

Applied Microeconometrics - Program Evaluation

Detailed Outline

Marco Caliendo

www.caliendo.de - caliendo@iza.org

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- **Audience:** This is a Graduate Course taught in English and open to CGS students and other PhD students of the University of Cologne.
- **Objectives:** The aim of this course is to provide participants with a deeper understanding of microeconomic estimation techniques. We will use the topic "Program Evaluation" to illustrate and discuss several methods, e.g., selection models, instrumental variables, difference-in-differences, panel data models, regression-discontinuity design and matching estimators. The course will be split in ten theoretical and ten practical sessions. There will also be time to discuss specific problems and present own research in a seminar at the end of the course.
- **Location/Room/Time:** Seminar-Room 14a (Ground floor), IBW-Building, Herbert-Lewin-Str. 2
Thursday, January 15, 2009, 9am-5pm
Friday, January 16, 2009, 9am-5pm
Thursday, January 22, 2009, 9am-5pm
Friday, January 23, 2009, 9am-5pm
Friday, January 30, 2009, 9am-5pm
Seminar (tba)
Exam: Monday, February 16, 2009, 10-12am
- **Requirements/Pre-Requisites:** Attendance and active participation in all sessions is required; at the end of the course there will be a 60min exam.
During the practical sessions we are going to implement the discussed estimators with STATA. Hence, a basic knowledge of STATA (data handling, running do-files, etc.) is a pre-requisite for the course. If you are not familiar with STATA you might want to check the online introduction (including lecture movies) from the UCLA Academic Technology Service <http://www.ats.ucla.edu/stat/Stata/notes3/>. The relevant estimation commands and ado-files will be explained during the course.

This is the detailed outline with a reading list. Even though the course will not presume knowledge of the reading list, it may be helpful for a better understanding to have read some of the papers. The papers which will be heavily discussed during the course are indicated with (*).

1. Introduction in Program Evaluation

- (a) The Evaluation Framework
- (b) Parameters of Interest and Selection Bias
- (c) Social Experiments
- (d) Linking the Potential-Outcome Framework to Textbook Econometrics
- (e) Selection on Observables and Unobservables
- (f) Effect Heterogeneity

Blundell and Costa Dias (2002)
Burtless (1995)
Caliendo and Hujer (2006*)
Holland (1986)
Heckman, LaLonde, and Smith (1999)
LaLonde (1986*)

2. Basic Econometric Principles I: OLS

- (a) The Classical Multiple Linear Regression Model

- (b) Least Squares Regression
- (c) Goodness-of-Fit and Variance
- (d) Inference and Hypothesis Testing
- (e) Problems and Extensions

Wooldridge (2003, Chapter 2-4)
Gujarati (1995, easy accessible)
Greene (2003, more advanced)

3. **Basic Econometric Principles II: Limited Dependent Variables**

- (a) Linear Probability Model
- (b) Logit and Probit Models
- (c) Truncation and Tobit Model
- (d) Other Models

Wooldridge (2003, Chapter 17)
Wooldridge (2004, Chapter 15-16, more advanced)
Greene (2003, Chapter 19-20, more advanced)
Maddala (1999)

4. **The Principle of Unconfoundedness**

- (a) Introduction
- (b) The Basic Idea of Matching under Unconfoundedness
- (c) Redefining Selection Bias
- (d) How do Matching and Regression under UCF differ?

Imbens (2004*)
Heckman, Ichimura, Smith, and Todd (1998)
Heckman and Robb (1985)
Lechner (1999)
Rosenbaum and Rubin (1983)
Rosenbaum and Rubin (1985b)
Rubin (1974)

5. **The Implementation of Matching I**

- (a) Introduction
- (b) Exact or Cell Matching
- (c) The Balancing Property of the Propensity Score
- (d) Estimating the Propensity Score
- (e) Overlap and Common Support
- (f) Choosing a Matching Algorithm

Abadie and Imbens (2006)
Caliendo and Kopeinig (2008*)
Dehejia and Wahba (1999*)
Dehejia (2005)
Heckman, Ichimura, and Todd (1998)
Hirano, Imbens, and Ridder (2003)
Imbens (2000)
Lechner (2001)

Lechner (2002a)
Lechner (2002b)
Rosenbaum and Rubin (1985a)
Sianesi (2004)
Smith and Todd (2005a*)
Smith and Todd (2005b)
Zhao (2004)

