Nonparametric and Semiparametric Estimators," in *Handbook of Econometrics*, Volume 5.

LEE, MYOUNG-JAE *Methods of Moments and Semiparametric Econometrics for Limited Dependent Variable Models*, Springer-Verlag, New York, 1996.

POWELL, J. (1994): "Estimation of Semiparametric Models." *Handbook of Econometrics, Volume 4*. eds. R.F. Engle and D.L. McFadden, 2443-2521

WELLNER JA, KLAASSEN CAJ, RITOV Y. (2006): "Semiparametric models: a review of progress since BKRW (1993)" In: Fan J, Koul HL, editors. *Frontiers in Statistics*. Imperial College Press; London: pp. 25?44.

#### INDEX MODELS

ICHIMURA, H. "Semiparametric Least Squares (SLS) and Weighted SLS Estimation of Single-Index Models" in *Journal of Econometrics*, 58, pp. 71-120.

ICHIMURA, H. AND L. LEE ( 1991): "Semiparametric Least Squares Estimation of Multiple Index Models: Single Equation Estimation," in *Nonparametric and Semiparametric Methods in Economics and Statistics*, ed. by W.A. Barnett, J. Powell, and G. Tauchen (Cambridge, England: Cambridge University Press) 3-49.

#### PARTIAL LINEAR MODELS

ROBINSON, P. (1988): "Root-N Consistent Nonparametric Regression." *Econometrica*, 56, 931-954.

ENGLE, R.F., GRANGER, C.W.J., RICE, J. AND A. WEISS (1986): "Semiparametric Estimates of the Relation between Weather and Electricity Sales" in *JASA*, 81, pp.310-320.

#### DISCRETE CHOICE MODELS

General reference:

AMEMIYA, T., Chapter 9.

Some classic papers:

- BLUNDELL, RICHARD W. AND JAMES L. POWELL “ Endogeneity in Semiparametric Binary Response Model ”, *Review of Economic Studies*, Vol. 71, 2004,655-679.
- MANSKI, C.F., “ Maximum Score Estimation of the Stochastic Utility Model of Choice”, *Journal of Econometrics*, Vol. 3, 1975: 205-228.
- HOROWITZ, J.L., “ A Smoothed Maximum Score Estimator for the Binary Response Model”, *Econometrica*, Vol. 60, No.3, 1992: 505-532.
- KLEIN, R.W. AND R.H. SPADY, “ An Efficient Semiparametric Estimator for Binary Response Models”, *Econometrica*, Vol. 61, No.2, 1993: 387-422.
- ICHIMURA, H. “ Semiparametric Least Squares Estimation of Single Index Models (SLS) and Weighted SLS Estimation of Single Index Models.” *Journal of Econometrics*, 58, 71-120, 1993.

#### TOBIT MODELS

- POWELL, J., “ Least Absolute Deviations Estimation for the Censored Regression Model”, *Journal of Econometrics*, 1984: 303-325.
- POWELL, J., “ Symmetrically Trimmed Least Squares Estimation for Tobit Models”, *Econometrica*, 1986: 1435-1460
- COSSLETT, “ Semiparametric estimation of a regression model with sampling selectivity”, in *Nonparametric and semiparametric methods in Econometrics and Statistics* (Barnett, Powell and Tauchen, eds), Cambridge University Press, 1991.
- AHN, H. AND J.L. POWELL, “ Semiparametric Estimation of Censored Selection Models with a Nonparametric Selection Mechanism”, *Journal of Econometrics*, Vol. 58(1), 1993:3-30.
- HONORE, B.E. AND J.L. POWELL, “ Pairwise Difference Estimators of Censored and Truncated Regression Models”, *Journal of Econometrics*, Vol. 64, 1994:241-278.
- HECKMAN, J. (1980): “Addendum to Sample Selection Bias as specification Error,” in *Evaluation Studies Review Annual*, ed. by E. Stromsdorfer and G. Frakas. San Fransisco, Sage.
- POWELL, J. “Estimation of Semiparametric Models” in *Handbook of Econometrics*, Volume 4, pp. 2444-2521.

#### (H) PANEL DATA MODELS

- CHAMBERLAIN, G., “Panel Data”, *Handbook of Econometrics*, Vol. II, Chapter 22
- ARRELANO, MANUEL, *Panel Data Econometrics*, Oxford University Press, 2003.
- MANUEL ARELLANO AND RAQUEL CARRASCO (2003) “Binary choice panel data models with predetermined variables,” in *Journal of Econometrics*, Volume 115, Issue 1, July 2003, Pages 125-157.

BUNDELL, RICHARD AND STEPHEN BOND “Initial conditions and moment restrictions in dynamic panel data models ” in JOURNAL OF ECONOMETRICS, Vol. 87, Issue 1,

WOOLDRIDGE, JEFFREY *Econometric Analysis of Cross Section and Panel Data*, MIT Press, 2010.

HECKMAN, JAMES “Statistical Models for Discrete Panel Data” in MANSKI, C.F. AND D.L. MCFADDEN (EDS), *Structural Analysis of Discrete Data with Econometric Applications*, MIT Press, 1981. (Chapter 3)

HECKMAN, JAMES “The Incidental Parameters Problem and the Problem of Initial Conditions in Estimating a Discrete Time-Discrete Data Stochastic Process” in MANSKI, C.F. AND D.L. MCFADDEN (EDS), *Structural Analysis of Discrete Data with Econometric Applications*, MIT Press, 1981. (Chapter 3)

#### (I) TOPICS IN PROGRAM EVALUATION

Mostly, see course slides.

HECKMAN, JAMES J., LALONDE, ROBERT J. AND SMITH, JEFFREY A. (1999): “The Economics and Econometrics of Active Labor Market Programs” in *Handbook of Labor Economics*, Volume 3A, eds. Orley C. Ashenfelter and David Card.

TODD, PETRA E. (2005): “Evaluating Social Programs with Endogenous Program Placement and Selection of the Treated,” *Handbook of Development Economics*, downloadable from <http://athena.sas.upenn.edu/petra/papers/hae.pdf>

IMBENS, GUIDO AND JEFFREY WOOLDRIDGE. (2009): “Recent Developments in the Econometrics of Program Evaluation,” in *Journal of Economic Literature*, Vol. 47, No. 1, p. 5-86.

GLEWWE, PAUL AND PETRA E. TODD (2020, forthcoming): “Impact Evaluation in Developing Countries: Methods, Theory and Practice,” book to be published by the World Bank.