THE PENNSYLVANIA STATE UNIVERSITY
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

CE 523 **ANALYSIS OF TRANSPORTATION DEMAND**

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Goals: A) Understand the fundamentals of travel demand analysis; B) Formulate and estimate statistical/econometric models; C) Gain hands-on experience on demand modeling using real data; D) Develop the skills needed to write scientific papers.

COURSE OUTLINE

1. Course Overview
    - Travel Demand Overview
    - Activity Analysis and Travel Patterns
    - Traveler Surveys in Travel Demand
    - Typology of Variables and Examples
    - The LIMDEP and SPSS Software
    - Input and Output Files
    - Plots, Descriptive Statistics, Frequencies
2. Statistical Inference
    - Sampling and Descriptive Statistics
    - Point Estimation (Finite-sample and large-sample properties)
    - Maximum Likelihood Estimation: Poisson Model
    - Hypothesis Testing: Likelihood Ratio
    - NPTS, The Puget Sound Transportation Panel, Other surveys
3. Multiple Linear Regression Models
    - Review of Linear Model and Ordinary Least Squares
    - Violation of the Gauss-Markov Theorem Assumptions: Heteroskedasticity
    - Omission of Relevant and Inclusion of Irrelevant Variables
    - Autocorrelated Disturbances
    - Trip generation models using cross-sectional and panel data
4. Models with Discrete Dependent Variables
    - Models with Binomial Outcomes: Linear, Probit, and Logit
    - Models of Proportions: Aggregate Modal Split
    - Index Functions and Random Utility Models
    - Discrete choice model and Mode choice
5. Unordered Multiple Choice(or Outcome) Models
    - Unordered Multiple Choices: Conditional Logit Model (Mode Choice Models)
    - Independence from Irrelevant Alternatives and Related Tests
    - Nested Logit Model: Mode Choice, Survey Participation
    - Bivariate Probit Models: Panel Attrition and Residential Relocation
6. Ordered Dependent Variables
    - Ordered Logit and Probit: Opinions and Attitudes, Car Ownership
    - Count Data and the Poisson Regression Model
7. Contingency Tables
    - 2X2 Tables
    - Testing Collapsibility of Tables
    - Goodman's Hierarchical Models
    - CHAID and an application for TDM
8. Multilevel Models
    - Linear Models
    - Non-linear Models
    - Mixed continuous and discrete variable models

9. Data Problems
    - Multicollinearity, Missing Data, Aggregation
    - Measurement Error in X and in Y
10. Limited Dependent Variable Models
    - Truncation and Censoring
    - Single and Double Censored Regression Model: One limit and two Limit Tobit
11. Selectivity
    - Selectivity and Truncation:
    - Program Participation and Travel Behavior (Telecommuting)
    - Residential Relocation (RR) and Trip Frequency
    - Dummy Endogenous Variable: RR and Modal Split
    - Switching Regressions: Disequilibrium with Known Sample Separation
12. Systems of Equations and Simultaneous Equations
    - Systems of Regression Equations: Modal Split Equations
    - Correlated Disturbances and Estimation (SURE,GLS,FGLS)
    - Notions of Simultaneous Equations: structural and reduced forms
13. Dynamic Models
    - Heckman's General Model
    - Time Series of Cross Sections: The Dutch and Puget Sound Panels
    - Fixed and Random Effects Linear Models
14. Duration Models
    - Duration Data
    - Hazard Models - Survival Analysis
15. Current Research Topics in Travel Demand
    - Activity-based Approaches
    - Time-Use Studies
16. Course Presentations