UNIVERSITY TRANSPORTATION RESEARCH CENTER
RESEARCH BRIEF

PROJECT TITLE: DATA COLLECTION AND ECONOMETRIC ANALYSIS OF THE DEMAND FOR NONMOTORIZED TRANSPORTATION

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Fostering sustainable mobility for secure and livable communities is key to address the current environmental and energy crises. There are successful examples of cities for which bicycling is playing a major role in their paths toward sustainability. For example, 5.8% of commuters in Portland cycle to work. The percentage in New York City is only 0.6%, despite 345 miles of bicycle routes being added in the last decade. To encourage the use of non-motorized alternatives we need to better understand the motives underlying demand.

Econometric travel demand models are highly valuable for assessing the effect of policies and incentives seeking to reduce the indiscriminate use of car. In fact, forecasting demand using discrete choice models has proved to be successful in the case of modal split among motorized alternatives. However, there are several challenges in applying choice modeling to non-motorized options. Users of the transportation system may be motivated to cycle or walk not because of the tradeoff between cost and time, but because of health and environmental benefits of these alternatives. At the same time, there are several factors that may discourage the use of non-motorized transportation, such as poor accessibility, safety concerns, and unfavorable route and weather conditions. For instance, it is often argued that the North East has poor climate to encourage the use of biking.

This research project focuses on two related problems that are relevant for better informing policies targeting sustainable transportation as well as safer and more livable cities. The first research project is to exploit a latent segmentation approach to discrete demand to model non-motorized transportation choices and characterize both utilitarian and recreational cycling users.

The second research project is to improve the analysis of cycling demand subject to weather conditions by analyzing time series of automatic cycling counts.

In this project, we derived a latent class model with a class assignment mechanism based on the latent bicycle status of the respondent. Two segments were identified: more-skilled and experienced cyclists, versus less-skilled- and non-cyclists. The two segments have different sensitivities to the factors that may encourage or discourage riding a bike. For instance, slope inclination is considered almost 3 times as bad by less-skilled cyclists. Heavy traffic affects twice as much to less-skilled cyclists, who also consider rain to be 2.4 times more bothersome (and snow almost 4 times more bothersome) than more-skilled cyclists. On the other hand, bike lanes are 1.6 times more appreciated by less-skilled cyclists. Because in cycling route decisions there is no direct monetary cost involved, to analyze differences in the taste parameters we have proposed to use the ratio of the marginal rate of substitution with respect to travel time. In addition, we measured the diminishing negative effect of a hilly topography (slope inclination) as a function of the physical condition of the cyclist.

In terms of policy recommendations, our results suggest that the provision of bike lanes may encourage an increase in the modal share of cycling, especially among those individuals using a bike infrequently, or mostly for recreational purposes.

We also examined the performance of several ridership prediction models, including the Negative Binomial regression and time-series models such as SARIMA and SARIMAX. Using cycling counts for Portland, we show that the SARIMAX model that includes weather conditions (temperature and precipitation) as explanatory variables performs best in out-of-sample prediction. Future research in State Space models is needed for overcome the problems of SARIMAX when predicting ridership in periods with really poor weather.

In sum, both the discrete choice and time series analyses coincide in that poor weather conditions are indeed a main determinant for discouraging cycling as a transportation alternative.