Econometrics 522A
Spring, 2019
Hidehiko Ichimura, TA: Zejin Shi

Syllabus

We will review various econometric methods often used in empirical studies in economics. We will study the leading econometric model, the linear regression model and its variations in the first half. In the second half, we will study the models which are non-linear in parameters and also non-parametric or semiparametric models.

For each models, we study appropriate methods to estimate the parameters of the model under consideration. For each of the methods covered, we examine

1. underlying assumptions each method is based for having desirable properties,
2. how the properties of the estimation method are established, and
3. how these models and estimation methods are used in practice.

In order to implement the methods we study in class, we will use, in recitations, Stata/R (statistical packages) and Python, a popular script language. For numerical purposes, Julia is an excellent alternative for Python. But Julia is still not mature enough compared to Python in the user base size. In some cases, when speed is an issue, it is useful to be able to use a generic compile based programming language such as Fortran 90/95/2003, C++, or Go. Even in those cases, it is recommended to program first in a script language, profile the time use, and then to substitute only the time intensive bottlenecks with programs written in a compile based programming language.

As you will learn, these models and methods have many limitations. However, these are the bread and butter approaches many researchers currently use around the world to examine empirical issues not just in economics but also in any field in science. If you can improve any of these methods in a significant way that will be an important contribution to our knowledge.

The goal of the course is to equip you with the basic tools of econometric analysis so that you can not only begin to explore economic data with good understanding of the limitations of the tools at hand but also to be able to modify parts of the methods to suit your needs.

TAs for the course is Zejin Shi. He will hold a recitation and an office hour each week, clarify the hard to understand part of the lectures and explain the answers to the problem sets.

Lectures: Mon 9:30-10:45 and Wed 9:30–10:45, 401KK.

Recitations: Fri 14:30–15:30 401KK.

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Zejin Shi: email: shizejin94@gmail.com, office: 401C office hours: Fri 15:30-16:30.

Course Web-Page: `https://sites.google.com/site/econ522aeconometrics/`

Grades: based on the mini-exam scores (X), a midterm exam (Y), and a final exam (Z) using the following formula:

$$0.25X + \max\{0.25Y + 0.5Z, 0.75Z\}.$$

Mini-exams are only a slight variations of the weekly problem sets to make sure all of you have an incentive to solve the problem sets on your own regularly. Everyone who solved the problem sets and understood the answers should be able to obtain a full mark.

The textbook for the course is

- Hansen, B. (2018) "Econometrics" (`https://www.ssc.wisc.edu/~bhansen/econometrics/Econometrics.pdf`)

- Large-Sample Theory (Lectures 6–8, H: Chap 6–7)

  1. Various modes of convergences
  2. LLN and CLT
  3. References
     - *Amemiya, T. (1985) "Advanced Econometrics," Harvard University Press. Chapter 3.
     - Serfling, R. J. (1980) "Approximation Theorems of Mathematical Statistics," John Wiley & Sons. (a new edition is forthcoming)
     - Newey, W. and D. McFadden (1994) "Large Sample Estimation and Hypothesis Testing," Vol. 4, R. Engle and D. McFadden (eds). North-Holland.
  4. Asymptotic Properties of the OLS estimator

- LRM (Continued) (Lectures 9–10, H: Chap 8–9)

  1. Hypothesis testing (1.4, 2.4)
  2. Deviations from the classical LRM and their consequences
  3. Heteroskedasticity consistent variance-covariance matrix estimator (2.5–2.8)
  4. Cluster sampling
  5. Prediction (2.9)
  6. Specification tests

  - Arthur S. Goldberger (1991) "A Course in Econometrics," Harvard University Press. Chapters 20–22.
  - Wooldridge, J. (2015) Chapter 4.
  - *Brent R. Moulton (1990) "An Illustration of a Pitfall in Estimating the Effects of Aggregate Variables on Micro Units," Review of Economics and Statistics, 72, 334–338.
  - *Card, D. and Krueger, A. (1994) "Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania," American Economic Review, 84,772–793.
  - *Romano, J. P., Shaikh, A. M., Wolf, M. (2008) "Formalized data snooping based on generalized error rates," Econometric Theory, 24 (2), 404-477.

- Resampling Methods (Lectures 11–12, H: Chap 10)

  1. Jackknife
  2. Bootstrap
  3. Wildbootstrap
  4. Subsampling

  - *B. Efron and R. J. Tibshirani (1993) An Introduction to the Bootstrap (Chapman & Hall)
  - D. N. Politis and J. P. Romano (1999) Subsampling (Springer)
  - J. P. Romano and A. Shaikh (2012) "On the Uniform Asymptotic Validity of Subsampling and the Bootstrap," Annals of Statistics, 40 (6), 2798–2822.

