

# Discrete Choice Modeling

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**Objective:** The aim of this course is to provide the students with the necessary analytical tools to formulate appropriate discrete choice models, estimate them and draw proper inference. These models are typically employed in examining microeconomic behavior. Three fields of interest here are health economics transport and marketing. These sometimes take place in the setting of large panel data sets such as the European Community Health Panel Data Survey (ECHP) and the British Household Panel Survey (BHPS) to name two among many. The key features of these data sets are their numerous interesting qualitative measures such as health status and labor force participation, and their panel type structure. In transport and marketing, the common setting is choice among multiple alternatives, such as travel mode, product brands and rankings. Discussion will consider specification, estimation, inference and analysis of models for several types of discrete data. We will develop the background theory then examine many applications using “real” data sets. The course will conclude with a workshop centered on current research by participants of the course and the concurrent mini-conference, the Danish Choice Modeling Day.

**Abstract: Discussion will include these topics:**

- (1) Discrete Choice Models
  - Basic descriptive tools: Linear regression, kernel density estimator
  - Dichotomous data models (logit, probit)
  - Polytomous data models (multinomial choice, ordered choice)
- (2) Panel / Longitudinal Data
  - Fixed effects
  - Random effects
  - Heterogeneity; latent classes and random parameters
  - Dynamic models and endogenous variables
  - Endogeneity and control function estimation
  - Endogenous sample selection and attrition
- (3) Multinomial Choice Models
  - Multinomial logit and probit
  - Scaled multinomial logit
  - Partial effects and elasticities in choice models
  - Random utility and random regret
  - Generalized models, latent classes, mixed models
  - Willingness to pay space
  - Hybrid choice models
  - Stated choice experiments and panel data
  - Attribute nonattendance

## **Course Outline and Agenda**

Time	December 16 <sup>th</sup>	December 17 <sup>th</sup>	December 18 <sup>th</sup>
9.00-10.30	Introduction. Regression, binary choice, estimation, inference, discrete choice models.	Topic 5 - Heterogeneity	More advanced models – Scale adjusted LC models, WTP space models, models applied for best-worse data etc.
10.30-11.00	Coffee break	Coffee break	Coffee break
11.00-12.00	Multinomial logit Scaled MNL Estimation, inference, elasticities, analysis	Topic 6 – Latent Class models	Hybrid choice models - the integration of latent variable and choice models
12.00-13.00	Lunch break	Lunch break	Lunch break
13.00-14.00	MNL extensions, nested logit, MN Probit	Topic 7 - RPL	Workshop
14.00-14.30	Coffee break	Coffee break	Coffee break
14.30-16.30	Lab exercises	Lab exercises	Workshop

### **Data for Lab Sessions and Practicals**

Data sets for exercises will be provided with the program. Students may wish to work on their own projects as well. If you are not already using NLOGIT (or LIMDEP), you can import your data into NLOGIT by obtaining or converting your data file in standard CSV format. (If you have a data file that is in an Excel spreadsheet, xls or xlsx, format, just read it back into Excel and use Save As... to save it as a CSV file.)

**Resources, references and applications are all placed on the course home page**

<http://people.stern.nyu.edu/wgreene/DCMD2013.htm>

## **Major References**

- Hensher, D., J. Rose and W. Greene, (2005), *Applied Choice Analysis*, Cambridge University Press
- Cameron, A. and Trivedi, P., (2005) *Microeconometrics*, Cambridge University Press
- Greene, W., (2012) *Econometric Analysis*, Prentice Hall. (Chapters 11, 12, 14, 15, 17-19 are posted on the course website.)
- Wooldridge, J. (2010) *Econometric analysis of cross-section and panel data*, 2<sup>nd</sup>. Ed., MIT Press.
- Greene, W. and Hensher, D. (2010) *Modeling Ordered Choices*, Cambridge University Press (OrderedChoiceModeling.pdf)

## **Background References** (These are placed on the course website.)

- Terza, J., Basu, A. and Rathouz, P. (2008): “Two-Stage Residual Inclusion Estimation: Addressing Endogeneity in Health Econometric Modeling,” *Journal of Health Economics*, 27, 531-543. (Terza\_J-Basu\_A-Rathouz\_p-ResidualInclusion.pdf)
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- Greene, W., “Testing hypotheses about interaction terms in nonlinear model,” *Economics Letters*, 107 (2010) 291–296 (Greene-InteractionTerms-ECOLET.pdf)

