



Interdependences between household residential and car ownership behavior: a life history analysis



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ABSTRACT

Once a transportation system is built or a land-use policy is carried out, it influences people's travel behavior and their lives for a long time period. It is therefore important for policy makers to understand people's decisions on travel behavior and lives over a longer time period. However, little has been known about the interdependences between life domains, especially over the life course (i.e., biographical interdependences) in the context of residential and car ownership behavior. To fill this gap, this study aims to clarify households' biographical interdependences relating to residential and car ownership biographies by explicitly incorporating the influence of household structure and employment/education biographies. Biography is defined based on a general concept of mobility that indicates a change occurring in a life domain. For this purpose, a Web-based life history survey was conducted in November 2010 and 1000 households living in major Japanese cities provided valid data. Aggregate analysis and exhaustive CHAID analysis were carried out, focusing on the occurrence times of mobilities in each biography. Results confirm obvious two-way cause–effect relationships over the life course between residential and car ownership biographies that are further influenced by household structure and employment/education biographies. Especially, not only short-term but also long-term state dependence and future expectations within and across life domains are clarified. Household structure and employment/education biographies are found to be more influential on residential biography than car ownership biography. Though residential biography is seen to be more influential on car ownership biography, the other two biographies also play an important role in explaining the car ownership mobility decision. All these findings suggest the necessity of developing intra-domain and inter-domain biographical interdependence models with flexible structures that capture the influences of state dependence and future expectations over different time scales in the life course in a unified framework.

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1. Introduction

Much previous research has recognized that employment, education, residential household structure, and travel choices are not independent of each other, and individuals or households alter their lifestyle by collectively adjusting their behaviors in varied aspects relating to land use and transportation policies (Eliasson and Mattsson, 2000; Waddell, 2001; Scheiner, 2007; Xiong and Zhang, 2014; Zhang, 2014). In this sense, once a transportation system is built or a land-use policy is carried out, it influences people's travel behavior and their lives in other domains (e.g., residential, household structure, housing, employment, and education) for a

long time period (e.g., 10 years, 20 years, or even longer). Consequently, understanding people's decisions on travel behavior and lives from the long-term perspective is one of the most fundamental requirements to transport policy makers. In other words, a life course dynamic analysis that incorporates interdependences between different life domains is required. In this study, such interdependences between life domains over the life course are called “biographical interdependences”.

The life course approach has been applied by demographic and housing researchers in various research fields (e.g., Mayer and Tuma, 1990; Wissen and Dykstra, 1999). From their viewpoints, people's behavior can be explained by its continuity over a lifetime and by specific events that involve major changes in other life domains. The life course is further subdivided into a series of trajectories that are comprised of a sequence of events and episodes (defined as the period between two consecutive events) in certain

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life domains. Analyzing the biographical interdependences over different life course trajectories has been the key interest of life course researchers (Ommeren et al., 1999; Wissen and Dykstra, 1999; Dieleman, 2001). Essentially, there are two types of biographical interdependences over the life course: intra-domain and inter-domain interdependences. Intra-domain interdependence may be caused by historical experience (state dependence) or future expectations. As for future expectations, their role in explaining people's choice behavior has been confirmed in other disciplines, with the recognition that people's numerous behaviors are forward-looking (e.g., Kuklinski and West, 1981; Manski, 1999; Carvajal et al., 2000; Chan and Stevens, 2004; Khan and Dhar, 2007; Van der Klaauw and Wolpin, 2008; Van der Klaauw, 2012). However, little has been known in the context of residential and travel behavior. Interdependence between different domains may sometimes exist, because events in one domain are frequently connected to changes in other domains. For instance, a move to a suburban area may increase the probability of car ownership change, and therefore travel behavior. Inter-domain interdependence can be also observed with respect to state dependence and future expectations.

To date, a growing body of research has emerged to analyze the change in travel demand from a biographical viewpoint in the transportation field (Lanzendorf, 2003; Van der Waerden et al., 2003; Scheiner, 2006). Most researchers agree that changes in travel behavior (or travel mobility) need to be captured by explicitly linking with residential mobility, household mobility, employment/education mobility, and mobilities of other life domains. Even though mobility, in plain language, means the ability to move or be moved freely and easily, "the concept of mobilities encompasses both the large-scale movements of people, objects, capital and information across the world, as well as the more local processes of daily transportation, movement through public space and the travel of material things within everyday life," as stated by Hannam et al. (2006). This study follows this general definition of mobility and deals with mobilities in four life domains: residential, household structure, employment/education, and travel behavior domains, where the last domain only refers to car ownership (hereafter, called the car ownership domain).

