# Advanced Applied Econometrics

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## Course organization

- The course takes place on Fridays (in general), 9:00 - 12:00 at DIW Berlin (Room Ostrom).
- All material can be found here: `https://github.com/AppliedEconBerlin/bsoe_gc_aae_2026`
- PhD: Credit points: 9 ECTS
- Master: Credit points: 6 ECTS
- First session: April 17, 2026
- Final session: July, 10, 2026
- Exam: July, 17, 2026
- Compulsory reading in bold.
- PhD Evaluation: if this course is taken for credits, the final grade will be determined by
  - 4 problem sets (to be completed in groups of max. 3 participants), weighted 1/8 each,
  - a final exam, weighted 1/2.
- Master Evaluation:
  - 3 problem sets out of 4 (to be completed in groups of max. 3 participants),
  - a final exam (weighting depends on the rules of your program)

## Course objectives

- Discuss central methods and current advances in applied econometrics.
- Provide insights into empirical strategies developed in important papers in the Labour, Public & IO literatures (now applied in many other fields), with a focus on identification.
- Discuss in-depth a variety of econometric frameworks and their core assumptions for causal and counterfactual analysis. Give students an understanding of why and when adding structure informed by economic theory can be important.
- Establish basic estimation techniques & numerical methods such as simulation and numerical integration.

# 1 Omitted Variable Bias, Assessing Models, Fisher Inference, Stata (April 17, FW)

In this session, we will cover different topics of general interest, before turning to more specific methods. These are (a) sometimes we are just left with the OLS. Can we learn anything from coefficient movements and the stability of our estimates when including or excluding more controls?, (b) in this course we will not talk about inference much but here is one powerful method for inference in experiments (that can also be applied in non-experimental settings) that works without distributional assumptions, its Fisher inference..., (c) for both topics we will use Stata, so this is being introduced alongside.

- Assessing endogeneity problems in OLS through coefficient movements
- Fisher inference
- Introduction to Stata software

## References


Oster, Emily, (2019), Unobservable Selection and Coefficient Stability: Theory and Evidence, Journal of Business & Economic Statistics, 37, issue 2.

Altonji, J. G., Elder, T. E., & Taber, C. R. (2005). Selection on Observed and Unobserved Variables: Assessing the Effectiveness of Catholic Schools. Journal of Political Economy, 113(1), 151â€“184.

Alwyn Young, Channeling Fisher: Randomization Tests and the Statistical Insignificance of Seemingly Significant Experimental Results, The Quarterly Journal of Economics, Volume 134, Issue 2, May 2019.

**Scott Cunningham (2018), Causal Inference: The Mixtape, Chapter "Randomization Inference",** `https://mixtape.scunning.com/04-potential_outcomes#randomization-inference`.

Richard Murphy, and Gill Wyness and Felix Weinhardt (2021) Who teaches the teachers? A RCT of peer-to-peer observation and feedback in 181 schools. The Economics of Education Review 2021, vol. 82. `https://doi.org/10.1016/j.econedurev.2021.102091`


# 2 Panel Data/Fixed Effects (April 24, FW) - note change of room and location only for this session: HU Hörsaal 203

- Fixed effects and first differences: identification and interpretation
- Application to panel settings and beyond

## References


**Raj Chetty, Adam Looney, and Kory Kroft (2009), Salience and Taxation: Theory and Evidence, *American Economic Review*, 99 (4), 1145-1177.**

**Scott Cunningham (2018), Causal Inference: The Mixtape, Chapter "Panel Data",** `https://mixtape.scunning.com/08-panel_data`.

Jens Hainmueller and Dominik Hangartner (2019), Does Direct Democracy Hurt Immigrant Minorities? Evidence from Naturalization Decisions in Switzerland, *American Journal of Political Science*, 63 (3), 530-547.

Victor Lavy, Olmo Silva and Felix Weinhardt (2012) The Good, The Bad and The Average: Evidence on Ability Peer Effects in Schools, *Journal of Labor Economics*, 20 (2), pp. 367-414. `https://doi.org/10.1086/663592`

Natalie Irmert, Jan Bietenbeck, Linn Mattisson and Felix Weinhardt (2023), Autonomous Schools, Achievement and Segregation, CEP/LSE-Discussion Paper 1968. http://cep.lse.ac.uk/pubs/download/dp1968.pdf

# 3 Difference-in-difference (May 8, FW)

- Canonical DID model
- Event study framework, two-way fixed-effects
- Potential issues: Staggered treatment, parallel trends, inference

## References


Joshua D. Angrist and Jörn-Steffen Pischke (2008), Mostly Harmless Econometrics: An Empiricist's Companion, Chapter 5.2, Differences-in-differences: Pre and Post, Treatment and Control.

Martha J. Bailey and Andrew Goodman-Bacon (2015), The War on Poverty's Experiment in Public Medicine: Community Health Centers and the Mortality of Older Americans, *American Economic Review*, 105 (3): 1067-1104.

