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A multidimensional mixed ordered-response model for analyzing weekend activity participation

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Abstract

The objective of this paper is to examine the frequency of participation of individuals in out-of-home non-work and non-school episodes over the weekend. A multivariate mixed ordered response formulation accommodating the effects of explanatory variables and capturing the dependence among the propensity to participate in different activity types is presented and applied using a San Francisco Bay area travel survey conducted in 2000. The results indicate the important effects of household sociodemographics (income, household structure, and bicycle ownership), individual sociodemographics (age, employment status, gender, and availability of driver's license), internet use, location effects, and day of week/seasonal effects. Interestingly, the results show that motorized vehicle ownership and urban form characteristics of the individual's neighborhood (land-use mix and density) do not have a statistically significant effect on stop-making propensity for any of the activity purposes. The lack of effects of these variables may be due to self-selection of individuals and households into neighborhoods based on their travel preferences. That is, individuals and households may locate themselves based on their motorized vehicle ownership preferences and mobility preferences. In addition to the effect of several variables on stop-making, the model also reveals substitution and complementarity effects among different activity types due to unobserved factors.

Keywords: Multivariate mixed ordered response; Weekend activity participation; Activity-travel patterns; Simulated maximum likelihood; Day of week and season effects

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1. Introduction

The last decade has seen the emergence of the activity-based modeling approach as not only a behaviorally sound paradigm to analyze travel behavior, but also as a viable and implementable approach to forecasting travel demand (see Bhat and Koppelman, 1999; Pendyala and Goulias, 2002, and Arentze and Timmermans, 2004). Specifically, several operational analytic frameworks within the activity analysis paradigm have been formulated, and some metropolitan areas have even implemented these frameworks (Waddell et al., 2002; Castiglione et al., 2003).

While there has been substantial progress in the development and implementation of activity-based travel analysis efforts, almost all (if not all) of these efforts have focused on weekday activity-travel patterns. Even within the context of weekday activity-travel patterns, much emphasis has been placed on the patterns of workers (for example, see Bhat and Singh, 2000; Hamed and Mannering, 1993; Strathman et al., 1994; Mahmassani et al., 1997; Pendyala et al., 2002). However, the recognition that the analysis of non-worker activity-travel behavior also provides important input to transportation planning has led to an increasing focus on the activity-travel behavior of non-workers. For example, the frameworks of Bowman and Ben-Akiva (2000) and Kitamura and Fujii (1998) are applicable to both workers and non-workers. Bhat and Singh (2000), Bhat and Misra (2001), and Misra et al. (2003), on the other hand, emphasize the fundamental differences in the underlying factors and mechanisms influencing the activity and travel-related decisions of workers and non-workers, and propose exclusive frameworks for modeling the activity-travel decisions of workers and non-workers. But all these frameworks have examined worker and non-worker activity-travel behavior only on weekdays.

The objective of this paper is to examine the activity travel patterns of individuals on weekend days. To our knowledge, this is the first study to adopt an activity-based model framework to examine weekend activity episode participation. Bhat and Gossen (2004) analyzed weekend activity participation behavior, but restricted their attention to only recreational episodes. Besides, their analysis was rather specific and focused on the substitutions between in-home and out-of-home recreational activities. Parsons Brinckerhoff Quade and Douglas (PBQD) Inc. (2000) analyzed the dimensions of weekend travel, and compared and contrasted weekend and weekday travel. While providing several useful insights into weekend travel, the PBQD study was focused on a descriptive examination of travel patterns and not on modeling the activity-travel patterns as a function of relevant attributes of the activity-travel environment and individual/household demographics.

The motivation for the focus on weekend non-work and non-school activity-travel patterns in this paper is multifold. First, weekend travel has been increasing over time and constitutes approximately 26% of total trips during the week (Federal Highway Administration and Bureau of Transportation Statistics, 1995). Thus, the average percentage of total weekly trips during a weekend day (=26/2 or 13%) is about the same as the average percentage of total weekly trips during a weekday (=74/5 or 15%). This conclusion is also corroborated by the PBQD study in the New York metropolitan area, which found that the household daily person trip rate during the weekends (about 8 trips/household) is not substantially lower than that during the weekdays (between 8 and 9 trips/household). As expected, the PBQD study also found that the non-work person trip rate is higher on weekends than on the average weekday. Second, the PBQD study observed that about half of all weekend trips are undertaken during the midday period