## **Multinomial Choice**

- Economic Choices, *American Economic Review*, McFadden, D. (2001). McFadden’s Nobel Prize lecture.
- Mixed MNL Models for Discrete Response, McFadden, D. and Train, K., *Journal of Applied Econometrics*, 2000.
- The Behaviour of the Maximum Likelihood Estimator of Limited Dependent Variable Model in the Presence of Fixed Effects, Greene, W., *Econometric Journal*, 2004.
- Discrete Choice Models, W. Greene, (a survey of discrete choice models), *Palgrave Handbook of Applied Econometrics*, 2009.
- Functional Form and Heterogeneity in Models for Count Data, W. Greene, (a survey of models for count data); *Foundations and Trends in Econometrics*, 2007.
- Modeling Ordered Choices, (W. Greene, 2008) A survey of the literature on ordered choice models. Published as *Modeling Ordered Choices*, Greene, W. and Hensher, D., Cambridge University Press, 2010.
- Removing the scale factor confound in multinomial choice models to obtain better estimates of Preference. *Proceedings of the Sawtooth Software Conference*. Magidson, J. and Vermunt, J. 2007.
- Accounting for latent attitudes in willingness-to-pay studies: the case of coastal water quality improvements in Tobago. *Environmental and Resource Economics*, 52, 109-131, HESS, S. & BEHARRY-BORG, N. 2012.

## **Applications in Health Economics:** (These are placed on the course website.)

- Finkelstein, A. et al., “The Oregon Health Insurance Experiment: Evidence from the First Year,” *Quarterly Journal of Economics*, 127, 2, 2012, pp. 1057-1106. (finkelstein-oregon.pdf)
- Lagarde, M., “Investigating attribute non-attendance and its consequences in choice experiments with latent class models,” *Health Economics*, 5, 2013, pp. 554-567. (Lagarde.pdf)
- Scott, Schurer, Jensen and Sivey, “The Effects of an Incentive Program on Quality of Care in Diabetes Management,” *Health Economics*, 18, 9, 2009, pp. 1091-1108. (Scott-et-al-LCM.pdf)
- Johnston, D., Schurer, S., Shields, M., “Maternal Gender Role Attitudes, Human Capital Investment, and Labor Supply of Sons and Daughters, IZA Discussion paper 6656, June, 2012. (Johnston-Schurer-Shields-REM.pdf)
- Jones, A. and S. Schurer, “How does Heterogeneity shape the Socioeconomic Gradient in Health Satisfaction,” *Journal of Applied Econometrics*, 26, 4, 2011, pp. 549-579. (Jones-Schurer-2011.pdf)
- Bago d’Uva, T. and A. Jones, “Health care utilisation in Europe: New evidence from the ECHP,” *Journal of Health Economics*, 28, 2009, pp. 265-279. (Bago\_d’Uva-Jones-LatentClass.pdf)
- Contoyannis, P., Jones, A. and N Rice, “The Dynamics of Health in the British Household Panel Survey,” *Journal of Applied Econometrics*, 19, 2004, pp. 473-503. (Jones-et-al-HealthSatisfaction.pdf)
- Riphann, R., Wambach, A. and Million, A., “Incentive Effects in the Demand for Health Care: A Bivariate Panel Count Data Estimation,” *Journal of Applied Econometrics*, 18, 2003, pp. 387-405. (RWM-MixedModel.pdf)
- Winkelmann, R., “Health Rare Reform and the Number of Doctor Visits – An Econometric Analysis,” *Journal of Applied Econometrics*, 19, 2004, pp. 455-472. (Winkelmann-DoctorVisits.pdf)
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- Van Ophem, H., “The Frequency of Visiting a Doctor: Is the Decision to Go to Independent of the Frequency,” *Journal of Applied Econometrics*, 26, 2011, 872-879. (VanOphem-TwoPartModel.pdf)
- Laporte, A., Karimova, A. and B. Ferguson, “Quantile Regression Analysis of the Rational Addiction Model, Investigating Heterogeneity in Forward Looking Behavior,” *Health Economics*, 19, 2010, 1063-1074. (Laporte-QuantileRegression.pdf)
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