Given the above considerations, this study aims to clarify households' biographical interdependences (both intra-domain and inter-domain) in the context of residential and travel behavior by explicitly incorporating the influence of two more life domains, i.e., household structure and employment/education domains. Since dealing with life course dynamics needs longitudinal data, a Web-based retrospective life story survey covering each respondent from 18 years of age to the time of the survey was carried out in Japan in November 2010, and 1000 households provided valid information relating to the four mobilities. Various dynamic residential and travel behavior models have been developed; however, these have been mainly from the short-term and/or medium-term perspective. Therefore, modeling of behavior dynamics over the life course has been an unresolved issue. Motivated by these facts and considering the complexity involved in decisions on the above four mobilities over the life course, this study applies an exhaustive Chi-squared Automatic Interaction Detector (CHAID) approach (a typical data mining approach) to capture households' biographical interdependences. Models derived from such data mining approaches are also called rule-based models (e.g., Arentze et al., 2000).

The remaining part of this paper is organized as follows. Section 2 provides a brief literature review of existing studies about the interdependences between residential mobility, household structure mobility, employment/education mobility, and car ownership mobility. Section 3 introduces the life story survey and the collected data. Thereafter, aggregation results are shown and

explained in Section 4. Section 5 presents the exhaustive CHAID analysis results. The study is concluded in Section 6.

2. Households' biographical interdependences

Biography means the course of a person's life, and is defined as a series of mobilities in each life domain over the life course in this study, while *mobility* indicates a change occurring in each domain. Mobility defined in such a way is similar to the concept of a life event. Especially in the literature regarding residential and travel behavior, such a life event mainly refers to a change in job, workplace, or household members and/or their status and has been used as an explanatory variable for residential and travel behavior. However, in this study, such life events are treated as a part of the dependent variables in this study. For the above reasons, mobility is used instead of life event in this study, which defines the following four types of biographies using the concept of mobility as follows:

- (1) *Residential biography*: a series of residential mobilities caused by relocation over the life course.
- (2) *Household structure biography*: a series of mobilities in household members' statuses (e.g., getting married, child-birth, divorce, or children leaving home).
- (3) *Employment/education biography*: a series of mobilities in one's job and/or school (e.g., commencement of job, university entry, change of job or education, or retirement).
- (4) *Car ownership biography*: a series of mobilities of car ownership as a tool for travel. This is a specific type of travel biography (and refers to mobility biography in the general literature on transportation), which may include season tickets or prepaid IC cards for public transportation systems, ownership of bicycles, and major travel modes in daily life.

This study captures the interdependences between the above four types of biographies. Relevant existing studies are briefly reviewed below.

Residential mobility is a special biographical moment, in which familiar routines are likely broken (Scheiner, 2006). The consequences of this are changes in the accessibility of opportunities, which include the workplace, transport systems, retail and leisure facilities, relatives' places of residence, and so on (Van der Waerden et al., 2003). The motivation for residential mobility might be a change (mobility) in household structure, or employment, or transport means. Alternatively, these changes could also be the result of residential mobility. For instance, residential mobility was found to be closely related to the employment and household structure biographies, such as household formation, birth of children, or workplace change (Dieleman and Mulder, 2002). Concerning the relation with car ownership mobility, some efforts have been made to explain residential mobility over the life course underlying travel demand (Scheiner, 2006; Van Ommeren et al., 2000; Lanzendorf, 2003, 2006). It has been concluded that travel behavior and long-term residential mobility are intertwined decision flows within the life course. For example, Scheiner (2006) argued that residential location is not only a predetermined condition of individuals' travel behavior, but also an outcome of a household decision, and this decision manifests itself either in staying or in moving. Moreover, travel behavior, travel changes, and accessibility of opportunities may also be criteria or even constraints for residential mobility decisions. Beige and Axhausen (2008) found a strong interrelation between residential mobility and the ownership of mobility tools (cars or season tickets for public transportation systems) by using retrospective survey data covering the information during 1984–2005. Rashidi et al. (2011) jointly modeled the interdependences between the timing of a vehicle

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