6. The Implementation of Matching II

- (a) Assessing the Matching Quality
- (b) Effect Estimation
- (c) Combining Propensity Score Matching with Other Methods
- (d) Sensitivity Analysis
- (e) Programme Heterogeneity
- (f) Sequential Matching
- (g) Dynamic Treatment Assignment

→ Literature: see 'The Implementation of Matching I'

7. Instrumental Variables

- (a) Basic Model
- (b) Multiple Instruments and 2SLS
- (c) IV in the Treatment Effect Notation
- (d) IV-Estimator with Heterogeneous Treatment Effects

Angrist (1990)
Angrist, Imbens, and Rubin (1996)
Angrist and Krueger (1991)
Card (1995)
Imbens and Angrist (1994)

8. Selection Models

- (a) General Framework
- (b) Treatment Effects Framework
- (c) Summary and Comments

Heckman (1978)
Heckman (1979)
Wooldridge (2004)
Greene (2003)

9. Other Topics

- (a) Regression Discontinuity Design
- (b) More Difference-in-Differences
- (c) Panel Data Models
- (d) Which Estimator to Choose?

Angrist and Lavy (1999)
Hahn, Todd, and Van der Klaauw (2001)
Wooldridge (2004)

References

- ABADIE, A., AND G. IMBENS (2006): "Large Sample Properties of Matching Estimators for Average Treatment Effects," *Econometrica*, 74(1), 235–267.
- ANGRIST, J. (1990): "Lifetime Earnings and the Vietnam Era Draft Lottery: Evidence from Social Security Administrative Records," *American Economic Review*, 80(3), 313–336.
- ANGRIST, J., AND A. KRUEGER (1991): "Does Compulsory School Attendance Affect Schooling and Earnings?," *Quarterly Journal of Economics*, 106(4), 979–1014.
- ANGRIST, J. D., G. W. IMBENS, AND D. B. RUBIN (1996): "Identification of Causal Effects Using Instrumental Variables," *Journal of the American Statistical Association*, 91(434), 444–472.
- ANGRIST, J. D., AND D. LAVY (1999): "Using Maimodis' Rule to Estimate the Effect of Class Size on Scholastic Achievement," *Quarterly Journal of Economics*, 114(2), 533–575.
- BLUNDELL, R., AND M. COSTA DIAS (2002): "Alternative Approaches to Evaluation in Empirical Microeconomics," *Portuguese Economic Journal*, 1, 91–115.
- BURTLESS, G. (1995): "The Case for Randomized Field Trials in Economic and Policy Research," *Journal of Economic Perspectives*, 9(2), 63–84.
- CALIENDO, M., AND R. HUIJER (2006): "The Microeconomic Estimation of Treatment Effects - An Overview," *Allgemeines Statistisches Archiv*, 90(1), 197–212.
- CALIENDO, M., AND S. KOPEINIG (2008): "Some Practical Guidance for the Implementation of Propensity Score Matching," *Journal of Economic Surveys*, 22(1), 31–72.
- CARD, D. (1995): "Earnings, Schooling, and Ability Revisited," in *Research in Labor Economics*, ed. by S. Polachek, vol. 14. JAI Press, Greenwich Connecticut.
- DEHEJIA, R. (2005): "Practical Propensity Score Matching: A Reply to Smith and Todd," *Journal of Econometrics*, 125, 355–364.
- DEHEJIA, R. H., AND S. WAHBA (1999): "Causal Effects in Nonexperimental Studies: Reevaluating the Evaluation of Training Programs," *Journal of the American Statistical Association*, 94(448), 1053–1062.
- GREENE, W. H. (2003): *Econometric Analysis*. New York University, New York.
- GUJARATI, D. N. (1995): *Basic Econometrics*. McGraw-Hill, USA.
- HAHN, J., P. TODD, AND W. VAN DER KLAUW (2001): "Identification and Estimation of Treatment Effects with a Regression-Discontinuity Design," *Econometrica*, 69(1), 201–209.
- HECKMAN, J. (1978): "Dummy Endogenous Variables in a Simultaneous Equation System," *Econometrica*, 46, 931–959.
- (1979): "Sample Selection Bias as a Specification Error," *Econometrica*, 47 (1), 153–161.
- HECKMAN, J., H. ICHIMURA, J. SMITH, AND P. TODD (1998): "Characterizing Selection Bias Using Experimental Data," *Econometrica*, 66(5), 1017–1098.
- HECKMAN, J., H. ICHIMURA, AND P. TODD (1998): "Matching as an Econometric Evaluation Estimator," *Review of Economic Studies*, 65(2), 261–294.
- HECKMAN, J., R. LALONDE, AND J. SMITH (1999): "The Economics and Econometrics of Active Labor Market Programs," in *Handbook of Labor Economics Vol. III*, ed. by O. Ashenfelter, and D. Card, pp. 1865–2097. Elsevier, Amsterdam.
- HECKMAN, J., AND R. ROBB (1985): "Alternative Models for Evaluating the Impact of Interventions," in *Longitudinal Analysis of Labor Market Data*, ed. by J. Heckman, and B. Singer, pp. 156–245. Cambridge University Press, Cambridge.
- HIRANO, K., G. IMBENS, AND G. RIDDER (2003): "Efficient Estimation of Average Treatment Effects using the Estimated Propensity Score," *Econometrica*, 71(4), 1161–1189.