Marianne Bertrand, Esther Duflo, Sundhil Mullainathan (2004), How much should we trust differences-in-differences estimates? *Quarterly Journal of Economics*, 119 (1):249-275.

**Scott Cunningham (2018), Causal Inference: The Mixtape, Chapter "Difference-in-Differences",** https://mixtape.scunning.com/09-difference_in_differences.

Jonathan Roth, Pedro H. C. Sant'Anna, Alyssa Bilinski, John Poe (2022), "What's Trending in Difference-in-Differences? A Synthesis of the Recent Econometrics Literature," https://www.jonathandroth.com/assets/files/DiD_Review_Paper.pdf

Jan Bietenbeck, Andreas Leibing, Jan Marcus and Felix Weinhardt (2023) European Economic Review, vol. 154. https://doi.org/10.1016/j.euroecorev.2023.104431

Felix Weinhardt (2014) Social Housing, Neighborhood Quality and Student Performance, Journal of Urban Economics 2014, vol. 82: pp.12-31. https://doi.org/10.1016/j.jue.2014.06.001


# 4 IV (May 15, FW)

- Introduction: The Wald estimator, IV with homogeneous treatment effects, assessment of instruments
- LATE: can we learn anything when treatment effects are heterogeneous?
- Stata implementations
- Essential references in bold

## References


**Cunningham, Scott (2018), Causal Inference: The Mixtape, Chapter "Instrumental Variables",** https://mixtape.scunning.com/07-instrumental_variables.

**Imbens, Guido W. 2010. "Better LATE Than Nothing: Some Comments on Deaton (2009) and Heckman and Urzua (2009)." Journal of Economic Literature, 48 (2): 399-423.**

**Marbach, M., & Hangartner, D. (2020). Profiling Compliers and Noncompliers for Instrumental Variable Analysis. Political Analysis, 28(3).**

**Angrist, Joshua, et al. "Multiple Experiments for the Causal Link between the Quantity and Quality of Children." Journal of Labor Economics, vol. 28, no. 4, 2010.**

Angrist, Joshua D., and William N. Evans. "Children and Their Parents' Labor Supply: Evidence from Exogenous Variation in Family Size." The American Economic Review, vol. 88, no. 3, 1998

Acemoglu, Daron, Simon Johnson, and James A. Robinson. 2001. "The Colonial Origins of Comparative Development: An Empirical Investigation." American Economic Review, 91 (5): 1369-1401.

Lundborg, Petter, Erik Plug, and Astrid Würtz Rasmussen. 2017. "Can Women Have Children and a Career? IV Evidence from IVF Treatments." American Economic Review, 107 (6): 1611-37.

# 5 Regression discontinuity (May 22 - May 29, FW; location on May 29th only: DIW Berlin 3.3.002A-C

- Introduction: Sharp and fuzzy RD
- Threats to identification and RD diagnostics (bunching, covariate distribution)
- Specification issues: choice of bandwidth, polynomial, control variables
- Regression kink design
- Geographic regression discontinuity

## References


**Cunningham, Scott (2018), Causal Inference: The Mixtape, Chapter "Regression Discontinuity", `https://mixtape.scunning.com/06-regression_discontinuity`.**

Dahl, G. B., Løken, K. V., & Mogstad, M. (2014). Peer effects in program participation. *American Economic Review*, 104(7), 2049-2074.

Dell, M. "The Persistent Effects of Peru's Mining Mita." *Econometrica* 78, no. 6 (2010): 1863-1903.

Gelman, A. and G. Imbens (2019): "Why High-Order Polynomials Should Not Be Used in Regression Discontinuity Designs," *Journal of Business & Economic Statistics*, 37, 447-456.

Jessen, J., Kuehnle, D., & Wagner, M. (2021). "Is voting really habit-forming and transformative? Long-run effects of earlier eligibility on turnout and political involvement from the UK." *Working paper*

Lee, David S., and Thomas Lemieux. 2010. "Regression Discontinuity Designs in Economics." *Journal of Economic Literature*, 48 (2): 281-355.

McCrary, J. (2008): "Manipulation of the running variable in the regression discontinuity design: A density test," *Journal of Econometrics*, 142, 698-714.

Niklas Gohl, Elisabeth Kurz, Peter Haan and Felix Weinhardt (2023) Working Life and Human Capital Investment: Causal Evidence from Pension Reform. Labour Economics vol. 84(October). `https://doi.org/10.1016/j.labeco.2023.102426`

Sanchis-Guarner, R., Montalban, J., & Weinhardt, F. (2021). Home broadband and human capital formation. Available at SSRN 3772087. `https://www.cesifo.org/DocDL/cesifo1_wp8846.pdf`

# 6 Introduction: econometric modeling of economic choices / Python coding (June 5, PH and MS)

- **Methodology fights** Angrist and Pischke (2010), Frijters (2013), Halle (2022), Heckman (2010), Keane (2010), Rust (2010), Rust (2014), Wolpin (2013)
- **Basics discrete choice** van Soest (1995), Train (2009)

## References


Angrist, Joshua and Jörn Pischke (2010), "The Credibility Revolution in Empirical Economics: How Better Research Design is Taking the Con out of Econometrics," *Journal of Economic Perspectives* 24 (2), 3-30.

