

DIW Graduate Course: Structural Econometrics in Labor and IO

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1 Course organization

- The course takes place on Wednesdays, 14:30 - 17:30, at DIW in Room 2.2008 (Room Ferdinand Friedensburg).
- 10 three hour sessions in 12 weeks + a final exam.
- First session: April 20th, 2016
- Final session: July 13th (Exam), 2016
- Compulsory reading in bold.
- Evaluation: if this course is taken for credits, the final grade will be determined by
 - 2 problem sets (to be completed in groups of max. 2 participants), weighted 1/3 each, and
 - a final exam, weighted 1/3.

2 Course objectives

- Discuss advantages and limitations of structural econometric models. Give students an understanding of why and when adding structure is important.
- Provide insights into strategy (especially, identification) in important papers in structural Labour, Public & IO literature. Give a feel of how one may go about establishing a structural model.
- Establish basic estimation techniques & numerical methods such as Simulation, Numerical integration and Discretisation.
- Provide introduction to the matrix programming language Matlab. Loops vs. vectorisation; readability vs. speed; sustainable coding for several projects.

3 Introduction to Structural Approaches (April 20, PH)

- **Numerical methods** Judd (1998), Train (2009)
- **Methodology fights** Angrist and Pischke (2010), Frijters (2013), Heckman (2010), Keane (2010), Rust (2010), Rust (2014), Wolpin (2013)

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.

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.

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

4 Static discrete choice in Labour (April 27, PH)

- Labour supply analyses using discrete choice framework
- Identification & Estimation with individual unobserved heterogeneity
- Discuss with practical session (code available)

Reference

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

5 Static discrete choice in IO (May 4, HU)

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

References

Ackerberg, D., L. Benkard, S. Berry, and A. Pakes (2007), “Econometric Tools for Analyzing Market Outcomes,” in J. J. Heckman and E. Leamer, eds., *Handbook of Econometrics*, North-Holland, Chapter 63, 4171-4276, Section 1.

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.

Einav, Liran and Jonathan Levin (2010), “Empirical industrial Organization: A Progress Report,” *Journal of Economic Perspectives* 24 (2), 157-160.

Reiss, P. and F. Wolak (2007), “Structural econometric modeling: Rationales and examples from industrial organization,” in J. J. Heckman and E. Leamer, eds., *Handbook of Econometrics*, North-Holland, Chapter 64, 4277-4415.

6 Static discrete choice in IO (May 18, 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.

Nevo, Aviv (2000), “A Practitioner’s Guide to Estimation of Random-coefficients Logit Models of Demand,” *Journal of Economics and Management Strategy* 9 (4), 513-548.

7 Dynamic discrete choice in IO (May 25, HU)

- Introduction to dynamics.
- Estimating single-agent discrete choice models: 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.

8 Dynamic discrete choice in IO (June 1, HU)

- Coding exercise: Rust (1987)
- Examples of more recent applications to demand estimation.
- Conditional choice probability (CCP) estimation.

References

Arcidiacono, Peter and Paul B. Ellickson (2011), “Practical methods for estimation of dynamic discrete choice models,” *Annual Review of Economics*, 3, 363-394.

Crawford, Gregory and M. Shum (2005), “Uncertainty and learning in pharmaceutical demand,” *Econometrica* 73(4), 1137-1174.

Gowrisankaran, Gautam and Marc Rysman (2012), “Dynamics of consumer demand for new durable goods,” *Journal of Political Economy* 120(6), 1173-1219.

Hotz, Joseph V. and David A. Miller (1993), “Conditional choice probabilities and the estimation of dynamic models,” *Review of Economic Studies* 60, 497-529.

Hotz, Joseph V., David A. Miller, S. Sanders, and J. Smith (1994), “A simulation estimator for dynamic models of discrete choice,” *Review of Economic Studies* 61(2), 265-289.

9 Dynamic discrete choice in Labour (June 8, PH)

- ! Room change to Schmoller !
- 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.