- HOLLAND, P. (1986): "Statistics and Causal Inference," *Journal of the American Statistical Association*, 81(396), 945–960.
- IMBENS, G. (2000): "The Role of the Propensity Score in Estimating Dose-Response Functions," *Biometrika*, 87(3), 706–710.
- (2004): "Nonparametric Estimation of Average Treatment Effects under Exogeneity: A Review," *The Review of Economics and Statistics*, 86(1), 4–29.
- IMBENS, G., AND J. ANGRIST (1994): "Identification and Estimation of Local Average Treatment Effects," *Econometrica*, 62(2), 467–475.
- LALONDE, R. (1986): "Evaluating the Econometric Evaluations of Training Programs with Experimental Data," *American Economic Review*, 76(4), 604–620.
- LECHNER, M. (1999): "Earnings and Employment Effects of Continuous Off-the-Job Training in East Germany After Unification," *Journal of Business Economic Statistics*, 17(1), 74–90.
- (2001): "Identification and estimation of causal effects of multiple treatments under the conditional independence assumption," in *Econometric Evaluation of Labour Market Policies*, ed. by M. Lechner, and F. Pfeiffer, pp. 1–18. Physica-Verlag, Heidelberg.
- (2002a): "Programme Heterogeneity and Propensity Score Matching: An Application to the Evaluation of Active Labor Market Policies," *The Review of Economics and Statistics*, 84(2), 205–220.
- (2002b): "Some practical issues in the evaluation of heterogenous labour market programmes by matching methods," *Journal of the Royal Statistical Society, A*, 165, 59–82.
- MADDALA, G. S. (1999): *Limited-dependent and qualitative variables in econometrics*. Econometric society monographs, Cambridge University Press.
- ROSENBAUM, P., AND D. RUBIN (1983): "The Central Role of the Propensity Score in Observational Studies for Causal Effects," *Biometrika*, 70(1), 41–50.
- (1985a): "The Bias due to Incomplete Matching," *Bioometrics*, 41(1), 103–116.
- (1985b): "Constructing a Control Group Using Multivariate Matched Sampling Methods that Incorporate the Propensity Score," *The American Statistician*, 39(1), 33–38.
- RUBIN, D. (1974): "Estimating Causal Effects to Treatments in Randomised and Nonrandomised Studies," *Journal of Educational Psychology*, 66, 688–701.
- SIANESI, B. (2004): "An Evaluation of the Swedish System of Active Labour Market Programmes in the 1990s," *The Review of Economics and Statistics*, 86(1), 133–155.
- SMITH, J., AND P. TODD (2005a): "Does Matching Overcome LaLonde's Critique of Nonexperimental Estimators?," *Journal of Econometrics*, 125(1-2), 305–353.
- (2005b): "Rejoinder," *Journal of Econometrics*, 125, 365–375.
- WOOLDRIDGE, J. M. (2003): *Introductory Econometrics - A Modern Approach*. Thomson South Western, 2 edn.
- WOOLDRIDGE, J. M. (2004): *Econometric Analysis of Cross Section and Panel Data*. Massachusetts Institute of Technology, Massachusetts.
- ZHAO, Z. (2004): "Using Matching to Estimate Treatment Effects: Data Requirements, Matching Metrics, and Monte Carlo Evidence," *The Review of Economics and Statistics*, 86(1), 91–107.