- Single Equation IV, (Lectures 13–15, H: Chap 11–12)

  1. Examples where $E(y|x) \neq x'\beta_0$
  2. IV method
  3. Large sample properties of the IV
  4. Wald, Likelihood Ratio, Lagrangean Multiplier
  5. Specification tests

- **Suresh de Mel, David McKenzie, Christopher Woodruff (2009) "Are Women More Credit Constrained? Experimental Evidence on Gender and Microenterprise Returns," American Economic Journal: Applied Economics 1:3, 1–32.

- Nonparametric Analysis (Lecture 18–20, H: Chap 17–19)

  1. Theories
     - **Lecture Note
       * *Chen, X. (2007) "Large Sample Sieve Estimation of Semi-Nonparametric Models," Handbook of Econometrics, Vol. 6B, ed. by J. Heckman and E. Leemer. Amsterdam: North-Holland.
       * *Ichimura, H. and P. Todd (2007) "Implementing Nonparametric and Semiparametric Estimators," Handbook of Econometrics, Vol. 6B, ed. by J. Heckman and E. Leemer. Amsterdam: North-Holland.
       * *Robinson, P. "Nonparametric Estimators for Time Series," Journal of Time Series Analysis, 4(3), 185–207.
       * *Newey, W. K. "Convergence Rates and Asymptotic Normality for Series Estimators," Journal of Econometrics, 79, 147–168.
       * **Silverman, B. W. (1986) Density Estimation, Chapman and Hall.
       * **Fan, J. and I. Gijbels (1995) Local Polynomial Modeling and Its Applications, Chapman and Hall.
  2. Empirical Examples
     - **Quah, D. (1996) "Twin Peaks: Growth and Convergence in Models of Distribution Dynamics," CEP DP, Centre for Economic Performance, LSE.
       * **Subramanian, S. and Deaton, A. (1996) "The Demand for Food and Calories," Journal of Political Economy, 104(1), 133–162.
       * **Blundell, R. and Duncan, A. (1998) "Kernel Regression in Empirical Microeconomics," Journal of Human Resources, 33(1), 62–87.

- Semiparametric Analysis (Lectures 21–24)

  1. Theories
     - **Lecture Note
       * *Powell, J. (1994) "Estimation of Semiparametric Models," Handbook of Econometrics, Vol. 4, ed. by R. F. Engle and D. L. McFadden. Amsterdam: North-Holland.
       * *Matzkin, R. (1994) "Restrictions of Economic Theory in Nonparametric Methods," Handbook of Econometrics, Vol. 4, ed. by R. F. Engle and D. L. McFadden. Amsterdam: North-Holland.*
       * *Arellano, M. and Honore, B. (2001) "Panel Data Models: Some Recent Developments," Handbook of Econometrics, Vol. 5, ed. by J.J. Heckman and E.E. Leamer. Amsterdam: North-Holland.
       * *Chen, X. (2007) "Large Sample Sieve Estimation of Semi-Nonparametric Models," Handbook of Econometrics, Vol. 6B, ed. by J. Heckman and E. Leemer. Amsterdam: North-Holland.
       * *Ichimura, H. and P. Todd (2007) "Implementing Nonparametric and Semiparametric Estimators," Handbook of Econometrics, Vol. 6B, ed. by J. Heckman and E. Leemer. Amsterdam: North-Holland.
       * **Robinson, P. M. (1988) "Root- N-Consistent Semiparametric Regression," Econometrica, 56, 931–954.
       * **Powell, J. L., J. H. Stock, and T. M. Stoker (1989) "Semiparametric Estimation of Index Coefficients," Econometrica, 57, 1403–1430.
       * **Ichimura, H. (1993) "Semiparametric Least Squares (SLS) and Weighted SLS Estimation of Single-Index Models," Journal of Econometrics, 58, 71–120.

- *Silverman, Bernard W. (1986) Density Estimation for Statistics and Data Analysis, Chapman & Hall.
- *Buchinsky, M. (1994) "Changes in the U. S. Wage Structure 1963–1987: Application of Quantile Regression," Econometrica, 62, 405–458.
- Chamberlain, G. (1994) "Quantile regression, censoring, and the structure of wages," in Proceedings of the Sixth World Congress of the Econometric Society, ed. C. Sims and J. J. Laffont, Cambridge University Press.
- Chernozhukov, V. and Hansen, C. (2005) "An IV Model of Quantile Treatment Effects," Econometrica, 73 (1), 245–261.

- Final Exam