Integrating parking behaviour in activity-based travel demand modelling: Investigation of the relationship between parking type choice and activity scheduling process

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Abstract
Importance of parking policy in defining urban transportation system performance in any urban area is well recognized. Being a major out-of-pocket cost element in the private automobile mode choice, parking (availability, type, location, capacity and cost) is a key policy tool in making the private automobile competitor to the urban transit. With the increasing concerns of sustainability, policy makers and planners are looking for ways to reduce dependency on the automobile by devising various parking policies. From the activity-based travel demand points of view, parking supply at the activity destination may affect activity-travel decision making process. In this context, parking supply and use appears to be a critical part of the strategy to better manage transportation demand. Even if we agree on the importance of parking, this topic has received less attention than other parts of the activity-travel decision processes. Actually, a lot of attention has been continuously put into the analysis and modelling of travel behaviours. However, parking is considered mostly exogenous to the activity-based travel demand models. In most case parking availability is considered as an exogenous variable in mode choice model and or activity location choice model components of an activity-based travel demand model (Roorda et al, 2008). However, comprehensive study on how activity types are related to parking behaviour (in terms of parking type choice, location choice and parking duration) is rare in literature. Even though cars (one of the major modes of urban transportation) are parked around 80% of the time (RAC Foundation, 2004), less research has been conducted in the domain of parking supply and demand from activity-travel points of view. Actually, parking availability, utilization ratio, location and type are critical factors that affect and constraint peoples’ activity-travel behaviour. So, it is important to investigate how parking supply affect activity-travel choice and vice versa. This paper investigates this critical issue. It presents econometric models for parking demand and supply interactions. Major objectives are to understand how parking supply affects activity-travel behaviour. The major advantage that this paper exploits is the availability of detailed parking information with respect to activity type, location and duration for the study area. The next section focuses on this.

While parking spaces are becoming strategic commodities in urban areas, few datasets are available to permit precise measurement of the use of parking infrastructures. Partial data are sometimes available through the conduct of periodic inventories of subset of parking spaces (private, public, and on-street) or using small surveys generally with small samples. This is one of the major reasons that parking behaviour is neglected in activity-based travel demand modelling practice. The current paper benefits from the availability of specific questions added to successive recurrent large-scale travel surveys conducted in the Greater Montreal Area (GMA). In the GMA, these large-scale surveys have been conducted for more than 35 years, approximately every 5 years. They allow gathering detailed information on the daily trips of around 5% of the population. In 2003, some 350,000 trips made by around 165,000 people gathered in 70,000 households were collected. In the three latest travel surveys (1998, 2003 and 2008 that is currently being conducted), the technical committee on travel surveys added a new question (1998/2003) regarding the use of parking spaces in some urban districts (central part of the area in 1998, Montreal Island in 2003 and 2008). Parking spaces were classified according to their jurisdiction (private/public), location (indoor/on the street/outdoor) and rates
Capitalising on this previous work, this paper presents econometric models of parking type choice and parking duration choice. These models aims at explaining the duration of the parking by type of driver (home location, age, gender), activity purpose and parking space used at the destination (type and rate). The paper employs two types of econometric models: Discrete Choice model and Discrete-Continuous Choice model to compare parking behaviour with respect to different activity types. The models are based on Random Utility Maximization (RUM) theory. It is assumed that individual maximizes the utility of parking choice based on different destination activity classifications. Considering correlations between alternative parking types, locations and durations, a Generalized Extreme Value (GEV) model is specified for Discrete Choice model. As an alternative to the Discrete Choice framework a Discrete-Continuous framework is developed to recognize the fact that parking duration may work as continuous variable. As parking duration defines the total cost of parking, hazard based duration model may be more appropriate than discrete duration model. Hazard based duration model is integrated within discrete choice framework of parking type and location choice using Lee’s transformation technique. Such technique generates a new econometric specification of GEV-Hazard model. Two modelling approaches are compared to investigate parking choice behaviour. As mentioned earlier, separate models are developed for individual destination activity types. In each case relationship between average destination activity duration, parking choice behaviour is critically investigated.

Based on interpretation of estimated model parameter, the paper contributes to the literature by investigating several critical issues in activity-based travel demand modelling. Critical issues under investigation are: how parking choice behaviour varies according to destination activity types, whether parking choice should be considered endogenous to the activity/travel generation and scheduling processes, and how parking supply attributes should be specified for increasing behavioural validly of parking choice model. The paper also contributes to the literature in terms of comparing alternative advanced econometric models: Discrete Choice GEV model and Discrete-Continuous GEV-Hazard model for activity/travel choice modelling.

References