10 Equilibrium job search (June 15, LH)

- Discuss how on-the-job search generates wage dispersion of observationally equivalent workers
- Identification and estimation using duration data

Reference

Burdett, Kenneth and Dale Mortensen “Wage Differentials Employer Size and Unemployment” (1998), *International Economic Review* 39 (2), 257-273.

11 Equilibrium search models (June 29, LH)

- model of firm competition via counter-offers
- Identification and Estimation using duration data
- Inferring productivity dispersion from wage dispersion

Reference

Postel-Vinay, Fabien and Jean-Marc Robin (2002), “Equilibrium Wage Dispersion with Worker and Employer Heterogeneity”, *Econometrica* 70 (6), 2295-2350.

12 Estimation via SMM & Validation (July 6, LH)

- Validation
- Simulated Method of Moments

13 Exam (July 13, LH)

14 Further reading

IO: Static demand

Akerberg, Daniel and Rysman, Marc (2005), "Unobserved product differentiation in discrete choice models: estimating price elasticities and welfare effects," *Rand Journal of Economics*, 36(4), 771-788.

Armstrong, Timothy B. (2013), "Large market asymptotics for differentiated product demand estimators with economic models of supply," working paper.

Bajari, Patrick L., Fox, Jeremy T., and Stephen P. Ryan (2007), "Linear Regression Estimation of Discrete Choice Models with Nonparametric Random Coefficient Distributions," *American Economic Review: Papers and Proceedings*, 97(2), 459-463.

Berry, Steven T. and Philip Haile (2014), "Identification in Differentiated Products Markets Using Market Level Data," *Econometrica*, forthcoming.

Berry, Steven T., Levinsohn, James, and Ariel Pakes (2004), "Differentiated Products Demand Systems from a Combination of Micro and Macro Data: The New Vehicle Market," *Journal of Political Economy*, 112(1), 68-104.

Berry, Steven T., Linton, Oliver, and Ariel Pakes (2004), "Limit Theorems for Estimating the Parameters of Differentiated Product Demand Systems," *Review of Economic Studies*, 71(3), 613-654.

Berry, Steven T. and Ariel Pakes (2007), "The Pure Characteristics Demand Model," *International Economic Review*, 48(4), 1193-1225.

Chiou, Lesley and Joan L. Walker (2007), "Masking identification of discrete choice models under simulation methods," *Journal of Econometrics*, 141(2), 683-703.

Dubé, Jean-Pierre, Fox, Jeremy T., and Che-Lin Su (2012), "Improving the Numerical Performance of Static and Dynamic Aggregate Discrete Choice Random Coefficients Demand Estimation," *Econometrica*, 80 (5), 2231-2267.

Fox, Jeremy T., il Kim, Kyoo, Stephen P. Ryan, and Patrick L. Bajari (2011), "A Simple Estimator for the Distribution of Random Coefficients," *Quantitative Economics*, 2, 381-418.

Fox, Jeremy T., il Kim, Kyoo, Stephen P. Ryan, and Patrick L. Bajari (2012), "The Random Coefficients Logit Model Is Identified," *Journal of Econometrics*, 166(2), 204-212.

Fox, Jeremy T., Kim, Kyoo il, and Chenyu Yang (2013), "A simple nonparametric approach to estimating the distribution of random coefficients in structural models," working paper.

Fox, Jeremy T. and Amit Ghandi (2013), "Nonparametric identification and estimation of random coefficients in multinomial choice models," working paper.

Freyberger, Joachim (2012), "Asymptotic theory for differentiated products demand models with many markets," CeMMAP working paper CWP19/12.

Gentzkow, Matthew and Jesse M. Shapiro (2013), "Measuring the sensitivity of parameter estimates to sample statistics," working paper.

Ghandi, Amit, Lu, Zhentong, and Xiaoxia Shi (2013), "Estimating demand for differentiated products with error in market shares," working paper.