Frijters, Paul (2013) "The Limits of Inference Without Theory", *Economic Record* 89, 429-432.

**Haile, Phil (2022), Models, Measurement, and the Language of Empirical Economics, slides at DropboxLink**

Heckman, Jim J. (2010), "Building Bridges Between Structural and Program Evaluation Approaches to Evaluating Policy," *Journal of Economic Literature* 48(2), 356-398.

Judd, Kenneth L. (1998), *Numerical Methods in Economics*, MIT Press, Cambridge, MA.

Keane, Michael P. (2010), "Structural vs. Atheoretic Approaches to Econometrics," *Journal of Econometrics* 156, 3-20.

Rust, John (2010), "Comments on: 'Structural vs. atheoretic approaches to econometrics' by Michael Keane," *Journal of Econometrics* 156 (1), 21-24.

Rust, John (2014), "The Limits of Inference with Theory: A Review of Wolpin," *Journal of Economic Literature* 52 (3), 820-850.

Train, Kenneth E. (2009), Discrete Choice Methods with Simulation, Cambridge University Press.

**van Soest, Arthur (1995), "Structural models of family labor supply: A discrete choice approach", *Journal of Human Resources* 30 (1), 63-88.**

Wolpin, Kenneth I. (2013), The limits of inference without theory, MIT Press.


# 7 Demand estimation with market-level data (June 12, HU)

- Estimating demand and supply parameters in markets with differentiated products using aggregate (product-level) data
- Coding exercise: preliminaries

## References


**Berry, Steven T. (1994), "Estimating Discrete Choice Models of Product Differentiation," *Rand Journal of Economics* 25 (2), 242-262.**

**Berry, Steven T., Jim Levinsohn, and Ariel Pakes (1995), "Automobile Prices in Market Equilibrium," *Econometrica* 63 (4), 841-890.**

Berry, Steven T. and Philip A. Haile (2021), "Foundations of Demand Estimation," In *Handbook of Industrial Organization* 4(1), 1-62.

Conlon, Christopher and Jeff Gortmaker (2020), "Best Practices for Differentiated Products Demand Estimation with pyblp," *The RAND Journal of Economics* 51(4), 1108-1161.

# 8 Demand estimation with market-level data (June 19, HU)

- Recap Berry et al. (1995)
- Coding exercise: Berry et al. (1995) nested fixed-point (NFP) algorithm
- Discuss extensions and alternative estimation methods

### References

**Berry, Steven T., Jim Levinsohn, and Ariel Pakes (1995), "Automobile Prices in Market Equilibrium," *Econometrica* 63 (4), 841-890.**

**Conlon, Christopher and Jeff Gortmaker (2020), "Best Practices for Differentiated Products Demand Estimation with pyblp," *The RAND Journal of Economics* 51(4), 1108-1161.**

# 9 Dynamic discrete choice (June 26, HU)

- Introduction to dynamics
- Estimating a single-agent dynamic discrete choice model: Rust (1987) engine replacement problem

### References

Magnac, Thierry and David Thesmar (2002), "Identifying dynamic discrete decision processes," *Econometrica* 70 (2), 801-816.

**Rust, John (1987), "Optimal replacement of GMC bus engines: An empirical model of Harold Zurcher," *Econometrica* 55, 999-1033.**

**Rust, John (1994), Structural estimation of Markov decision processes, In R. Engle and D. McFadden (Eds.), *Handbook of Econometrics* 4, 3081-3143, North-Holland. Amsterdam.**

# 10 Dynamic discrete choice (July 3, PH, MS)

- Dynamic incentives to labour supply: investing in human capital
- More on Discretisation
- Interpolation

### Reference

Keane, M., P. Todd, and K. Wolpin (2011), "The Structural Estimation of Behavioral Models: Discrete Choice Dynamic Programming Methods and Applications," in *Handbook of Labor Economics*, ed. by O. Ashenfelter and D. Card, Elsevier, vol. 4, 1 ed.

**Keane, Michael and Kenneth Wolpin (1997), "The Career Decisions of Young Men", *Journal of Political Economy* 105 (3), 473-522.**

# 11 Dynamic discrete choice in Labour II (July 10, PH, MS)

- Dynamic incentives to labour supply: the role of education, full time and part time experience
- Identification and validation of structural parameters
- Policy Simulation

### Reference

**Blundell, Richard, Monica Costa-Dias, Costas Meghir, and Jonathan Shaw (2016), "Female Labour Supply, Human Capital and Welfare Reform", *Econometrica* 84(5), 1705-1753.**

## 12 Exam (July 17)