Alternative Structures for a Vehicle Availability Model for the Philadelphia Region

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Abstract

A new disaggregate vehicle availability model has been developed for DVRPC, the MPO for the Delaware Valley (Philadelphia) metropolitan area. The development of the model included an exploration of two alternative model structures and was based on a data set which includes a number of alternative variables measuring both travel accessibility by mode and the quality of the pedestrian environment. Each of the candidate models has five alternatives: zero, one, two three, and four or more household vehicles available. The alternative model structure include a standard multinomial logit (MNL) and a series of ordered response binary logit (ORL) models. The MNL model reflects the assumption that households choose, at a single point in time, which of the five vehicle availability levels they will have. The ORL models assume that households reach their final vehicle availability level in a sequential manner. First, they decide whether or not to have a vehicle or to have one or more vehicles. If they decide to have one or more vehicles, this process continues by deciding whether to have one vehicle or to have two or more vehicles. Subsequent steps of the same type occur until one of the original five alternatives has been selected.

The alternative model structures developed for DVRPC both include the following types of variables:

- Household characteristics such as annual income, household size, and number of workers;
- Characteristics of the zone of residence including population, household and employment densities;
- Subjective assessments of factors affecting the pedestrian environment, including sidewalk availability, ease of street crossings, building setbacks, and street connectivity; and
- Zonal highway and transit accessibility measures such as the number of jobs which can be reached within stated times by each mode.

It was possible to estimate acceptable models for both the MNL and ORL structures. The choice of the final recommended model structure was based on considerations of overall accuracy in replicating base year survey and Census data, on the geographic distribution of the errors of each model structure, and on the reasonableness of the alternative future-year forecasts. The paper will present the background of the modeling effort, discuss the bases of the two alternative model structures, summarize the estimation results, show the comparative validation done of each structure, and discuss the resulting selection of a final model for the Philadelphia region.