Chandra R. Bhat  
Adnan Abou-Ayyash Centennial Professor of Transportation  
Engineering, Department of Civil, Architectural & Environmental Engineering  
The University of Texas at Austin

Modeling Consumers’ Choice of Multiple Items Simultaneously: A Methodological Approach with Application to Household Vehicle Holdings and Use

ABSTRACT:
Several consumer demand choices related to travel decisions are characterized by the choice of multiple alternatives simultaneously. Examples of such choice situations include vehicle type holdings and usage, and activity type choice and duration of time investment of participation. In the former case, a household may hold a mix of different kinds of vehicle types (for example, a sedan, a minivan, and a pick-up) and use the vehicles in different ways based on the preferences of individual members, considerations of maintenance/running costs, and the need to satisfy different functional needs (such as being able to travel on weekend getaways as a family or to transport goods). In this case, the choice of vehicle type is a discrete choice, while the usage (say, in annual miles) of each chosen vehicle type is a continuous choice. In the case of activity type choice and duration, an individual may decide to participate in multiple kinds of recreational/social activities within a given time period (a discrete choice), and allocate different durations of participation for each activity (a continuous choice). Other travel-related and consumer demand situations characterized by the choice of multiple alternatives include airline fleet mix and usage (for an airline carrier), carrier choice and transaction level (for a shipper), brand choice and purchase quantity for frequently purchased grocery items (for households or individuals), and stock selection and investment amounts (for households, individuals, or firms).

This presentation discusses a simple and parsimonious Multiple Discrete-Continuous Extreme Value (MDCEV) econometric approach to handle multiple discreteness (i.e., the choice of multiple alternatives at the same time) within the broader Kuhn-Tucker (KT) multiple discrete-continuous economic consumer demand framework. The paper examines several issues associated with the MDCEV model and other extant KT multiple discrete-continuous models. The paper also proposes a new utility function form that enables clarity in the role of each parameter in the utility specification, presents identification considerations associated with both the utility functional form as well as the stochastic nature of the utility specification, and discusses the relationship between earlier KT-based multiple discrete-continuous models. An application of the MDCEV approach to examine household vehicle holdings (vehicle body type, vintage, make, and model) and use is discussed. Data for the analysis is drawn from the 2000 San Francisco Bay Area Travel Survey. The model results indicate the important effects of household demographics, household location characteristics, built environment attributes, and vehicle attributes on household vehicle holdings and use. The model is then applied to predict the impact of land use and fuel cost changes on household vehicle holdings and usage. Such predictions can inform the design of proactive land-use, economic, and transportation policies to influence household vehicle holdings and usage in a way that has the potential to alleviate the negative impacts, such as traffic congestion, fuel consumption and air pollution, of automobile dependency.
BIO:

**Dr. Chandra R. Bhat** is the Adnan Abou-Ayyash Centennial Professor in Transportation Engineering at The University of Texas at Austin, where he teaches courses in transportation systems analysis and transportation planning. He is also the Associate Chairman of the Department of Civil, Architectural & Environmental Engineering. Dr. Bhat is widely recognized nationally and internationally as a leading expert in the area of travel demand modeling and travel behavior analysis. His methodological research interests and expertise are in the areas of econometric and mathematical modeling of consumer behavior, including discrete choice analysis, discrete-continuous econometric systems, and hazard duration models.

Dr. Bhat holds a PhD in Civil Engineering from Northwestern University, a Masters in Transportation Engineering from Virginia Polytechnic Institute and State University and a BA in Civil Engineering from the Indian Institute of Technology in Madras, India. Dr. Bhat received the 2004 Walter L. Huber Award and the 2005 James Laurie Prize from the American Society of Civil Engineers (ASCE) in recognition of his contributions to “innovative methods in transportation systems analysis and modeling.” He also received the 2006 Lockheed Martin Aeronautics Company Award for Excellence in Engineering Teaching, the highest teaching honor awarded by the College of Engineering at UT Austin.