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Travelers' Route Choice Behavior in Risky Networks

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Abstract
The accurate modeling of travelers' route choice decision making when faced with unreliable (risky) travel times is necessary for the assessment of policies aimed at improving travel time reliability. Two major objectives are studied in this thesis. The first objective is to evaluate the applicability of a process model to route choice under risk where the actual process of decision making is captured. Traditionally, we adopt "as-if" econometric models to predict people's route choice decisions. The second objective is to investigate travelers' capability to incorporate future real-time traffic information into their current route choice decision making. Two separate stated preference (SP) surveys were conducted for each objective. The first SP survey used an interactive map in a computer based test. The second SP survey used a full-scale high-fidelity driving simulator.

Compared with econometric models, process models have been rarely investigated in travel decision making under risk. A process model aims to describe the actual decision making procedure and could potentially provide a better explanation to route choice behavior. A process model,

Priority Heuristic (PH), developed by Brandstatter et al. (2006) is introduced to the travel choice context and its probabilistic version, Probabilistic Priority Heuristic (PPH), is developed and estimated in this study. With data collected from a stated preference (SP) survey which is based on an animated computer interface, one econometric model, Rank-Dependent Expected Utility (RDEU) model, and two other alternative models were compared with the PPH model in a cross validation test to investigate their data-fitting and predictive performance. Our results show that the PPH model outperforms the RDEU model in both data-fitting and predictive performance. This suggests that the process modeling paradigm could be a promising new area in travel behavior research.

With the advance of information and telecommunication technology, real-time traffic information is increasingly more available to help travelers make informed route choice decisions when faced with unreliable travel times. A strategic route choice refers to a decision taking into account future diversion possibilities at downstream nodes based on real-time information not yet available at the time of decision-making. Based on the data collected from a driving simulator experiment and a matching PCbased experiment, a mixed Logit model with two latent classes, strategic and nonstrategic route choice, is specified and estimated. The estimates of the latent class probabilities show that a significant portion of route choice decisions are strategic and subjects can learn to make more strategic route choice as they have more experience with the decision scenarios. Non-parametric tests additionally show that network complexity adversely affects travelers' strategic thinking ability in a driving simulator environment but not in a PC environment and a parallel driving task only affects strategic thinking ability in a difficult scenario but not a simple one. In addition, we find that people's strategic thinking ability are influenced by their gender and driving experience (mileage) in the non-parametric analysis, but not in the modeling work. These findings suggest that a realistic route choice model with real-time traffic information should consider both strategic and non-strategic behavior, which vary with the characteristics of both the network and the driver.