Heiss, Florian and Viktor Winschel (2008), "Likelihood approximation by numerical integration on sparse grids," *Journal of Econometrics*, 144(1), 62-80.

Hess, Stephane, Train, Kenneth E., and John W. Polak (2006), "On the use of a modified latin hypercube sampling (MLHS) method in the estimation of a mixed logit model for vehicle choice," *Transportation Research Part B: Methodological*, 40(2), 147-163.

Knittel, Christopher R. and Konstantinos Metaxoglou (2014), "Estimation of Random Coefficient Demand Models: Two Empiricists' Perspective," *Review of Economics and Statistics*, 96(1), 34-59.

Nevo, Aviv (2001), "Measuring Market Power in the Ready-To-Eat Cereal Industry," *Econometrica*, 69 (2), 307-342.

Reynaert, Mathias and Frank Verboven (2013), "Improving the performance of random coefficients demand models – the role of optimal instruments," *Journal of Econometrics*, forthcoming.

Skrainka, Benjamin S. (2011), "A large scale study of the small sample performance of random coefficient models of demand," working paper.

Skrainka, Benjamin S. and Kenneth L. Judd (2011), "High performance quadrature rules: how numerical integration affects a popular model of product differentiation," working paper.

Su, Che-Lin and Kenneth L. Judd (2012), "Constrained Optimization Approaches to Estimation of Structural Models," *Econometrica*, 80 (5), 2213-2230.

Train, Kenneth E. (2008), "EM Algorithms for Nonparametric Estimation of Mixing Distributions," *Journal of Choice Modeling*, 1(1), 40-69.

IO: Dynamic discrete choice

Ackerberg, Daniel, Chen, Xiaohong, and Jinyong Hahn (2012), "A practical asymptotic variance estimator for two-step semiparametric estimators," *Review of Economics and Statistics*, 94(2), 481-498.

Aguirregabiria, Victor, and Pedro Mira (2010), "Dynamic Discrete Choice Structural Models: A Survey," *Journal of Econometrics*, 156(1), 38-67.

Aguirregabiria, Victor and Pedro Mira (2002), "Swapping the nested fixed point algorithm: A class of estimators for discrete Markov decision models," *Econometrica*, 70(4), 1519-1543.

Bajari, Patrick, Chernozhukov, Victor, Hong, Han, and Denis Nekipelov (2009), "Nonparametric and semiparametric analysis of a dynamic discrete game," working paper.

Blevins, Jason R. (2014), "Sequential monte carlo methods for estimating dynamic microeconomic models," working paper.

Erdem, T. and Michael Keane (1996), "Decision-making under uncertainty: Capturing dynamic brand choice processes in turbulent consumer goods markets," *Marketing Science*, 1-20.

Hendel, Igal and Aviv Nevo (2006), "Measuring the implications of sales and consumer stockpiling behavior," *Econometrica*, 74(6), 1637-1673.

Hendel, Igal and Aviv Nevo (2014), "Intertemporal price discrimination in storable goods markets," *American Economic Review*, forthcoming.

Larsen, Bradley J., Oswald, Florian, Reich, Gregor, and Dan Wunderli (2012), "A test of the extreme value type I assumption in the bus engine replacement model," *Economics Letters*, 116(2), 213-216.

Norets, Andriy (2009), "Inference in dynamic discrete choice models with serially correlated unobserved state variables," *Econometrica*, 77(5), 1665-1682.

Melnikov, O. (2013), "Demand for differentiated durable products: the case of the US computer printer market," *Economic Inquiry*, 51(2), 1277-1298.

Nair, Harikesh (2007), "Intertemporal price discrimination with forward-looking consumers: application to the US market for console video-games," *Quantitative Marketing and Economics*, 5(3), 239-292.

Pakes, Ariel (1986), "Patents as options: some estimates of the value of holding European patent stocks," *Econometrica*, 54, 755-784.

Reich, Gregor (2013), "The bus engine replacement model with serially correlated unobserved state variables: a deterministic approach," working paper.